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Introduction to Impact-Based Forecast Warning Services (IBFWS)

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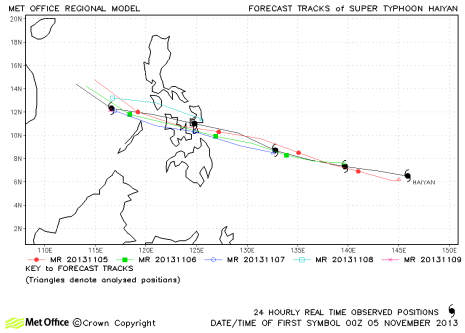
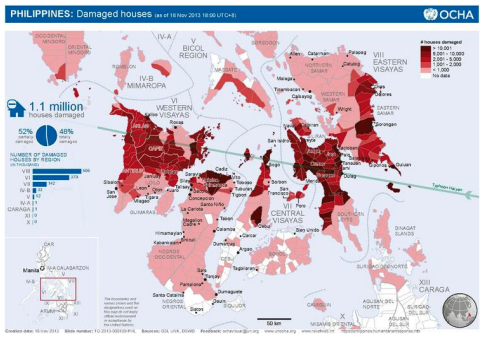
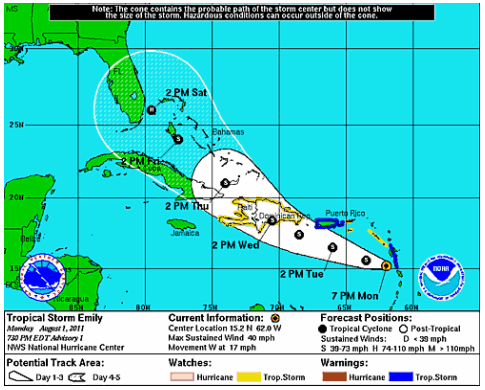
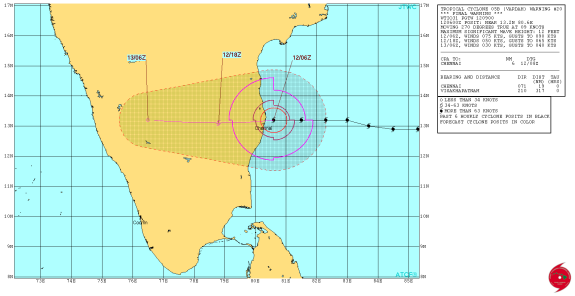
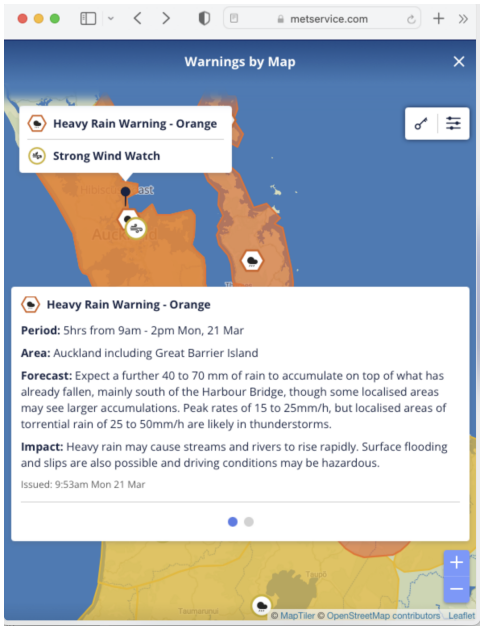
Module 1: Fundamentals of IBFWS					
1.		960px-Basey_after_ Yolanda.JPG	Credit: By Lawrence Ruiz,	https://en.wikipedia.org/wiki/Typhoon_Haiyan#/media/File:Basey_after_Yolanda.JPG	CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=43911464

2.		1620px-Philippine_island_of_Binuluanguan_Following_Typhoon_Haiyan_MOD_45156472.jpg	LPHOT Keith Morgan,	https://commons.wikimedia.org/w/index.php?curid=30512881	Images are downloadable at high resolution, made available at http://www.defenceimagery.mod.uk for reuse under the OGL (Open Government License).
3.		Haiyan-forecast-UK Met.gif	UK Met Office	UK Met Office	Permission granted
4.		1080px-Tacloban_Typhoon_Haiyan_2013-11-13.jpg	Trocaire, Ireland DSC_0749,	https://commons.wikimedia.org/w/index.php?curid=29660396	https://creativecommons.org/licenses/by-nc/2.0/

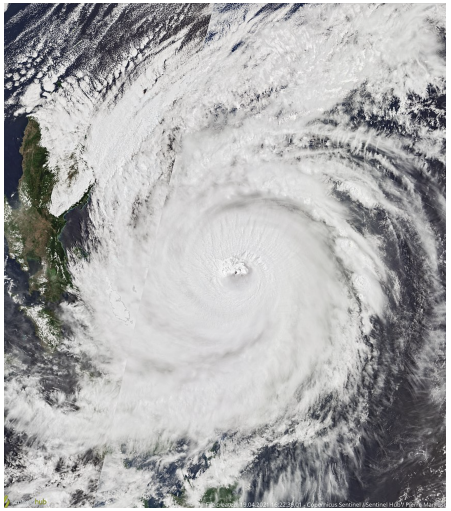
5.		ReliefNet_Map_of_Damaged_houses_Typhoon_Haiyan.pdf	ReliefWeb, UN Office for the Coordination of Humanitarian Affairs - See more at: http://reliefweb.int/map/philippines/philippines-damaged-houses-18-nov-2013-1800-utc8#sthash.cEfqVP84.dpuf	https://en.wikipedia.org/wiki/File:ReliefNet_Map_of_Damaged_houses_Typhoon_Haiyan.pdf	Public Domain
6.		Emily2011path233014W5_NL_sm.gif	NOAA/NWS	https://www.nhc.noaa.gov/archive/2011/graphics/al05/loop_5W.shtml	Public domain

7.		Father Carries Daughter to Safety Country Haiti, Port-au-Prince UN_DAM/Haiti - Jeanne storm/2022Feb02 - Library - 0bf.jpg/UN7686194_0bf_Standard.jpg	UN Photo/Logan Abassi	Unique Identifier UN7686194 https://dam.media.un.org/	https://shop.un.org/rights-permissions
8.		Headline: MINUSTAH Peacekeepers Assist Flood Victims in Haiti UN_DAM/Haiti - Jeanne storm/2022Feb02 - Library - 0c0.jpg/UN7686195_0c0_Low_Resolution.jpg	UN Photo/Logan Abassi	Unique Identifier: UN7686195 https://dam.media.un.org/	https://shop.un.org/rights-permissions

9.		JTWC_io0516.gif	Joint Typhoon Warning Center, US Navy	https://upload.wikimedia.org/wikipedia/commons/d/d8/JTWC_io0516.gif	public domain
10.		Meteorologist at Indonesia Meteorological and Geophysical Agency, BMKG	WMO	https://flic.kr/p/EP4xxU	https://creativecommons.org/licenses/by-nc-nd/2.0/

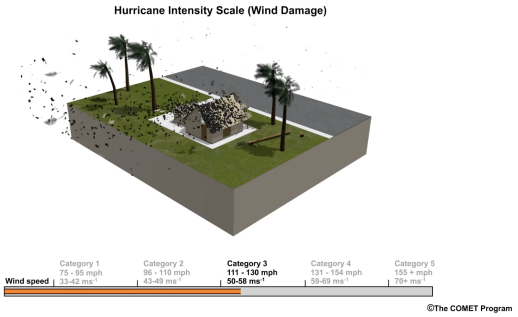
11.		heavyrain-impact-mobile-NZMetSvc21Mar2022.png	NZ MetService	Warnings & Watches page, Meteorological Service of New Zealand, https://www.metservice.com/warnings/home	
12.		pexels-photo-6754173.jpeg	Photo by Pavel Danilyuk	from Pexels	https://www.pexels.com/license/ Free to use

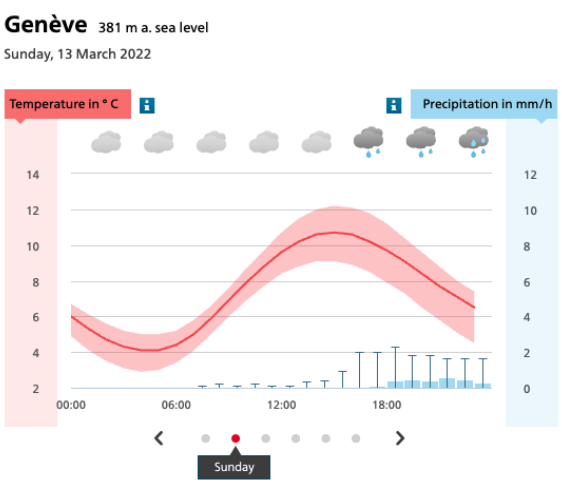
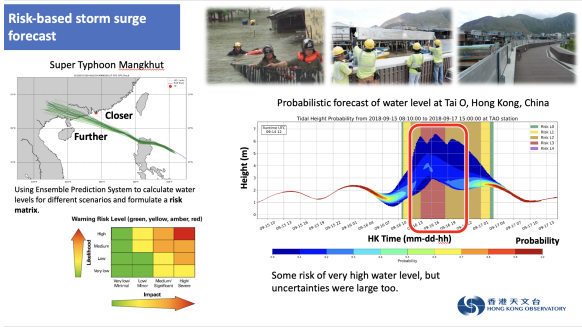
13.		nws_radio.meted.jpg	NOAA/NWS St. Louis, MO	https://www.meted.ucar.edu	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C
14.		Forecaster_work.jpg	NOAA	https://www.meted.ucar.edu/	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C
15.		5545703979_732654fb1c_h.jpg	Photo by Khalfan Said, U.S. Embassy, Tanzania	https://flic.kr/p/9s4bzR	https://creativecommons.org/licenses/by/2.0/

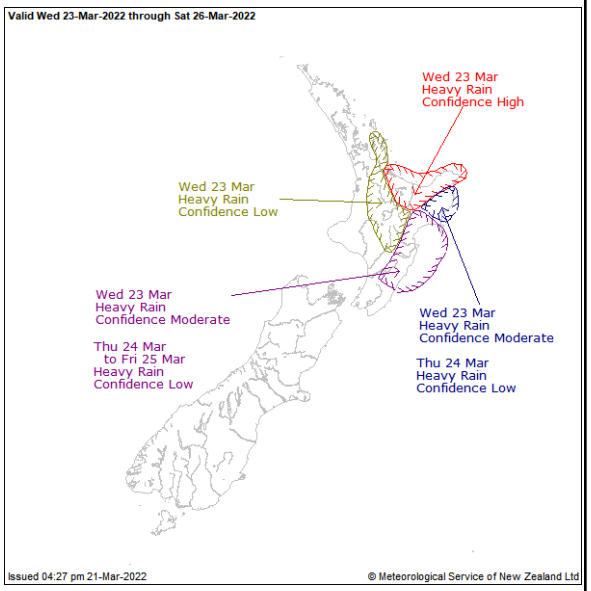
16.		51102011688_c576512e48_b.jpg	UNDP Climate	https://flic.kr/p/2kRHaH3	https://creativecommons.org/licenses/by-nc/2.0/
Module 2: Roadmap to the IBFWS Paradigm					
17.		Super_Typhoon_Surigae_near_the_Philippines_-_April_19th,_2021_(51126373195).jpg	Pierre Markuse	https://flickr.com/photos/24998770@N07/51126373195	https://creativecommons.org/licenses/by/2.0/deed.en

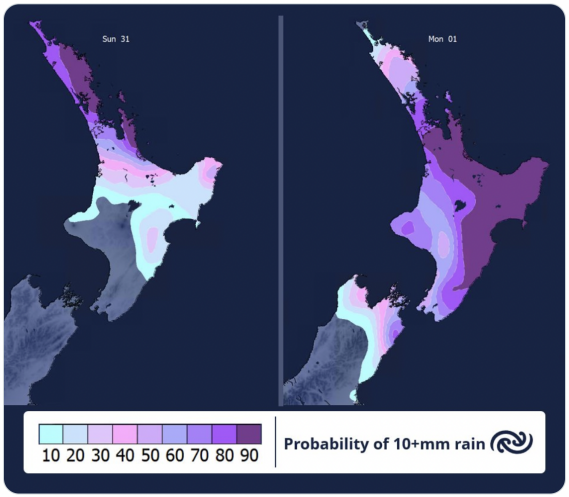
18.		10695722693_9dd99835f2_c.jpg	AusAID	https://flic.kr/p/hi9nHX	https://creativecommons.org/licenses/by/2.0/
19.		House by creek	Lon Goldstein		https://creativecommons.org/licenses/by-nd/2.0/

20.		Hurricane-katrina-port-sulphur-la-4-14-06-this-is-a-post-mitigated-home-that-bba139.jpg	Marvin Nauman/FEMA	https://nara.getarchive.net/media/hurricane-katrina-port-sulphur-la-4-14-06-this-is-a-post-mitigated-home-that-bba139	Public domain - FEMA
21.		House 2.jpg House at ground level	Adanna Robertson-Quimby		https://creativecommons.org/licenses/by-nd/2.0/

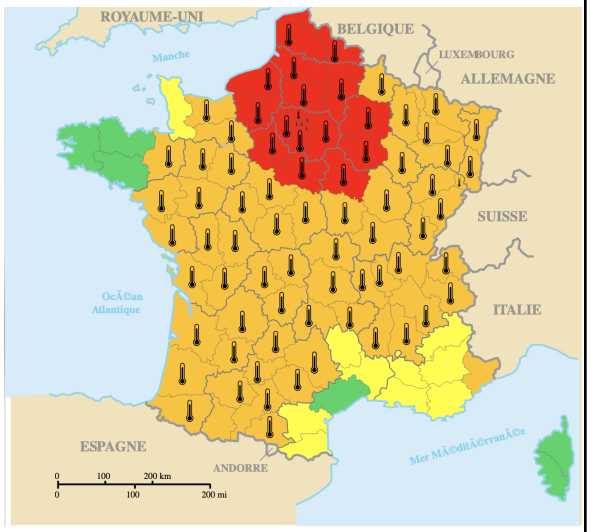
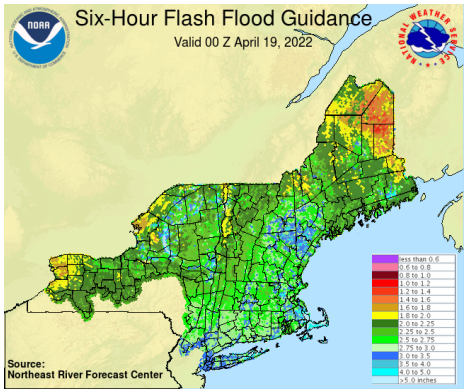
22.		3883928876_efccf3e42f_o.jpg	Max Barners	https://flic.kr/p/6Vd9JY	https://creativecommons.org/licenses/by-nd/2.0/
23.		Video and stills	COMET/UCAR	https://www.youtube.com/watch?v=W3ghU4e2OKY	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C

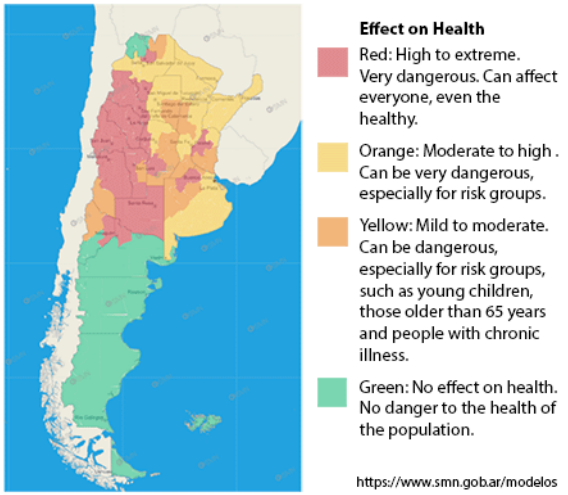
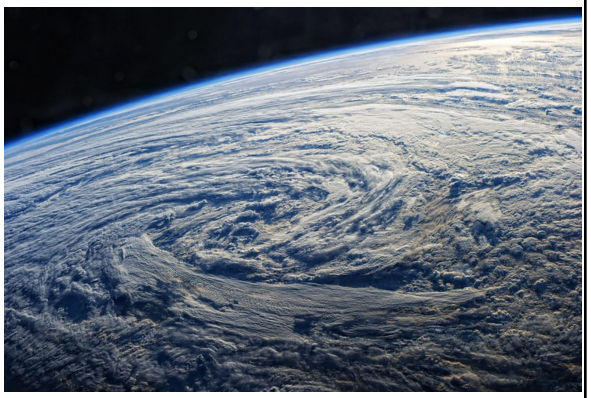
24.		MeteoSuisse-prob-fcst11Mar2022.png	MeteoSwiss	https://www.meteoswiss.admin.ch/home.html	Courtesy MétéoSuisse
25.		Module3_Q2Q3KKH1803.pptx			Courtesy Hong Kong Observatory

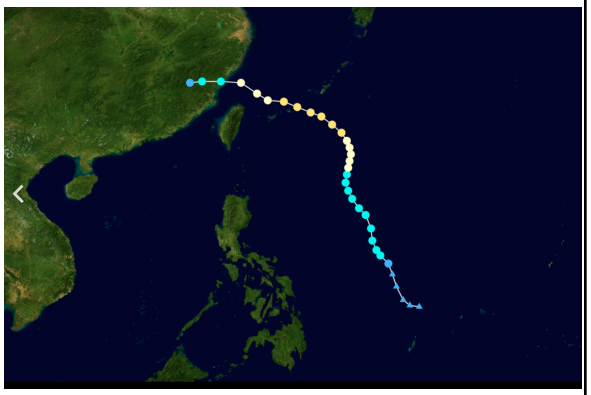
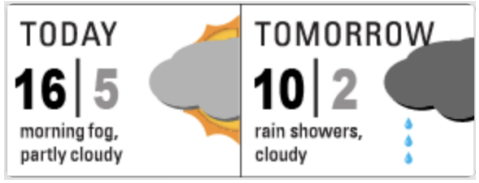
26.		HeavyRainProbMap_NZMetSvc21Mar2022.png		NZ MetService Warnings & Watches page, Meteorological Service of New Zealand, https://www.metservice.com/warnings/home	Courtesy Meteorological Service of New Zealand

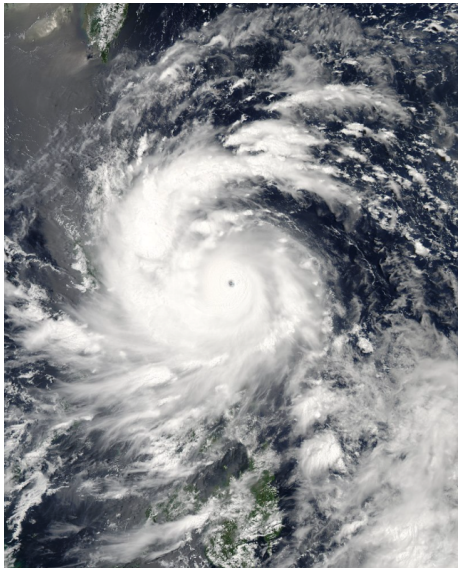
27.	← Tweet MetService @MetService Across the North Island, most places are likely to see some rain from Sunday. Eastern areas have the highest probability, especially on Monday, with the upper South Island also getting a taste to close out the long weekend. Check out the outlook at bit.ly/SWOutlook ^Tahlia  9:10 PM · May 28, 2020 · TweetDeck 3 Retweets 5 Likes	Tweet-ProbFcst-NZMetSvc28May2020.png		NZ MetService Warnings & Watches page, Meteorological Service of New Zealand, https://www.metservice.com/warnings/home	Courtesy Meteorological Service of New Zealand

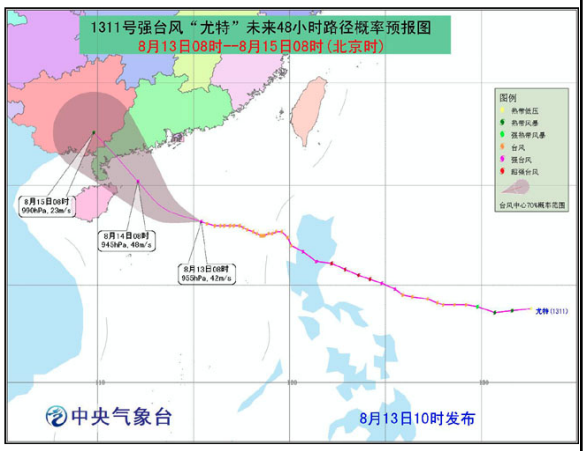
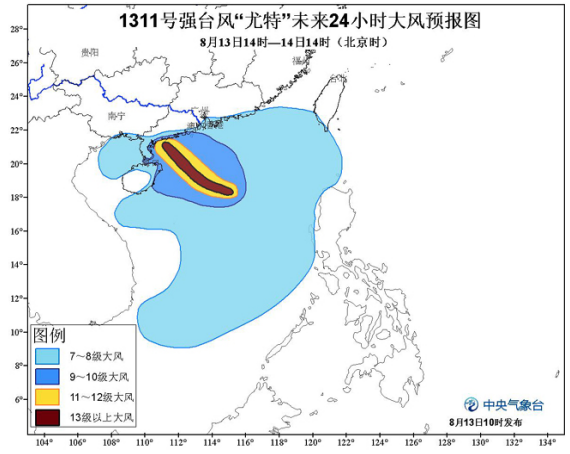
28.	**Example of spatial variation in thresholds from the Meteorological and Hydrological Service of Croatia** Temperature thresholds for the heatwave hazard for eight towns in Croatia **Minimum temperature (°C)** Osijek 20.1 21.2 22.9 Zagreb 20.2 21.3 22.9 Karlovac 20.0 21.1 22.7 Gospić 17.0 18.0 19.6 Rijeka 22.7 23.7 25.1 Knin 20.5 21.6 23.1 Split 25.8 26.8 28.2 Dubrovnik 25.4 26.3 27.6 **Maximum temperature (°C)** Osijek 35.2 36.7 38.8 Zagreb 33.7 35.1 37.1 Karlovac 34.5 35.9 38.0 Gospić 32.1 33.4 35.4 Rijeka 32.7 33.9 35.5 Knin 35.5 36.9 39.0 Split 33.9 35.1 36.7 Dubrovnik 32.3 33.2 34.7 **Description of thresholds** Moderate heatwave hazard High heatwave hazard Extreme high heatwave hazard	Croatia_thresholds_example_wmo_1150_pt1.png	WMO	Guidelines on Multi-hazard Impact-based Forecast and Warning Services https://library.wmo.int/index.php?lvl=notice_display&id=17257 Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II https://library.wmo.int/index.php?lvl=notice_display&id=21994	

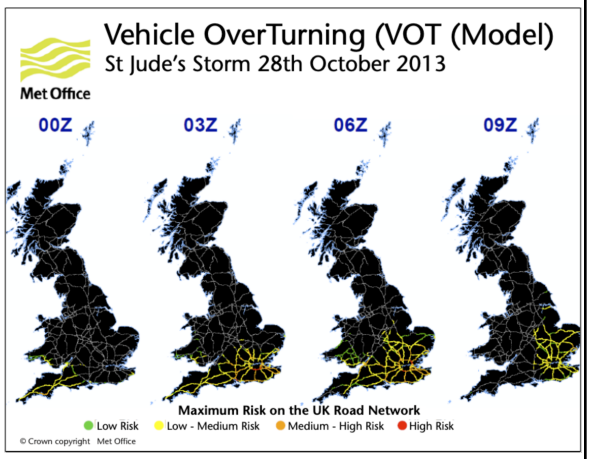
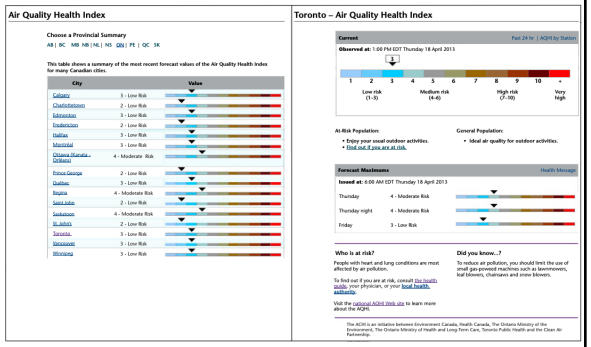
29.		843px-Meteo_France_weather_warning_map_-_24-25.07.2019.svg.png	By User:Ternoc - Own work	https://commons.wikimedia.org/w/index.php?curid=80716459	Public Domain
30.		ffg1_6hr_19Apr2022_00z_NERFC.png	NOAA/NWS	https://www.weather.gov/serfc/ffg	Public domain

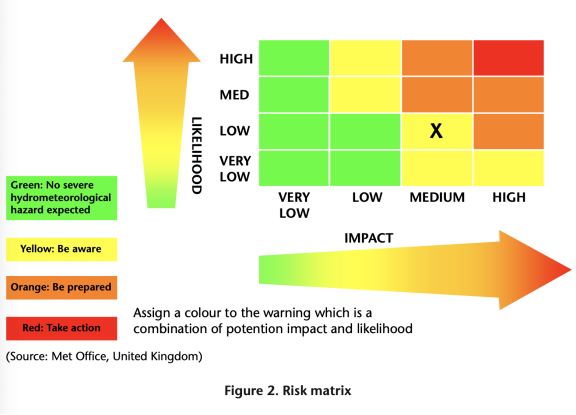
31.		Argentina_heatwave_13jan20221838h.png	Modified from source	https://www.smn.gob.ar/modelos	Credit: Courtesy Argentinian National Meteorological Service
32.		Edited ISS037 image of Typhoon Fitow, close to Taiwan. 10105483996_3414 6e76aa_c.jpg	Stuart Rankin	https://flic.kr/p/goZfjG	https://creativecommons.org/licenses/by-nc/2.0/

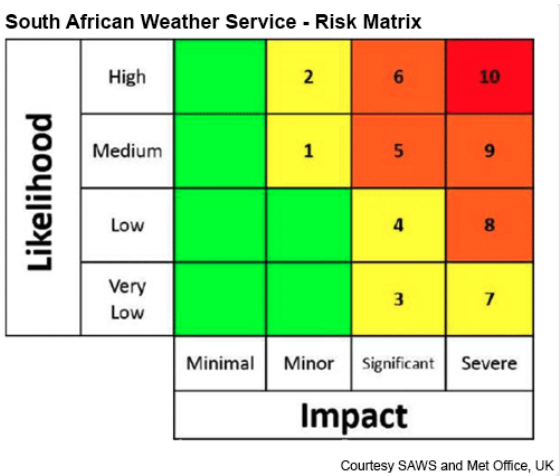
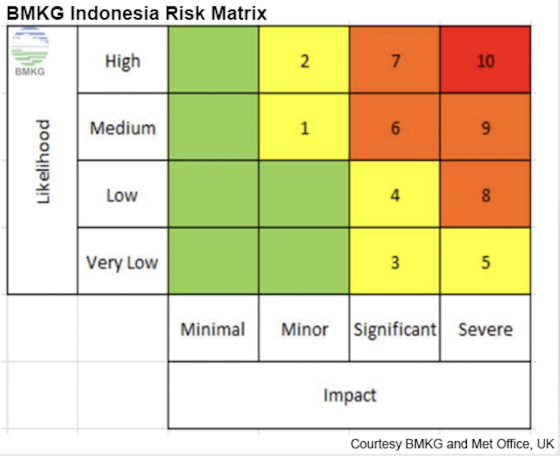
33.		1165px-Fitow_2013_track.png	Meow, Background image NASA/. Tracking data Joint Typhoon Warning Center	https://en.wikipedia.org/wiki/Typhoon_Fitow#/media/File:Fitow_2013_track.png	Public domain
34.		forecast-today_and_tomorrow.png	Parhamr	https://commons.wikimedia.org/wiki/File:Newspaper_weather_forecast_-_today_and_tomorrow.svg	https://creativecommons.org/licenses/by-sa/3.0
35.		Storm-843732_1280.jpg	Reslmaier,	https://www.needpix.com/photo/410098/	public domain

36.		AftermathBertha-4123970_67291d76.jpeg	John Lucas	https://www.geograph.org.uk/photo/4123970	https://creativecommons.org/licenses/by-sa/2.0/
37.		864px-Utor_2013-08-11_0515Z.jpg	Jeff Schmaltz, LANCE/EOSDIS MODIS Rapid Response Team, NASA GSFC	http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=81837 , Public Domain, https://commons.wikimedia.org/w/index.php?curid=27658452	Public domain

38.		typhoon_utor_track_fcst_cma-aug2013.jpeg	China Meteorological Administration	http://www.cma.gov.cn/en2014/news/News/201408/t20140812_255794.html	Courtesy of China Meteorological Administration
39.		typhoon_utor_impact_fcst_cma-aug2013.jpeg	China Meteorological Administration	http://www.cma.gov.cn/en2014/news/News/201408/t20140812_255794.html	Courtesy of China Meteorological Administration

40.		UK_VOT_model_stJudes28Oct2013.png	UK Met Service	Guidelines on Multi-hazard Impact-based Forecast and Warning Services https://library.wmo.int/index.php?lvl=notice_display&id=17257 Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II https://library.wmo.int/index.php?lvl=notice_display&id=21994	Courtesy UK Met Service
41.		air_quality_Env_Canada.png		https://weather.gc.ca/airquality/pages/index_e.html	

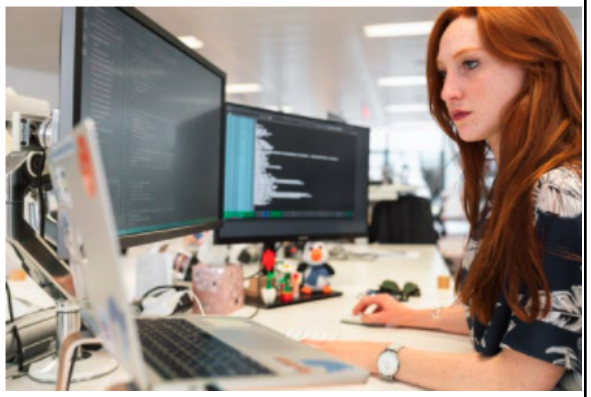
42.	 (Source: Met Office, United Kingdom) **Figure 2. Risk matrix**	risk_matrix_metoffice_UK.png	UK Met Service	Guidelines on Multi-hazard Impact-based Forecast and Warning Services https://library.wmo.int/index.php?lvl=notice_display&id=17257 Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II https://library.wmo.int/index.php?lvl=notice_display&id=21994	Courtesy UK Met Service

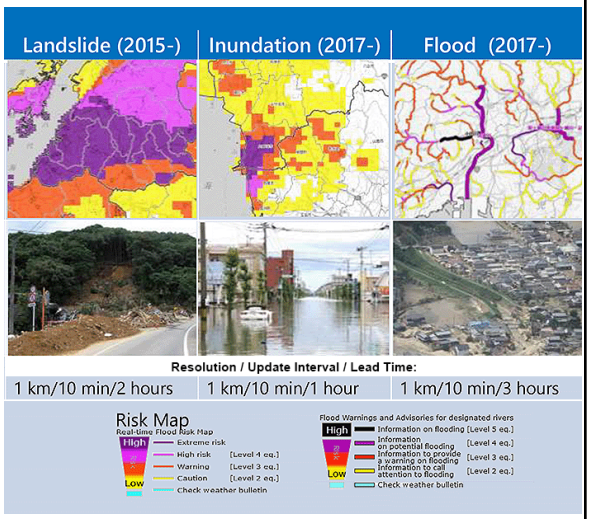
43.		SAWS_risk.png			Courtesy SAWS and Met Office, UK
44.		BMKG-Indonesia_risk.png			Courtesy BMKG and Met Office, UK
Module 3: Best Practises for Collaboration and Strategic Partnerships in IBFWS					

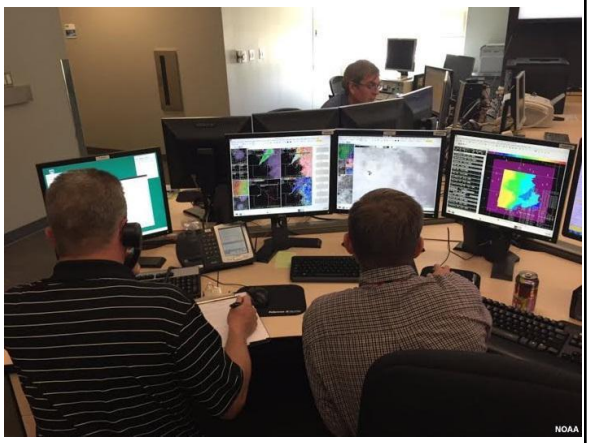
45.			**Photo by** Denniz Futalan **from** Pexels		
46.			**Photo by** RF._.studio **from** Pexels		
47.			**Photo by** Matheus Bertelli **from** Pexels		

48.			**Photo by** cottonbro **from** Pexels		
49.			**Photo by** Harrison Haines **from** Pexels		

50.			**Photo by** RODNAE Productions **from** Pexels		
51.			**Photo by** Markus Spiske **from** Pexels		

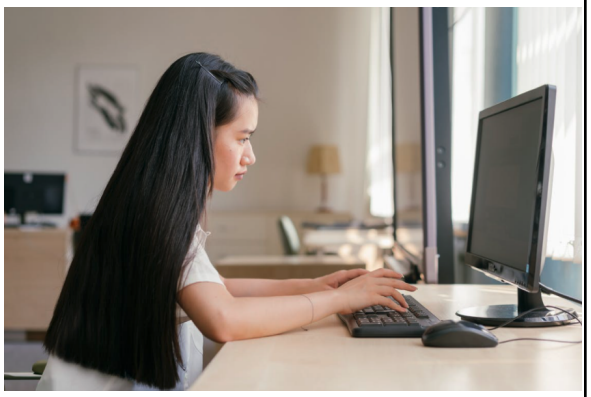
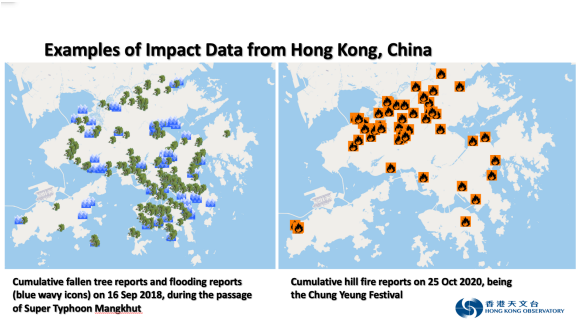
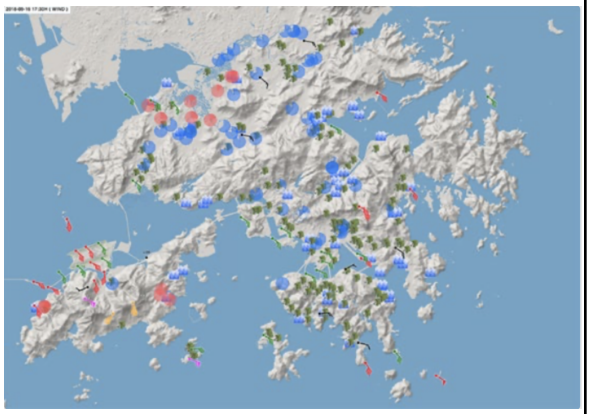
52.			**Photo by** ThisIsEngineering **from** Pexels		
53.			**Photo by** Yan Krukov **from** Pexels		

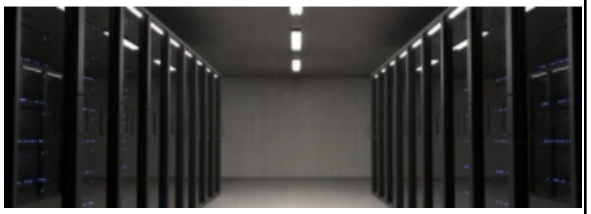
54.	 Figure 3. United Kingdom Natural Hazards Partnership		Met Office UK	WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II: Putting Multi-hazard IBFWS into Practice https://library.wmo.int/index.php?lvl=notice_display&id=21994	Courtesy Met Office UK
55.		JMA_Real-time_Risk_Map_modified.png	JMA	Japan Meteorological Agency (JMA)	Courtesy Japan Meteorological Agency (JMA)

56.		forecaster_work.jpg	NOAA	https://www.meted.ucar.edu/	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C
57.		pexels-pixabay-260367.jpg	Pixabay	Photo by Pixabay from Pexels: https://www.pexels.com/photo/accident-action-danger-emergency-260367/	public domain,cco

58.			**Photo by** ThisIsEngineering **from** Pexels		
59.		imet_coordinate.jpeg	NOAA/NWS	https://www.meted.ucar.edu/	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C

60.		nws_fire_desk_NWS.meted.jpg	NOAA/NWS Tallahassee, FL	https://www.meted.ucar.edu/	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C
61.		start_burn.jpeg	Brent Lawrence, USFWS	https://www.meted.ucar.edu/fire/sitrep/media/graphics/start_burn.jpg	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C
62.		DBK_FOC_3554_01_13_2017a.jpg	California Department of Water Resources	https://pixel-ca-dwr.photoshelter.com/index	public domain - per Ryan Endean, Assistant Deputy Director, Public Affairs Office, California Department of Water Resources (DWR), ryan.endean@water.ca.gov)

63.			**Photo by** Mikhail Nilov **from** Pexels		
64.		Impact_data_chart_KKH1803.pptx	Hong Kong Observatory (HKO)		Courtesy Hong Kong Observatory (HKO)
65.		GIS_ImpactData_mangkhut.png		WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II: Putting Multi-hazard IBFWS into Practice https://library.wmo.int/index.php?lvl=no	

				tice_display&id=21994	
66.			Photo by Manuel Geissinger from Pexels		
67.			**Photo by** Yan Krukov **from** Pexels		
68.			**Photo by** Christina Morillo **from** Pexels		

69.			**Photo by** fauxels **from** Pexels		
70.			**Photo by** Canva Studio **from** Pexels		
71.		**IMG_2145.JPG**	UK Met Office	UK Met Office	Permission granted

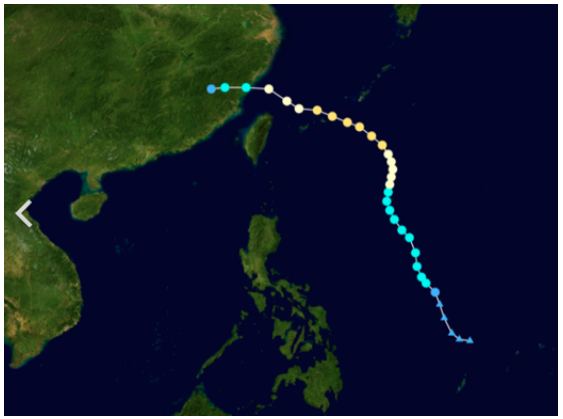
72.		KJ_oroville_FERC_0452_08_07_19.JPG	California Department of Water Resources	https://pixel-ca-dwr.photoshelter.com/index	public domain - per Ryan Endean, Assistant Deputy Director, Public Affairs Office, California Department of Water Resources (DWR), ryan.endean@water.ca.gov)
73.			**Photo by** fauxels **from** Pexels		

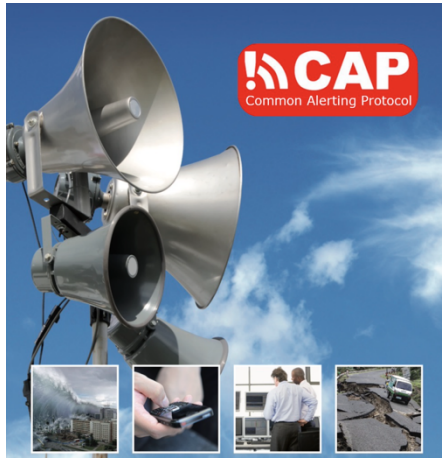
74.			**Photo by** Tima Miroshnichenko **from** Pexels		
75.		fcst-action-game-UKMet.png	Met Office, UC	https://understandrisk.org/wp-content/uploads/FBEA-Game-v5-1.pdf	Met Office, UC

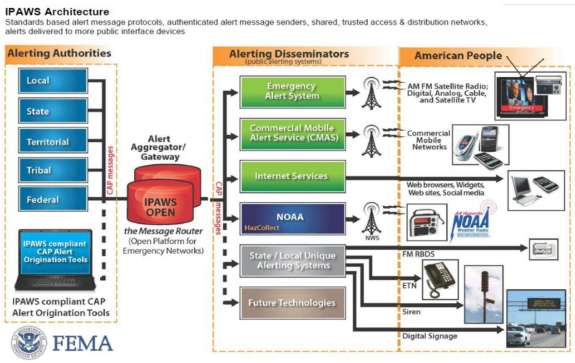
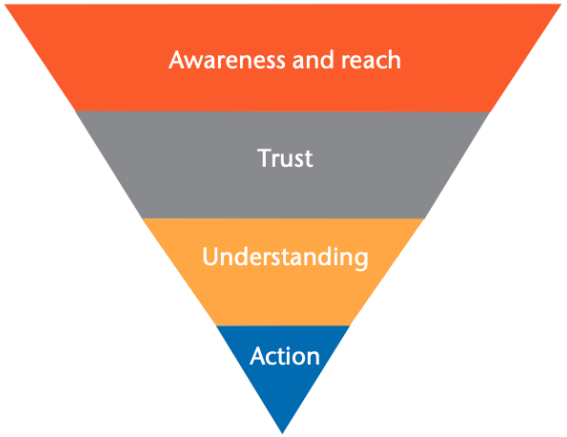
76.		P1012655.JPG	UK Met Office	UK Met Office	Permission granted
77.			**Photo by** ICSA **from** Pexels		
Module 4: Effective Communications Strategies for Impacts-Based Warnings					

78.		Traffic_direction_statepolice.png	U.S. Army National Guard photo by Capt. Brendan Mackie	https://nara.getarchive.net/	public domain
79.		Disaster_center_mgr_fema.png	Jocelyn Augustino/FEMA		Public domain
80.		road_repair_crew.png			public domain

81.		Downed_Power_Lines_(17157695726)(1).jpg	Tony Webster		https://creativecommons.org/licenses/by/2.0/deed.en
82.		Snow_road.jpg	NSSL NOAA	https://www.meted.ucar.edu/	COMET Terms of Usehttps://www.meted.ucar.edu/about_legal.php#C

83.		1920px-Fitow_2013_track.png	By Meow - Created by Meow using WikiProject Tropical cyclones/Tracks. The background image is from NASA. Tracking data is from the Joint Typhoon Warning Center[1]	https://en.wikipedia.org/wiki/Typhoon_Fitow#/media/File:Fitow_2013_track.png https://commons.wikimedia.org/w/index.php?curid=28812172	Public Domain
84.		TADDHighRes-sm.gif	NWS NOAA	https://www.weather.gov/safety/flood-turn-around-dont-drown	Public domain

85.		14197246562_626339166f_o.jpg	Fairfax County	https://flic.kr/p/nCyAM9	https://creativecommons.org/licenses/by-nc-nd/2.0/
86.		CAPcoverimage.jpg	WMO	https://etrp.wmo.int/course/view.php?id=157	https://creativecommons.org/licenses/by-sa/4.0/

87.		IPAWS-US-CAP-diagram.png	FEMA	https://etrp.wmo.int/course/view.php?id=157	Public domain
88.		REACH_model.png		Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II https://library.wmo.int/index.php?lvl=notice_display&id=21994	

89.		NZTweet-seasonal-1-30Jan2019.png	Courtesy Meteorological Service of New Zealand	NZ MetService	Courtesy Meteorological Service of New Zealand

90.		NZTweet-seasonal-2-27Jan2019.png	Courtesy Meteorological Service of New Zealand	NZ MetService	Courtesy Meteorological Service of New Zealand

91.		NZTweet-seasonal-explainer-3-25Sept2019.png	Courtesy Meteorological Service of New Zealand	NZ MetService	Courtesy Meteorological Service of New Zealand
92.		winter-ready-ireland.png		https://www.gov.ie/en/publication/3670b1-be-winter-ready/ Guidelines on Multi-hazard Impact-based Forecast and Warning Services Part II https://library.wmo.int/index.php?lvl=no	

				tice_display&id=21994	
93.			MetService New Zealand	https://fb.watch/bTNpDkSvzO/	
94.		Ocean Buoys	WMO	https://www.youtube.com/playlist?list=PLNaX-uTWSWrHr554n5hLdemL-idLcefMq	

95.		Coastal Inundation	WMO	https://www.youtube.com/playlist?list=PLNaX-uTWSWrGZ4yEMaYyv4o2SiQT20nsz	
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