

## Final Writing Assignment

4th International Distance Learning Course:  
Basic Hydrological Sciences -2017 for Asian Region (WMO RA-II)  
( 16 October – 30 November 2017 )

**The responsibilities of the work office (Direction of Information and Warning Hydrological Systems), the services that are particularly provided in the Del Plata basin.**

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## INTRODUCTION:

As a result of the floods produced in the period 1982/1983, a Hydrological Warning Operational Center (Centro Operativo de Alerta Hidrológico - COAH) was put into operation, whose operation was entrusted to the National Institute of Water Science and Technique, now the National Water Institute (Instituto Nacional del Agua - INA). After the increase, the INA took charge of the development and operation of the Information System and Hydrological Alert System (Sistema de información y Alerta Hidrológica SiyAH-INA) of the Del Plata basin, a task that it carries out without interruptions to date.



*Illustration 1: Del Plata basin*

## FUNCTIONS AND OBJECTIVES:

Among its functions, SiyAH is dedicated to:

- 1.- Coordinate with the departmental, provincial, national and international agencies the acquisition and exchange of the necessary water information to the objectives of the systems.
- 2.- To supervise the execution of the numerical forecasts of heights and flows that allow to make predictions based on the data collected in real time, designing and executing the work methodologies for a growing participation of the users in the Alert Systems.
- 3.- Direct the Hydrological Warning Service of the Del Plata Basin, providing information, forecasts and risk alerts in a timely manner to government, provincial and other affected public and private sectors, and supervise the other hydrological warning systems of the Institute .
- 4.- Coordinate the tasks, processing, storage and management of water, cartographic and satellite image information, in order to ensure the availability and reliability of such information in an Integrated System.

The main objectives of the INA-SiyAH are aimed at developing and operating the hydrological warning and forecasting service of the Basin Del Plata and coordinating the numerical and documentary information related to water resources. To carry out the objectives, it presents an internal flowchart composed of three areas: Hydro-meteorology, remote sensing and GIS and hydrological forecasting and modeling.

### **STRUCTURE AND OPERATION:**

The direction of SiyAH has focused its activity on the development and implementation of a computer architecture aimed at integrating the flow of hydrological information belonging to multiple organizations that generate information for the capitalization of it. This architecture was conceived and promoted within the area of remote sensing and GIS and was carried out under a paradigm of interoperability based on free software tools. It benefits from collaboration with other government institutions, such as the National Meteorological Service of Argentina (Servicio Meteorológico Nacional - SMN), the Undersecretary of Water Resources (Subsecretaría de Recursos Hídricos - SSRRHH), national universities, other areas belonging to the INA such as the Computational Hydraulics Program (Programa de Hidráulica Computacional - PHC-INA) and organizations related to the problem that is addressed.

For the elaboration of products and reports, SiyAH's management does not have its own data network, but, as mentioned above, it is fed by information generated by different organisms: The data of river flow and height come mainly from Prefecture Naval Argentina, Naval Hydrography Service, Mixed Technical Commission of Salto Grande, Entidad Binacional Yacyretá, EVARSA, COREBE, SSRRHH, Meteorological Information Center FICH-UNL. Precipitation data are extracted from the Argentine SMN, National Centers of Environmental Prediction (NCEP / NOAA USA) Temporal Forecasting Center for Climate Studies (CPTEC / INPE / MCT, Brazil), National Institute of Meteorology (INMET / MAPA, Brazil) , SENAMHI (Bolivia), in addition to rainfall data provided by the pluviometric network of provincial agencies and the National Institute of Agricultural Technology (Instituto Nacional de Tecnología Agropecuaria - INTA). In terms of satellite data, the captures taken by the Landsat 5-TM, 7-ETM, 8-OLI, Sentinel 1-A and 2A and MODIS sensors are used as a basis.

From the adoption of the data, various products are generated related to the presentation of antecedent conditions, observations of the moment and the elaboration of forecast, such as:

The disclosure of hydrometric data for the reference points within the silver basin, in which are visualized by each river, the name of the station, its height recorded on the day and its corresponding levels of alert and evacuation, these values they are updated daily.



NIVELES HIDROMETRICOS (cm) (02:00hs)															FECHA: 04/12/2017	
ESTACION	LECTURA (cm)	VAR. DIARIA	NIVEL ALERTA	NIVEL EVAC.	ESTACION	LECTURA (cm)	VAR. DIARIA	NIVEL ALERTA	NIVEL EVAC.	ESTACION	LECTURA (cm)	VAR. DIARIA	NIVEL ALERTA	NIVEL EVAC.		
<b>RIO IGUAZU</b>																
ANDRESITO	72	-28	1050	1350	IGUAZU	1450	-100	2500	4000							
<b>RIO PARAGUAY</b>																
PILCOMAYO	SD	-----	535	600	FORMOSA	448	2	780	830	BERMEJO	408	0	650	700		
ISLA DEL CERRITO	480		620	680												
<b>RIO PARANA</b>																
LIBERTAD	1470	-120	2900	3100	ELDORADO	1200	-30	2100	2300	POSADAS	1002	0	1100	1200		
ITUZAINGO	200	0	350	400	ITA IBATE	340	-10	700	750	ITATI	474	-3	680	750		
CORRIENTES	449	2	650	700	BARRANQUERAS	447	2	800	650	BELLA VISTA	447	13	800	640		
GOYA	441	11	520	570	RECONQUISTA	384	4	510	530	ESQUINA	394	0	500	540		
LA PAZ	461	0	580	615	SANTA ELENA	465	0	690	725	PARANA	359	-1	470	500		
SANTA FE	380	-4	530	570	DIAMANTE	414	-1	530	550	ROSARIO	368	0	500	530		
<b>DELTA DEL PARANA</b>																
V. CONSTITUCION	309	1	400	450	SAN NICOLAS	283	2	420	500	RAMALLO	247	-2	350	400		
VICTORIA	366	2	460	490	IBICUY	95	10	280	310	PARAMACITO	167	7	230	260		
SAN PEDRO	208	10	340	380	BARADERO	185	15	280	310	ZARATE	110	20	200	220		
ESCOBAR	60	-----	300	350	CAMPANA	50	-5	220	245	SAN FERNANDO	120	40	300	350		
<b>RIO URUGUAY</b>																
PEPURI MINI	110	-24	-----	-----	EL SOBERBIO	145	-10	-----	-----	ALBA POSSE	130	-20	-----	-----		
PANAMBI	190	-----	-----	-----	SAN JAVIER	180	-22	800	1000	PTO. CONCEPCIÓN	227	-4	1550	1650		
GARRUCHOS	264	-23	1200	1400	SANTO TOME	364	-36	1050	1200	ALVEAR	330	-22	950	1100		
PASO LIBRES	326	0	750	850	MONTE CASEROS	306	0	750	850	S. GRANDE ARR.	3536	-4	3550	3600		
S.GRANDE ABAJO	674	-81	1730	1780	CONCORDIA	336	-24	1100	1250	COLON	202	S/E	710	790		
CONC. URUGUAY	175	11	530	630	P. GUALEGUAYCHU	158	10	350	380	B. GUALEGUAYCHU	148	10	290	315		
FUENTES: PREFECTURA NAVAL ARGENTINA - COMISION TECNICA MIXTA SALTÓ GRANDE - ENTIDAD NACIONAL YACYRETA																
CAUDALES HIDROMETRICOS (m3/s)															FECHA: 04/12/2017	
ESTACION	VALOR CALCULADO				ESTACION	VALOR CALCULADO				ESTACION	VALOR CALCULADO					
ANDRESITO	1062				YACYRETÁ EROG.	15900				SANTO TOME	2100					
PILCOMAYO					CORRIENTES	20817				PASO DE L' LIBRES	3620					
										APORTE S.GRANDE	3550					

Illustration 2: Hydrometric data for the stations of interest.

Monthly reports on future scenarios are prepared based on the products generated by other weather agencies, either the national map prepared by the SMN, such as the one generated by the CPTEC of Brazil for the Del Plata Basin and the map of anomalies generated for SiyAH.

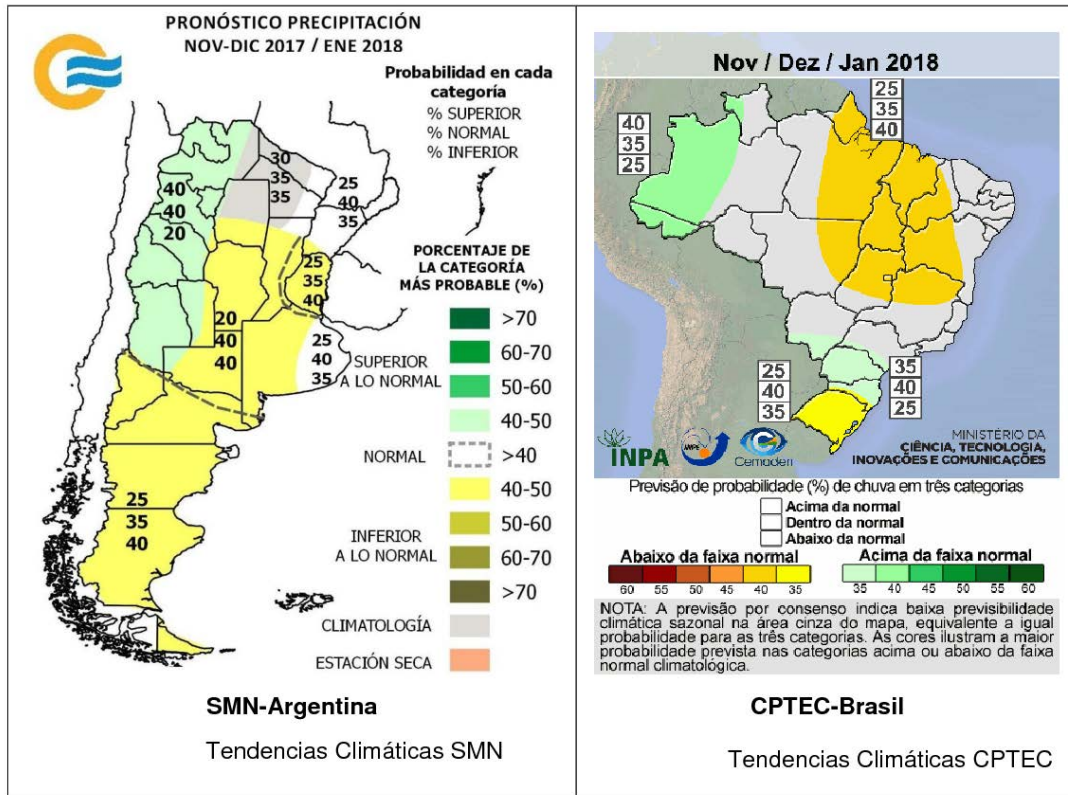


Illustration 3: Climatic trends used in monthly reports.

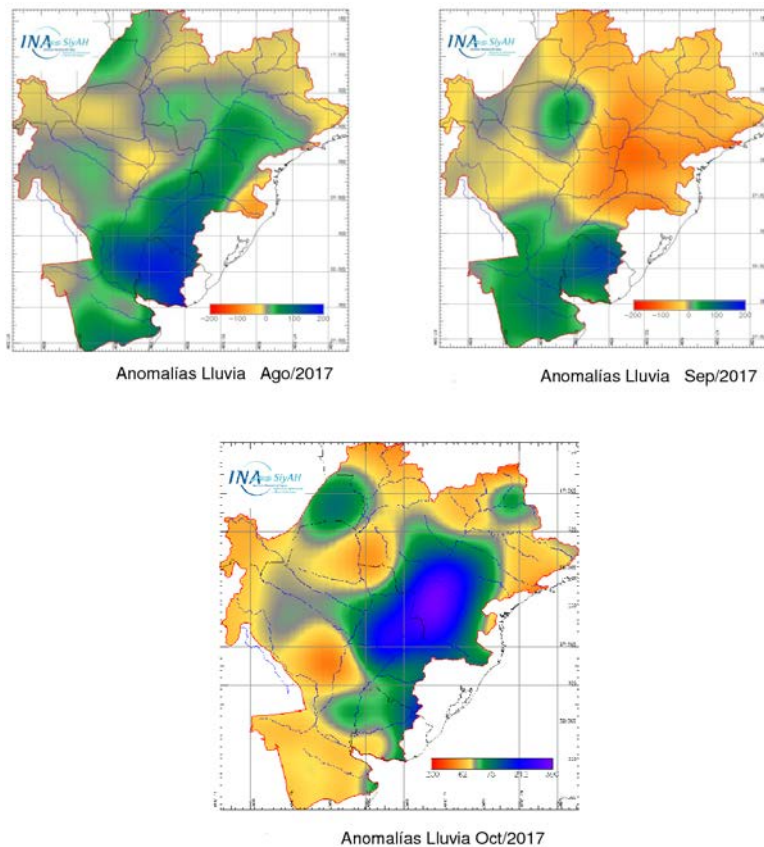


Illustration 4: Map of anomalies used in monthly reports.

Forecast is made weekly with trends for points of interest of the Del Plata basin in Argentina.

### PRONOSTICOS PARA EL 05-DIC-2017 Y TENDENCIA PARA EL 12-DIC-2017

Estaciones	Nivel Hoy (*) (m)	Altura Media OCTUBRE (1992 / 2016) (m)	Nivel de Alerta (m)	Nivel de Evacuación (m)	Pronóstico (m) para el	Estado	Tendencia (m) para el	Estado
	01-dic-2017				05-dic-2017		12-dic-2017	
CORRIENTES	<b>4.30</b>	3.90	6.50	7.00	<b>4.60</b>		<b>4.09</b>	
BARRANQUERAS	<b>4.29</b>	3.92	6.00	6.50	<b>4.58</b>		<b>4.10</b>	
GOYA	<b>4.29</b>	3.85	5.20	5.70	<b>4.45</b>		<b>4.12</b>	
RECONQUISTA	<b>3.81</b>	3.52	5.10	5.30	<b>4.00</b>		<b>3.70</b>	
LA PAZ	<b>4.64</b>	3.95	5.80	6.15	<b>4.57</b>		<b>4.53</b>	
PARANÁ	<b>3.66</b>	2.87	4.70	5.00	<b>3.57</b>		<b>3.50</b>	
SANTA FE	<b>3.88</b>	3.17	5.30	5.70	<b>3.80</b>		<b>3.68</b>	
ROSARIO	<b>3.71</b>	2.93	5.00	5.30	<b>3.61</b>		<b>3.65</b>	

\* A \*:Valores que superan el nivel de alerta      \* E \*:Valores que superan el nivel de evacuación  
 \* s/d \*:Sin dato      (\*): Dato de las 00:00hs

Illustration 5: Forecast on a weekly basis.

Although daily, weekly and monthly reports are generated for the entire basin, special reports are also developed for particular cases in the subbasins of Del Plata basin. This is done by request due to the large extension in Argentine territory and SiyAH does not have the organizational structure for the preparation of forecast for all sub-basins of Del Plata basin in Argentina.

Parallel to the elaboration of forecast, various products derived from satellite images are made, mainly oriented to present the background conditions, the current conditions of the system and reflect the changes suffered by it. This in turn supported by products resulting from research developed in the same area.

The investigations are aimed at the observation of surface water behavior, through the NDWI analysis, using the Landsat 5-TM, 7-ETM, 8-OLI, Sentinel 1A-2A and MODIS sensors. The variety of sensors used allows to supply in a certain way the limitations of the others, as well as, the temporal resolution is covered with MODIS, since it allows to cover the whole of the silver basin in a capture, for particular cases, at more specific levels The spatial resolution provided by the Sentinel sensor is adequate.

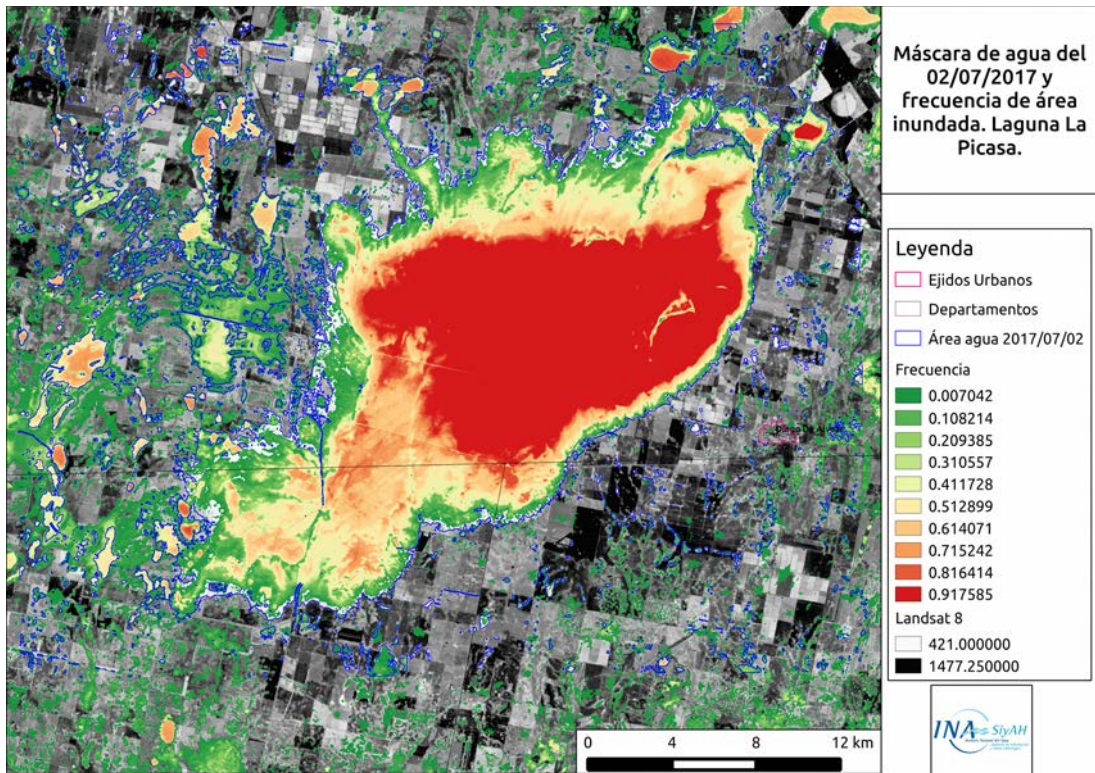


Illustration 6: Map of frequency of flooded area in contrast with current surface water level.

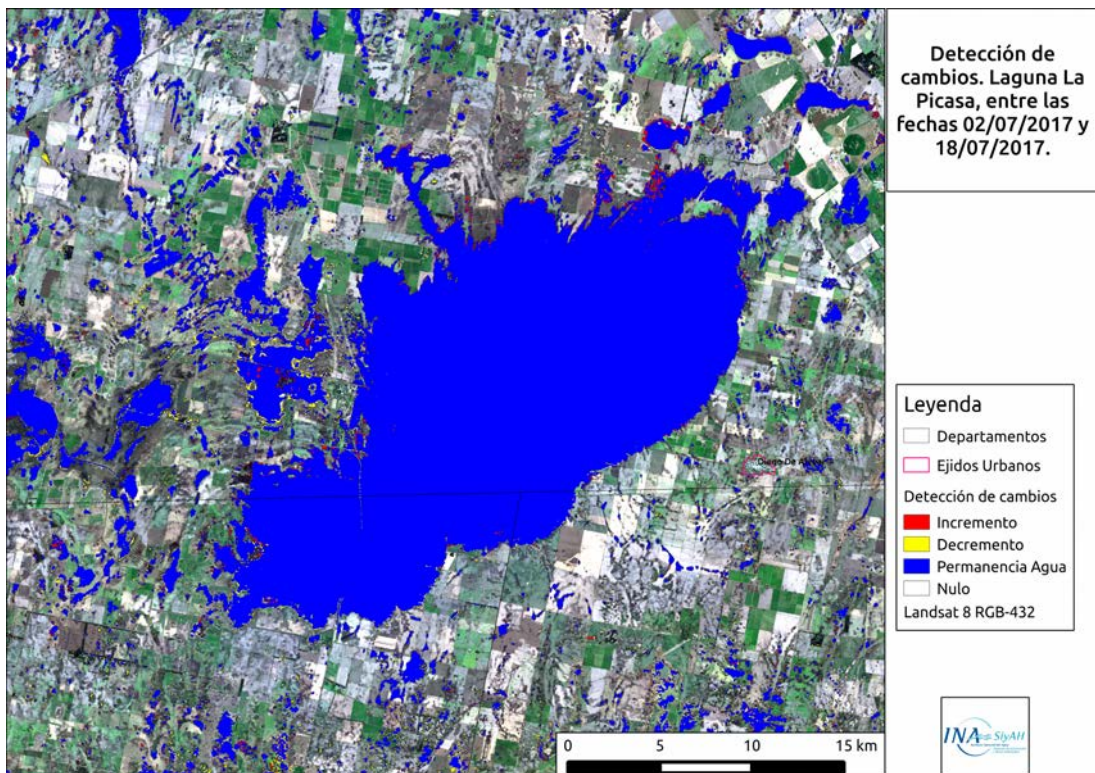
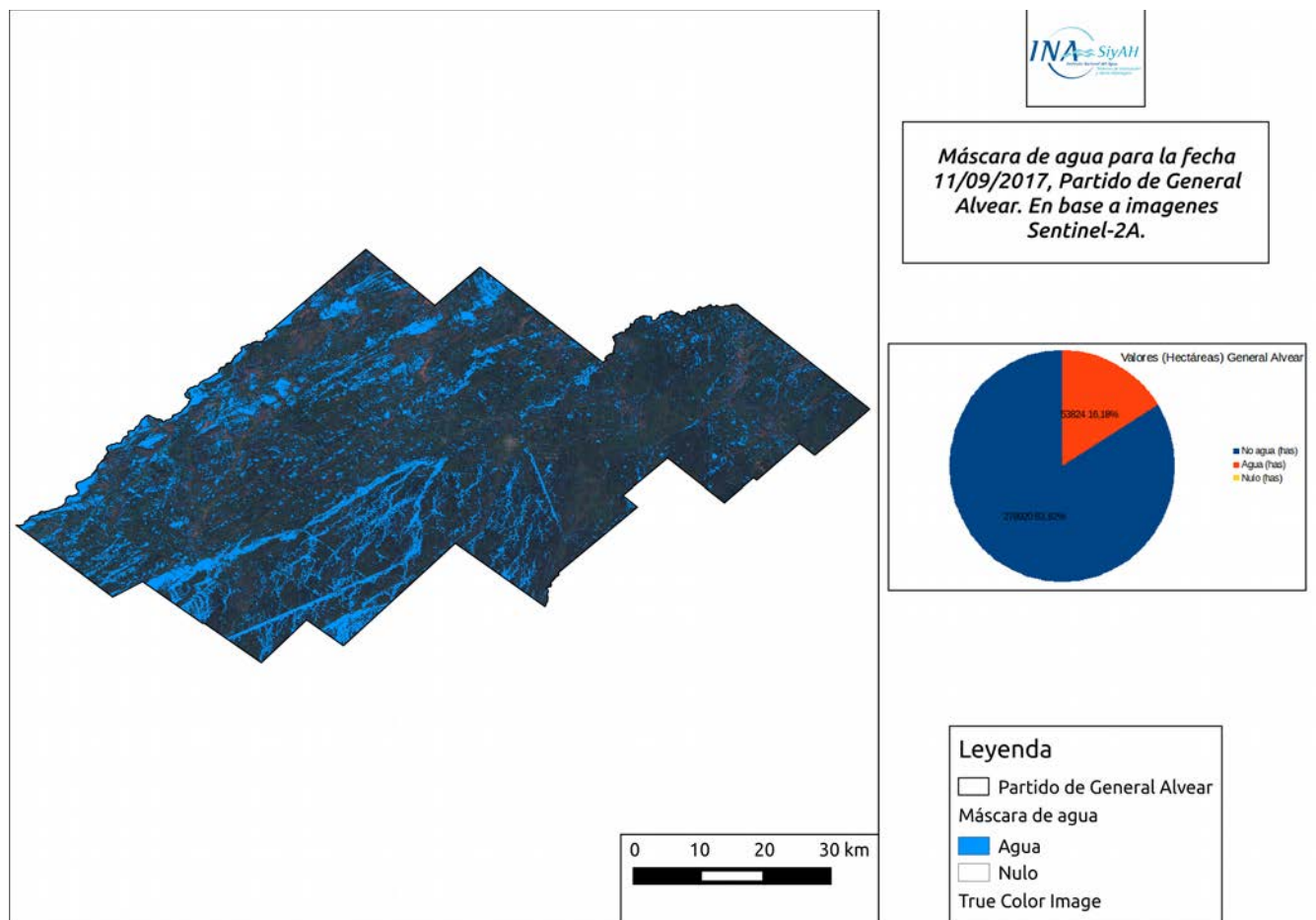


Illustration 7: Changes detections between periods of interest.



*Illustration 8: Situation of surface water updated at the departmental level.*

The increase in the demand for information from third parties and at the same time that a great boost is being given to the development of webmapping tools and online consultations at a global level, the area is preparing a platform that has the function of satisfying that demand, by which the user has access to the historical data of hydrometric level, flow, flooded area, soil moisture, precipitation, etc., freely and online.



## Monitor de estado hídrico de las cuencas - SIyAH - INA

ID: 1109 - RIO: Paraná - ESTACION: Puerto Iguazú

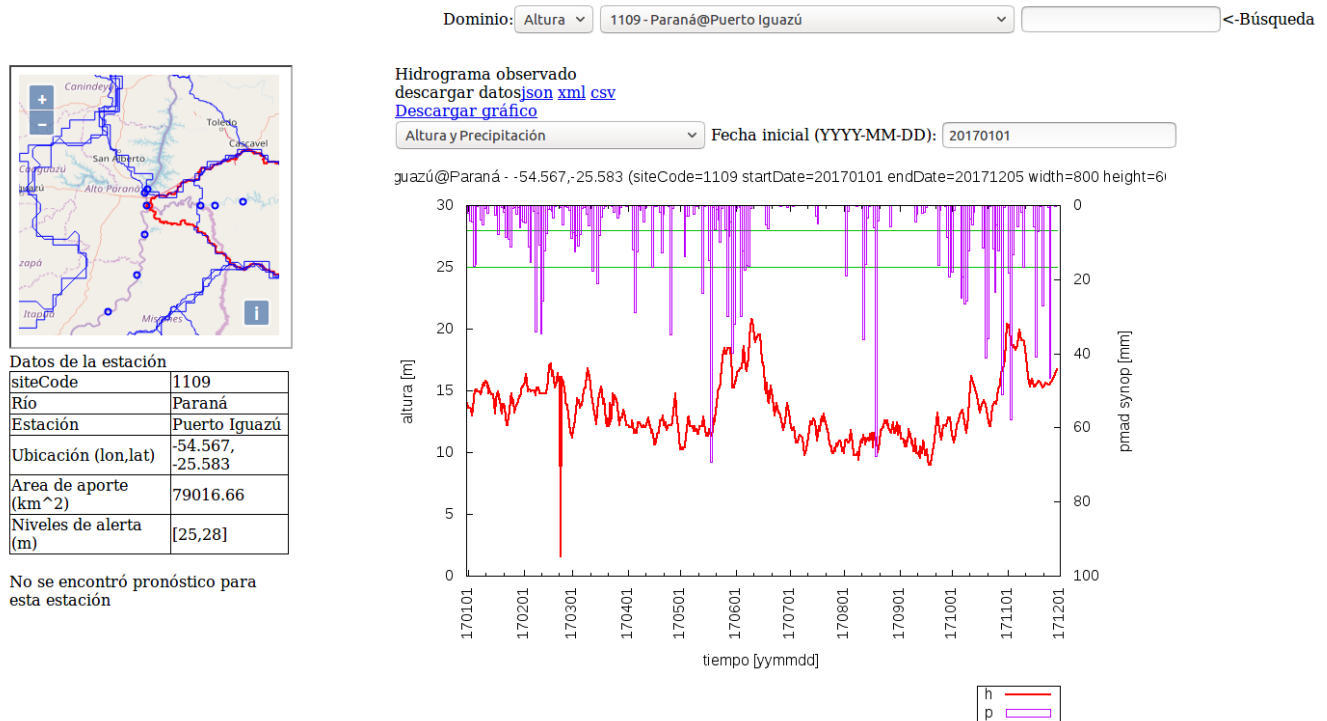


Illustration 9: Example of online consultation on the hydrograph for the requested section.

## DISCUSSION:

From its constitution, the direction of the information and hydrological warning system had the objective of monitoring and elaboration of products for the entire Del Plata basin in Argentina, mainly for the Paraná, Uruguay and Paraguay rivers. Due to the performance employed in the works generated, of course, the analysis units were increasing, taking by area of study various sub-basins of the Del Plata basin, such as Gualeguay, Salado, Arrecifes and rivers of urban basins, such as Luján, Reconquista and San Antonio de Areco. In this sense, the direction was aimed at pointing to the *scalability* of the system, that is, incorporating hydrological information nodes in various degrees (at the sub-basin, regional and basin level) and which in turn allows the development of information in a scalable manner, which makes extrapolation possible. of the information.

Due to the different sources of information and the incapacities of not having a centralized own measurement system, the structure of the afore mentioned information system was generated, consisting of the capture of information generated in the field, the processing and the incorporation into the database, so that it can be used in the generation of products.

Although the interoperability of the data is encouraged from the area, there is no tradition in Argentina in which the provision of the data generated is easily accessible to third parties, therefore, due to the characteristic of the system developed in the direction, this It presents a disadvantage, since it supposes a double effort in the handling of the information and since the demand this in constant expansion turns out to be something complex.