



Joint CALMet XVI - CONECT 3 Conference

Programme Book



CALMet XVI

CONECT

UNESCO
World Network
of Hydroclimatologists

UNESCO
Intergovernmental
Panel on
Climate Change

"Future-Proofing Meteorological Training:
Bridging Collaboration, Experience, and Innovation.

2025

Hybrid

Online and In Person in Florence, Italy
24 to 28 November 2025



Welcome to the Joint CALMet XVI - CONECT 3 Conference

The **Joint CALMet XVI – CONECT 3 Conference** builds on a long tradition of collaboration and knowledge-sharing within the international training community. By bringing together the **CALMet community of practice** and the **CONECT network of WMO education and training partners**, this event provides a unique opportunity to reflect on past achievements, explore new approaches, and chart the way forward for capacity development in meteorology, hydrology, climate, and related Earth system sciences. The following sections introduce CALMet and CONECT, the two communities that form the foundation of this joint conference.



About CALMet

The **Community for the Advancement of Learning in Meteorology and related sciences (CALMet)** has provided a unique international forum for sharing experiences, ideas, and innovations in education and training. CALMet brings together trainers, instructional designers, forecasters, practitioners, researchers, and managers working across meteorology, hydrology, climate, and related Earth system sciences.

Through its biennial conferences that have been delivered in both face-to-face and online format since 1999, CALMet has built a vibrant global community of practice. The conference serves as a platform for exchanging best practices, testing emerging learning technologies, and strengthening professional networks that continue to have a significant impact on education and training worldwide. CALMet activities are grounded in shared values: openness and diversity, collaboration and respect, and a commitment to advancing professional development through continuous learning and innovation. More about CALMet can be seen in [CALMet Commons](#)



About CONECT

The **Consortium of WMO Education and Training Collaborating Partners (CONECT)** is a self- governing body formed by education and training stakeholders of the World Meteorological Organization. It provides a structured platform for discussion, coordination, and sharing of ideas that contribute to improved capacity development worldwide.

CONECT's overarching objective is to strengthen the coordination and sustainability of education and training efforts in Earth system sciences—including weather, climate, water, and related environmental fields. It acts as a formal mechanism to achieve the goals of the WMO Global Campus initiative, while also complementing the work of the [Capacity Development Panel \(CDP\)](#) of the WMO Executive Council. **By minimizing duplication, aligning resources, and maximizing impact, CONECT helps ensure that global training initiatives are coherent, technically sound, and cost-effective. It also fosters stronger collaboration among providers, enabling the international community to meet the evolving needs of learners and institutions.** Learn more about CONECT [here](#)

Welcome from the Organizers

Dear Colleagues,

It is our great pleasure to welcome you to the Joint CALMet XVI – CONECT 3 Conference, held in Florence, Italy, and connected globally through an inclusive hybrid format.

For the first time, CALMet and CONECT come together in one event — creating a vibrant, international space for learning, collaboration, and shared progress. Together, we celebrate our diverse experiences while building stronger connections across the global education and training community.

*Under the theme “**Future-Proofing Meteorological Training: Bridging Collaboration, Experience, and Innovation**,” this year’s conference highlights the power of partnerships, creativity, and knowledge exchange in strengthening the skills and capabilities of our shared workforce.*

From 24–26 November, CALMet XVI will feature keynotes, workshops, posters, and discussions across three time zones — bringing together voices and ideas from every region. The conference continues 27–28 November with the CONECT-3 Meeting, where education and training Partners will come together to review progress, exchange lessons learned and shape the future of global collaboration.

Jointly organized by the WMO Regional Training Centre in Florence (CNR-IBE, Italy), the CALMet Working Group, and the CONECT Management Group, this event embodies the spirit of openness, inclusiveness, and community that defines our network.

We look forward to inspiring exchanges, new ideas, and lasting partnerships — whether you are joining us in Florence or connecting online from across the world.

Warm Regards,

The Organizers 

Heleen ter Pelkwick (KNMI)	SUN Jingrong (CMATC)
Roro Yuliana Purwanti (BMKG/ WMO)	Markus Zygmuntowski (DWD)
Barbara Bourdelles (ENM MeteoFrance)	Nacéra Chergui (MSC)
Felipe Vannucci (SMN)	Stephen Kerr (ECCC)
Romina Mezher (SMN)	Vagner Anabor (USM)
Vesa Nietosvaara (EUMETSAT)	Helenir Oliveira (INMET)
Mick Pope (BoM)	Lucieta Guerreiro Martorano (INMET)
Tsvetomir Ross-Lazarov (COMET)	Marina Baldi (CNR-IBE/ WMO RTC Italy)
Luciane Veeck (WMO)	Vieri Tarchiani (CNR-IBE/WMORTC Italy)
Winifred Jordaan (CONECT)	

How the Joint CALMet XVI – CONECT 3 Conference Will Work?

The **Joint CALMet XVI – CONECT 3 Conference** is designed to maximize participation and inclusiveness across the global meteorological and hydrological education and training community. Hosted in **Florence** and **online**, the event combines live sessions, in-person activities, and continuous online engagement to ensure all participants can benefit, regardless of location or time zone. All online sessions will be recorded for later access.

CALMet XVI: 24–26 November 2025

The first three days focus on the themes of **Collaboration**, **Experience**, and **Innovation**, with sessions offered across **Eastern**, **Central European/Florence**, and **Western** time zones.

- *Eastern and Western programmes* feature 2.5-hour online blocks, including keynote presentations and interactive workshops or regional discussions.
- *Florence sessions* include 3-hour hybrid sessions in the morning and in-person sessions in the afternoon, with a joint Western–Florence session on Day 3 (13:00–17:00 UTC).

Poster contributions are available online throughout the week, with opportunities for discussion both asynchronously and during dedicated on-site sessions in Florence.

CONECT-3: 27–28 November 2025

Join colleagues from the CONECT Community and partners worldwide on **Days 4 and 5** to reflect on progress, share lessons learned, and strengthen collaboration across institutions. Through thematic discussions and practical working sessions, we will explore new ways to increase participation, expand our community, and support the long-term impact of the WMO Global Campus initiative. Offering a unique opportunity to align our efforts and spark new partnerships, you won't want to miss it.

Please note that if any decisions require a vote during the CONECT meeting, only **CONECT Plenary members** will be eligible to vote. Not sure whether your institution is part of the CONECT Plenary? Visit [About CONECT](#) to view the current composition of the Plenary.

Conference Platform and Schedule

The conference platform is hosted on the **WMO ETRP Moodle**: [Joint CALMet-XVI CONECT-3 | ETRP Moodle Site](#), providing access to materials, discussion forums, and asynchronous interaction throughout the event. Participating in asynchronous discussions the Forums will open on the first day of the Conference. There will be a Forum for each topic. Please keep the forum discussions focused by reacting to the posts within the same thread (just reply).

The **program and schedule** include contributions from across the international community. In this book, you will find a day-by-day agenda of both CALMet and CONECT sessions. CALMet's abstracts are organized under the three CALMet themes: *Collaboration*, *Experience*, and *Innovation*.



The Agenda

The Joint **CALMet XVI – CONECT-3 Conference** has been designed to accommodate participants across multiple regions and time zones, ensuring that everyone can engage meaningfully in the programme. The schedule below provides an overview of the programme structure for the full week.

	CALMet-XVI			CONECT-3	
	Monday, 24 November 2025 <i>Collaboration</i>	Tuesday, 25 November 2025 <i>Experience</i>	Wednesday, 26 November 2025 <i>Innovation</i>	Thursday, 27 November 2025	Friday, 28 November 2025
Eastern Time Zone					
Florence Time Zone					
Western Time Zone					
	Online Program 0100 to 0330 UTC	Online Program 0100 to 0330 UTC	Online Program 0100 to 0330 UTC	Hybrid Program 0800 to 1100 UTC	Hybrid Program 0800 to 1100 UTC
	In-Person Program 1300 to 1600 UTC	In-Person Program 1300 to 1600 UTC	Hybrid Joint Program for Florence and Western 1300 to 1700 UTC	Hybrid Program 0930 to 1100 UTC	Hybrid Program 0800 to 1100 UTC
	Online Program 1700 to 1930 UTC	Online Program 1700 to 1930 UTC			

Joint CALMet XVI - CONECT Conference

Conference Theme: Future-Proofing Meteorological training: Bridging Collaboration, Experience and Innovation

Day 1: Monday, 24 November 2025 (Collaboration)	
0100 - 0330 UTC	Eastern Time Zone (Online Programme) - Chair: Asteria Satyaning Handayani (BMKG)
0100 - 0115 UTC (15')	Welcoming message Director of ETR Office and CALMet Co-Chair
0115 - 0145 UTC (30')	32. Utilizing the Protégé Effect: A "Training for Trainers" Model for Disaster Mitigation and Climate Change Adaptation (Anggi Dewita - BMKG)
0145 - 0215 UTC (30')	33. Strengthening Cross-Sectoral Collaboration in Capacity Development for "Met-Plus/Plus-Meteorology" - Meteorology as an Enabler in other sectors (Qi Zhou - CMA)
0215 - 0230 UTC (15')	Break
0230 -0330 UTC (60')	Regional Discussion (Facilitated by Kirsty Tunner - BoM) Discussion on training needs and opportunities in the Region.
08:00 to 11:00 UTC	Florence Time Zone (Hybrid Programme) - Chair: Winifred Jordaan (CONECT)
0800 - 0830 UTC (30') 0900 - 0930 CET	Opening session in Florence
0830 - 0900 UTC (30') 0930 - 1000 CET	26. The International Advanced School in Agricultural Meteorology: from an initial bet to a consolidated initiative (Marina Baldi - CNR IBE Italy)
0900 - 0930 UTC (30') 1000 - 1030 CET	73. Competency-Based Development of Climate Education Courses in Ukraine: The ClimEd Project (Inna Khomenko -- Odesa Mechnikov Univ)
0930 - 1000 UTC (30') 1030 - 1100 CET	Break -- Group Photo
1000 - 1100 UTC (60') 1100 - 1200 CET	Regional Discussion (Facilitated by Winifred Jordaan CONECT) Discussion on training needs and opportunities in the Region.
1100 - 1300 UTC (120') 1200 - 1400 CET	Lunch Break

1400 - 1700 CET	Florence Time Zone (In Person Programme) - Chair: Mick Pope (BoM)
1400 - 1430 CET (30')	28. Blooming BIP-Ms: Transformation of graduate training at the Bureau of Meteorology (Mick Pope - BoM)
1430 - 1530 CET (60')	5. Collaboration in Action: Experience a Case Clinic, the quintessential social learning activity (Madalina Ungur - EUMETSAT)
1530 - 1615 CET (45')	* Coffee + Posters
1615 - 1700 CET (45')	83. Training gaps, challenges and possible solutions in SOFF countries (Giora Gershtein - GeoSphere)
1700-1930 UTC	Western Time Zone (Online Programme) - Chair: Markus Zygmuntowski (DWD)
1700 - 1715 UTC (15')	Welcoming message Director of ETR Office and CALMet Co-Chair
1715 - 1745 UTC (30')	77. First and Second International Workshop on WMO Professional Competencies Framework for Sea Ice Analysts and Forecasters (Alejandro de La Maza - Navy Weather Service)
1745 - 1815 UTC (30')	36. Strengthening Regional Collaboration through the WMO-CGMS VLab Pilot Project supporting the Early Warning for All Initiative: Sharing experiences and best practices among regional Training Centres of Excellence (Diego Souza - INPE)
1815 - 1830 UTC (15')	Break
1830 - 1930 UTC (60')	61. Leveraging Community Expertise in Earth Observation Capacity Needs Assessments: A Design Workshop on New Guidance (Erin Martin - EOTEC DevNet)

Tuesday, 25 November 2025 (Experience)

0100 - 0330 UTC	Eastern Time Zone (Online Programme) - Chair: John Carlo Lambreto (PAGASA)
0100 - 0130 UTC (30')	31. Rebuilding the Fire Weather Competency program at the Australian Bureau of Meteorology (James Pescott - BoM)
0130 - 0200 UTC (30')	57. A Case Study on Building a Hierarchical and Categorized Micro-Course Resource System for Mobile-Based Weather Science Popularization (Xue Han - CMATC)
0200 - 0215 UTC (15')	Break
0215 - 0245 UTC (30')	29. Online learning, are we going too far? The urgent need to maintain face to face engagement (t - BMKG)
0245 - 0315 UTC (30')	30. A Journey in Creating a Flip-To-Classroom Competency Based Subject (Tristan Oakley - BoM)
0315 - 0330 UTC (15')	

08:00 to 11:00 UTC Florence Time Zone (Hybrid Programme) - Chair: Heleen ter Pelkwijs (EUMETCAL)	
0800 - 0830 UTC (30') 0900 - 0930 CET	25. Co-Creating Engaging Learning for Meteorologists: Instructional Design in Practice at MeteoSwiss (Claudia Stocker - MeteoSwiss)
0830 - 0900 UTC (30') 0930 - 1000 CET	22. Exploration on Enhancing the Human Resources Capacity Building in the Meteorological Industry (Prof. Suchun Wang - WMO RTC Nanjing China)
0900 - 0930 UTC (30') 1000 - 1030 CET	50. LOSiC-UCR: Enhancing Student Learning through Applied Meteorological Training (Alberto Salazar-Murillo - University of Costa Rica)
0930 - 1000 UTC (30') 1030 - 1100 CET	Break
1000 - 1030 UTC (30') 1100 - 1130 CET	41. Enabling new capability and preserving knowledge through peer-to-peer learning (Gina Lawrie - BoM)
1030 - 1100 UTC (30') 1130 - 1200 CET	48. Bridging Knowledge and Practice: How We Train Operational Forecasters at The Norwegian Meteorological Institute (Pernille Borander - Norwegian Met Institute)
1100 - 1300 UTC (120') 1200 - 1400 CET	Lunch Break
1400 - 1700 CET	Florence Time Zone (In Person Programme) - Chair: Nacéra Chergui (MSC)
1400 - 1500 CET (60')	3. EUMETSAT Simulator tool - workshop (Vesa Nietosvaara - EUMETSAT)
1500 - 1545 CET (45')	* Coffee + Posters
1545 - 1700 CET (60 to 75')	84. Round Table - Building competencies and collaboration beyond knowledge and skills: Insights from a transnational partnership (Vieri Tarchiani - IBE-CNR Italy)
1700-1930 UTC	Western Time Zone (Online Programme) - Chair: Markus Zygmuntowski (DWD)
1700 - 1730 UTC (30')	37. What Everyone Should Know About Teaching and Learning (Yanina Belline Saibene - rOpenSci)
1730 - 1800 UTC (30')	78. Chile Navy (Alejandro de La Maza - Navy Weather Service)

1800 - 1815 UTC (15')	Break
1815 - 1930 UTC (75')	Regional Discussion (Facilitated by Romina Mezher - SNM) Discussion on training needs and opportunities in the Region.

Wednesday, 26 November 2025 (Innovation)

0100 - 0330 UTC	Eastern Time Zone (Online Programme) - Chair: Sun Jingrong (CMATC)
0100 - 0130 UTC (30')	40. From Manual to Intelligent - Using AIGC and RAG Technology to Create Engaging Meteorological and Hydrological Training (Luoyuze Chen - CMATC)
0130 - 0200 UTC (30')	81. Utilization of Artificial Intelligence for Classifying Rainfall from Satellite Imagery (Richard Mahendra Putra - BMKG)
0200 - 0215 UTC (15')	Break
0215 - 0245 UTC (30')	27. Integrating AI into Meteorological Education: Empowering Instructors and Enhancing Learning with Intelligent Assistants (Yang Zhao - CMATC)
0245 - 0315 UTC (30')	51. Enhancing Seasonal Forecast Communication Through Interactive Dashboards (Dian Nur Ratri - BMKG)
0315 - 0330 UTC (15')	

08:00 to 11:00 UTC	Florence Time Zone (Hybrid Programme) - Chair: Stephen Kerr (ECCC)
0800 - 0830 UTC (30') 0900 - 0930 CET	38. Harnessing (AI) Artificial Intelligence for Next-Generation Meteorological Training: From Data Integrity to Immersive Learning (Abdelillah Otrmane Cherif - Institut Hydrometeorologique de Formation et de Recherches - Algeria)
0830 - 0900 UTC (30') 0930 - 1000 CET	82. Issues and Challenges for incorporating Artificial Intelligence based Earth System Prediction (AI-ESP) Technologies into WMO Integrated Processing and Prediction System (WIPPS) (Eunha Lim - WMO)
0900 - 0930 UTC (30') 1000 - 1030 CET	Break
0930 - 1100 UTC (90') 1030 - 1200 CET	6. Join the Debate: AI-driven weather forecasting models should replace traditional human-led analysis in training and decision-making (Madalina Ungur - EUMETSAT)
1100 - 1300 UTC (120') 1200 - 1400 CET	Lunch Break

13:00 to 17:00 UTC	Joint Florence and Western Time Zone (Hybrid Programme) - <i>Chair: Stephen Kerr (ECCC)</i>
1300 - 1400 UTC (60') 1400 - 1500 CET	70. Collaboration and Innovation in VLab: AI and Jupyter Notebooks for Meteorological Satellite Training (Marcial Garbanzo Salas - Vlab TSO/ Univ. Costa Rica)
1400 - 1430 UTC (30') 1500 - 1530 CET	* Coffee + Posters
1430 - 1530 UTC (60') 1530 - 1630 CET	43. Leveraging Generative AI in Instructional Design: A Case-Based Workshop? (Tsvet Ross-Lazarov - COMET)
1530 - 1600 UTC (30') 1630 - 1700 CET	Break
1600 - 1700 UTC (60') 1700 - 1800 CET	44. Build Talking-Head Videos with AI: Fast, Customizable Content Using Synthesia (Tsvet Ross-Lazarov - COMET)

All posters (focused on all topics) available online 24/7 from 24 November 2025 at 00:00 UTC

Agenda and Workplan – CONECT-3

Third Meeting of the Consortium of WMO Education and Training Collaborating Partners

Thursday, 27 November 2025 (Day-1)

This meeting is part of the Joint CALMet XVI – CONECT-3 Conference. Registered participants attending the Joint Conference will find the link to attend this meeting online in the Conference website (See Day-4 and Day-5 of Conference Programme).

No	Agenda Item	Lead Facilitator	Presentation	Duration	Local Time in Florence	Time in UTC
1	Welcome and Opening Remarks <i>Formal opening of CONECT-3, featuring welcoming statements by the WMO Secretariat, the host institution, and the Chair.</i>	WMO representative (TBC); Host representative (TBC); Winifred Jordaan, Chair of CONECT	Opening Remarks	20'	10:30 - 10:50	09:30 - 09:50
2	CONECT Progress Report: Achievements and Lessons Learned <i>A presentation highlighting CONECT's key achievements and activities since the previous plenary, including progress on agreed actions and initiatives supporting WMO's education and training priorities.</i>	Winifred Jordaan, Chair of CONECT	Presentation and Discussions	30'	10:50 - 11:20	09:50 - 10:20
3	Insights from CALMet-XVI and Regional Discussions <i>A synthesis of outcomes and insights from the CALMet-XVI Conference and related regional dialogues.</i>	Heleen ter-Pelkwick and Yuliana Purwanti, Co-Chairs of CALMet	Presentation and Discussions	40'	11:20 - 12:00	10:20 - 11:00
<i>Lunch Break</i>				120'	12:00 – 14:00	11:00 – 13:00
4	Strategic Updates from the WMO Secretariat <i>Updates from WMO Secretariat relevant to CONECT</i>	Mingmei Li, Director of WMO ETR Office	Presentation and Discussions	30'	14:00 – 14:30	13:00 – 13:30
5	Education & Training Marketplace: Collaboration Edition <i>A marketplace activity to highlight current and upcoming training initiatives and connect institutions that are seeking collaboration.</i>	Facilitated by WMO Secretariat	Interactive marketplace	45'	14:30 – 15:15	13:30 – 14:15
<i>Coffee Break</i>				30'	15:15 – 15:45	14:15 – 14:45
6	Harnessing Artificial Intelligence for the Future of Training and Capacity Development	Facilitated by WMO Secretariat	Round Table	75'	15:45 – 17:00	14:45 – 16:00
<i>Wrap-up Day-1</i>		Winifred Jordaan, Chair of CONECT		5'	17:00 – 17:05	16:00 – 16:05

Agenda and Workplan – CONECT-3

Third Meeting of the Consortium of WMO Education and Training Collaborating Partners

Friday, 28 November 2025 (Day-2)

No	Agenda Item	Facilitator	Presentation	Duration	Local Time in Florence	Time in UTC
7	Engaging the Next Generation: Youth Outreach Strategies <i>Generating ideas and content to attract youth to meteorology, hydrology, climatology.</i>	Facilitated by CONECT-MG: Mick Pope, Solangela Cuevas, Stephen Kerr, and Vagner Anabor	Presentation and Discussions	60'	09:00 - 10:00	08:00 - 09:00
8	Empowering Women in Training and Capacity Development <i>Exploring challenges and solutions to increase women's inclusion in training programs.</i>	Facilitated by WMO Secretariat	Presentation and Discussions	45'	10:00 - 10:45	09:00 - 09:45
	<i>Coffee Break</i>			30'	10:45 – 11:15	09:45 – 10:15
9	Expanding CONECT Membership and Strengthening Volunteer Engagement <i>Exploring ways to increase engagement of CONECT members.</i>	Facilitated by CONECT-MG: Eduard Podgaiskii and Winifred Jordaan	Presentation and Discussions	45'	11:15 - 12:00	10:15 - 11:00
	<i>Lunch Break</i>			120'	12:00 – 14:00	11:00 – 13:00
10	Building Sustainability: Succession Planning for Training Institutions <i>A discussion of strategies for continuity and institutional knowledge transfer.</i>	Facilitated by CONECT-MG: Bernie Connell, Winifred Jordaan, and Arpita Mandal	Presentation and Discussions	90'	14:00 – 15:30	13:00 – 14:30
	<i>Coffee Break</i>			30'	15:30 – 16:00	14:30 – 15:00
11	CONECT-3 Summary and Proposals for the Next Plenary	Winifred Jordaan, Chair of CONECT	Presentation and Discussions	30'	16:00 – 16:30	15:00 – 15:30
12	Closing Reflections and Any Other Business	Winifred Jordaan, Chair of CONECT	Closing remarks	30'	16:30-17:00	15:30-16:00

🔗 Link of the CALMet - CONECT Sessions

CALMet Day 1 Monday, 24 November 2025 Collaboration	Eastern Time Zone: 0100 - 0300 UTC	BMKG Zoom Meeting
	Florence Time Zone: 0800 - 1100 UTC	EUMETSAT Zoom Meeting
	Florence Time Zone: 1400 - 1700 CET	In person participation
	Western Time Zone: 1700-1900 UTC	EUMETCAL Teams Meeting
CALMet Day 2 Tuesday, 24 November 2025 Experience	Eastern Time Zone: 0100 - 0300 UTC	BMKG Zoom Meeting
	Florence Time Zone: 0800 - 1100 UTC	EUMETSAT Zoom Meeting
	Florence Time Zone: 1400 - 1700 CET	In person participation
	Western Time Zone: 1700-1900 UTC	EUMETCAL Teams Meeting
CALMet Day 3 Wednesday, 24 November 2025 Innovation	Eastern Time Zone: 0100 - 0300 UTC	BMKG Zoom Meeting
	Florence Time Zone: 0800 - 1100 UTC	EUMETSAT Zoom Meeting
	Joint session for the Florence and Western Time Zone: 1300-1700 UTC	
CONECT Day 1 Thursday, 27 November 2025 and CONECT Day 2 Friday, 28 November 2025	Florence Time Zone: 0800 - 1600 UTC	WMO Zoom Meeting
<i>* Click the Teleconferencing System link to access the session</i>		

List of Abstracts

COLLABORATION

Keynote

26. The International Advanced School in Agricultural Meteorology: from an initial bet to a consolidated initiative (**Marina Baldi - CNR IBE Italy**)

28. Blooming BIP-Ms: Transformation of graduate training at the Bureau of Meteorology (**Mick Pope - BoM**)

32. Utilizing the Protégé Effect: A "Training for Trainers" Model for Disaster Mitigation and Climate Change Adaptation (**Anggi Dewita - BMKG**)

33. Strengthening Cross-Sectoral Collaboration in Capacity Development for "Met-Plus/Plus-Meteorology" - Meteorology as an Enabler in other sectors (**Qi Zhou - CMA**)

36. Strengthening Regional Collaboration through the WMO-CGMS VLab Pilot Project supporting the Early Warning for All Initiative: Sharing experiences and best practices among regional Training Centres of Excellence (**Diego Souza - INPE**)

73. Competency-Based Development of Climate Education Courses in Ukraine: The ClimEd Project (**Inna Khomenko -- Odesa Mechnikov Univ**)

77. First and Second International Workshop on WMO Professional Competencies Framework for Sea Ice Analysts and Forecasters (**Alejandro de La Maza - Navy Weather Service**)

83. Training gaps, challenges and possible solutions in SOFF countries (**Giora Gershtein - GeoSphere**)

Workshop

5. Collaboration in Action: Experience a Case Clinic, the quintessential social learning activity (**Madalina Ungur - EUMETSAT**)

61. Leveraging Community Expertise in Earth Observation Capacity Needs Assessments: A Design Workshop on New Guidance (**Erin Martin - EOTEC DevNet**)

Poster

8. Recognizing digital training in meteorology in Africa: a solution to reduce the lack of continuing education for meteorologists (**Léonel MBA NKILLI - CAA Gabon**)

9. From Training to Transformation: Co-Developing Forecasting Capacities for Early Warning in West Africa (**Vieri Tarchiani - CNR IBE Italy**)

11. Building Local Capacity through Cascading Agrometeorological Training in Niger: A scalable model from the PRIMESA initiative (**Maurizio Bacci - CNR IBE Italy**)

14. Inter-institutional collaboration to strengthen capacities in early warning systems for the implementation of impact-based forecasts at regional level (**Daniela D'Amen - SMN Argentina**)

15. Hackathons: Accelerating Collaboration to Deliver High-Impact Meteorological Training — From Concept to Implementation in Days (**Heleen ter Pelkwick - KNMI/ EUMETCAL Netherlands**)

16. The EUMETCAL programme: How a Collaboration within the Meteorological Education and Training Community works (**Heleen ter Pelkwick - KNMI/ EUMETCAL Netherlands**)

17. Survey on weather-specific training of (future) deck officers. Early preliminary results (**Brindusa Cristina CHIOTOROIU - Constanta Maritime University, Romania**)

20. Integrated and Immersive Training for monitoring climate effect on different ecosystem compounds: from past experiences to proposal of collaborations among RTC WMO, European LTER Network, National Research Council of Italy and LAMMA Consortium, at Pianosa Research Base (Italy) (**Francesco Sabatini - CNR IBE Italy**)

21. Proposed Teaching Program for the Meteorology Engineering Cycle (**Khaled Mahdi - Institut Hydrométéorologique de Formation et de Recherches Algeria**)

34. Current training activities and programs conducted by VLab CoE Morocco (**Tahar Saouri VLab CoE Morocco**)

39. Teamwork in Action: Co-creating the Course and Resources Together (**Asteria S. Handayani - BMKG Indonesia**)

45. Leveraging Satellite Data for Disaster Management: Collaboration from the Brazilian VLab Center of Excellence in Developing Training Resources for Flood and Thunderstorm Monitoring to Support the Early Warning for All Initiative (**Diego Souza - INPE Brazil**)

46. Training Resources for Hazard Monitoring using Satellite Information: SMN Center of Excellence's Contribution to the Early Warning for All Initiative (**Luciano Vidal - SMN Argentina**)

47. Developing Courses on Data Analysis for Climate Services in Ukraine (**Alina Semerhei-Chumachenko - Odesa Univ Ukraine**)

55. Building Competence for Observers and Forecasters in Timor-Leste toward GBON Compliance (**Noer Nurhayati - Indonesia**)

60. Collaborative Training Through the WMO-CGMS VLab Regional Focus Group of the Americas and the Caribbean (**Erin Sanders - Cooperative Inst, for Research in the Atmosphere USA**)

62. Empowering Women for Resilient Weather, Water and Climate Services (**Luciane Veeck - WMO Switzerland**)

65. Climatic and Socio-Economic Indicators in Climate Product Design for Climate Services (**Larysa Nedostrelova - Ukraine**)

66. Impact-based Forecasting in the Caribbean (**Hugh Atherley - CIMH Barbados**)

67. International and National Legal Instruments on Climate Change (**Larysa Nedostrelova - Ukraine**)

68. Enhancing Meteorological and Hydrological Service Capacities and Regional Cooperation through the ENANDES+ Project (**Romina Mezer - SNM Argentina**)

69. Utilizing AI for Enhanced, Continuous, and Modular Meteorological Training at RTC SMN Argentina (**Romina Mezer - SNM Argentina**)

72. Development of the course "Viticulture of Ukraine" for climate service in Ukraine (**Viktoriia Kuryshyna - Ukraine**)

74. Shared Guidance and Resources from the WMO-CGMS VLab to Support the Early Warnings for All Initiative (**Bernadette Connel - CIRA USA**)

75. Advancing Competencies in Meteorological Instrument Calibration through WMO Self-Paced Online Training (**Eunjin Choi - WMO Switzerland**)

76. Strengthening Regional Meteorological Training: Case-Based Modules on Hurricanes and Lightning in Costa Rica (**Gabriela Mora -Rojas - Univ of Costa Rica**)

80. Enhancing Early Warnings Systems: Training and Insights from Severe Weather Case Studies in Argentina (**Maite Cancelada - FCEN UBA Argentina**)

85. INMET: Strengthening Global Collaboration for Training and Capacity Development through Educational Actions and Strategic Partnerships (2023–2025) (**Lucieta Guerreiro Martorano - INMET**)

EXPERIENCE

Keynote

22. Exploration on Enhancing the Human Resources Capacity Building in the Meteorological Industry (**Prof. Suchun Wang - WMO RTC Nanjing China**)

25. Co-Creating Engaging Learning for Meteorologists: Instructional Design in Practice at MeteoSwiss (**Claudia Stocker - MeteoSwiss**)

29. Online learning, are we going too far? The urgent need to maintain face to face engagement (**Ratih Prasetya - BMKG**)

30. A Journey in Creating a Flip-To-Classroom Competency Based Subject (**Tristan Oakley - BoM**)

31. Rebuilding the Fire Weather Competency program at the Australian Bureau of Meteorology (**James Pescott - BoM**)

37. What Everyone Should Know About Teaching And Learning (**Yanina Belline Saibene - rOpenSci**)

41. Enabling new capability and preserving knowledge through peer-to-peer learning (**Gina Lawrie - BoM Australia**)

48. Bridging Knowledge and Practice: How We Train Operational Forecasters at The Norwegian Meteorological Institute (**Pernille Borander - Norwegian Met Institute**)

50. LOSiC-UCR: Enhancing Student Learning through Applied Meteorological Training (**Alberto Salazar-Murillo - University of Costa Rica**)

57. A Case Study on Building a Hierarchical and Categorized Micro-Course Resource System for Mobile-Based Weather Science Popularization (**Xue Han - CMATC**)

78. Chile Navy (**Alejandro de La Maza - Navy Weather Service**)

Workshop

3. EUMETSAT Simulator tool - workshop (**Vesa Nietosvaara - EUMETSAT**)

84. Round Table - Building competencies and collaboration beyond knowledge and skills: Insights from a transnational partnership (**Vieri Tarchiani - IBE-CNR Italy**)

Poster

1. 10 years of experience and contribution to the Baltic+ course (**Izolda Marcinoniene - Lithuanian HMS - Lithuanian**)

4. EUMETSAT Simulator tool workflow (**Natasja Strelec Mahovic - EUMETSAT**)

7. Meteorological Analysis of the Heavy Rainfall Event on 24 August 2024 over Eastern Sudan Using EUMETSAT Satellite Data (Haitham Khogly - Sudan)
10. Climatology of cyclones on the coast of the states of São Paulo and Rio de Janeiro and the use of programming languages to identify oceanic phenomena (Helio Marques - Brazil)
13. The Drought Observatory: A Climate Service Where Access Becomes Learning (Ramona Magno - IBE CNR Italy)
18. Building an Online Interactive Ecosystem through Structured Interaction Design: Lessons from a Meteorological Training Program (Zehao Song - China)
23. Shared insights by connecting the Training College to Operational Naval Air Stations through real-time and recent weather and climate events (Stephen Dorling - Royal Navy UK)
24. A Gallery of Meteorological Teaching Resources (Chris Webster - New Zealand)
35. From traditional training to interactive experience: our journey (Maria Laura Poletti - CIMA Italy)
52. Integrating fire weather information for successful decision making (Marines Campos - Argentina)
56. Building Curiosity in Meteorology (Yosaphat Donny - BMKG)
58. eGAFOR - Collaborative Cross-Border Forecast for General Aviation (Ladislav Coso - Croatia)
63. Mid-Term Reflections from the UNEP–GCF and BMKG Capacity-Building Program on Hydro-Meteorological Resilience in Timor-Leste (Nina Sasmita - BMKG)
64. Community-Based Rainfall Monitoring as a Tool for Climate Education and Capacity Building in Rural Argentina (Raul Andres Duran - SNM Argentina)
71. Active strategies in teaching meteorology: Experience implementing problem-based learning. (Solangela Sanchez - Chile)
79. Connecting Cultures and Building Capacity Through Inclusive Learning: Experiences from the MTG Arabic Workshop, the Annual SAC Course, and a Modular micro-Learning Proposal (Zamzam Rawahi - VLab CoE Oman)

INNOVATION

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38. Harnessing (AI) Artificial Intelligence for Next-Generation Meteorological Training: From Data Integrity to Immersive Learning (Abdelillah Otmane Cherif - Institut Hydrometeorologique de Formation et de Recherches - Algeria)
40. From Manual to Intelligent - Using AIGC and RAG Technology to Create Engaging Meteorological and Hydrological Training (Luoyuze Chen - CMATC)
51. Enhancing Seasonal Forecast Communication Through Interactive Dashboards (Dian Nur Ratri - BMKG)
81. Utilization of Artificial Intelligence for Classifying Rainfall from Satellite Imagery (Richard Mahendra Putra - BMKG)
82. Issues and Challenges for incorporating Artificial Intelligence based Earth System Prediction (AI-ESP) Technologies into WMO Integrated Processing and Prediction System (WIPPS) (Eunha Lim - WMO)

Workshop

6. Join the Debate: AI-driven weather forecasting models should replace traditional human-led analysis in training and decision-making (**Madalina Ungur - EUMETSAT**)

43. Leveraging Generative AI in Instructional Design: A Case-Based Workshop? (**Tsvet Ross-Lazarov - COMET**)

44. Build Talking-Head Videos with AI: Fast, Customizable Content Using Synthesia (**Tsvet Ross-Lazarov, - COMET**)

70. Collaboration and Innovation in VLab: AI and Jupyter Notebooks for Meteorological Satellite Training (**Marcial Garbanzo Salas - Vlab TSO/ Univ. Costa Rica**)

Poster

2. Collaborative Framework for Identifying Educational and Training Needs Across WMO Regions (**Maryam Toufani Shahraki - RTC Teheran Iran**)

42. From Theory to Application: CMA's Hands-on Training Design Empowers Early Warning Capacity Building (**Guolin Han - CMA**)

49. AI in meteorology and hydrology education (**Baktiyor Kadyrov - Uzbekistan**)

54. AI-Driven Video Production for Meteorological Training Promotion: An Innovative Practice for Future-Oriented Meteorological Training (**Haoyu Wang - CMA China**)

59. Contextual Flipped Group Classroom (CFGC) Model: Enhancing Science Understanding (**Nasrah - Univ. Muhammadiyah Indonesia**)

Abstracts

COLLABORATION

The International Advanced School in Agricultural Meteorology: from an initial bet to a consolidated initiative

ID: 26

Authors:

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Abstract

WMO has paid great attention to Agrometeorology over the years: since late '90s the Commission on Agricultural Meteorology (CAgM) successfully operated, replaced in 2020 by the Standing Committee on Services for Agriculture (SC-AGR). The SC-AGR has (as CAgM had), among its objectives, to provide capacity building, technical advice, and tools in agrometeorology, due to the strict interconnection between meteorology and agriculture. The importance of training in agrometeorology is confirmed in the WMO Report No. 258 (2009) "Guidelines for curricula in agricultural meteorology": a milestone in this perspective. Today, although technology has made great steps forward, for example, enabling the use of new data assimilation and modeling techniques to support agricultural management, there are still many gaps in the training and the ability of farmers to use these tools. Therefore, there is a need not only to develop new climate services, but also to offer comprehensive training to young farmers who, after completing their academic studies, they find themselves facing the daily life of agricultural businesses in a context of extreme weather events.

Taking inspiration from the European context, the Italian Association of Agrometeorology, AIAM, in partnership with the WMO-RTC in Italy, a few years ago began offering a school designed for PhD students, post-Doc, and young entrepreneurs. The International Advanced School in Agricultural Meteorology (5th edition in 2025) allowed participants to engage with experts from Universities, Research Institutions, and international organizations (FAO, ESA, CGIAR/IWMI, Alliance of Bioversity International), also taking advantage from lessons learnt from international initiatives (EU COST-Actions).

The School has featured cutting-edge topics like CSA, Water management, Precision farming, Water harvesting, Risk management in agriculture, Micrometeorology, Urban heat and Urban forestry, Application of AI and ML for analysis of complex datasets. During the one-week schools, participants learnt how to use tools such as AquaCrop (FAO), WaPOR (FAO), the Copernicus database (ESA), Decision Support Systems (CNR), ARIS and APSIM (BOKU), Soil Moisture monitoring from space (CNR) Remote sensing data reduction and analysis (UniPD). They also visited farms, water consortia, etc and learned about the use of cutting-edge instruments for agriculture.

The experience of these five years has been possible thanks primarily to two factors. The first is that, since its foundation in 1997, AIAM mission is enhancing and promoting agrometeorological research offering training for young scientists. Secondarily, the design of the schools takes advantage of the experience gained over the years by members of the Scientific Committee in WMO-CAgM and WMO experts' groups, and from exchanging ideas with WMO-ETR.

The experience of the International Advanced School in Agricultural Meteorology represents a good starting point for building broader programs and new training methodologies, also based on the participants' and trainers' comments collected at the end of each course. The programs developed so far are certainly replicable in other contexts and transferable to other formats (online, hybrid), although the practical part, if delivered in presence, much more appreciated by participants, offers higher quality results. Finally, the School can be extended worldwide in collaboration with INSAM (International Society on Agricultural Meteorology).

Blooming BIP-Ms: Transformation of graduate training at the Bureau of Meteorology**ID: 28****Author:**

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Abstract

The Basic Instruction Package for Meteorologists (BIP-M) is the fundamental requirement for the training of operational forecast meteorologists. The recent edition of BIP-M learning outcomes (WMO No. 1083, 2023) reflects some significant changes in both the content and the way in which a BIP-M may be delivered. This includes a greater focus on higher level Bloom's taxonomy activities which inform delivery and assessment of material, the broader competency context of training, and the need to service a broad array of learners and organisations.

The Bureau of Meteorology Training Centre (BMTC) is a globally recognised provider of a BIP-M, training staff for internal and external stakeholders, including the Weather Ready Pacific program. In response to both the new WMO No. 1083 and evolving stakeholder requirements, the BMTC has begun a major transformation of its training program. The result will be a more agile, flexible, role focussed, and educationally contemporary program.

This paper discusses the various considerations in making major changes to the program: from operational requirements and contextualisation for various stakeholders, to andragogy, learning design, and a blended learning approach.

Utilizing the Protégé Effect: A "Training for Trainers" Model for Disaster Mitigation and Climate Change Adaptation**ID: 32****Authors:**

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Abstract

The Indonesian Agency for Meteorology, Climatology, and Geophysics (BMKG) proposes an innovative initiative titled "Training for Trainers," designed to strengthen community capacity in facing the challenges of natural disasters and climate change. This program focuses on a peer-to-peer training model, where selected high school students from a designated project school will be trained directly by BMKG staff. The training will cover essential materials on natural disaster mitigation as well as climate change mitigation and adaptation strategies. The goal is to equip these young participants with practical knowledge and survival skills.

What makes this program unique is its application of the pedagogical principle known as the "protégé effect" or "learning by teaching" (LdL - Lernen durch Lehren). Based on this theory, the process of teaching others significantly deepens the understanding and knowledge retention of the teacher themselves. After being trained by BMKG, the high school students will be directed to become "trainers" for elementary school students, where they will adapt and re-deliver the material they have mastered. This process not only effectively disseminates knowledge to a younger audience but also intrinsically strengthens the high school students' comprehension and ability to act.

This model aims to activate active and interactive learning, encouraging students to organize their thoughts, identify gaps in their knowledge, and enhance cognitive skills such as analysis and evaluation. Moreover, this method also builds crucial life skills, including effective communication, problem-solving, and leadership. We are confident that this approach will create a new wave of skilled and motivated young educators who will continuously strengthen our community's resilience to evolving environmental challenges.

Strengthening Cross-Sectoral Collaboration in Capacity Development for “Met-Plus/Plus-Meteorology” - Meteorology as an Enabler in other sectors**ID: 33****Authors:**

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Abstract

CMA International Cooperation and Training Centre (CMA ICTC) attaches great importance to strengthening global and cross-sectoral collaboration for further development in the field of capacity building.

We have close collaboration with colleagues from meteorology, hydrology, ecology and relevant fields. CMA ICTC gives full play to its geographical advantages arising from its colocation with other central CMA facilities and its easy access to the latter's resources. CMA ICTC extensively cooperates with various institutions from different fields, pays attention to the exchange and development of training experience and theory, and unites various institutions and different units of CMA to customize professional skills and management training. Deep cooperation was established with Academy for International Business Officials (AIBO) of MOFCOM, Foreign Environmental Cooperation Centre of Ministry of Ecology and Environment, School of Administration of the State Administration for Market Regulation, Agricultural Information Institute of CAAS, and Foreign Economic Cooperation Centre of MARA. CMA ICTC faculty is empowered with its domestic and international counterparts plus senior experts and scholars from the National Meteorological Centre (NMC), National Climate Centre (NCC), National Satellite Meteorological Centre (NSMC) and Civil Aviation Meteorological Centre to teach participants the latest progress and selected exemplars in the fields of operational technology, practical applications, strategic policies, etc. Experts from WMO, EUMETSAT, ICAO, US, UK, Australia and other countries or international organizations are invited to give lectures and join the Forums at workshops to broaden the participants' international vision. At the same time, CMA ICTC strengthens cooperation with other regional centres such as the World Meteorological Centre (Beijing) and regional WIGOS centres to jointly organize international training workshops and actively perform its duties as a RTC.

Our training events benefit participants from various fields. In fields such as climate and climate change, meteorological management, nowcasting, agricultural meteorology, and aviation meteorology—which exhibit strong interdisciplinary relevance and broad demand—trainees from non-meteorological and non-hydrological sectors constitute over 10% of participants. These trainees primarily come from diverse sectors including aviation and transportation, universities and educational institutions, ecology and environment, agriculture, forestry, fisheries, municipal engineering and emergency management, commerce, aerospace, water resources, diplomacy, food and pharmaceuticals, geophysics, mining and energy, information and communication, judiciary, and media. All of CMA ICTC's flagship international training programs have been highly praised, accumulating over 2,000 positive trainee feedback comments.

Strengthening Regional Collaboration through the WMO-CGMS VLab Pilot Project supporting the Early Warning for All Initiative: Sharing experiences and best practices among regional Training Centres of Excellence.

ID: 36

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Abstract

The World Meteorological Organization (WMO) promotes “The Early Warnings for All initiative (with) aims to ensure universal protection from hazardous hydrometeorological, climatological and related environmental events through life-saving early warning systems by the end of 2027, a call echoed by the United Nations Secretary-General António Guterres in 2022.” Pillar 2 of EW4All, led by WMO, focuses on detection, observation, monitoring, analysis, and forecasting, leveraging space technologies to enhance early warning capabilities. To support this effort, the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) under the WMO and the Coordination Group for Meteorological Satellites (CGMS) launched a collaborative pilot training initiative in 2024 for WMO Regional Associations III & IV that cover North, Central, and South America and the Caribbean. Using information gathered from a WMO rapid assessment survey of priority hazards for member countries, the initiative supports VLab Centres of Excellence in Argentina, Barbados, Brazil, Costa Rica to provide training materials to cover at least two priority hazards, fostering collaboration among diverse stakeholders to produce accessible, regionally tailored resources. The participating VLab Centers of Excellence (CoEs) include the Caribbean Institute for Meteorology and Hydrology (CIMH) in Barbados, Brazil’s National Institute for Space Research (INPE), the University of Buenos Aires’ Department of Atmospheric and Ocean Sciences (DCAO), Argentina’s National Meteorological Service (SMN), and the University of Costa Rica, developing training materials focusing on hazards like floods, heatwaves, hail, tropical cyclones, squall lines, fog, volcanic ash, and lightning. Each Centre is responsible for organizing case examples and preparing the resources in their native language. This presentation aims to share the experiences and best practices from the Centres of Excellence, foster regional collaboration and promote EW4All training engagement.

Competency-Based Development of Climate Education Courses in Ukraine: The ClimEd Project
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Abstract

Developing sustainable capacity in climate services requires systematic and competency-based education at multiple levels. The Global Framework for Climate Services (GFCS) has identified critical gaps in the skills needed for effective service provision, especially in less developed countries (WMO, 2018). In Ukraine, climate services remain in the early stages of development, and one of the key challenges is preparing specialists and closing the gap between providers and users of climate information.

The Erasmus+ Project 'Multilevel Local, Nation- and Regionwide Education and Training in Climate Services, Climate Change Adaptation and Mitigation – ClimEd', 15.11.2020 – 14.05.2026, directly addresses this need by collaboratively designing a comprehensive suite of courses spanning postgraduate education, professional development, and public engagement.

At the postgraduate level, two full programmes are being developed: Climate Service (PhD) and Climate Service (Master). Both focus on advanced climate data management, the use of climate model outputs, climate product development, and the integration of climate policy and communication into climate services. Complementing these, the Master's programme in Climate Change Adaptation and Mitigation provides interdisciplinary training on climate impacts and vulnerability, climate change economics, and public engagement, with particular relevance for specialists working in climate-dependent economic sectors.

In addition, the project is elaborating professional development courses for climate experts, decision-makers, and specialists from climate-dependent economic sectors.

All courses are tailored to sectoral needs identified through surveys of 297 stakeholders from agriculture, healthcare, urban economy, water management, energy, infrastructure/construction,

and nature preservation, together with 48 climate service providers from the Ukrainian Hydrometeorological Center.

To broaden the societal impact, massive open online courses are also being developed to enhance climate literacy among the general public.

The ClimEd initiative demonstrates how global partnerships can be harnessed to develop integrated climate education pathways - from postgraduate training to massive open online courses - thus providing a replicable model for strengthening human capacity in climate services.

First and Second International Workshop on WMO Professional Competencies Framework for Sea Ice Analysts and Forecasters**ID: 77****Authors:**

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Abstract

WMO Ice Analysts and Forecasters Competencies Framework Workshops (2024-2025), hosted by the IICWG, aimed to enhance global ice forecasting skills.

The 2024 workshop focused on introducing the framework, assessing current skills and identify gaps, through five sessions with different presentations, case discussions and surveys. Outcomes included a clearer understanding of regional needs and a collaborative platform for ongoing development.

The 2025 workshop refined the framework, defining detailed competencies, assessment methods, and implementation strategies. Activities involved presenting draft standards, case studies, scenario exercises, and developing an action plan for phased rollout. Results included finalized training recommendations and commitments for worldwide adoption for the framework on a service level and formation requirements.

These two workshops established a standardized, competency-based approach to improve ice analysis and forecasting, supporting safer navigation and climate research. The initiative promotes international collaboration, continuous improvement and preparedness for evolving challenges in polar and maritime regions.

Training gaps, challenges and possible solutions in SOFF countries

ID: 83

Authors:

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Abstract

The Systematic Observations Financing Facility (SOFF) initiative aims to close the global observational gap by helping countries meet Global Basic Observing Network (GBON) requirements—ensuring sustainable operation of both surface and upper-air meteorological stations.

GeoSphere Austria serves as one of the most active SOFF Peer Advisors, currently supporting nine countries across three regions:

- Africa: South Sudan, Chad, Djibouti, and Sierra Leone
- Caribbean: Guyana, Dominica, St. Lucia, and St. Vincent and the Grenadines
- Asia: Lao PDR

A major challenge in addressing the observation gap is education and training (ETR). In our work, we have encountered capacity needs at all levels—from technical personnel to senior management and national stakeholders. This presentation will highlight key training gaps identified across our countries of engagement and the approaches we are taking to address them.

The presentation will also outline the importance of building strong collaborations with national, regional, and international training partners, and explore how the global education and training community can further support and amplify these efforts. This includes:

- Strengthening and empowering local and regional ETR institutions
- Developing targeted capacity-building programs
- Fostering long-term international partnerships

In addition, there will be a discussion on the regional specificities of these training gaps, including language barriers, technological limitations, and cultural contexts, and how these differences can be addressed through tailored, inclusive training strategies.

The presentation's goal is to spark dialogue on how the education and training community can play a central role in ensuring the sustainability and effectiveness of global observational Systems.

Collaboration in Action: Experience a Case Clinic, the quintessential social learning activity
ID: 5**Authors:**

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Abstract

Sometimes events dominate how we think about what we do – the course, the workshop, the seminar. In the world of training and capacity development, collaboration is often treated as a logistical arrangement, but behind every effective partnership lies a web of values, relationships and challenges. Many of us are working to integrate social or community learning approaches in our practice, for example, through communities of practice (CoPs).

This workshop offers a space to explore a Case Clinic in action. Rooted in social learning theory, the Case Clinic is a structured, empathetic process for peer-to-peer problem-solving. One participant presents a real-world challenge from their practice, and the group listens, reflects and inquires - not to prescribe solutions, but to generate insight.

Case Clinics are widely appreciated in CoPs for their ability to surface collective wisdom, deepen trust and turn reflection into action. Participants will experience the method firsthand and explore how such practices can support collaboration in their training communities. They will also gain practical skills in facilitation, experience deep listening, and reflect on how to foster spaces that value learning, care, and mutual support in professional development contexts.

Leveraging Community Expertise in EO Capacity Needs Assessments: A Design Workshop on New Guidance

ID: 61

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Abstract

EOTEC DevNet and partners have developed new online guidance that synthesizes global experience on the conduct of Earth observation (EO) capacity building needs assessments. The resource outlines five foundational steps of an assessment and curates practical tools, examples, and tips. Currently in beta, the guidance is designed as a living document that will evolve with community contributions.

This interactive, online workshop will have two parts:

- Interactive small group sessions to test the guidance, provide feedback, and suggest ideas for its future development.
- Short interventions and discussion to highlight approaches to needs assessment and skills analysis, and spark further exchange among participants. Speakers include NASA ARSET (confirmed) and Space4GEO (tentative).

Participants will gain practical exposure to assessment approaches, learn from peer experiences, and strengthen their professional networks. Moderators will facilitate discussion to ensure broad participation.

Objectives

The workshop will:

- Introduce the purpose and structure of the EO capacity building needs assessment guidance.
- Provide hands-on opportunities to test the guidance through small group discussions.
- Collect feedback on strengths, gaps, and needed improvements.
- Demonstrate how participants can contribute their own examples, tools, and case studies.
- Stimulate dialogue about complementary needs assessment and skills analysis approaches.
- Build a community of contributors who can continue shaping and applying the resource.

Benefits for Participants

- Strengthen skills in applying assessment methods through interactive exercises.
- Learn directly from peers and experts through real-world case studies.
- Expand professional networks by connecting with peers in a small groups setting.
- Contribute their own experience to make the resource more useful to others.
- Find a new way to contribute and engage with the EO capacity building community.

Format and Activities

The 75-minute online session will combine short presentations with interactive exercises. After a brief overview of the guidance, participants will join breakout groups, each focusing on one element of the guidance. Using structured prompts, groups will test the resource's usefulness and relevance, then report back on gaps and ideas for improvement. Speakers will provide flash talks to catalyze broader participant sharing of examples, tools, or case studies.

Conclusion

By creating a collaborative space for testing, feedback, and exchange, this workshop will ensure that the EO capacity building needs assessment guidance is practical, adaptable, and responsive to the needs of the EO capacity building community. Participants will not only strengthen their own understanding of capacity building assessments but also play an active role in shaping a global resource that advances capacity building efforts worldwide.

Recognizing digital training in meteorology in Africa: a solution to reduce the lack of continuing education for meteorologists**ID: 8****Author:**

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Civil Aviation Authority of Gabon; Gabon

Abstract

One of the most challenges facing the aviation meteorology in Africa is the lack of training, especially continuing training.

In most African states, aviation meteorologists are not regularly trained due to the lack of funds and the few number of meteorology african training centres.

Therefore, it is urgent to address this issue by using new technology such as digital learning. However, most of training modules are not yet recognized in Africa, in a result meteorologists are not encouraged to attend such training.

The obvious thing to do it's to recognize some meteorology online training. In doing so, we would significantly improve the level of expertise in weather sciences in a very affordable manner. But some measures have to be undertaken before, including selecting relevant online courses, monitoring the process of online learning and encouraging meteorologists trainers to develop online courses.

This simple initiative will definitely reduce the gap between African meteorologists and those out of Africa.

From Training to Transformation: Co-Developing Forecasting Capacities for Early Warning in West Africa

ID: 9

Authors:

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Abstract

In Sub-Saharan Africa, the operational implementation of regional Numerical Weather Prediction (NWP) models remains a significant challenge due to limited financial and technical resources, insufficient understanding of tropical weather systems, and the inadequate performance of global models in simulating rainfall over the region. Although recent developments—such as cloud computing and convection-permitting models—offer new opportunities, forecasting intense rainfall events, often linked to mesoscale convective systems, continues to be a major limitation for effective early warning systems.

Within the framework of the SLAPIS Sahel project, a development cooperation initiative, the Regional Training Center in Italy designed and implemented a blended and integrated training programme aimed at enhancing the capacities of the National Meteorological Services (NMSs) of Niger and Burkina Faso. The objective was to enable local forecasters, modelers, and IT personnel to operationalize regional NWP chains in support of hydrometeorological early warning systems.

The training strategy adopted a multi-tiered approach:

- On-site training brought together multidisciplinary teams for joint learning sessions, combining theory and hands-on practice on local computing clusters, facilitated by experts from the Tuscany Regional Meteorological Service (LaMMA).
- Targeted distance learning modules via webinars addressed specific thematic needs for forecasters and modelers.
- Long-term international training stages embedded two selected modelers (focal points) within the operational team at LaMMA, providing immersive exposure and fostering a “training-of-trainers” model.
- Knowledge transfer was sustained through cascading activities led by focal points, including local seminars, weekly online briefings, and on-the-job training sessions.

This capacity-building effort was anchored in a structured co-development process (Carter et al., 2019), which guided its implementation in five iterative phases:

1. Identifying key actors and building partnerships, starting with a survey and exploratory missions to assess general needs and establish collaboration.
2. Building common ground, through foundational training in Niger and Burkina Faso and immersion of local trainees within the Italian forecasting environment.
3. Co-exploring operational needs, enabling local teams to test models on their infrastructure and reflect on service improvements.
4. Co-developing solutions, such as customizing model chains, refining post-processing workflows, and fine-tuning outputs via remote and in-person support.
5. Evaluating outcomes, including validation of model forecasts with observational and satellite data, and continuous revision of products and tools via weekly briefings.

Compared to conventional training programmes, this integrated approach demonstrated several advantages: it fostered a shared understanding of local and technical challenges, established competent focal points in each NMS, and promoted iterative learning and trust-building. The

dynamic feedback loop between training, implementation, and evaluation has strengthened not only the technical capacities but also the collaborative relationships among African and European meteorological institutions, paving the way for sustained innovation in early warning services.

Building Local Capacity through Cascading Agrometeorological Training in Niger**A scalable model from the PRIMESA initiative****ID: 11****Authors:**

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Abstract

Within the framework of the PRIMESA initiative, funded by the Italian Agency for Development Cooperation (AICS), a structured multi-scale training program is being implemented in Niger to enhance the use of agrometeorological information for climate-resilient agriculture. In collaboration with the National Directorate of Meteorology (DMN) and the Ministry of Agriculture of Niger, this training scheme builds on lessons learned from the earlier ANADIA project and aims to reach farmers through a cascading training model.

The program begins at the national level, where international experts train technical staff from the DMN and the Ministry of Agriculture on key topics such as the use of low-cost rain gauges (pluviomètres paysans), seasonal forecasts, and 10-day agrometeorological bulletins to support decision-making in agronomic crop management. These national trainers then deliver training at the regional level to agricultural extension officers, who subsequently work directly with farmers in the field.

The approach combines in-person sessions, practical demonstrations, printed and digital materials, and communication via rural radio and WhatsApp groups during the growing season. Preliminary evidence shows that trained farmers not only better understand weather and climate information but also apply it more effectively leading to improved yields.

This experience underscores the importance of co-developing training content with local actors and creating robust, multi-level partnerships to ensure that meteorological information is not only disseminated but understood and used effectively at the community level. The model developed in Niger offers a replicable approach for other regions facing similar challenges in agricultural adaptation and training dissemination.

Inter-institutional collaboration to strengthen capacities in early warning systems for the implementation of impact-based forecasts at regional level**ID: 14****Authors:**

Daniela D'Amen; National Meteorological Service; Argentina.
Carolina Cerrudo; National Meteorological Service; Argentina.

Julián Goñi; National Meteorological Service; Argentina.
Juan Bazo; Climate Centre; Peru

Abstract

Early Warning Systems (EWS) represent one of the fundamental tools for disaster risk management (DRM). The goal of the Early Warning for All (EW4All) initiative is to ensure that, by 2027, every person on the planet is protected by an early warning system that contributes to the protection of life, property, the environment and the reduction of economic losses. This initiative establishes four pillars, or core elements, that make up the early warning chain, which are led by the respective organizations:

- Pillar 1: Understanding disaster risk (UNDRR).
- Pillar 2: Detection, observation, monitoring, analysis and forecasting of hazards (WMO).
- Pillar 3: Dissemination and communication of warnings (ITU).
- Pillar 4: Preparedness and response capabilities (IFRC).

In this context, the National Meteorological Service of Argentina, the WMO Regional Training Centres in Argentina and Peru and the Climate Centre of the International Federation of Red Cross and Red Crescent Societies (IFRC), in coordination with the main implementing agencies of the initiative, held the first webinar in May 2024 to raise awareness of the need to join efforts to achieve the goal of the EW4All initiative. This meeting brought together 400 participants from all over the Americas with the aim of strengthening collaboration between the different agencies, sharing work experiences, improving the communication of warnings and alerts, promoting the implementation of impact-based forecasts and the cataloguing of severe events (WMO, 2024).

In order to give continuity to this process of interaction, the National Meteorological Service of Argentina and the Climate Centre of the International Federation of Red Cross and Red Crescent Societies, together with the collaboration of the Regional Training Centres of Argentina and Peru, developed from 12 to 30 May 2025 the virtual course "Strengthening strategic collaborations for the implementation of impact-based forecasts" with the objective of recognizing the importance of impact-based forecasts for risk communication, acquiring tools and good practices for the implementation of these forecasts and identifying possibilities for partnerships and instances of collaboration between agencies. The content of the course emphasized a cross-cutting approach based on the various pillars of the EW4All initiative and was oriented to staff from scientific and technical organizations involved in issuing early warnings, National Disaster and Emergency Risk Management Offices, humanitarian sector personnel, and NGOs. The course had 468 participants from 22 different countries, and it was dictated in Spanish in this first edition.

Hackathons: Accelerating Collaboration to Deliver High-Impact Meteorological Training — From Concept to Implementation in Days**ID: 15****Authors:**

Heleen ter Pelkwick, EUMETCAL Programme/KNMI, The Netherlands

Fabienne Werder, EUMETCAL Programme/MeteoSwiss, Switzerland

Tsvet Ross - Lazarov, EUMETCAL Programme/COMET Programme, United States of America

Tomislav Marekovic, EUMETCAL Programme/DHMZ, Croatia

Abstract

Experience how the EUMETCAL Programme harnesses the energy of hackathons to energise innovation, collaboration, and high-impact learning in meteorological training. The EUMETCAL hackathons brought together experts from multiple National Meteorological Services to rapidly co-develop e-learning modules on a variety of different meteorological topics and to produce materials that would otherwise have taken months to create. These immersive, hands-on events foster dynamic teamwork, accelerate creation of blended learning content, and strengthen community bonds across services. This presentation will unpack how hackathons serve as a powerful vehicle for empowering trainers, sharing expertise, and delivering targeted, efficient training aligned with WMO competency standards. Attendees will leave inspired by EUMETCAL's scalable approach to community-driven education and with an idea / insight on how hackathon-style collaboration can be adopted globally to elevate meteorological capacity building.

The EUMETCAL programme: How a Collaboration within the Meteorological Education and Training Community works.**ID: 16****Authors:**

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Tomislav Marekovic, EUMETCAL Programme/DHMZ, Croatia

Fabienne Werder, EUMETCAL Programme/MeteoSwiss, Switzerland

Tsvet Ross - Lazarov, EUMETCAL Programme/COMET Programme, United States of America

Abstract

This poster will introduce conference participants to the EUMETCAL Programme. EUMETCAL is the collaborative network of Europe's National Meteorological Services, dedicated to boosting education and training opportunities across the community. We connect trainers, share expertise, and co-create engaging online and blended learning resources that meet WMO competency standards. From interactive webinars and coaching to a growing e-learning catalogue on satellite, radar, and BIP-M competencies, EUMETCAL empowers Members to deliver high-quality, cost-effective training. Our Achievements include an expanding e-learning catalogue on satellite, radar, and WMO BIP-M competencies, developed through partnerships with Members and the wider WMO Global Campus community. Together, we are building an active network of educators who innovate, share, and shape the future of meteorological training—while avoiding duplication and maximising collective impact.

Survey on weather-specific training of (future) deck officers. Early preliminary results.**ID: 17****Author:**

Brindusa Cristina CHIOTOROIU; Constanta Maritime University, Romania;

Abstract

The STCW Convention and Code (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers) are currently undergoing a comprehensive review and revision process, with the goal of updating global standards for seafarer training, certification, and watchkeeping to reflect new trends and challenges in the maritime industry.

The purpose of this study is to address outdated weather training requirements both at operational and managerial levels.

In this regard a survey was conducted among students enrolled in the Bachelor- and master-level programmes in Constanta Maritime University, Romania. The respondents had weather-specific training during their bachelor studies, according to the IMO curricula at operational and managerial levels and at least 3 months of sea experience.

The survey questionnaire includes a mixture of quantitative and qualitative questions with the aim to see if their weather training is useful for their at-sea experience.

The early conclusions highlight the most common weather sources used today onboard and the effectiveness of different types of weather training in weather skills' development.

Integrated and Immersive Training for monitoring climate effect on different ecosystem compounds: from past experiences to proposal of collaborations among RTC WMO, European LTER Network, National Research Council of Italy and LaMMA Consortium, at Pianosa Research Base (Italy)

ID: 20

Authors:

Francesco Sabatini; IBE-CNR; Italy
 Giulio Betti; LaMMA Consortium; Italy
 Lorenzo Gardin; IBE-CNR; Italy
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 Anita Maienza; IBE-CNR; Italy
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 Francesco Primo Vaccari; IBE-CNR; Italy

Abstract

The island of Pianosa (Tuscan Archipelago National Park) offers unique characteristics that make it an ideal open-air laboratory for scientific research and training. Its limited human presence, combined with distinct climatic, geological, hydrological, and ecological features, provides exceptional conditions for studying environmental processes in both terrestrial and marine ecosystems. The island's historical legacy as an Agricultural Penal Colony ceased in 1998, and its current status as a protected area, further enhance its value for research and environmental education. Within this context, the Pianosa Research Base (BRP-CNR), managed by three institutes of the National Research Council of Italy (Institute of Bioeconomy, IBE, Institute of Geosciences and earth resources, IGG, and Institute of Marine Environmental Research, ISMAR), provides a strategic infrastructure for supporting scientific and training activities.

Introduction and context

The Institute of Bioeconomy (CNR-IBE), also acting as a WMO Regional Training Centre -RTC (<https://rtc-moodle.ibe.cnr.it/>), has longstanding experience in capacity building, environmental monitoring, and climate science education. In collaboration with LaMMA Consortium (<https://www.lamma.toscana.it/en>), IBE has developed a training model that combines classroom learning with hands-on experience in the field. This proposal aims to bring together these assets—Pianosa as a natural lab and IBE's expertise in training—to create immersive, interdisciplinary learning experiences focused on climate change, environmental monitoring, and sustainable management. The initiative exploits synergies with the eLTER network and other CNR institutes to support the development of replicable, high-quality training modules targeting early-career researchers, technicians, students, and public administration staff.

Methodological and Training Approach

The proposed training model is hybrid, experiential, and transdisciplinary. It combines classroom instruction with fieldwork, digital tools, and collaborative problem-solving. Participants could include early-career researchers, technicians, public administration staff, and students. Core themes include observations across different environmental compartments, climate modeling, sustainable resource management, and scientific communication. Activities foster active learning through data collection, analysis, and presentation, integrating digital platforms and remote sensing tools.

Strengths and Challenges of the Proposed Training Model

While the integrated training model offers significant educational and collaborative benefits, it is important to acknowledge both strengths and challenges.

Pros:

- High educational value through experiential learning.
- Strong institutional collaborations enhance credibility and resource sharing.
- Possibility to work in an ideal open-air laboratory (Pianosa).
- Technical infrastructure, instrumentation and connectivity available on site..
- Potential for international visibility and alignment with European infrastructures

Cons:

- Logistical complexity due to island location, requiring careful planning of transportation and equipment.
- Higher costs for meals and transport.
- Access potentially limited due to seasonal constraints , environmental and law regulations due to the coexistence of several Public institutions (Tuscan Archipelago National Park ; Ministry of Justice , local authorities etc..).
- Risk assessment (accessibility/distance from hospitals and emergency rooms), insurance coverage.

Proposed Teaching Program for the Meteorology Engineering Cycle**ID: 21****Authors:**

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Khalida Bekrentchir, Institut Hydrométéorologique de Formation et de Recherches - Oran, Algeria.

Abstract

Proposed teaching program for the Meteorological Engineer training cycle

This paper proposes a structured teaching program for the Meteorological Engineering training cycle, designed to meet the growing scientific and professional demands of the field. The curriculum is built on a strong foundation in mathematics, physics, computer science, and atmospheric sciences, and progresses toward advanced modules in synoptic meteorology, climate dynamics, numerical weather prediction, hydrology, and environmental monitoring.

The program emphasizes the use of modern technologies such as Geographic Information Systems (GIS), remote sensing, and data science, while also promoting hands-on learning through laboratory work, field observations, and internships in meteorological centers. Cross-cutting themes—including climate change adaptation, disaster risk reduction, renewable energy applications, and sustainable resource management—are integrated to ensure a multidisciplinary perspective.

By aligning with international standards and the guidelines of the World Meteorological Organization (WMO), the program seeks to prepare future meteorological engineers with the knowledge and skills needed to address emerging challenges in weather forecasting, climate services, and environmental management. Ultimately, it aims to produce graduates capable of contributing both nationally and internationally to scientific research, operational meteorology, and policy support.

Current training activities and programs conducted by VLab CoE Morocco**ID: 34****Author:**

Tahar Saouri, Institution: General Directorate of Meteorology, Morocco

Abstract

The Morocco CoE, which is specialised in Satellite training for Meteorology, is responsible for conducting training activities in order to improve the use of satellite data and products from meteorological and environmental satellites through advanced remote sensing training. Our key partners are EUMETSAT, ASMET and MetEd. The (CoE) of Casablanca have organized various online and in-person courses in recent years in different topics like nowcasting, maritime and identification of atmospheric and surface features. The center of excellence have also ensured the activities related to asmet15, the learners received the require skills to forecast and monitor strong winds and dangerous waves using observational tools, numerical models and case study analysis of extreme marine weather events.

Moreover, training needs and some evolving challenges for satellite training based on the experiences of organizing training courses have been encountered such as the management of a heterogeneous group with different levels of knowledge and the fundraising for learning activities and training tools

Finally, In order to implement well its training activities, to support and enhance training and capacity development efforts and therefore to ensure that these activities are aligned with the application of new technologies and strategies in meteorology and training, the future strategic objectives of CoE Morocco have been set in particular the creation of new Training modules and resources on MTG in collaboration with other CoEs and EUMETSAT for maintaining and enhancing the users' skills.

Teamwork in Action: Team in Action: Co-Creating Resources and Course Together

ID: 39

Authors:

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Abstract

Since its recognition as the WMO Regional Training Center in Indonesia, the Indonesian Agency for Meteorology, Climatology, and Geophysics (BMKG) has been involved in a number of efforts and initiatives to build courses and develop learning resources. The courses were designed in collaboration with staff members from other NMHSs, education and training partners and related communities. This joint effort brought together Subject Matter Experts (SMEs), Instructional Designers (IDs), and supervisors to co-create a shared learning resource.

Through the development of the course, our team was faced with various challenges, not only related to the aspects of the course (e.g., structure and coherence of resources, module refinement, and course sustainability), but also in maintaining effective collaboration and the dynamics across roles in the team, related institutions, and satellite communities. Prior studies recommend that elements such as commitment, regular discussions, and institutional support are essential to keep the project aligned and moving forward. Another study from Nortvig & Christiansen (2017) showed that projects have a greater tendency to thrive if the institutions involved tackle the challenges jointly.

This poster will discuss the three layers of collaboration, the dynamic challenges, how to overcome them, as well as insights and lessons learned from developing resources. They are summarized as follows:

1. Collaboration Between Roles (SMEs and IDs):

The interaction between SMEs and IDs has been educational for both sides: SMEs provided technical expertise, while IDs brought pedagogical and learner-focused design. Through this exchange, SMEs evolved from merely providing an excess of materials to being thoughtful about how to align those materials, while IDs began to carefully ensure that the materials were not overly simplistic. We addressed challenges such as misaligned expectations, role friction, or shifting availability by adopting a relational working approach in terms of aligning motives, building shared purpose and sense of belonging, and sharing responsibility. Regular meetings and consistent communication are the key.

2. Collaboration Between Organizations:

The project prioritized existing resources from partner institutions, which often used different platforms and frameworks. This has led to findings, such as incoherency in format, scope, and learning outcomes, as well as challenges with copyright and platform compatibility. We found that using connected systems for broader accessibility can be a solution. In this way, we achieved harmonization of learning outcomes with the available resources.

3. Collaboration Between Communities and Entities:

Communities such as CALMet, CONECT, VLab, RTC networks, and other related groups act as developers, reviewers, and pilot partners in the process. Sustaining their collaboration requires regular updates on contacts, resources, activities, and new products, yet fragmented or outdated information remains a challenge. We managed to find a workable solution to this challenge by using formal knowledge-sharing that agreed among partners.

To sum up, from this project, we acknowledged that working in collaboration requires full commitment, regular discussions, and a sense of belonging between involved parties.

Leveraging Satellite Data for Disaster Management: Collaboration from the Brazilian VLab Center of Excellence in Developing Training Resources for Flood and Thunderstorm Monitoring to Support the Early Warning for All Initiative**ID: 45****Authors:**

Diego Souza; INPE; Brazil

Regina Ito; INPE; Brazil

Caio Sena; INPE; Brazil

Abstract

Since 2007, the Brazilian National Institute for Space Research (INPE), through its Meteorological Satellites and Sensors Division, has served as a Centre of Excellence (CoE) within the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS) Virtual Laboratory for Education and Training in Satellite Meteorology (VLab). As a CoE, INPE supports the WMO Space Programme by enhancing the utilization of satellite data, particularly for developing countries in South and Central America and Portuguese-speaking African nations. In 2024, INPE joined the WMO-CGMS VLab pilot training initiative for WMO Regional Associations III and IV, focusing on creating training resources in native languages for priority meteorological hazards. This effort directly supports the WMO's Early Warnings for All (EW4All) initiative by targeting floods and thunderstorms. These hazards were identified through a WMO Rapid Assessment survey and recognized as national priorities in Brazil by the WMO Regional Office for the Americas and the World Weather Research Programme. Brazil's diverse geography and climate make it highly vulnerable to flash floods and severe thunderstorms, which often lead to urban flooding, infrastructure damage, crop losses, and, unfortunately, loss of life or displacement of populations. The catastrophic 2024 Rio Grande do Sul floods, between the end of April and mid-May 2024, are included as one of the case studies in the developed training resources, illustrating these risks. Persistent heavy rainfall and storms caused Guaíba Lake in Porto Alegre to rise to 5.31 meters, surpassing the 1941 record, resulting in over 180 fatalities, landslides, and widespread destruction. Such events underscore the urgent need for effective early warning systems and targeted training. INPE's training resources leverage satellite observations from geostationary platforms, including GOES-East's Advanced Baseline Imager (ABI) and Geostationary Lightning Mapper (GLM), as well as Low Earth Orbit (LEO) satellites such as the Joint Polar Satellite System (JPSS). Materials include RGB composites, precipitation rates, precipitable water, soil moisture, and nighttime imagery, enabling near-real-time monitoring of floods and thunderstorms. They also incorporate meteorological analyses of atmospheric troughs, subtropical jet streams, and low-level jets that contributed to the 2024 flood severity. Through this pilot initiative, INPE collaborates with CoEs in Argentina, Barbados, and Costa Rica, sharing expertise to develop regionally tailored training resources. This collaborative approach strengthens capacity in satellite meteorology, particularly for resource-limited regions, and supports EW4All's goal of enhancing early warning systems by 2027. This poster will present INPE's experiences in developing and implementing these training materials, highlighting strategies for collaboration among regional CoEs, the integration of satellite and meteorological data, and lessons learned from addressing priority hazards. By sharing these experiences, the initiative exemplifies how regional cooperation and targeted training can bridge knowledge gaps, promote the effective use of satellite data, and ultimately contribute to more resilient early warning systems in the Americas.

Training Resources for Hazard Monitoring using Satellite Information: SMN Center of Excellence's Contribution to the Early Warning for All Initiative

ID: 46

Authors:

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 Juan Ignacio Vera Amor; SMN (National Meteorological Service); Argentina

Abstract

Within the National Meteorological Service (SMN) of Argentina, a Regional Satellite Meteorology Training Center of Excellence (CoE) has been operating since 2009 under the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) initiative of the World Meteorological Organization (WMO). Various initiatives have been implemented within the CoE for the region, especially for Spanish-speaking countries. Training in satellite-related topics is a constant challenge due to the new technologies and innovations in the sector, requiring continuous updates from meteorological services.

In 2023, the WMO approved its 2024-2027 strategic plan, highlighting the Early Warning For All initiative and a capacity development framework. One of its main objectives is monitoring hazards and their impacts. During 2024, the SMN CoE Argentina was invited by VLab to develop training materials for meteorological and hydrological services in Spanish as part of an initiative carried out in the Regional Association III and IV. The goal of this project is to promote the use of satellite tools for monitoring the region's main hazards so they can be utilized to improve early warning systems in national meteorological and hydrological services (NMHS). Due to their impact on aviation and related sectors, the SMN CoE Argentina selected two threats for training material development: fog and volcanic ash.

The dispersion of volcanic ash in the atmosphere, originating from volcanic eruptions and wind erosion of volcanic ash deposits, causes environmental impacts and affects human activities at different scales, making its detection of utmost importance. The Volcanic Ash Advisory Centre (VAAC) Buenos Aires at the SMN monitors the presence of volcanic ash to contribute to aviation safety. Monitoring and tracking volcanic ash clouds through remote sensors mounted on board satellites is possible. The training resource will explore multiple tools for monitoring the different stages of the Ubinas volcano ash plume using BTD, Ash/SO₂ RGB, and ABI-L2-VAAF satellite products. Students will analyze data from the July 19, 2019 eruption during which a large explosion expelled ash and gases over six kilometers above the volcano's crater. By using this resource, students will gain insights into early warning systems for volcanic ash-related hazards, enhancing their capabilities in supporting aviation safety and disaster response efforts.

On the other hand, fog has a significant impact on the normal development of socio-economic activities as it directly affects airport operations. Therefore, adequate monitoring and forecasting to improve early warning systems is a priority for NMHSs. The information provided by meteorological satellites is critical for diagnosing and monitoring areas affected by fog and low stratus with high temporal and spatial resolution. The goal of this resource is to provide students with satellite tools for identifying and monitoring fog using various products, such as BTD or an RGB composite. To achieve this, students will analyze data from a case study recorded over Argentina that affected several airports in the region.

By developing these training resources, the SMN CoE Argentina aims to strengthen the capacities of NMHSs in the region, enhancing their ability to monitor and respond to atmospheric hazards.

Developing Courses on Data Analysis for Climate Services in Ukraine

ID: 47

Authors:

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Abstract

Climate services are increasingly important for decision-making in sectors such as agriculture, water management, and energy. However, their effectiveness depends on the availability of professionals trained in advanced methods of data analysis and interpretation. This paper presents the development of specialized courses on data analysis for climate services in Ukraine, designed for master's students in meteorology and related disciplines. The courses integrate theoretical foundations with practical exercises in handling observational datasets, reanalysis products, and climate indices, using modern tools such as R and Python. Particular attention is given to data quality control, homogenization, and visualization techniques. The initiative contributes to capacity building in climate services and supports the integration of Ukraine into the European and global climate education network.

The course "Data and Information for Climate Services" (DICS) is one of the core components of the professional cycle of disciplines within the master's program "Climate Change Mitigation and Adaptation" <http://re.climed.network/course/view.php?id=26>

This course aims to equip professional meteorologists, senior and mid-level managers in meteorological services, as well as master's students in the natural sciences, with the skills to work effectively with climate databases for the provision of climate services.

Competencies. Participants will gain the ability to access, process, and interpret climate information to meet end-user needs, making use of major international services and climate data repositories (e.g., IRI/LDEO Climate Data Library, Copernicus Climate Data Store, IS-ENES Climate4Impact, etc.).

Whenever possible, a blended learning format is recommended for master's students, as it enables them to organize their study schedule more effectively. Given their academic background, master's students are generally well-prepared for online learning, since they typically demonstrate strong independent learning skills, effective time management, and high motivation. It is essential to adapt the learning process to the individual needs and interests of each student, offering opportunities to select the topics of practical assignments. Such individualization fosters deeper engagement and enhances student motivation.

The learning activities will include lectures and practical exercises delivered either in the classroom or online. Case studies will be conducted using time series of meteorological and climate data, enabling students to analyze the spatiotemporal distribution of climate indicators and assess climate change.

Practical exercises will focus on retrieving climate data from various sources and generating time series. The main tasks will involve the computation of fundamental climate products, such as climatological normals and anomalies, as well as Climate Indices defined by the WMO.

Tests will be administered for each topic of the DICS. At the end of the course, a final assessment of learning outcomes will be carried out, consisting of both theoretical and practical components (40 questions in total). Given the current challenging conditions in Ukraine, master's groups may be offered asynchronous online learning, complemented by the option of synchronous sessions.

Courses on data analysis for climate services are essential for building national resilience and supporting evidence-based decision-making in key sectors. For Ukraine, such programs strengthen

integration into European initiatives and prepare a new generation of experts capable of addressing the challenges of climate change.

**Building Competence for Observers and Forecasters in Timor-Leste toward
GBON Compliance****ID: 55****Authors:**

Noer Nurhayati, BMKG; Indonesia
Wadayantolis, BMKG; Indonesia

Abstract

Global Basic Observing Network (GBON) represents a significant change in how countries exchange observational data that is important for accurate weather, climate, and water services. For Timor-Leste, a small island developing country in Southeast Asia, the gap analysis and reviewed of GBON was made in 2023 under the Systematic Observations Financing Facility (SOFF) program; a UN- Funded program co-created by WMO, UNDP and UNEP to close the climate and weather observations data gap in countries. The gap analysis study revealed that Timor-Leste requires at least two observation points based on the GBON horizontal requirement for surface observation stations. Another gap is the lack of proper telecommunication system to submit the report through GTS or WIS 2.0. Partnering with FMI and UNEP as SOFF peer advisor and technical partner, BMKG will continue support the end-user engagement, regional networking, and advanced training on observation systems, calibration, and IT operations for DNMG, the NMHS of Timor-Leste.

Prior to the commencement of SOFF, there has been an UNEP–GCF project “Enhancing Early Warning System to Build Greater Resilience to Hydro-Meteorological Hazards in Timor-Leste (FP171)”. In response to the Seroja Tropical Cyclone (2021) and learning from its catastrophe, this project supports Timor-Leste in strengthening climate information services and early warning systems. Through this project, there will be renewal and replacement of 9 AWSs and 2 AWOS in Timor-Leste. In this GCF project, BMKG’s role focuses on building the technical capacity of DNMG staff through a series of training in basic meteorology, surface observation, field calibration, and quality management. Throughout the three years period from 2022 to 2024, as much as 24 DNMG staff received training via benchmarking, on-the-job training, workshops, and site inspections in Indonesia (Jakarta, Kupang, Denpasar) and in Timor-Leste (Dili, Suai). Gender balance was also considered in participants selection. Further training and knowledge transfer activities have been delivered and shall persist from BMKG’s meteorologists, meteorology technicians, senior lecturers, forecasters and observers to DNMG technical staff using hands-on training and project-based learning methods. After each training, participants were given assignments in the form of action plans to be implemented at DNMG Timor-Leste. The training evaluation was conducted using the third level of Kick Patrick’s model to measure whether the training was impactful and applicable in the country. In addition, continuous communication between trainers and participants, as well as coaching and mentoring processes, is expected to produce palpable output and beneficial outcomes from the collaboration between the two countries.

Collaborative Training Through the WMO-CGMS VLab Regional Focus Group of the Americas and the Caribbean**ID:** 60**Authors:**

Erin Sanders; Cooperative Institute for Research in the Atmosphere; USA

Bernadette Connell; Cooperative Institute for Research in the Atmosphere; USA

José Gálvez; Cooperative Institute for Research in the Atmosphere; USA

Abstract

The Regional Focus Group (RFG) of the Americas and the Caribbean is part of the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS) Virtual Laboratory for Education and Training in Satellite Meteorology (VLab). It is a collaborative training effort between the National Oceanic and Atmospheric Administration, USA and the WMO Centres of Excellence in Argentina, Barbados, Brazil, and Costa Rica. More than 250 monthly virtual sessions have been conducted since it began in 2004, and over these years participants have joined in from 70 countries, building an international community of practice and learning with a focus on satellite imagery and products for operational use. The weather briefings address regional forecasting challenges across meteorology, hydrology, and related disciplines. The success of the RFG is in its ability to make global connections through the exchange of regional knowledge and perspectives, skills, technologies, and diverse expertise. We will reflect on the importance of a collaborative and international approach and demonstrate that informal interactions can enhance training through relevant discussion and observational learning.

Empowering Women for Resilient Weather, Water and Climate Services**ID: 62****Authors:**

Luciane Veeck; WMO; Switzerland

Izel Guven; WMO; Switzerland

Maria Mercedes Baca; WMO; Switzerland

Abstract

Advancing gender equality in science is fundamental to achieving the Sustainable Development Goals and to strengthening the global response to climate-related challenges. Women remain underrepresented in meteorology, hydrology, and climate sciences, despite their crucial role in advancing research, innovation, and the provision of services that support societies' resilience to extreme events and climate change.

This poster highlights the importance of promoting the participation, leadership, and recognition of women in these fields, in line with United Nations system priorities and WMO commitments to gender equality, diversity and inclusion. It presents key facts on the current status of women in science, outlines barriers that persist in professional and academic environments, and illustrates good practices that are helping to foster equitable opportunities.

By drawing attention to these issues, the poster seeks to encourage dialogue and action within the education and training community. Ensuring the full engagement of women in meteorology, hydrology, and climate sciences is not only a matter of fairness, but also a prerequisite for excellence in science and for delivering services that meet the needs of all communities.

Climatic and Socio-Economic Indicators in Climate Product Design for Climate Services**ID: 65****Authors:**

Larysa Nedostrelova; Odesa I.I. Mechnikov National University; Ukraine

Inna Khomenko; Odesa I.I. Mechnikov National University; Ukraine

Halyna Borovska; Odesa I.I. Mechnikov National University; Ukraine

Halyna Katerusha; Odesa I.I. Mechnikov National University; Ukraine

Abstract

The course "Climate Products (Climatic and Socio-Economic Indicators for Climate Services)" is a fundamental part of the professional curriculum within the Master's program in Climate Services. Its primary aim is to prepare experts capable of utilizing advanced tools and methodologies to deliver high-quality, user-oriented climate information, along with clear explanations of its potential uses. Students will learn to develop and analyze various climate products relevant to different regions and time scales. Human activities have significantly disrupted the natural substance cycles in the biosphere – cycles that have evolved over millennia. Climate change further transforms natural resources, impacting not only those directly related to the climate but also those indirectly influenced by changing climatic conditions. The primary audience for this course consists of master's-level students at higher education institutions in Ukraine who are pursuing studies in the field of climate services. Additionally, the course can serve as a professional development or upskilling opportunity for specialists in meteorology and climatology, as well as for professionals in other sectors where climate-based decision-making is essential.

Impact-based Forecasting in the Caribbean**ID:** 66**Authors:**

Hugh Atherley; Caribbean Institute for Meteorology and Hydrology; Barbados

Shawn Boyce; Caribbean Institute for Meteorology and Hydrology; Barbados

Abstract

The Caribbean Institute for Meteorology and Hydrology (CIMH) is a World Meteorological Organization (WMO) Regional Training Centre (RTC) that delivers training to meteorological, hydrological and climate service personnel among others at various levels. The CIMH is currently collaborating with partners through the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) to develop training resources to enhance impact-based forecasting workflows for flooding in support of the WMO Early Warnings for All (EW4All) initiative.

The Small Island Developing States (SIDS) of the Caribbean are affected by several natural hazards such as severe weather, flooding, tropical cyclones, landslides, drought, fires, earthquakes and volcanoes. These challenges are exacerbated by their small size and modest Gross Domestic Product (GDP) to support resilience building and recovery. Notwithstanding, effective early warning systems provide a mechanism to enhance mitigation and reduce losses. The SIDS in the Caribbean are highly exposed to hydrometeorological hazards which often interact. Such interrelations often complicate impact forecasting and assessments resulting in unexpected losses.

On November 14, 2024, Sara, the eighteenth named storm of the 2024 Atlantic hurricane season formed from a tropical depression in the Caribbean Sea near the coast of Honduras. Although it did not develop into a hurricane, its slow movement and heavy rainfall caused severe flooding, particularly in Honduras, Belize, Nicaragua, and Guatemala.

This poster presents a training module tailored to National Meteorological and Hydrological Services (NMHSs) in Caribbean SIDS which provides guidance on the integration of satellite-based products within impact-based forecasting workflows for flooding. Training is reinforced through a case study application focused on the impact of Sara on Belize. The primary objective of the module is to build technical and institutional capacity in the Caribbean region for implementing and operationalizing impact-based forecasting for flooding. Specific objectives include the (i) development skills to integrate meteorological, hydrological, and vulnerability data to predict and communicate likely impacts, (ii) application of locally relevant products and services, (iii) promotion of coordination between National Meteorological and Hydrological Services (NMHSs), disaster management agencies, and other response personnel and (iv) fostering of regional knowledge sharing and cooperation across Caribbean SIDS.

Following the completion of the module, participants should be able to (i) understand the components of an early warning system, (ii) understand the impact-based forecasting process, (iii) identify satellite-based products which support impact-based forecasting and early warning in the Caribbean and (iv) manipulate and apply products to assess expected flood impacts and validate forecasts in part through the use of a case study. Collaboration with other Centres of Excellence (CoEs) and the sharing of VLab resources support continued capacity building for the benefit of the hydrometeorological community.

International and National Legal Instruments on Climate Change**ID: 67****Authors:**

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Oleh Prokofiev; Odesa I.I. Mechnikov National University; Institute of Climate-Smart Agriculture of the National Academy of Agrarian Sciences of Ukraine; Ukraine

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Abstract

The course “International Agreements and National Legislation in the Field of Climate Change” is a fundamental part of the professional curriculum within the master's program “Climate Change Mitigation and Adaptation.” It is designed to enhance students' analytical competencies in environmental and climate law, build a solid understanding of states' legal obligations and the mechanisms for fulfilling them, and promote practical approaches for aligning national legislation with international climate standards. The course's primary objective is to provide students with comprehensive knowledge of both international agreements and domestic climate-related legislation, emphasizing their significance in shaping global and national climate policies. It explores major international legal frameworks such as the Paris Agreement, the Kyoto Protocol, and the UN Framework Convention on Climate Change, along with their implementation mechanisms and Ukraine's legislative and policy responses to climate change. The course primarily targets master's students at Ukrainian institutions of higher education specializing in climate services. However, it may also serve as a professional development opportunity for specialists in meteorology, climatology, and related fields where climate-informed decision-making is essential. This includes policymakers, legal professionals, public officials involved in environmental governance or international cooperation, as well as civil society actors and experts interested in climate policy implementation.

Enhancing Meteorological and Hydrological Service Capacities and Regional Cooperation through the ENANDES+ Project

ID: 68

Authors:

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Abstract

The ENANDES+ project, titled "Strengthening climate adaptation capacities through the implementation of climate services" (WMO, 2023), is a significant initiative aimed at enhancing the capabilities of National Meteorological and Hydrological Services (NMHS) in six Andean countries (Argentina, Bolivia, Chile, Colombia and Peru) to produce essential weather, water and climate (WWC) services. Funded by the Swiss Agency for Development and Cooperation (SDC), the project also seeks to improve institutional coordination, involve social actors in WWC service co-design, and optimize regional planning through South-South Cooperation or South-South Twinning (SST), a model based on joint efforts and collective knowledge exchange.

A key coordinating body for effective technical coordination is NUREX (Regional Expertise Nucleus), comprising six NMHS, two Regional Climate Centers (RCC), and two Regional Training Centers (RTC) from Region III and MeteoSwiss. This works specifically focuses on the contributions of CRF-ARG, CRC-SAS, and SMN of Argentina in capacity development within the project's SST framework and the continuous collaboration of MeteoSwiss.

Under ENANDES+, 29 SSTs were established across nine thematic areas. SMN leads Frost and WIGOS SSTs, while CRC-SAS leads Climate and Data SST. RTC-ARG plays an active role in all these SSTs, assessing training needs, and organizing joint work plans and implementation with partners, like RTC-Peru, to optimize resources and avoid duplication.

Between 2024 and 2025, eight courses were conducted for Spanish-speaking countries, utilizing the RTC-SMN's Moodle platform, synchronous meetings, and in-person training at SMN. Additionally, MeteoSwiss specialists conducted technical missions to Andean countries, including Argentina, where hybrid workshops on topics like data management and WIGOS were held in May and November 2024. Videos and lectures are accessible on the RTC-SMN Moodle platform.

As the ENANDES+ project approaches its conclusion in 2026, its primary goal is to serve as a model of good practices in regional and global capacity development cooperation.

**Utilizing AI for Enhanced, Continuous, and Modular Meteorological Training at RTC SMN Argentina
ID: 69****Authors:**

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Elian Wolfram, National Meteorological Service, Argentina

Abstract

In recent years, the use of new technologies has increased across various fields of scientific activities. With the advancement of digital tools, some of which are derived from Artificial Intelligence (AI), new doors have opened for educational and training activities where digital teaching materials place the student at the center—not only as a reader of content, but also as an active participant who interacts, transforms, and chooses how to enhance their capabilities. In this context, updating or redesigning already created digital resources and developing materials that encourage new generations to continue their training is a challenging yet motivating goal.

The Regional Training Center of the National Meteorological Service (RTC-SMN) of Argentina, recognized by the World Meteorological Organization (WMO) in 1983, has provided capacity development in education and training for meteorologists, forecasters, observers, and other technicians and professionals in these disciplines since its inception. Training is offered to personnel of National Meteorological and Hydrological Services (NMHSs) of WMO Regional Associations III (South America) and IV (Central America).

In 2013, the RTC took a significant step by incorporating virtual education through the Moodle platform, a milestone that allowed for the democratization of continuous training at the national level, breaking down geographical and social barriers that had previously limited access to ongoing educational development within the National Meteorological Service. Additionally, the work of educators was optimized by providing them with tools to create and manage courses, as well as to promote effective communication and collaboration environments between teachers and students.

Currently, the challenges stemming from digitalization and the limitations of access to e-learning platforms have been overcome, enabling an unprecedented expansion of educational outreach. In light of the emergence of new technologies and the widespread use of AI, the RTC is actively working on reformulating modular curricular designs and incorporating new Spanish-language courses to offer to the region. These are enriched with emerging technologies demanded by new generations, such as simulations of real environments and situations to facilitate the development of practical skills and the application of theoretical concepts in safe and controlled contexts.

In this transformative process, AI tools are being incorporated not only to enhance the visual aspects of educational materials but also to improve the design and structuring of courses. These technologies are helping us work more efficiently and creatively, enabling more dynamic, flexible, and learner-centered educational experiences. Furthermore, efforts are being made to strengthen these themes throughout the region, fostering a collaborative approach to innovation in training and ensuring that the benefits of these emerging tools are accessible to a broader community of professionals and students.

Development of the course "Viticulture of Ukraine" for climate service in Ukraine**ID: 72****Author:**

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Abstract

Viticulture in Ukraine has a rich history and continues to develop despite modern challenges. Due to favorable climatic conditions and soil diversity, Ukraine is a promising region for growing grapes and producing wine.

Viticulture is closely linked to climate service, which involves adaptation to different climatic conditions, such as frost resistance and drought. Thus, in the south of the country, irrigation and drip irrigation are necessary, while in the colder northern and eastern regions, winter shelter of vineyards is required.

Successful viticulture primarily depends on the availability of specialists trained in the latest technologies for growing grapes, taking into account the climatic conditions of each region and the choice of varieties.

The specialized course "Viticulture of Ukraine" is designed for master's degree students in the field of agrometeorology, and can also be useful for specialists in growing grapes and producing wine, juices of small and large agricultural holdings.

The purpose of this course is to provide knowledge and skills in the field of viticulture in the use of climate databases to professional agronomists, top and middle managers of winemaking holdings, product suppliers, as well as in the training of master's students in agrometeorology.

The course "Viticulture of Ukraine" includes:

1. Lectures on the theoretical foundations of the discipline
2. Practical classes using observation data and climate indices determined by WMO, based on modern methods of analysis and interpretation of the results.
3. Systems for assessing the level of knowledge gained based on a test system.

It should also be noted that during practical classes, students of the course gain access to international services and repositories of climate information, learn to process and interpret it to meet the needs of end consumers, using modern processing tools such as Rstudio and Python to perform statistical calculations and visualize data.

In organizing the teaching method, a mixed type of information delivery is usually used: online and offline, which allows you to conveniently organize the educational process taking into account the individual needs of each student and increase their motivation and interest in receiving information. Thus, the introduction of the course "Viticulture of Ukraine" not only contributes to raising the level of training of specialists in the field of climate services for such sectors of Ukraine as viticulture and winemaking, but also allows Ukraine to more quickly integrate into the European and global network of climate education.

Shared Guidance and Resources from the WMO-CGMS VLab to Support the Early Warnings for All Initiative**ID: 74****Authors:**

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Zoya Andreeva, WMO-SSU, Switzerland

Abstract

The efforts presented demonstrate the influence of many interconnected communities that have worked together over the past 25 years. These communities connect through the activities of the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS). Two groups of particular importance include the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) and the Satellite Data Requirements Group (SDR). In the early 2000s, both of these groups recognized the importance of adequate access and display of both geostationary and Low earth orbiting satellite imagery and products, and adequate training to use the imagery and products to improve weather forecasts for the public. A long-term goal of VLab is “Globally share knowledge, experience, methods, and tools related to access and usage of satellite data, especially in support of WMO Members that have limited resources.” Objectives that support this include:

- 1) Transfer the improved scientific understanding and technological advances that can lead to enhanced National Meteorological and Hydrological Services (NMHSs), and the evolution of the services they provide.
- 2) Promote the uptake of satellite data in research and institutions.
- 3) Respond to new and emerging service demands for weather, water and climate. These include impact-based decision support services (IDSS) and the application of the Global Framework for Climate Services (GFCS) in support of marine and land applications.

Along the way and with the help of the Social Sciences, we also recognize the importance of communicating an appropriate message to the public.

All these aspects were important for the WMO-CGMS Pilot project to develop training for priority projects under the UN Early Warning for All Initiative (EW4All)

As a follow-on to the training developed under EW4All that is presented in other posters and keynotes, we expand on other available formal and informal resources to reinforce the training developed and provide a community of learning and practice to support one another.

Advancing Competencies in Meteorological Instrument Calibration through WMO Self-Paced Online Training**ID: 75****Authors:**

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Ercan Buyukbas, WMO, Republic of Türkiye

Abstract

Accurate and reliable meteorological observations depend on well-calibrated instruments and competent personnel. To address capacity gaps identified across National Meteorological and Hydrological Services (NMHSs), particularly among technicians working in observation and measurement, the World Meteorological Organization (WMO) has developed a structured self-paced online training course on instrument calibration.

The course is hosted on the WMO Education and Training Programme (ETRP) portal and provides modularized content covering eleven topics, including measurement terminology, metrology in meteorology, calibration of temperature, humidity, pressure, wind, and precipitation instruments, as well as laboratory competencies, inter-laboratory comparisons, and calibration certificates. Each module combines background knowledge, demonstrations, and quizzes, offering learners the flexibility to progress from foundational to advanced levels.

This poster introduces the training development process, learning design, and key resources, and outlines how the course supports WMO Members in strengthening capacity for standardized calibration practices aligned with WMO guidelines. By promoting accessible and cost-effective learning, this initiative contributes to enhancing the global consistency and traceability of meteorological measurements, ultimately supporting better quality data for weather and climate services.

Strengthening Regional Meteorological Training: Case-Based Modules on Hurricanes and Lightning in Costa Rica**ID: 76****Author:**

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Abstract

Costa Rica is undertaking a strategic and collaborative initiative to strengthen regional meteorological education and training through the development of two virtual modules, created under the framework of the World Meteorological Organization's "Early Warnings for All" (EW4All) initiative. This effort is led by one of the country's Regional Training Centers (RTCs)—the University of Costa Rica (UCR), also serving as a WMO-designated Center of Excellence (CoE). In partnership with the National Meteorological Institute (IMN) and the Costa Rican Electricity Company (ICE), the initiative aims to produce high-impact, case-based learning materials that blend academic theory with operational relevance and social attention. The first module focuses on tropical cyclones, specifically Hurricanes Otto (2016) and Iota (2020), both of which had significant impacts on Costa Rica. These cases have been studied over the years in various academic, operational, and research contexts, but this marks the first time they are being formally structured into a comprehensive training module. The module begins with a conceptual definition of tropical cyclones, followed by a theoretical overview of their formation, structure, and forecasting techniques. It then transitions into applied case studies that examine the meteorological evolution of Otto and Iota, the forecasting challenges they posed, and the inter-agency coordination required for emergency response. The module also reflects on the social and environmental consequences of these events, offering lessons learned that are directly applicable to future preparedness efforts. The second module emerged organically from recent inter-institutional collaboration. Initially, ICE was contacted to provide lightning data for general educational purposes. However, during the first meeting, a particularly intense lightning event in Costa Rica's Central Valley on August 12–13, 2025 was identified as a compelling case study. In a subsequent meeting, another tragic event from July 2025 was discussed: a lightning strike that claimed the lives of two individuals, while their daughter survived and walked several kilometers to seek help. This deeply moving story adds a human dimension to the module, emphasizing the urgency of improving public awareness, safety protocols, and educational outreach related to lightning hazards. Both modules are structured in three pedagogical phases: 1. Definition and Conceptual Framing – Introducing the phenomenon with clear terminology and regional context.

2. Theoretical Foundations – Covering the scientific principles and mechanisms behind hurricanes and lightning. 3. Applied Case Studies – Analyzing real events with operational data, institutional coordination, and societal impact. These modules are designed to be interactive, adaptable, and scalable across Latin America. They will serve as reusable training resources for meteorologists, emergency managers, educators, and students, contributing to the sustainability of regional capacity development. The initiative also addresses broader needs, including the expansion of observational networks, deployment of radiosondes, and the cultivation of culturally responsive and engaging educational strategies. By integrating rigorous science, emotional storytelling, and institutional collaboration, Costa Rica's approach exemplifies how regional actors can co-create meaningful educational tools that safeguard communities and strengthen resilience. This initiative aligns also with CALMet CONECT's mission to foster innovation, share best practices, and promote professional development in meteorological and hydrological education. It is both a model of coordinated action and a call to deepen regional cooperation in preparing for the environmental challenges of tomorrow.

Enhancing Early Warnings Systems: Training and Insights from Severe Weather Case Studies in Argentina

ID: 80

Authors:

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Abstract

The Early Warnings for All (EW4All) initiative has fostered collaboration across the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab). Within this framework, Centres of Excellence from Argentina, Barbados, Brazil, and Costa Rica are developing together training resources tailored to the hazards of highest concern in their regions. The selection of hazards was a collaborative effort during VLab meetings, which ensured that regional needs were properly addressed. Each Centre brought its expertise and regional perspective.

As part of the WMO-CGMS VLab Centre of Excellence in Argentina, the Department of Atmospheric and Ocean Sciences at the University of Buenos Aires develops training resources that address the forecasting challenges of WMO Regions III and IV. Our contribution emphasizes collaboration and the adaptation of scientific research into practical education and training tools for early warning applications. A central focus of our work has been the co-development of training materials using two high-impact weather cases from central Argentina: a supercell hailstorm on November 11, 2018, and a strong mesoscale convective system associated with heavy precipitation on December 13 and 14, 2018. Both events were documented during the Remote sensing of Electrification, Lightning, And Mesoscale/microscale Processes with Adaptive Ground Observations (RELAMPAGO) and the Cloud, Aerosol, and Complex Terrain Interactions (CACTI) field campaigns, which provide a unique multi-platform dataset including radars, radiosondes, surface observations, and geostationary satellite data from GOES-16.

The first case, the November 2018 hailstorm, was associated with a supercell that produced significant damage in central Argentina. It was captured by the Advanced Baseline Imager (ABI) and Geostationary Lightning Mapper (GLM) aboard GOES-16, with additional targeted Mesoscale Domain Sector (MDS) scans that allowed high temporal resolution tracking of storm initiation and evolution. This case highlights the value of integrating satellite-based nowcasting tools into forecasting practice, demonstrating their potential for enhancing real-time monitoring and warning systems.

The second case, in December 2018, involved the development of a powerful mesoscale convective system (MCS) triggered by a cold front over central Argentina. Favorable conditions of high instability and strong wind shear supported long-lived supercells, which evolved into a squall line producing heavy precipitation. The system generated widespread severe weather, including urban flooding in Córdoba City. Documented during a RELAMPAGO Intensive Observation Period and later incorporated into the PREVENIR project, this case illustrates the difficulties of forecasting high- impact convection in complex terrain and the importance of combining high-resolution models, radar, and satellite observations for flash-flood early warning.

Building on these two case studies, DCAO-UBA has developed training modules that show practical ways to use satellite and in-situ data together in operational nowcasting. This effort contributes to improving early warning capacity across WMO Regions III and IV. This work will describe how the modules were designed, including how we chose the cases, integrated the available datasets, and adapted the material for training purposes. We will also share the main lessons from this pilot experience and discuss how collaboration with other Centres of Excellence can further improve and expand these resources within the EW4All framework.

INMET: Strengthening Global Collaboration for Training and Capacity Development through Educational Actions and Strategic Partnerships (2023–2025)**ID: 85****Authors:**

Lucietta Guerreiro Martorano, Brazil

Helenir Trindade de Oliveira, Daniella de Oliveira Batista, Lucas Firmo de Lima Silva (INMET)

Abstract

This report presents the actions undertaken by the National Institute of Meteorology (INMET) under the theme “Strengthening Global Collaboration for Training and Capacity Development”, based on data and analyses covering the period from 2023 to 2025. Following the return of in-person activities after the COVID-19 pandemic, interactions between INMET and educational institutions across the country increased significantly, through technical visits that allowed students to experience the operational routine of meteorological and climate monitoring. 1,853 students from 73 educational institutions, representing different educational levels, participated in these activities. To understand the engagement patterns, Principal Component Analysis (PCA) and cluster analysis were applied using eight variables that characterize visit volume, seasonality, and institutional profile. The first two principal components explained 100% of the total variance, with PC1 (81.4%) strongly associated with the number of students and institutions, while PC2 (18.6%) reflected the seasonality and profile of the visits. The biplot clearly highlighted two dominant vectors (students and schools) and grouped the months of 2023 within the quadrant representing higher engagement. In contrast, distinct patterns related to semester and type of institution characterized the distribution of 2024 and 2025. The dendrogram confirmed this separation, revealing two main groups: the first corresponding to the post-pandemic resumption phase (2023), and the second representing the institutional consolidation phase (2024–2025). These actions are fully aligned with the INMET Strategic Plan 2025–2031 and with Sustainable Development Goals (SDGs 4, 13, and 17), consolidating INMET as a strategic actor in capacity development in meteorology both in Brazil and internationally.

EXPERIENCE

Exploration on Enhancing the Human Resources Capacity Building in the Meteorological Industry

ID: 22

Authors:

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Abstract

With the intensification of global climate change and the frequent occurrence of extreme weather events, the significance of the meteorological industry in social and economic development has become increasingly prominent, and the capacity building of meteorological talents has always been a focus of attention. After more than three decades of development, the WMO Regional Training Center (Nanjing) boasts characteristics including long-term training experience, a wide range of professional fields, comprehensive educational and training levels, and a well-established training system. According to the World Meteorological Organization's (WMO) basic capacity building requirements for meteorologists (Basic Instruction Packages for Meteorologists, BIP-M) and meteorological technicians (Basic Instruction Packages for Meteorological Technicians, BIP-MT), the center's training programs have achieved full coverage from short-term professional training for business officials and technical talents to multi-level academic education for degree-oriented talents, including bachelor's, master's, and doctoral degrees. This presentation aims to explore how to further effectively enhance the capacity building of trainees through the analysis of trainees' learning situations, the improvement of the curriculum system, and the enhancement of training quality in the process of training management and service, based on the review, summary, and analysis of the center's work in recent years, to provide stronger talent support for the high-quality development of the meteorological field.

Co-Creating Engaging Learning for Meteorologists: Instructional Design in Practice at MeteoSwiss
ID: 25**Authors:**

Claudia Stocker; MeteoSwiss; Switzerland
Laura Beaudouin; MeteoSwiss; Switzerland
Fabienne Werder; MeteoSwiss; Switzerland

Abstract

At MeteoSwiss, we are applying instructional design principles to create meaningful, practice- oriented learning for meteorologists in line with the WMO competency framework. A recent example is an eLearning module on fog, born during a hackathon, where subject-matter experts and instructional designers worked hand in hand to co-create an engaging learning path with interactive activities grounded in real operational examples. The collaborative process not only fostered innovation, but also highlighted the value of combining expertise in meteorology with modern learning design.

This talk will showcase how our design approach – emphasizing authentic tasks, case-based learning, and reflection activities – engages learners in analysis, evaluation, and application of knowledge in realistic contexts. We will share lessons learned on co-creation, interactivity, and practical strategies to make online training both engaging and impactful for the meteorological community. To mirror our approach, the session itself will include interactive elements designed to actively involve participants, encourage reflection, and spark exchange among peers.

Online learning, are we going too far? The urgent need to maintain face to face engagement
ID: 29

Authors:

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Abstract

Recognizing the unique value of face-to-face (F2F) training is important as online learning grows, especially in fields such as meteorology, where hands-on skills are essential. F2F training offers real-time feedback, increased engagement, and practical demonstrations that online platforms cannot replicate. In-person sessions allow participants to interact directly with equipment, troubleshoot issues, and receive personalized guidance, ensuring both technical understanding and skill development.

The in-house training approach provides a hands-on learning experience in the workplace, allowing trainees to engage with real-time meteorological instruments. With expert trainers offering personalized support, participants can troubleshoot and practice maintenance tasks, ensuring that theoretical knowledge is applied effectively in a real-world setting. This direct interaction with equipment enhances competence and builds confidence in using complex instruments. Additionally, conducting training while performing on-site maintenance ensures efficiency in training budgets by consolidating learning and maintenance activities in one operation, minimizing downtime and resource allocation.

Combining F2F training with online learning modules creates a hybrid approach that combines the convenience of digital platforms with the benefits of in-person instruction. This model improves learning outcomes and fosters teamwork and problem-solving. While online learning offers flexibility, F2F training remains crucial for developing technical proficiency in fields such as meteorology, ensuring a comprehensive and effective training experience.

A Journey in Creating a Flip-To-Classroom Competency Based Subject**ID: 30****Authors:**

Tristan Oakley; Bureau of Meteorology; Australia

Abstract

Moving a subject to be flip-to-classroom can be daunting. How do you know you are on the right path? Will the content work? Is the content engaging? Is there the right balance between text reading and animations?

These are just some of the questions I faced when building the competency-based course, Marine and Oceanography, as part of the Bureau of Meteorology's Graduate Diploma Program. There are different ways to go about the flipping process, and it seems to heavily depend on the objectives of your course to get the balance right.

I will take you through the process I used to build the course from start to finish. I will outline the challenges I faced from lecture based content to be online modules. I will show how moving teaching content online freed up time for more tutorials and practicals to maximise the hands-on learning experience. Most importantly, I want to share the lessons I learnt from the processes, and where I know I can make improvements to the content for the future.

I am by no means an expert in flip-to-classroom, but hope the content presented here will give you ideas or inspire you to give flip-to-classroom a go.

Rebuilding the Fire Weather Competency program at the Australian Bureau of Meteorology**ID: 31****Author:**

James Pescott, Bureau of Meteorology, Australia.

Abstract

In this keynote presentation, I will share my experiences in rebuilding the Fire Weather competency program at the Australian Bureau of Meteorology – a Herculean task spurred by significant changes. Faced with the existential challenge of a new national operating model, major shifts in science and service changes, evolving ways of working, and the ongoing natural attrition of experienced meteorologists, my only choice was to innovate.

To overcome these challenges, I drew on all my 15 years of experience in training and assessment to comprehensively redesign the competency program to align with the new operational roles and service expectations, while ensuring compatibility with WMO standards and the principles of adult education. In particular, I will champion two essential components of the rebuild that proved critical to its success. First, the arduous task of detailing the performance evidence – a process that, once completed, proved pivotal in designing the assessment tools, including integrating existing resources and incorporating on-the-job learning into a flexible and efficient training program. Second, defining the highest level of competence to establish the top rung of a hierarchical structure, which could then be applied to other service areas and roles.

I will also reflect on additional lessons learnt from this experience and further validate these approaches through the subsequent application and refinement in rebuilding the Bureau of Meteorology Severe Thunderstorm competency program.

What Everyone Should Know About Teaching And Learning**ID: 37****Author:**

Yanina Bellini Saibene, rOpenSci, The Carpentries, R-Ladies and Universidad Austral, Argentina.

Abstract

Professionals in environmental and meteorological sciences, as well as those working in data science, statistics, and programming, face a dual challenge: on the one hand, keeping up with rapidly evolving technologies, and on the other, sharing that knowledge with colleagues, students, and broader communities of practice. Often, the teaching role appears unexpectedly: someone who has mastered a tool is invited to run a workshop, explain a method to a team, prepare documentation, mentor a junior colleague or even teach in more formal settings such as universities, short courses, or bootcamps. Yet, most of those individuals who take on these responsibilities have not received formal training in education and pedagogy to prepare them for teaching effectively.

This keynote offers a practical and accessible perspective on how we can improve our teaching skills without needing to become professional educators. We will review practical and evidence-based strategies for organizing and designing clear, engaging lessons, as well as materials that truly support learning. We will look at how to adapt explanations to the knowledge level of learners—whether beginners, competent practitioners, or experts—and how to select examples that resonate with their context and experience.

We will also explore the importance of checking for understanding throughout the teaching process. I will compare the value of formative assessment—helping us adjust our teaching in real time—with summative assessment, which measures outcomes at the end, and show how both can be applied strategically. In addition, we will discuss how to foster active learning, in contrast with passive learning, and what impact this has on motivation and knowledge retention. Feedback—both the kind we give and the kind we receive—will be highlighted as a key tool for building connections with learners and supporting their progress.

The talk will be illustrated with concrete examples from my own experience in the classroom, in mentoring, and in creating learning materials, all grounded in scientific research. Special attention will also be given to accessibility considerations and to adapting formats so that no one is left behind.

Enabling new capability and preserving knowledge through peer-to-peer learning**ID: 41****Author:**

Gina Lawrie, Bureau of Meteorology, Australia

Abstract

Peer-to-peer learning facilitates the transfer of highly relevant knowledge and skills in the workplace. It is strongly aligned with the principles of adult education, by integrating the wealth of experience adults bring into teaching methods.

With years of forecasting experience, our more senior forecasters are true subject matter experts in their field. By formalising a process for experienced meteorologists to share their knowledge with their less experienced peers, institutional knowledge is preserved, particularly as experienced meteorologists retire. Less experienced meteorologists are given access to invaluable training resources and a facilitated connection with more senior forecasters, which has become important with a remote or hybrid workforce.

The Australian Bureau of Meteorology's Aviation Forecasting Centre implemented "peer learning sessions" to enable the transfer of knowledge within the team. In this presentation I outline how these sessions were implemented, the challenges involved, benefits seen and important lessons learned. I will also discuss how peer-to-peer learning promotes a culture of continuous improvement, motivation and teamwork, while upskilling employees in a way that is directly applicable to their role.

Bridging Knowledge and Practice: How We Train Operational Forecasters at The Norwegian Meteorological Institute**ID: 48****Authors:**

Pernille Borander, The Norwegian Meteorological Institute, Norway
Magni Svanevik, The Norwegian Meteorological Institute, Norway

Abstract

This poster will describe how the Norwegian Meteorological Institute facilitates continuous professional development for operational forecasters. Newly employed meteorologists undergo a structured training program of approximately six months, including examinations that must be passed before assuming operational duties. In a profession where on-the-job experience is essential, it is equally important to provide systematic opportunities and common platforms for skill development and the exchange of experiences. With staff distributed across multiple locations throughout the country, ensuring equal access to training opportunities is a key priority.

Norway's varied geography—fjords, mountains, coastline and everything in between—creates distinct forecasting challenges, which provide valuable learning opportunities when shared across teams. To support this, the institute organizes annual and seasonal courses, both in person and in online or hybrid formats. Some courses are tailored for aviation and general meteorologists, while others are cross-disciplinary. Importantly, many of these courses are developed and delivered by operational meteorologists themselves, ensuring that training content remains relevant to practice.

Training also often includes dialog with partners in emergency preparedness and air traffic management, further strengthening its practical value. The poster will present examples of training approaches, highlight lessons learned, and discuss challenges such as knowledge transfer as experienced forecasters retire. By sharing these practices, we aim to contribute insights that may support other institutions in designing effective and sustainable training for operational meteorologists.

LOSiC-UCR: Enhancing Student Learning through Applied Meteorological Training
ID: 50

Authors:

Alberto Salazar-Murillo; University of Costa Rica; Costa Rica
Marcial Garbanzo-Salas; University of Costa Rica; Costa Rica
Ruben Madrigal-Cordero; University of Costa Rica; Costa Rica

Abstract

The Climate System Observation Laboratory (LOSiC) at the University of Costa Rica supports students in meteorology and related fields by providing hands-on opportunities to connect theory with practice. Many students require guidance in monitoring atmospheric and environmental variables, as well as in acquiring the technical skills necessary for their graduation projects.

To address this, LOSiC offers structured training in the design, construction, field deployment, and maintenance of IoT-based monitoring systems. Students are also introduced to software tools for data management, visualization, and analysis, enabling them to work with real datasets and develop problem-solving skills. This approach promotes active learning through cycles of observation, action, and reflection. The laboratory's experience demonstrates that real-world training environments enhance student learning outcomes. Participants learn to troubleshoot, adapt, and innovate while gaining confidence in applying knowledge. This presentation will highlight lessons, challenges, and strategies for sustaining these initiatives, including collaboration with university faculties.

A Case Study on Building a Hierarchical and Categorized Micro-Course Resource System for Mobile-Based Weather Science Popularization

ID: 57

Authors:

Xue Han,1.Faculty of Marxism, Northeast Normal University, Changchun, 130024, China.2.School of Marxism, Northeast Agricultural University, Harbin, 150030, China.

Huixin Li, China Meteorological Administration Training Center, Beijing, 100081, China.

Abstract

Centering on the capacity-building needs of weather information officers in rural areas and urban communities, this project establishes a hierarchical and categorized micro-course resource system for mobile-based weather science popularization. Guided by the “audience–objective–content–format–technology” logic, we systematically implement five core components:

1. Precision learner profiles

A structured analytical model of weather information officers is built on education level and environmental context, precisely defining the characteristics of the target audience for weather-science outreach.

2. Layered instructional objectives

Drawing on Bloom’s taxonomy of cognitive domains, we create a three-dimensional objective system covering knowledge transfer (cognitive), skill training (psychomotor), and disaster-prevention awareness (affective).

3. Content-value assessment model

A three-criteria evaluation mechanism—“goal relevance, practical-need fit, and career alignment”—is established to select scientifically sound and highly communicable weather-science content.

4. Micro-video design paradigm

An innovative “content–strategy–media” ternary design framework produces mobile-optimized assets:

- Contextualized case-study modules (AR-enhanced)
- Interactive Q&A training systems (AI voice recognition)
- Micro-video knowledge graphs (dynamic visualization)

5. Resource-system architecture

Integrating the evolution of modern educational technology, we deliver an end-to-end construction plan that encompasses curriculum frameworks, development models, and technical standards, supporting the digital transformation of weather-science training.

Chile Navy

ID: 78

Authors:

Alejandro de la Maza; Chile Navy Weather Service, CL

Fernanda de la Maza; Chile Naval Polytechnical Academy, CL

Abstract

Naval Polytechnical Academy (Coast Guard School) with the direct support from Chile Navy Weather Service specialists, trains its own marine meteorologists personnel, following the WMO competencies framework to enhance maritime safety and climate understanding. The program starts with foundational courses in atmospheric sciences, oceanography and navigation, building core physical science skills for both levels: officers (administrators and analysts) and crew members (technicians and observers).

Students then receive specialized meteorological training in weather forecasting, climate variability, and data analysis, following WMO standards. Practical skills are developed through simulations, internships, and real-time weather monitoring exercises, improving instrument interpretation and safety protocols.

The curriculum emphasizes communication, decision-making, leadership, and coordination, tailored for officers and mariners prentices. Officers focus on forecasting leadership, strategic planning, maritime coordination, climate analysis and programming tools, while mariners learn self-sufficiency in weather interpretation and safetyness, data quality control and technical maintenance of weather stations network.

Graduates receive WMO-aligned certification enabling them to serve on board the ships and maritime stations.

The program encourages ongoing professional development via refreshing courses, workshops, and international collaboration. Integrated training ensures meteorologists can effectively incorporate data into navigation, early warning forecasts, safety procedures regulations and maritime emergency responses.

This comprehensive approach combines scientific education with practical skills, preparing personnel for modern maritime meteorological challenges. Overall, the formation promotes safer, more efficient, and environmentally responsible maritime operations aligned with global standards, such as emergent technologies for monitoring and forecasting, early warnings for all initiative, impact based weather forecasts and the coastal effects of global warming and climate change.

EUMETSAT Simulator tool - workshop**ID: 3****Author:**

Vesa Nietosvaara, EUMETSAT, Germany
Natasa Strelec Mahovic, EUMETSAT, Germany

Abstract

Meteorological simulators have long played an important role in training by offering learners the chance to work through realistic weather scenarios in a structured, time-evolving environment. The simulators present a canned weather situation, allowing learners to investigate the meteorological data, make forecasts and adapt as new information becomes available, mirroring real forecasting situations.

An important part of effective simulation is the authenticity of the working environment, where the data flows as it does in an operational forecasting environment. Building such an authentic working environment has traditionally been time consuming, requiring time to retrieve the meteorological data for the case, to build the user interface, and to organize the data in the interface.

To address this, EUMETSAT has recently developed a lightweight meteorological simulator that runs on European Weather Cloud (EWC), allowing trainers to build customized simulator exercises more easily than before. The tool is freely available to the community.

In this hands-on CALMet workshop, participants will follow a step-by-step workflow to prepare a simple simulator exercise using existing data - the workflow being presented in the accompanying poster "EUMETSAT Simulator tool workflow"

Participants will gain practical experience in using the Simulator tool to build their own simulation-based learning activities.

Building competencies and collaboration beyond knowledge and skills: Insights from a transnational partnership**ID: 84****Authors:**

Vieri Tarchiani (1), Italy

Bernardo Gozzini (2), Francesco Pasi (1,2), Valerio Capecchi (2), Thomas Bere (3), Younoussa Adamou Sayri (4)

(1) IBE-CNR, (2) LaMMA, (3) ANAM, (4) DMN

Abstract

Training programs for staff of National Meteorological Services (NMSs) in developing countries often rely on short, intensive courses lasting one or two weeks, aimed at teaching the use of a specific technique or tool. While this approach can effectively enhance knowledge and technical skills, it rarely leads to a real increase in competence—which requires the long-term application of methods and tools within a specific operational context.

One effective way to build lasting competence is by embedding trainees into an operational team for a sufficiently long period to allow them to acquire not only technical knowledge but also hands-on operational experience and an understanding of the team's working practices. Moreover, this approach fosters long-term collaboration and helps establish mutually beneficial partnerships, particularly when the institutions involved have similar structures and capacities.

The roundtable will feature participants from the collaborative experience between the Meteorological Service of the Tuscany Region (LaMMA, Italy), the National Meteorological Services of Niger (DMN) and Burkina Faso (ANAM), with the support of the Italian National Research Council (CNR) through the Institute of Bioeconomy (IBE) and the WMO Regional Training Center in Italy.

10 years of experience and contribution to the Baltic+ course**ID: 1****Author:** Izolda Marcinonienė, Lithuanian HMS;**Abstract**

The Baltic+ course is a regional training devoted to weather forecasters. It involves three Baltic States and Poland and as a „plus“ – forecasters and instructors from Ukraine. The first Baltic+ started in 2015, in Tallinn (Estonia). It is sponsored by EUMETSAT and organized by rotation – it changes location every year.

According to the host needs the course is devoted to different themes and any of them has not been duplicated during this period. The most preferred knowledge and practical exercises linked to MSG and MTG data such as pre-convective and mature stage of convection in summer; strong wind, fog situations in cold season; communication with users. The course is in blended style thus the majority of participants attend 3 weeks online training and only about 1/3 of participants could meet face-to-face (for 3 days) at the place set up in advance.

During the online phase forecasters mostly acquire knowledge from resources added by instructors on EUMETSAT training Moodle platform and could get certificates after assessment of practical exercises. Participation on classroom phase requires more precision and activity as participants show their skills during practical exercises and using simulator. One of the challenges forecasters deal with – collaborative case study presentations. This part of training is the most impressive because they have the first public presentation in English and, moreover, discussions with colleagues are desirable.

To conclude, according to the course participants' and instructors' evaluation the Baltic+ course is the most beneficial path to take knowledge in satellite meteorology and has an advantage due to the similar weather conditions forecasters face to. Building relationships between neighbouring countries are valuable as people could discuss and find the best solution in complicated situations. Finally, the regional training costs comply with expectation.

EUMETSAT Simulator tool workflow**ID: 4****Authors:**

Natasa Strelec Mahovic, EUMETSAT, Germany

Vesa Nietosvaara, EUMETSAT, Germany

Abstract

The simulator is a simple web-based application designed to support experiential learning by placing users in front of a weather case, using an interface resembling a weather forecasting environment.

Developed over several years with valuable feedback from the EUMETCAL community, the tool continues to evolve to better serve the needs of trainers and learners across the meteorological community.

A key feature of the simulator tool is its accessibility and flexibility: users can easily create their own simulator exercises using the SIM Creator, which runs in the European Weather Cloud and is freely available.

Creating a simulator exercise contains the following steps:

- Preparing the images
- Naming the image files
- Building the directory structure
- Building the simulator
 - o Describing the case
 - o Defining data types and inserting products
 - o Defining tasks
- Downloading and testing the exercise

The poster will offer a step-by-step guide through the workflow of creating a simulator exercise and will serve as an introduction to a hands-on workshop where participants will be able to create their own simulator.

Meteorological Analysis of the Heavy Rainfall Event on 24 August 2024 over Eastern Sudan Using EUMETSAT Satellite Data**ID: 7****Author:** Haitham Khogly**Abstract**

The heavy rainfall in the Toker area on August 24, 2024, was the result of the combined effects of the northward movement of the ITCZ, the passage of tropical waves, the active phase of the MJO, and the influence of the southwest monsoon winds. These factors together created a conducive environment for enhanced convection and precipitation over eastern Sudan.

Climatology of cyclones on the coast of the states of São Paulo and Rio de Janeiro and the use of programming languages to identify oceanic phenomena**ID: 10****Author:**

Helio Marques, Institution: UERJ (Rio de Janeiro State University), Brazil

Abstract

The surge events are caused by atmospheric systems, usually associated with areas of instability and persistent winds that last for days. Often, these events cause severe damage to the Brazilian coast, resulting in significant losses to both property and people physical well-being. By representing the events through simplified patterns that frequently recur, it becomes easier to comprehend.

Systematic monitoring of oceanic conditions and data collection of key factors must be done to analyze these patterns. The main objective is to analyze oceanic surge events along the coast of Rio de Janeiro and São Paulo and to generate formation patterns that can be presented in a simplified and user-friendly user-friendly manner for the general public understanding of use of programming languages such as python to identify oceanic and climatic phenomenons. By analyzing those events and others, it becomes easier to understand and also helps to catalogue historical weather events along the coast that contain huge importance on the oceanic studies.

The Drought Observatory: A Climate Service Where Access Becomes Learning
ID: 13

Authors:

Ramona Magno; (IBE-CNR); Italy.
 Elena Rapisardi; (IBE-CNR); Italy.
 Arianna Di Paola; (IBE-CNR); Italy.
 Massimiliano Pasqui; (IBE-CNR); Italy.
 Leandro Rocchi; (IBE-CNR); Italy.
 Sara Quaresima; (IBE-CNR); Italy.
 Edmondo Di Giuseppe; (IBE-CNR); Italy.
 Marco Simonetti; (IBE-CNR); Italy.

Abstract

Climate services often reduce "service" to mere data delivery. The Drought Observatory (DO) droughtcentral.it demonstrates a different approach: climate information as implicit learning, where access becomes education and technical outputs become comprehensible knowledge, even for non-specialist users.

This inclusive design approach shapes services toward genuine accessibility, making maps, indices, and information not just technically clear but truly communicated. Rather than assuming expertise, we design for understanding.

Semantic Design in Practice

The Monthly Bulletin layout exemplifies this philosophy. Each index includes expandable explanations of its scientific characteristics and context-related interpretation, using plain language that explains rather than merely asserts. The interface guides users through reasoning processes, making contexts, assumptions, and implications explicit, transforming data points into pathways to understanding. Similar principles shape our WebGIS, interactive Glossary, and "Drought Scan" dashboard (coming soon service): how do we convey complex information while preserving clarity, navigability, and users' ability to orient themselves and act on what they learn?

Measurable Impact

Usage data confirms this approach works. Between 2022 and 2024, Monthly Bulletin visitors tripled (from 149 to over 480 monthly unique visitors) while maintaining high engagement (over 90 seconds average time on page). Media outreach—often initiated through website contact forms—demonstrates how natural, non-technical language enables dialogue with journalists while preserving scientific integrity.

Transferable Lessons for Meteorological Training

This success stems from multidisciplinary teams that enable true cross-pollination of expertise. Beyond climate specialists, our team includes developers, visual designers, and communication experts. This collaboration proves essential: e.g., a visual designer learns scientific accuracy constraints; researchers grasp design principles that guide comprehension.

The result is semantic design—visual choices that carry scientific meaning, not just aesthetic appeal. This cross-pollination creates hybrid competencies where design becomes integral to the scientific communication process, not superficial decoration.

Broader Applications

For meteorological and climate trainers, this demonstrates that accessible communication requires structural changes, not just simplified language. Building teams with diverse expertise, fostering cross-pollination between disciplines, and embracing semantic design principles can transform how we bridge the gap between scientific knowledge and public understanding.

The DO experience shows that viewing climate services as educational acts—spaces for implicit learning—can foster awareness, responsibility, and capacity for action. In an era of urgent climate communication needs, this approach offers practical strategies for democratising scientific knowledge.

Building an Online Interactive Ecosystem through Structured Interaction Design: Lessons from a Meteorological Training Program**ID: 18****Author:**

Zehao Song; China Meteorological Administration Training Centre; China

Abstract

Under the "Internet + Education" framework, the China Meteorological Administration Training Centre (CMATC) has transformed its in-person foundational meteorology training program for newly recruited graduates without meteorological backgrounds into a remote learning initiative. A critical challenge in this transition—from physical classrooms to cloud-based delivery—is fostering effective instructor-learner interaction and stimulating deep learning behaviors to enhance training quality. To address this, CMATC's distance education team designed an online teaching framework based on the constructivist "Hierarchy of Instructional Interaction" model, spanning three interaction levels: operational interaction, informational interaction, and conceptual interaction. Data from the 2024 training cycle revealed strong learner endorsement of the interactive mechanisms, with a 16.1% increase in certification pass rates and a dropout rate reduced to 7% compared to pre-implementation levels. Participants demonstrated significant improvements in knowledge application, problem-solving capabilities, and innovation awareness, with multiple learning outcomes successfully integrated into operational practices, contributing to enhanced meteorological service innovation and organizational effectiveness. This study demonstrates that structured, multi-level interaction design effectively activates the online learning ecosystem, offering a replicable and scalable model for improving remote meteorological education. The findings provide valuable insights for digital training initiatives in specialized professional domains.

Shared insights by connecting the Training College to Operational Naval Air Stations through real-time and recent weather and climate events.**ID: 23****Authors:**

Stephen Dorling; Hydrography and Meteorology Training Unit, Royal Navy;
Rebecca Smith; Hydrography and Meteorology Training Unit, Royal Navy;
Mollie Allerton; Hydrography and Meteorology Training Unit, Royal Navy;

Abstract

The Hydrography and Meteorology Training Unit (HMTU) provides support to Royal Navy Met-Ocean specialists, some of whom are Operational Meteorologists (OpMets) based at Naval Air Stations such as Culdrose, Yeovilton and Marham. Rather than rely solely upon extended training courses at HMTU in Plymouth, we are developing a continuous learning opportunity through the use of real-time and recent weather events, thereby more regularly connecting OpMets with Training Specialists. Written daily forecast guidance from the UK Met Office Expert Weather Team provides an initial common shared resource from which technical content is highlighted and the underpinning theory reinforced using imagery and animation. Content can be shared through the Navy's Virtual Learning Environment, facilitating discussion between OpMet teams, Senior Naval Air Station Officers and the Training Team. Over time, a library of weather event case studies is being developed, enhancing experiential learning and encouraging ongoing dialogue across our community. In this way, we are bridging knowledge and practice through real-world learning and active engagement via a form of continuous professional development (CPD).

A Gallery of Meteorological Teaching Resources**ID: 24****Author:**

Christopher Webster

Meteorological Service of New Zealand

New Zealand

Abstract

Over a career of 40+ years, the author has accumulated a wide range of instructional diagrams, animations and applications. Each was intended to assist instructors with broadening the understanding of the learners. In the process of developing these resources, the author has learnt ways to make these resources more effective, and some pitfalls that should be avoided.

This poster presents and shares a gallery of resources, together with a description of why the author believes each one works. It is arranged so that content starts at a basic level and more complex topics are at the end. Topics:

- Length of a degree of longitude
- Warm & Cold: oven & freezer
- Secondary school maths
- Geostrophic, Gradient and Cyclostrophic winds
- The Foehn wind, animated
- ISA
- Overnight cooling on land, animated
- VAAC regions, animated
- The Bergeron process
- Radar backscattering
- Decomposition of a Velocity field
- A Rossby wave animation

It is hoped that the reader will be able to use and extend these ideas in their own instructional setting.

From traditional training to interactive experience: our journey**ID: 35****Authors:**

Maria Laura Poletti; CIMA Research Foundation; Italy

Silvia Porcu; CIMA Research Foundation; Italy

Abstract

In recent years, corporate training has undergone a significant transformation, shifting from traditional in-person models to increasingly digital and interactive modalities. At CIMA Research Foundation we have experimented with and consolidated an hybrid e-learning approach built on a distinctive element: the full integration of expertise within the organization and the simplification of the material preparation process.

Our experience clearly demonstrates the added value of having, within the same team, both Subject Matter Experts (SMEs), custodians of technical and specialized knowledge, and Media Developers, capable of translating content into engaging and dynamic learning experiences. This synergy has enabled us to eliminate the need to outsource course production, thereby reducing timeframes and complexity while enhancing the overall quality of the final product.

Our process therefore differs from the industry “standard” because it begins with a simple and familiar approach: SMEs prepare materials as if they were delivering a traditional lecture, using slides and outlines. Building on this foundation, media developers step in to transform these presentations into interactive learning paths, carefully designing interfaces, simulations, practical exercises, and assessments. In this way, each professional can focus on their area of greatest expertise, ensuring both efficiency and consistency.

Another distinctive feature of our courses is their operational nature: not merely theoretical lessons, but experiences aimed at transferring concrete and immediately applicable skills, such as the use of software and tools required in daily work. In this context, the choice of LMS has proven crucial in addressing logistical challenges, such as connectivity issues in some of the environments in which we operate (remote areas, particularly in African countries, but also onboard ships) , the limited time available for in-person training and the need of regular trainings for the staff turnover in these operational environments.

The result is an e-learning model that is accessible, practical, and interactive, capable of leveraging internal expertise while offering learners a training experience closely aligned with real professional needs.

Integrating fire weather information for successful decision making**ID: 52****Authors:**

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Maria del Carmen Dentoni; Universidad Nacional de la Patagonia San Juan Bosco (Laboratorio de Ecología, Meteorología y Gestión de Incendios de Vegetación); Argentina;

Abstract

The limited use of weather information in fire management decision-making, despite significant scientific and technological advances, is our main concern. Meteorological information is essential at every stage of fire management—prevention, pre-suppression, suppression, recovery, and prescribed burning—but it has no value if not translated into concrete actions.

To address this issue, we combined our professional experiences as meteorologists—one in wildfire management operations and the other in training and environmental science—to develop a Guide that synthesizes key challenges and proposes a clear path forward. The development of meteorological support for wildfires in Argentina has provided many lessons that could be useful to other Latin American countries.

The proposed Guide adopts a holistic approach to wildfire and prescribed burn management, recognizing that success requires all elements to align. It presents a set of actions organized into three interconnected areas: are organized into three interconnected areas: (1) interpretation of atmospheric and fire interactions, (2) development of specific tools, and (3) implementation of actions and processes. It is intended for a broad audience—both users and service providers—including forecasters, firefighters, forestry personnel, managers, civil defense authorities, and others. This Guide brings all actors onto common ground, ensuring a shared understanding to tackle the challenge of wildfires while valuing their distinct perspectives. It emphasizes the need for clear communication—vital for decision-making—by fostering dialogue between forecasters and fire managers and promoting interagency collaboration. The process of integrating fire weather information in fire management decisions requires strengthening research, increasing the density and quality of meteorological observations, training to forecasters in fire weather, and to guarantee the continuity of the process.

Training is the bridge to interdisciplinary practice and to the effective use of weather information in fire management. Readers are encouraged to identify their training needs through reflection, analysis, and critical thinking. The Guide offers activities tailored to different actors and purposes. At its core, it focuses on people—building skills-based organizations through sustained training efforts that foster the competencies required to perform clearly defined tasks.

Successful fire management depends on collaboration, local experience, and innovation. We hope this Guide reaches all actors involved in fire management and inspires trainers to develop strategic training plans and practical applications.

Building Curiosity in Meteorology

ID: 56

Author:

Yosafat Donni Haryanto, BMKG, Indonesia

Abstract

Building curiosity in meteorology can be done by linking everyday natural phenomena with scientific knowledge. Because meteorology is closely related to human life, curiosity can be cultivated by starting with simple questions and moving on to complex global phenomena. Here are some approaches:

1. Starting from Everyday Experiences. Observe daily weather changes: why can a sunny morning turn into rain in the afternoon? Ask questions about surrounding phenomena: why do clouds have different shapes? Why is the wind strong in the afternoon? See the relationship between human activities and the weather: for example, fishermen, farmers, or aviation.
2. Connecting with Interesting Phenomena Extreme phenomena: hail, lightning, tropical storms, fog. Global phenomena: El Niño, La Niña, monsoons, MJO. Popular science: why is the sky blue? Why do rainbows form?
3. Simple Experiments and Observations. Make a simple hygrometer to measure humidity. Observe the movement of cloud shadows to understand wind direction. Measure temperature with a thermometer in a shaded area or an open area.
4. Connect with Major Issues. Climate change and its impact on floods, droughts, and forest fires. The role of meteorology in disaster management. How meteorology affects transportation, energy, and food.
5. Use Interesting Sources Weather and satellite image applications (Himawari, BMKG, Windy). Time-lapse videos of clouds, storms, or tropical cyclones. Popular books and articles about climate and extreme weather.

Examples of Creative Meteorology Learning Activities

1. “Today’s Weather vs. Forecast”

- Activity: Students record weather conditions (clouds, temperature, wind, humidity) every morning.
- Task: Compare with weather forecast applications (e.g., BMKG or Windy).
- Questions that arise: Why are forecasts sometimes inaccurate? What factors make weather difficult to predict?

2. “Cloud Hunting”

- Activity: Take photos of various types of clouds around the school/home.
- Task: Identify the types of clouds (Cirrus, Cumulus, Cumulonimbus, etc.) and then connect them with possible weather conditions.
- Curiosity:
- Why do clouds have different shapes? How can certain clouds be a sign of rain or storms?

3. "Analysis of Viral Phenomena"

- Activity: Discussion of viral videos about weather (e.g., hail, red skies, sun halos).
- Task: Find simple scientific explanations for these phenomena.
- Curiosity: What is the difference between hail and snow? Why are there double rainbows?

4. Role Play

- Activity: Divide students into teams representing the Meteorology, Climatology, and Geophysics Agency (BMKG), pilots, fishermen, and farmers.
- Task: Discuss how weather affects each profession.
- Curiosity: Why do pilots need jet stream forecasts? Why do farmers need to know the rainy and dry seasons?

5. Traces of Extreme Weather

- Activity: Encourage students to search for news about extreme weather (floods, cyclones, forest fires).
- Task: Connect these phenomena to the meteorological concepts currently being studied.
- Curiosity: Why is extreme weather becoming more frequent? How is it related to climate change?

Through activities like this, students not only hear theory, but also feel, observe, and discover for themselves that meteorology is closely related to their lives.

eGAFOR - Collaborative Cross-Border Forecast for General Aviation**ID: 58****Authors:**

Ladislav Čoso
Jasnica Krulc
Jadran Jurković
Stjepko Jančijev

All working in Croatia Control Ltd., Croatian Air navigation Services from Croatia

Abstract

Probabilistic forecasting is a relatively new approach to weather forecasting, and as such a need for new forecasting products for aviation has appeared. Most of the products were defined decades ago, and have basically remained the same ever since. Each FIR (flight information region) has a designated MWO (meteorological watch office) that issues meteorological products for aviation within its borders. A necessity for harmonization emerged since met phenomena know no political boundaries, and cooperation between MWOs from neighbouring FIRs became a necessity. SIGMET coordination is something that is slowly taking place, but meteorological products for General aviation (that usually flies at low levels) were uncoordinated, unharmonized and ununified. The idea emerged for a new transborder meteorological product for General Aviation which would include probabilistic forecasting and cover the most important meteorological phenomena for low level flights.

The basic idea was to develop a new product for low-level flights that contains probabilistic information on main weather phenomena that pose hazards to aviation: visibility, clouds, turbulence, cumulonimbus and freezing rain. The new product was named eGAFOR. The potential of this new product was recognized by the EU and it was financed through an EU project which started in 2017. Eight countries participated (Croatia, Slovenia, Serbia, Montenegro, Bosnia and Herzegovina, Hungary, Slovakia and Romania) in the Project, with Croatia Control as the project leader. The Project ended successfully in 2021., but eGAFOR continues its life as an Optional Module in EUMETNET's Aviation Support Programme. The main problem for the new product was the harmonization. The project participants didn't use the same forecasting methods nor criteria/thresholds, so a team of experts was formed in order to establish common criteria and methods. After a number of meetings, the problems were resolved and common criteria and thresholds were established. As a result, a booklet containing recommended practice was created.

During preparation for the operational issuing of the eGAFOR product, all forecasters in each company were trained through a number of internal workshops, and the recommended practice booklet was used for the training. Since forecasters previously weren't used to harmonization with colleagues in adjacent FIRs, joint live workshops were planned in the Project. At these workshops, forecasters were going to simulate the new product creation and issuing, and learn how to resolve harmonization problems. However, the COVID-19 pandemic prevented this. The solution was joint online workshops.

In 2022 the EUMETCAL eGAFOR online course was created, based on the booklet of recommended practice. The course is available on the EUMETCAL site, and was made with the participation of the members of the former expert team and EUMETCAL experts. This product, which is based on the simultaneous collaboration of dozens of forecasters from different MWOs, emphasizing a bottom-up approach rather than competition, has yielded significant benefits for aviation users across Europe.

In a way it served as a model for EUROCONTROL in making their own product CBCF (Cross-Border Convection Forecast) which is also an example of successful collaboration between aviation forecasters in Europe.

Mid-Term Reflections from the UNEP–GCF and BMKG Capacity-Building Program on Hydro-Meteorological Resilience in Timor-Leste

ID: 63

Author:

Nina Amelia Sasmita; BMKG;
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Amalia Solicha; BMKG;
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Adityawarman; BMKG;
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Abstract

In collaboration with the United Nations Environment Programme (UNEP) under the UNEP–GCF project “Enhancing Early Warning Systems to Build Greater Resilience to Hydro-Meteorological Hazards in Timor-Leste”, the Indonesian Meteorological, Climatological, and Geophysical Agency (BMKG), as a technical partner, is implementing a five-year capacity-building program (2022–2026) to expand and upgrade the meteorological observation network in Timor-Leste to comply with GBON standards. The program aims to strengthen the technical capacity of the National Directorate of Meteorology and Geophysics (DNMG) through structured training, on-the-job training (OJT), and field practice, with a focus on the maintenance, installation, and operation of Automatic Weather Stations (AWS), data communication through the WMO Global Telecommunication System (GTS), and basic meteorological observations.

The program employs a blended learning model combining classroom training in Indonesia, on-site field practice in Timor-Leste, and online sessions. OJT emphasizes hands-on learning, practical troubleshooting, and knowledge transfer through mentorship by BMKG technicians and forecasters. To sustain engagement, dedicated messaging groups have been used as platforms for real-time technical support and peer-to-peer exchange.

Although a comprehensive impact evaluation is planned for 2026, initial observations after three years indicate encouraging progress. DNMG staff have gained confidence and technical independence, with several AWS units now maintained locally. DNMG personnel have also begun leading minor installations and troubleshooting without direct BMKG supervision. Beyond technical achievements, the program has fostered stronger regional collaboration and mutual learning, laying the foundation for sustainable institutional partnerships.

Key challenges include differences in baseline competencies, language barriers, limited availability of localized spare parts, and gaps in network infrastructure. These issues highlight the importance of continuous mentoring, context-specific training modules, and institutional follow-up to ensure long-term sustainability.

This case contributes to the broader CALMet dialogue by demonstrating how south–south collaboration and peer-led technical training can enhance resilience in meteorological infrastructure in developing countries. Moving forward, the program will focus on skills assessments, tracer studies to monitor professional growth, and the documentation of localized best practices for replication in similar contexts.

Community-Based Rainfall Monitoring as a Tool for Climate Education and Capacity Building in Rural Argentina

ID: 64

Authors:

Raul Andres Duran; Servicio Meteorologico Nacional; Argentina.

Federico A. Robledo; CONICET – Universidad de Buenos Aires. Centro de Investigaciones del Mar y la Atmósfera (CIMA); Argentina.

Leandro B. Díaz; CONICET – Universidad de Buenos Aires. Centro de Investigaciones del Mar y la Atmósfera (CIMA); Argentina.

Abstract:

This work presents an innovative experience that combines scientific research, climate education, and community participation in the Bermejo Department (Chaco Province, Argentina). The study was carried out within the framework of the CLIMAX project, whose objective was to co-produce climate knowledge through the active participation of local stakeholders.

A network of non-conventional rainfall stations (ENCs) was established and operated by rural farmers, local families, and students from the Escuela de la Familia Agrícola (EFA) Nº68 Cancha Larga. Participants were trained to measure daily rainfall following World Meteorological Organization (WMO) standards, to record the data, and to link the results both to scientific analyses and to classroom activities. This participatory approach not only generated valuable climate information in a region with limited coverage of conventional stations but also promoted climate literacy and interdisciplinary learning, as rainfall measurements were incorporated into subjects such as mathematics, geography, and natural sciences.

The research compares data from conventional stations, community-based non-conventional stations, and bias-corrected satellite precipitation estimates (SQPE-OBS). Statistical analyses (BIAS, RMSE, Pearson correlation) were applied at multiple temporal scales (daily, monthly, seasonal, and annual) to assess data consistency, spatial variability, and the representativeness of the different sources.

The results highlight the potential of community networks to complement official observations, improve local understanding of rainfall variability, and strengthen adaptation strategies to extreme events. Furthermore, the case demonstrates how educational institutions and rural farmers can become active contributors to the production of meteorological knowledge, bridging the gap between scientific research and community needs. This experience may serve as a replicable model of climate services co-production and educational capacity building.

Goals/outcome; The session aims to showcase how community-based rainfall monitoring can serve both as a source of valuable scientific information and as an innovative educational tool. By presenting the experience of non-conventional rainfall stations managed by farmers, rural families, and a local agricultural school, the session will:

1- Demonstrate the potential of community-driven networks to complement conventional and satellite observations in data-scarce regions.

2- Highlight the integration of daily rainfall measurements into school curricula as a means to foster climate literacy and interdisciplinary learning.

Share lessons learned on co-production of climate knowledge between researchers, educators, and local communities, offering a replicable model for other regions.

The expected outcome is to inspire participants to consider participatory monitoring approaches as effective strategies for capacity building, educational innovation, and enhanced resilience to climate variability.

Active strategies in teaching meteorology: Experience implementing problem-based learning.**ID: 71****Author:**

Solangela Sánchez Cuevas; Escuela Técnica Aeronáutica; Chile

Abstract

This study presents the outcomes of implementing Problem-Based Learning (PBL) as an active teaching methodology to enhance meaningful learning in the course Ocean-Atmosphere Interaction (IOA), part of the Meteorology program at the Aeronautical Technical School (ETA). The approach is grounded in the recognition that students possess diverse learning styles (Kolb, 1981), and that active, collaborative participation in their own learning processes fosters the development of communication skills, both oral and written (Bonwell & Eison, 1991).

The proposal is based on the meaningful learning model (Biggs, 2006), which aims to increase student motivation through dynamic, student-centered instruction. Within this framework, PBL emerges as a highly effective strategy, using real-world problems as a starting point for acquiring and integrating new knowledge. The methodology emphasizes not only the final outcome, but also the learning process itself—highlighting the value of students' successes and mistakes as part of their cognitive development.

Connecting Cultures and Building Capacity Through Inclusive Learning: Experiences from the MTG Arabic Workshop, the Annual SAC Course, and a Modular micro-Learning Proposal.**ID: 79****Authors:**

Zamzam AL.Rawahi; COE-Muscat; Oman
Manal AL.Hashmi; COE-Muscat; Oman

Abstract

The Center of Excellence for Satellite Applications – Muscat is committed to fostering inclusive and flexible approaches in satellite meteorology training across the Middle East and North Africa (MENA). This effort combines three complementary initiatives that highlight our recent experiences and forward-looking proposals.

First, the MTG Arabic Workshop addressed the critical need for accessible satellite training by delivering advanced Meteosat Third Generation (MTG) content in Arabic. By targeting Arabic-speaking professionals, the workshop went beyond translation to create a learner-centered environment where participants could fully engage with scientific concepts in their native language, using training materials centered on weather cases from the region. This approach not only ensured a smoother and more effective learning experience but also fostered regional collaboration and laid the foundation for ongoing capacity building in the MENA region.

Second, the Annual Satellite Applications Course (SAC) has become a flagship regional program. Each year, SAC is carefully customized to address the needs of the region and its participants, introducing new learning tools and methods that best align with current priorities and operational realities. Key to its success is the use of pre-, mid-, and post-course surveys, which gather ongoing feedback and enable ongoing adjustments across both online and in-person phases. This strategy ensures that SAC remains adaptable, practical, and relevant for the target audience.

Building on these experiences, and to support ongoing learning and capacity development in the region, we propose a modular micro-learning resource that can be easily delivered through a hub or social learning platforms. The resources will offer concise, modular learning units in Arabic and English, covering satellite fundamentals, data services, and updates on MTG capabilities. By providing flexible, just-in-time learning opportunities, the initiative complements longer courses, such as SAC, while expanding access to high-quality training materials.

Together, these initiatives underscore our vision of inclusive, tailored, and future-oriented satellite training, aligned with CALMet's mission to foster effective learning and ensure equitable access to satellite knowledge worldwide.

INNOVATION

Integrating AI into Meteorological Education: Empowering Instructors and Enhancing Learning with Intelligent Assistants

ID: 27

Authors:

Yang Zhao; China Meteorological Administration Training Centre; China.

Jingrong Sun; China Meteorological Administration Training Centre; China.

Jinfang Hou; China Meteorological Administration Training Centre; China.

Abstract

This workshop explores innovative strategies for integrating Artificial Intelligence (AI) into meteorological education, focusing on both instructor development and student learning tools.

The first part addresses the challenge of rapidly evolving AI technologies for meteorology instructors, who are experts in their field but may lack extensive computer science backgrounds. We will discuss our approach to bridging this knowledge gap. We will share our methodology for transforming practical experience gained through participation in meteorological AI competitions into hands-on, relatable case studies and lab exercises for students. This process effectively translates theoretical AI concepts into applied meteorological contexts, enriching the curriculum.

The second part showcases a practical tool developed to enhance the online learning experience: a Meteorological Courseware Assistant powered by a chatbot and Retrieval-Augmented Generation (RAG). This assistant addresses the common challenge students face when navigating lengthy video-based course materials. It allows learners to ask natural language questions to instantly locate relevant segments within the video tutorials.

Harnessing (AI) Artificial Intelligence for Next-Generation Meteorological Training: From Data Integrity to Immersive Learning**ID: 38****Author:**

OTMANE CHERIF Abdelillah; IHFR; Algeria.

Abstract

The accelerating pace of climate change and the growing demand for accurate meteorological forecasting highlight the urgent need to modernize training approaches in meteorology and hydrology. Traditional pedagogical methods, while foundational, are increasingly insufficient to prepare professionals for the complex, data-rich, and rapidly evolving challenges of today. Artificial Intelligence (AI) and emerging digital technologies offer unprecedented opportunities to bridge this gap by fostering interactive, adaptive, and immersive learning environments.

This contribution explores how AI can be systematically integrated into meteorological training, combining my expertise in mathematics, artificial intelligence, and hydrometeorology. Drawing from recent research and educational practice at the Institut Hydrométéorologique de Formation et de Recherches (IHFR), I will highlight three key domains where AI is transforming training and assessment:

1 - Interactive and Immersive Learning – AI-powered simulations, virtual laboratories, and adaptive e-learning platforms allow learners to engage with meteorological models in real time, improving conceptual understanding and decision-making skills. These tools can reproduce extreme weather scenarios, enabling learners to practice response strategies without real-world risks.

2 - Data-Driven Training and Assessment – Machine learning models can personalize training pathways by analyzing learner performance, detecting knowledge gaps, and recommending targeted resources. Moreover, intelligent assessment systems provide immediate, nuanced feedback that goes beyond binary right-or-wrong evaluations, thereby fostering deeper learning outcomes.

3 - Ethics, Reliability, and Trust in AI Integration – The promise of AI must be balanced with careful consideration of its risks. Issues such as data bias, algorithmic transparency, data protection, and regulatory compliance remain critical to ensure trustworthy applications in education. I will present case studies where AI-based imputation methods were applied to fill gaps in long-term meteorological datasets, demonstrating both the potential and limitations of such approaches for training purposes.

In this workshop, I aim to share practical insights on how AI tools—ranging from predictive modeling to natural language processing—can be responsibly applied to both classroom-based and online meteorological training. I will discuss lessons learned from implementing AI-based teaching modules at IHFR, including successes in enhancing learner engagement and challenges related to data quality and institutional readiness.

The presentation will also address the importance of maintaining human oversight in AI-supported training. AI should augment rather than replace the educator, empowering instructors with advanced tools while preserving their role as mentors, guides, and ethical stewards of knowledge.

By the end of this contribution, participants will gain a clearer vision of how to embrace AI as a catalyst for innovation while safeguarding the integrity, reliability, and inclusiveness of

meteorological education. This aligns with the broader mission of the WMO community: to prepare a new generation of meteorologists and hydrologists who are not only technically skilled but also equipped to critically and responsibly engage with the digital tools that will shape the future of climate science.

From Manual to Intelligent - Using AIGC and RAG Technology to Create Engaging Meteorological and Hydrological Training**ID:** 40**Author:**

Chen Luoyuze; China Meteorological Administration Training Centre (CMATC); CHINA.

Abstract

The rapid evolution of Artificial Intelligence presents a monumental opportunity to transform how we develop and deliver training in the weather, water, and climate domain. For educators and trainers, the key challenge is navigating the complex landscape of new tools to create content that is not only efficient to produce but also accurate, engaging, and trustworthy. This presentation offers practical experience leveraging two powerful AI approaches/technologies—Artificial Intelligence Generated Content (AIGC) and Retrieval-Augmented Generation (RAG)—to meet this challenge.

This Keynote will share practical methods, tools, and hard-won lessons learned from applying these technologies to create high-quality training materials. The core focus will be on a critical question facing our community: how to harness the transformative power of AI to enhance learning while rigorously safeguarding the scientific integrity and trust of our training practices. The session will introduce a replicable, five-step workflow (Knowledge Deconstruction → Content Optimization → Intelligent Generation → Scene Adaptation → Quality Verification) as a roadmap for maintaining quality and control. It will explore a toolbox of current AI platforms, from RAG engines that ensure accuracy to AIGC platforms that radically simplify multimedia production. Finally, the presentation will address the critical challenges of responsible AI implementation, sharing strategies to manage everything from data quality and privacy to ethical considerations and the essential need for human oversight. Attendees will gain insights into a replicable workflow, discover a toolbox of current AI platforms, and explore strategies for responsible innovation in meteorological and hydrological education.

Enhancing Seasonal Forecast Communication Through Interactive Dashboards**ID: 51****Authors:**

Dian Nur Ratri, BMKG, Indonesia

Robi Muharsyah, BMKG, Indonesia

Rosi Hanif Damayanti, BMKG, Indonesia

Tiar Maharani, BMKG, Indonesia

Eggy Pandiagan, BMKG, Indonesia

Abstract

"Pinter Iklim" is a newly developed platform designed to integrate medium- and long-term climate predictions across Indonesia. The platform aims to provide more reliable and user-oriented climate information by combining national-scale forecasts with the expertise of local forecasters. While global and regional models are essential for capturing large-scale climate variability, their outputs often require calibration and adjustment to better reflect local realities. Through "Pinter Iklim," forecasters are enabled to apply their knowledge and experience in interpreting, correcting, and refining forecasts at the subnational scale, ensuring that predictions remain both scientifically robust and practically relevant. The platform also serves as a bridge between advanced climate science and end-users, particularly those in sectors highly sensitive to climate variability such as agriculture, water resources, and disaster management. By fostering integration and capacity building, "Pinter Iklim" represents an important step toward strengthening climate services and supporting climate-resilient decision-making across Indonesia

Utilization of Artificial Intelligent for Classifying Rainfall from Satellite Imagery**ID:** 81**Author:**

Richard Mahendra Putra, Indonesia

Abstract

The rapid advancement of artificial intelligence (AI) has created new opportunities for applying technology in meteorology, particularly in interpreting satellite imagery for learning and training purposes. Traditionally, understanding satellite images and linking them to specific weather phenomena has been the domain of meteorologists with specialized expertise. However, with the availability of user-friendly AI platforms such as Google's Teachable Machine, the process of satellite image interpretation can now be introduced to a wider audience, including non meteorologist trainees without technical or meteorological backgrounds.

This presentation highlights a case study on classifying different types of rainfall using satellite imagery. The dataset prepared for this study includes satellite images representing various weather conditions: cloudy skies, light rain, moderate rain, and heavy rain. Each image is carefully labelled according to the observed rainfall category, enabling the AI model to learn and recognize the unique visual patterns associated with each condition. By training the model with these labelled datasets, the system becomes capable of predicting and classifying the rainfall type whenever a new satellite image with similar characteristics is provided.

The primary objective is to demonstrate that satellite imagery interpretation can be simplified and made accessible through AI assistance. Instead of requiring in-depth meteorological knowledge, participants can rely on the trained model to support their understanding of the relationship between visual satellite features and actual rainfall intensity. This approach is not meant to replace the expertise of meteorologists but rather to provide an engaging and interactive way of learning for diverse participants, from students to professionals in other fields.

By integrating AI with satellite imagery, trainers can create practical, hands-on learning sessions that encourage exploration and innovation. Ultimately, this case study shows how AI can serve as a bridge between complex meteorological data and intuitive understanding, supporting better awareness of rainfall conditions and enhancing early warning education

Issues and Challenges for incorporating Artificial Intelligence based Earth System Prediction (AI-ESP) Technologies into WMO Integrated Processing and Prediction System (WIPPS)
ID: 82

Authors:

Eunha Lim World Meteorological Organization (WMO), Switzerland
David Richardson – European Centre for Medium-Range Weather Forecasts (ECMWF)
Yuki Honda - World Meteorological Organization (WMO)

Abstract

The WMO Integrated Processing and Prediction System (WIPPS) is a worldwide network of operational centres operated by WMO Members, which enable scientific and technological advances made in meteorology and related fields to be accessible and exploitable by WMO Members.

In line with one of WMO Strategic Objectives, the implementation of new technologies—particularly Artificial Intelligence (AI)—is a key focus for 2024–2027. The unprecedented pace of AI development, coupled with its applications to meteorological and hydrological value cycles for operational forecasting and warning, offers transformative potential for enhancing the capabilities of WMO Members and supporting the United Nations Early Warnings for All (EW4All) initiative.

Despite this potential, significant gaps remain in AI systems' ability to support forecasts and warnings for local high-impact weather and hydrological events. Addressing these gaps is essential, requiring testing and demonstration for operational use. Furthermore, there is a critical need to assist National Meteorological and Hydrological Services (NMHSs) worldwide in recognizing both the opportunities and challenges presented by AI technologies, enabling them to access innovations and maximize their utility.

These issues and challenges have been documented in "Issues and Challenges for Incorporating Artificial Intelligence-based Earth System Prediction (AI-ESP) technologies into WMO Integrated Processing and Prediction System (WIPPS)," which also includes pilot projects to address them (EC-79/INF.4.1(2)). The pilot projects aim to explore new prediction products, define technical requirements, and strengthen the underpinning scientific framework.

Following a review of the document, WMO Executive Council (EC) has requested INFCOM to develop a technical guideline on the use of AI-ESP (Recommendation 2(EC-79)), thereby ensuring a structured and coordinated approach to AI integration within WIPPS and ensure practical guidance for Members.

In parallel with this effort, a skills and knowledge framework is being developed to provide a systematic approach to enhancing forecasters' ability to interpret numerical weather prediction (NWP) products under WIPPS, potentially including AI-ESP products. Based on this framework, the WIPPS Learning Portal will be established and integrated into the WMO Education and Training Programme (ETRP) Moodle platform. The portal will serve as a centralized hub for training materials, technical documentation, and collaborative learning resources, supporting global capacity development and continuous professional advancement for WMO Members.

Join the Debate: AI-driven weather forecasting models should replace traditional human-led analysis in training and decision-making.

ID: 6

Author:

Madalina Ungur, Germany

Natasa Strelec Mahovic

Jose Martinez

Abstract

Innovation in training is often associated with new tools and technologies. Lately, AI dominates this conversation, generating excitement, skepticism and confusion. Many of us are already experimenting with generative AI in our personal and professional lives. AI is also reshaping the landscape of meteorology, from global forecasting models to interactive learning tools, but how far will it go?

This session offers a chance to explore this topic through a structured, participatory Debate around a provocative statement, such as:

“AI-driven weather forecasting models should replace traditional human-led analysis in training and decision-making.”

The format is simple: participants are randomly split into two teams, one to argue in favor of the statement, the other against it. Each team has 45-60 minutes to prepare their arguments, choose three speakers, and build their case using available resources, including generative AI tools such as ChatGPT to support brainstorming, summarising key points, and organising ideas.

After a fast-paced debate and closing arguments, we will step back and reflect on the experience: What did we learn about AI? What about ourselves as learners?

This debate is not about winners and losers. It’s a creative, energetic format that invites critical thinking, collaboration, and playful engagement with one of the most important questions facing training communities.

And if time allows, we may also take a sneak peek at a prototype chatbot being developed to support training at EUMETSAT

Leveraging Generative AI in Instructional Design: A Case-Based Workshop
ID: 43**Authors:**

Tsvet Ross-Lazarov; U.S.A.
Bruce Muller; U.S.A.
Patrick Parish; Switzerland
Luciane Veek; WMO; Switzerland

Abstract

Recent developments in the field of AI have made it possible to use ChatGPT and other AI platforms as an Instructional Design coach. These tools can generate ideas for engaging learning experiences and produce content and assessment questions quickly. After a brief introduction to large language and reasoning models, participants will use an AI platform to refine learning objectives, generate ideas for learning activities, content, and assessment questions for a case study. Participants will gain practical experience using AI tools to accelerate training development, while critically evaluating the accuracy and instructional soundness of AI-generated content.

Build Talking-Head Videos with AI: Fast, Customizable Content Using Synthesia**ID:** 44**Authors:**

Tsvet Ross-Lazarov; The COMET and EUMETCAL Programs; U.S.A.
Fabienne Werder; The EUMETCAL Program and MeteoSwiss; Switzerland
Laura Beaudouin; MeteoSwiss; Switzerland

Abstract

In this hands-on workshop, participants will explore how to use Synthesia, an AI-powered video creation platform, to rapidly generate professional talking-head videos for e-learning and training purposes. The session will begin with a brief overview of how Synthesia can streamline content production using realistic AI avatars and voiceovers. We will also take a critical look at some limitations, including perceived vs actual learning gains, ethical risks, and audience trust. Whether you're considering adopting similar tools or are already experimenting with them, this session will help you make informed, responsible decisions about how—and when—to use AI avatars effectively.

Participants will be guided through the process of entering their own text scripts, selecting avatars, and customizing visual and audio elements to produce talking-head videos in minutes—no video editing or camera skills required.

Attendees will need to create a free Synthesia account prior to the session and bring a short script (about 1–2 paragraphs) for a learning video they'd like to develop

Collaboration and Innovation in VLab: AI and Jupyter Notebooks for Meteorological Satellite Training**ID:** 70**Author:**

Dr. Marcial Garbanzo Salas, Ing. Diego Souza

Abstract

The WMO/CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) provides a collaborative environment where Centers of Excellence and Satellite Operators jointly enhance global capacity in satellite data utilization. Over the years, VLab has become a platform for co-developing training resources, sharing expertise, and bridging regional needs. In parallel, the rapid evolution of Artificial Intelligence (AI), particularly Large Language Models (LLMs), offers new opportunities to transform how training is designed, delivered, and experienced.

This workshop will explore how LLMs, when combined with Jupyter Notebooks, can serve as intelligent training companions for meteorological satellite applications. By leveraging carefully crafted prompts, participants can generate tailored code snippets, modify visualizations, and request automated explanations of satellite products such as cloud properties, convection indices, and lightning detection. One of the strengths of this approach is adaptability: using case studies from multiple satellite operators—including NOAA, EUMETSAT, JMA, CMA, and others—we will demonstrate how a single notebook structure can be easily adapted, improved, and even transitioned into operational workflows with the support of AI.

Building on pilot experiences in Regions III and IV, the workshop will present examples where AI-enhanced notebooks integrate GOES, Himawari, Fengyun, and Meteosat data. Participants will experience hands-on interaction with real datasets, guided by AI tools that reduce technical barriers, accelerate learning, and promote active engagement. Trainers can then focus on reinforcing conceptual understanding and ensuring methodological rigor. The session will also address collaboration opportunities with satellite operators to co-develop sustainable and inclusive training resources aligned with WMO competency frameworks.

By blending VLab's collaborative structure with AI-driven innovations, this workshop aims to demonstrate a pathway for future-proofing meteorological training. Participants will gain insights into the potential and limitations of LLMs in training, including ethical, technical, and pedagogical considerations, while contributing ideas to strengthen the WMO Global Campus vision.

Collaborative Framework for Identifying Educational and Training Needs Across WMO Regions**ID: 2****Authors:**

1. Maryam ToufaniShahraki; Director of the World Meteorological Organization (WMO) Regional Training Center (RTC) in Tehran, I.R. of Iran Meteorological Organization (IRIMO); Iran
2. Maria Mamaeva; Assistant to Rector of the WMO RTC in the RF, Member of the WMO EC Capacity Development Panel; Russian Federation

Abstract

In support of the World Meteorological Organization's (WMO) strategic goal to strengthen capacity development under the WMO Global Campus, the Regional Training Centre in Tehran (Tehran -RTC), in collaboration with the RTC in the Russian Federation, has developed an innovative electronic Training Needs Assessment tool, which is designed to help WMO Members identify their priority training needs in a systematic, data-driven, and inclusive manner.

The structure of the questionnaire is based on key WMO reference documents, including WMO-No. 1209, ETR-21, and the WMO Strategic Plan. It has been designed to allow for efficient data analysis using tools such as Excel and interactive dashboards. Moreover, the form is accessible, replicable, and adaptable for use across various WMO Regions.

The tool has been distributed among Members of Regional Association II (RA II) with the support of the RA II President and is currently being used for regional data collection. Early feedback from country members has been very positive, highlighting the clarity, simplicity, and relevance of the questions.

This approach enhances the alignment between training delivery and actual needs, enabling more effective use of resources. Although the tool was developed in Tehran, it is scalable for use across all WMO Regions and can serve as a reference model for other RTCs aiming to conduct structured and evidence-based training needs assessments.

From Theory to Application: CMA's Hands-on Training Design Empowers Early Warning Capacity Building**ID: 42****Authors:**

Guolin HAN, China Meteorological Administration International Cooperation and Training Center, China

Yubin YU, China Meteorological Administration International Cooperation and Training Center, China

Jinyang CHEN, China Meteorological Administration International Cooperation and Training Center, China

Abstract

Sharing experiences in international meteorological training on the AI Toolbox for early warning, led by CMA, provides a possibility to help solve the critical problems in international training: the disconnect between theoretical knowledge and real-world application.

Its core value lies in targeted solutions for diverse disaster contexts—by tailored, realistic modules to meet regional needs.

Beyond customization, the 1-on-1 tutoring by special mission called "ZHANG Qian" members turns complex tools into usable skills. Trainees don't just learn about AI models—they adjust parameters, simulate typhoon warnings using Shanghai's cases, and adapt multilingual alerts, building confidence to apply these in local work.

The post-training connection further extends impact: online Q&A and tech updates help trainees turn short-term learning into long-term practice. Together, we can narrow WMO's "last mile" gap in early warning, strengthening global meteorological resilience through hands-on, context-driven learning

AI In Meteorology And Hydrology Education**ID: 49****Author:**

Baktiyor Radyrov.

Hydrometeorology Research Institute, Tashkent,
Uzbekistan**Abstract**

Modern education in meteorology and hydrology is undergoing significant transformations due to the increasing volume of information, the complexity of curricula, and the growing need to train specialists capable of addressing global challenges. Traditional teaching methods are no longer sufficient to meet the requirements of flexibility, adaptability, and personalized learning. This opens new opportunities for the integration of innovative technologies, with artificial intelligence (AI) emerging as a key driver of change. AI has the potential not only to optimize educational processes but also to create fundamentally new approaches to professional training.

The primary objective of introducing AI into education is to explore its potential for enhancing learning efficiency, to identify its advantages and limitations, and to develop recommendations for integrating intelligent technologies into academic programs such as BIP-M and BIP-MT. Among the most relevant approaches are the use of chatbots and adaptive learning systems, the application of machine learning algorithms for student knowledge assessment, the implementation of atmospheric process simulators, and the use of intelligent dashboards for visualizing complex meteorological data.

Practical applications of these methods have already yielded promising results. Prototypes of virtual assistants and automated models for knowledge assessment have been developed, along with simulators that allow students to gain hands-on experience with atmospheric phenomena. Personalized distribution of learning materials not only promotes individualization but also reduces the workload of instructors and expands access to resources on a global scale.

Nevertheless, the adoption of AI in the educational process also poses challenges and limitations. Key issues include ethical concerns and trust in algorithms, the risk of data bias, insufficient training of instructors in the use of digital tools and limited technological infrastructure in some countries. These barriers highlight the need for careful planning, capacity building, and inclusive approaches to implementation.

In conclusion, artificial intelligence is steadily becoming an essential component of educational systems in meteorology and hydrology. However, its effectiveness is maximized only when combined with traditional teaching methods. Looking ahead, international collaboration within the framework of the World Meteorological Organization (WMO) will play a decisive role in creating a unified knowledge space and ensuring equal access to modern educational resources across nations.

AI-Driven Video Production for Meteorological Training Promotion: An Innovative Practice for Future-Oriented Meteorological Training**ID: 54****Author:**

Haoyu Wang
China Meteorological Administration Training Centre
China

Abstract

Against the backdrop of the theme "Future-Oriented Meteorological Training: Integration of Collaboration, Experience and Innovation", the visualized communication and characteristic demonstration of meteorological education and training are confronted with new demands and challenges. This paper focuses on the meteorological education and training work of the China Meteorological Administration Training Centre, and explores the innovative application path of AI technology in the original production of promotional videos, aiming to promote the upgrading of meteorological training communication models through technological empowerment.

The study has constructed an efficient creation chain integrating AI dubbing, AI text-to-image and image-to-video technologies, and successfully produced a promotional video featured on Xinhuanet. This video accurately showcases the "comprehensive + professional" characteristics of the meteorological education and training at the Centre, as well as the three-level meteorological distance education and training system with Chinese characteristics, which consists of a national- level main station, provincial-level secondary stations and grass-roots learning points—fully reflecting the collaborative advantages and systematic experience in the field of meteorological training.

Practice has shown that this technical solution effectively breaks through the bottlenecks of traditional video production: AI text-to-image and image-to-video technologies can quickly generate high-quality visual content based on text descriptions, significantly lowering the creation threshold for meteorological education and training scenarios that are highly professional or difficult to obtain materials through traditional methods. At the same time, the video works empowered by AI technology have achieved dual improvements in vividness and professionalism. They not only enhance the communication effect of the core training characteristics of the China Meteorological Administration Training Centre, but also attract widespread audience attention.

This research provides a referenceable practical paradigm for the integration and innovation of technology, experience inheritance and collaborative development in the field of meteorological training in the future, and contributes to promoting the high-quality and modern development of the meteorological education and training course.

Contextual Flipped Group Classroom (CFGC) Model: Enhancing Science Understanding
ID: 59**Author:**

Nasrah
Muhammadiyah University of Makassar
Indonesia

Abstract

The Contextual Flipped Group Classroom (CFGC) is an innovative instructional model that integrates the principles of Contextual Teaching and Learning (CTL) with the Flipped Classroom strategy in a collaborative group setting. This model was developed to address key challenges in science education, particularly the lack of conceptual understanding, limited student engagement, and the absence of meaningful reflection in the learning process. The CFGC model provides a meaningful, contextual, and joyful learning experience through five core syntaxes: Networked Learning, Active Inquiry, Student Empowerment, Reflective Practice, and Authentic Assessment. Developed using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) framework, the model underwent expert validation and was trialed both in limited and extended settings involving students and lecturers at Universitas Muhammadiyah Makassar. The model features a collaborative social system (teachers as facilitators, mentors, and motivators), multi-directional interaction principles, and robust support components including instructional materials, student worksheets, independent project guides, learning journals, lab equipment, and the Learning Management System. The initial pilot project showed that CFGC is highly valid, reliable, practical, and effective in enhancing science conceptual understanding and problem-solving skills. It also fosters positive learning dispositions such as curiosity, critical thinking, independence, responsibility, and accuracy. Future development of CFGC focuses on the integration of digital technologies particularly Augmented Reality (AR) to enrich learning experiences and expand implementation across subjects.

The Contextual Flipped Group Classroom (CFGC) model holds significant potential for enhancing the effectiveness of adult training and education, as it aligns with the principles of andragogy, which emphasize relevance, experience, autonomy, and problem-solving. By combining contextual learning, flipped classroom strategies, and collaborative group work, CFGC encourages learners to engage with content independently before class, and then utilize face-to-face sessions for active discussion, real-world problem solving, and deep reflection. This model is highly suitable for professional training contexts such as teachers, forecasters, observers, or adult learners, as it offers flexible, authentic, and meaningful learning experiences. Through key syntaxes like Active Inquiry and Reflective Practice, and supported by digital technology integration, CFGC strengthens conceptual understanding while also fostering essential soft skills such as critical thinking, leadership, and collaboration making it a responsive and sustainable approach to the demands of 21st-century learning.