

An aerial photograph showing a city in Uruguay with significant flooding. The water is a dark blue-grey color, covering large areas of the city and surrounding fields. The buildings and roads are visible through the water, and the overall scene is one of a major flood event.

2nd meeting for the Flood Forecasting Initiative - Advisory Group,

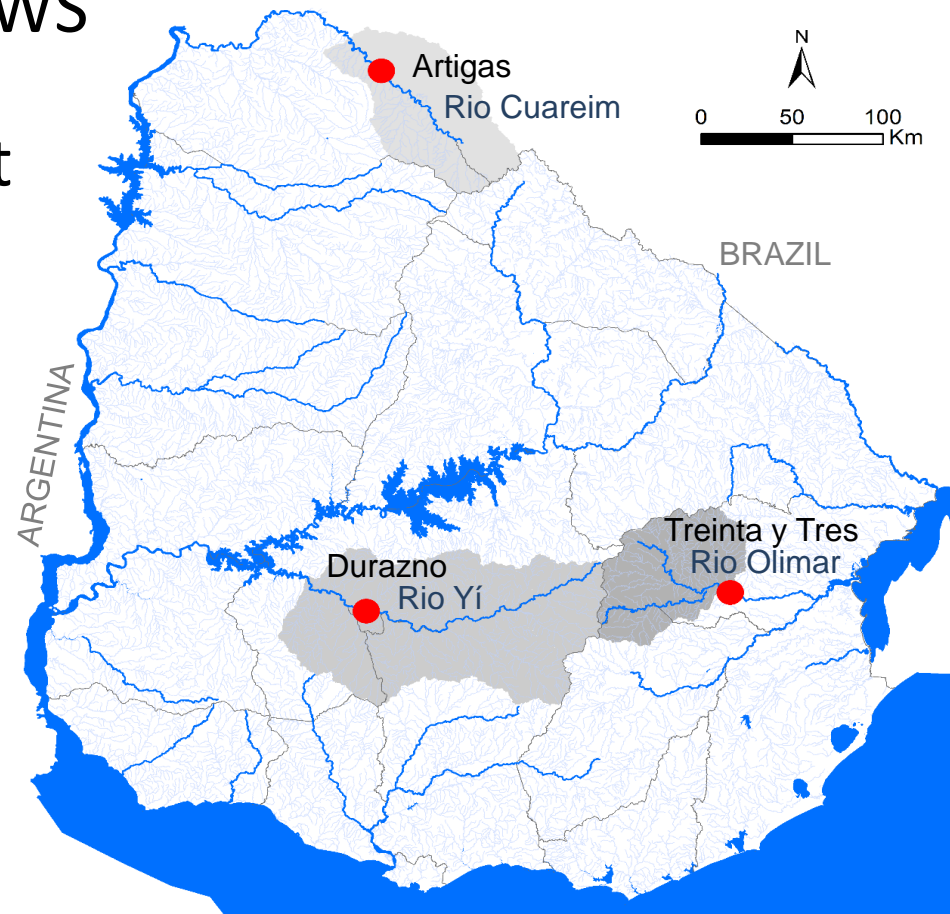
**STEPS TO EXTEND THE EARLY
WARNING SYSTEM OF
DURAZNO CITY TO THE CITIES
OF ARTIGAS AND TREINTA Y
TRES IN URUGUAY**

Jimena Alonso, Institute of Fluid Mechanics and Environmental
Engineering School of Engineering, UNIVERSIDAD DE LA REPÚBLICA

Geneva, Switzerland, 1-3 December 2015

Content

- Institucional framework
- Background on Durazno EWS
- Extending the Pilot Project
- Artigas and Treinta y Tres
- Conclusions



Institucional framework

- **INUMET:** Weather and meteorological Service. Oficial weather forecast and meteorological monitoring
- **DINAGUA:** Design and implementation of the water resources management national policy. Operation of river level-flow network.
- **SINAE:** Coordination unit for the Integrated Risk Management at national level
- **LOCAL GOVERNMENTS**
- **CECOED:** Local Emergency Coordination Center.
- **UTE & CTM:** Electric Co., telemetric hydrometric networks



BACKGROUND: EWS of Durazno city



Population: 33.576

Catchmentn area: 8.750 km²

Tc = 54 hs

Storms of May 2007 and February 2010 caused 5.500 to 6.000 evacuees (about 20% of the population)

BACKGROUND: EWS of Durazno city



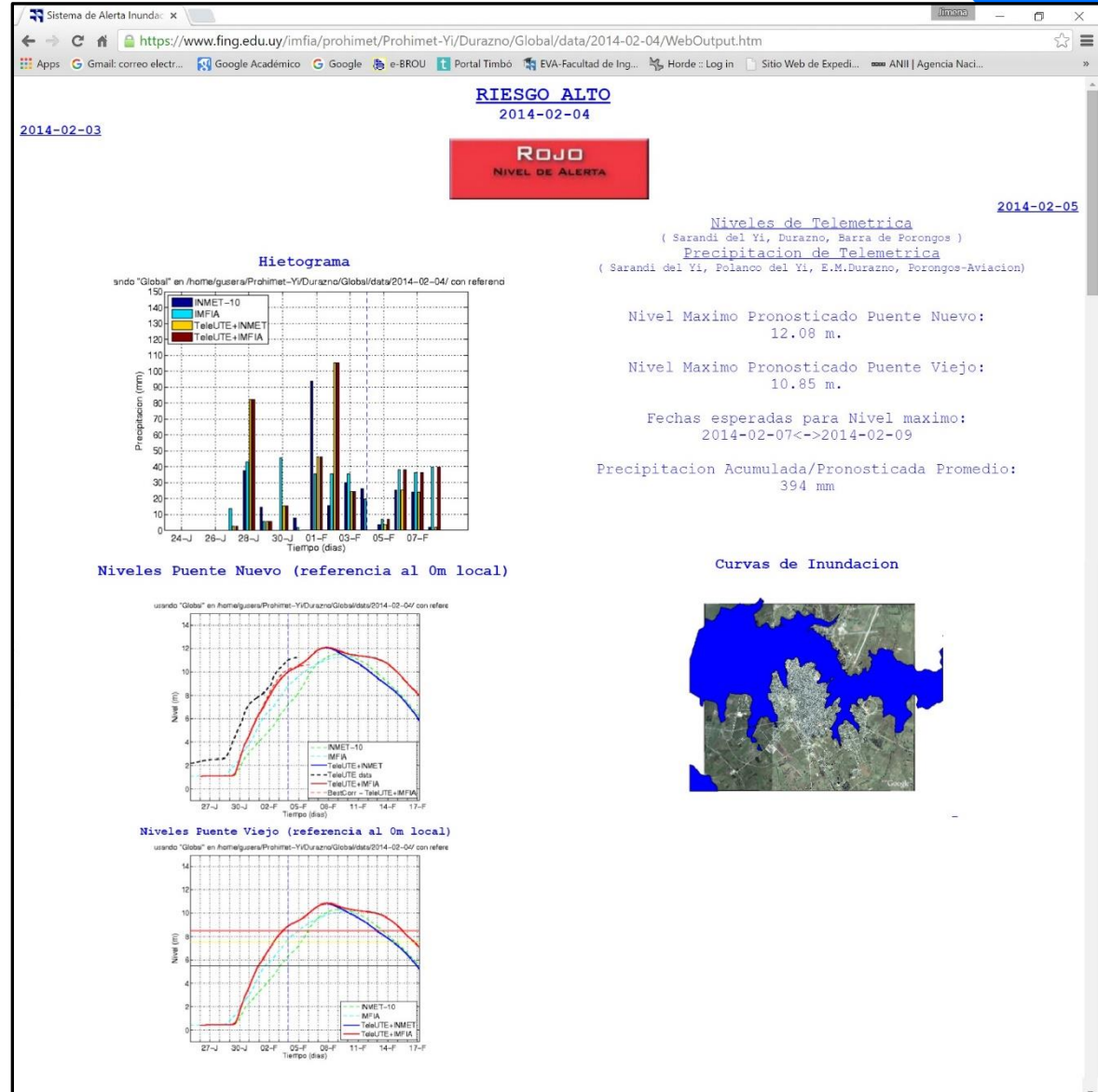
PROHIMET (Ibero-American Network for the monitoring and forecasting of hydrometeorological phenomena)

Financing: World Meteorological Organization (WMO)

Partners: IMFIA/School of Engineering (Direction) & School of Architecture UdelaR, INUMET, DINAGUA, MGAP, UTE, SINAE

Beneficiaries: Durazno Local Government, CECOED – Durazno

Execution: 2009 – 2011



EWS-Durazno: Input Data Acquisition



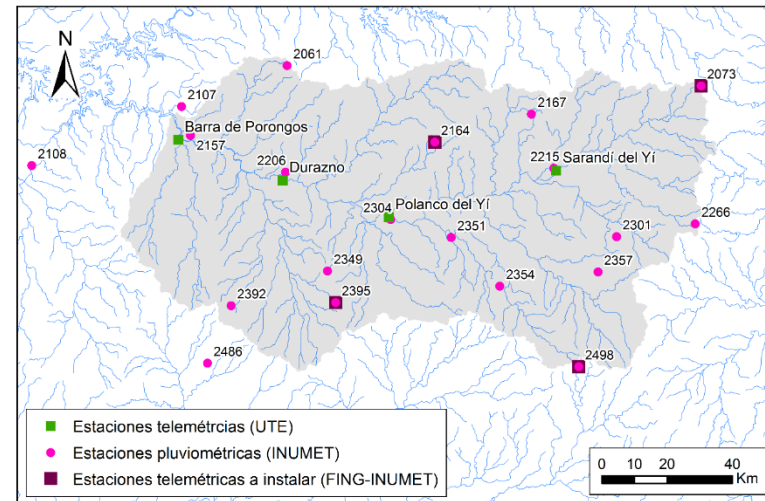
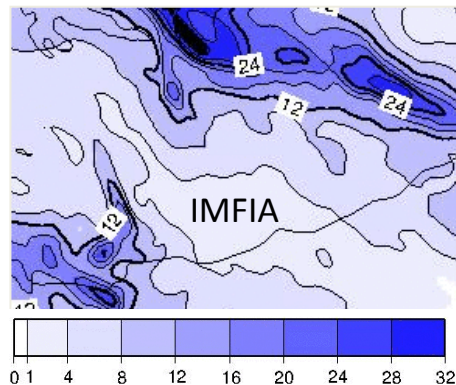
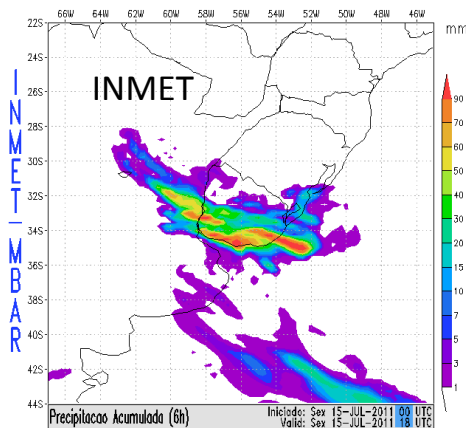
RAINFALL

Weather Forecast:

- INMET-Brazil (COSMO)
- IMFIA-Uy (WRF)

National rainfall observation networks:

- UTE Telemetric network (hourly)
- Raingauges INUMET (daily)



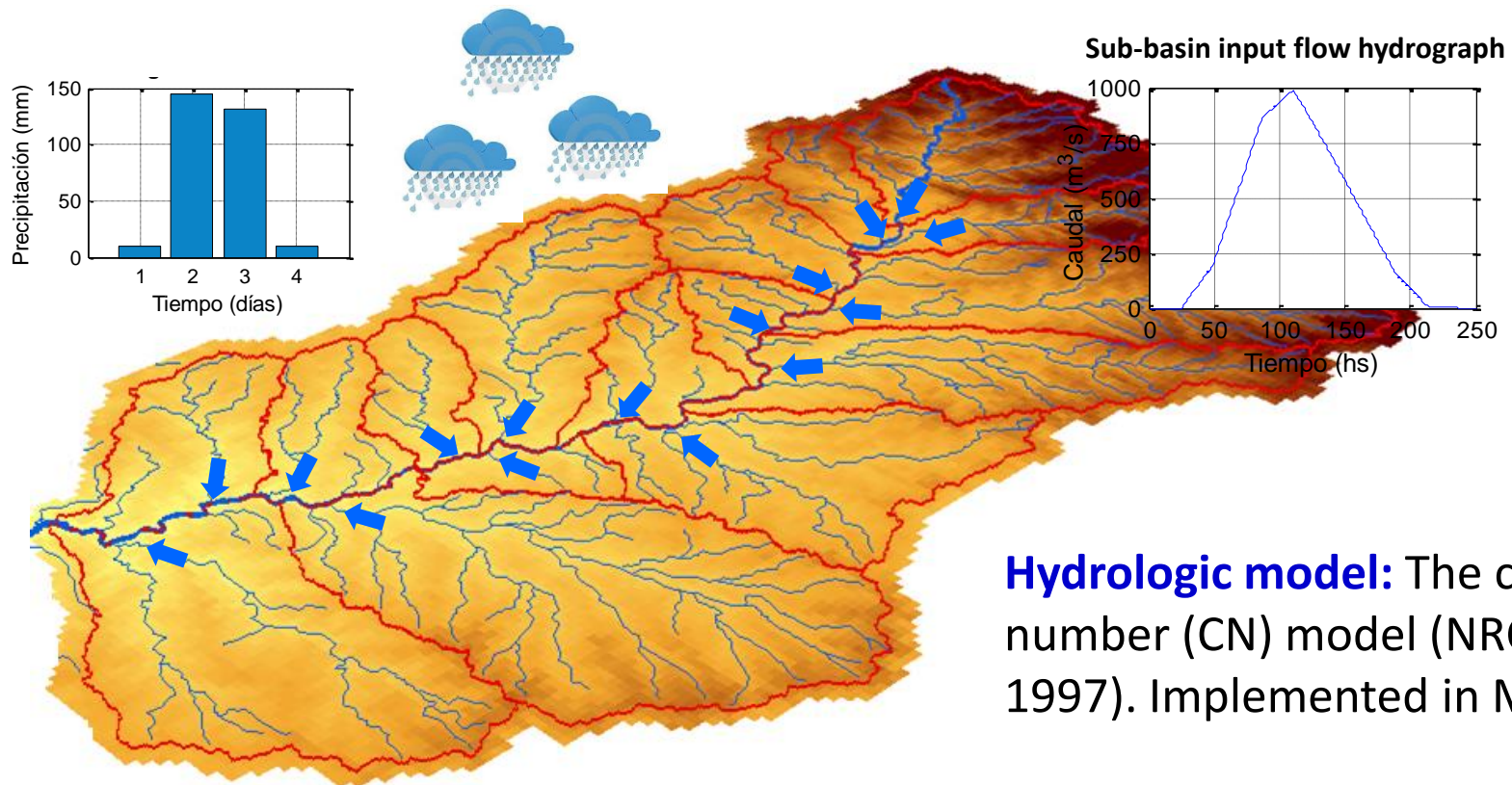
EWS-Durazno: Coupled H-H model



The coupled hydrologic-hydrodynamic model based on observed and forecasted rainfall provides quantitative information about the future evolution of water levels on flooded areas and its permanence in time.

1

A hydrologic model computes for each sub-basin the input flow hydrograph to Yi River. The input data is observed and forecasted rainfall.

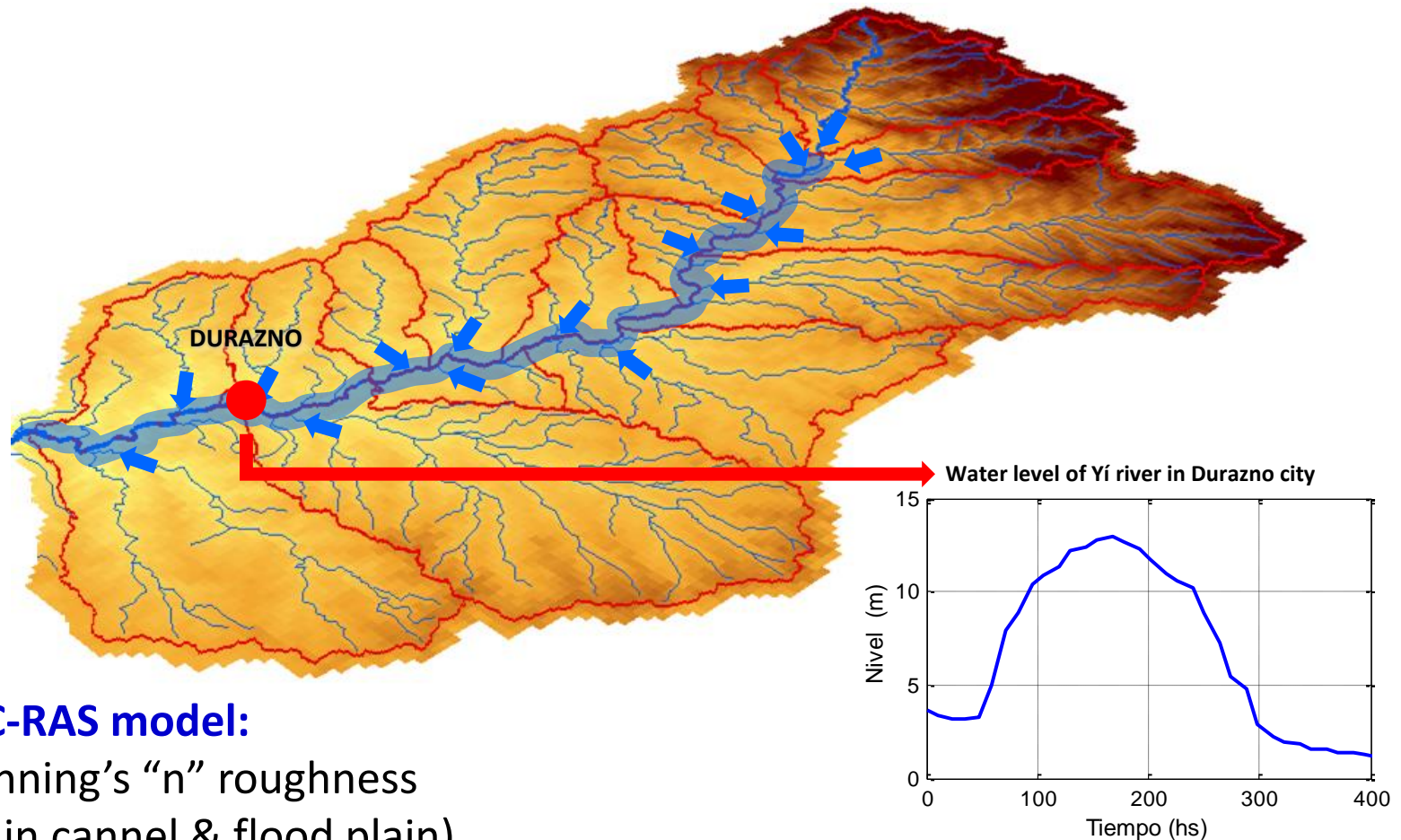


EWS-Durazno: Coupled H-H model



2

Simulation of the dynamics of water flow to estimate the water level in Durazno city at each time step.



EWS-Durazno: Risk module



Combination of:

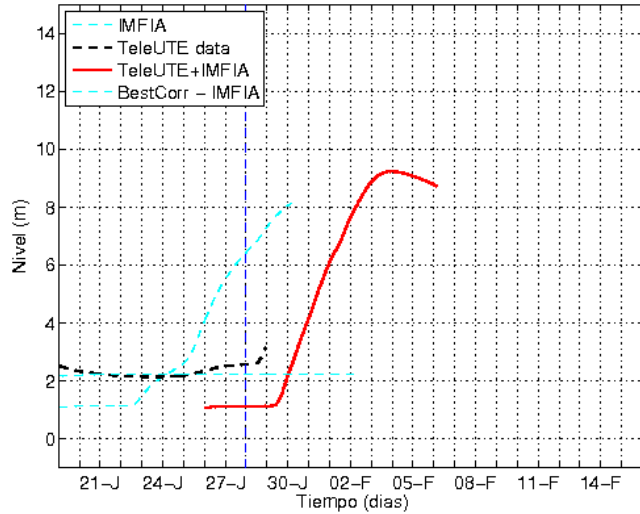
- Hydrodynamic level model's output
- DEM of the flood plain land surface (2m contour lines, 1m in urban area),
- Population survey
- Inventories of properties at flood plain

- Number and characteristics of the evacuee population
- Expected damage to properties

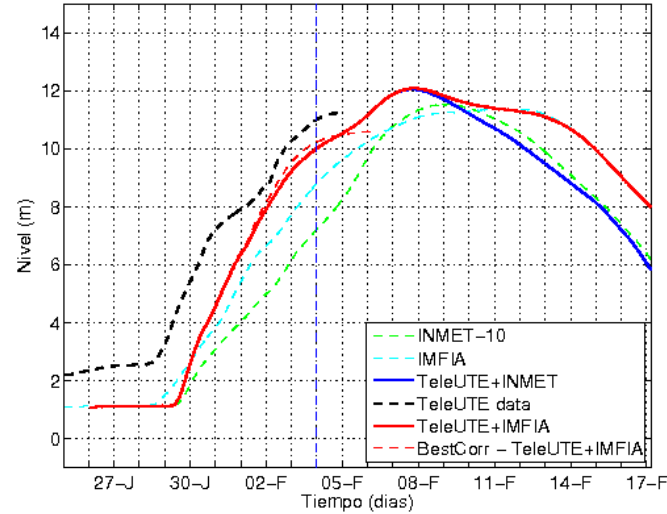
EWS Durazno: Jan-Feb 2014 flooding



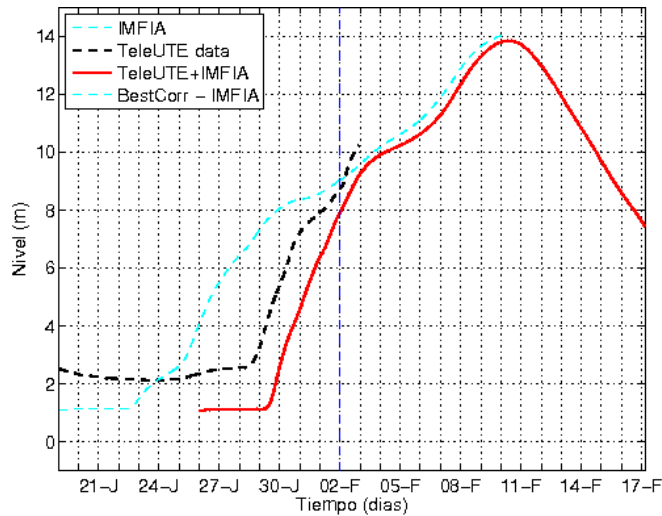
01/28/2014



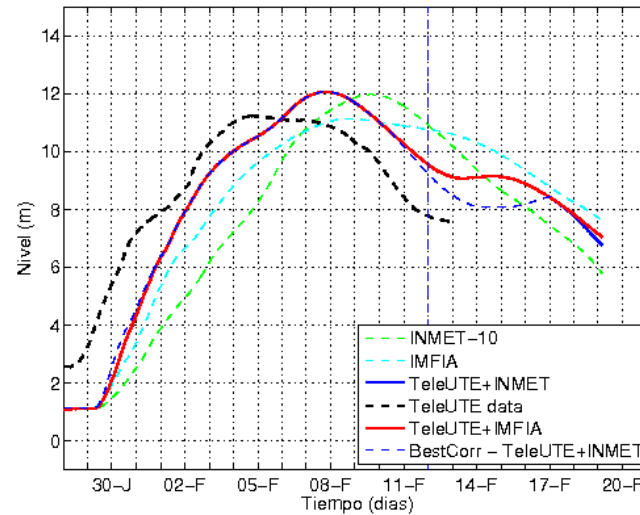
02/04/2014



02/02/2014



02/12/2014



Observed
rainfall:
Jan28-Feb06
387 mm

EWS Durazno: Jan-Feb 2014 flooding



The EWS allowed to manage the storm that took place between January 21 and February 11, 2014.

“Before there was chaos. People were evacuated without knowing which was the water level that would reach the river. People were evacuated 24 hours a day. Now we can manage the actions, using less trucks, with more time before the flood, more safely“

Jesus Mario Rodríguez, director of the Durazno Emergency Coordination Center, El Observador 02/08/2014.



Extending the Pilot Project

As consequence of the Durazno pilot project, national authorities promoted and supported the formulation of two complementary projects:

**STEPS TO EXTEND THE EARLY WARNING
SYSTEM OF DURAZNO CITY TO THE CITIES OF
ARTIGAS AND TREINTA Y TRES IN URUGUAY
(2014-2016)**

AGREEMENT WMO-Julio Ricaldoni Foundation
Financing: World Meteorological Organization

- Pre-HH model of the Cuareim & Olimar rivers
- Methodological proposal to real-time operation based on telemetric network
- Training local staff in the operation of the EWS
- Review of the Spanish translation of the WMO Manual on Flood Forecasting and Warning

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SATI-UY: EWS FOR FLOOD FORECASTING AND MANAGEMENT

Partners: IMFIA/School of Engineering (Direction) & School of Architecture UdelaR, INUMET, DINAGUA, SINAIE, Local Governments and CECOEDs of Durazno & Artigas
Financing: National Agency for Research and Innovation (ANII) & partners counterpart

- Implement a telemetry network for the EWS (project acquisition & ANA donation)
- To establish the Follow-up Coordination Unit (technical support to local actors)
- Technological transfer and Training to USPI

EWS of Artigas and Treinta y Tres



Artigas



Treinta y Tres



- Population: 40.658 inhabitants
- Basin area: 4.570 km²
- June 2001 flood: 7600 affected



- Population: 25.477 inhabitants
- Basin area: 9.200 km²
- May 2007 flood: 2800 affected

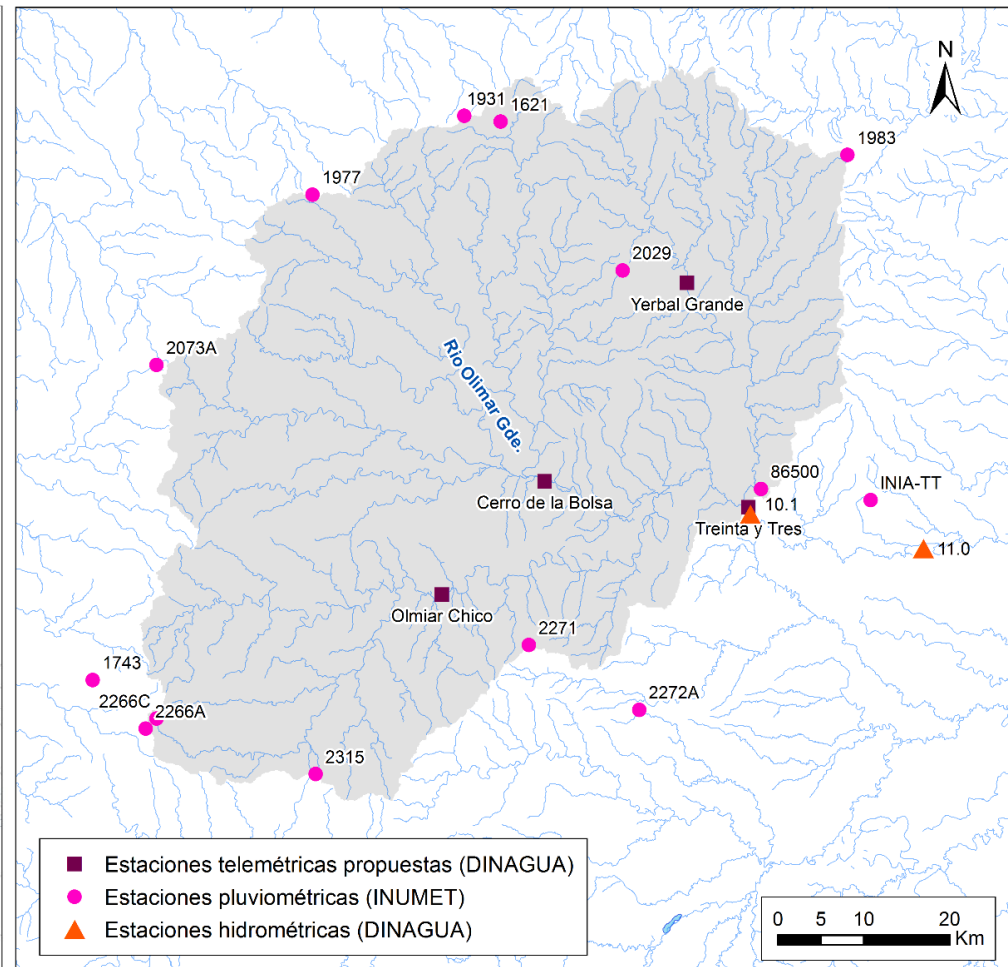
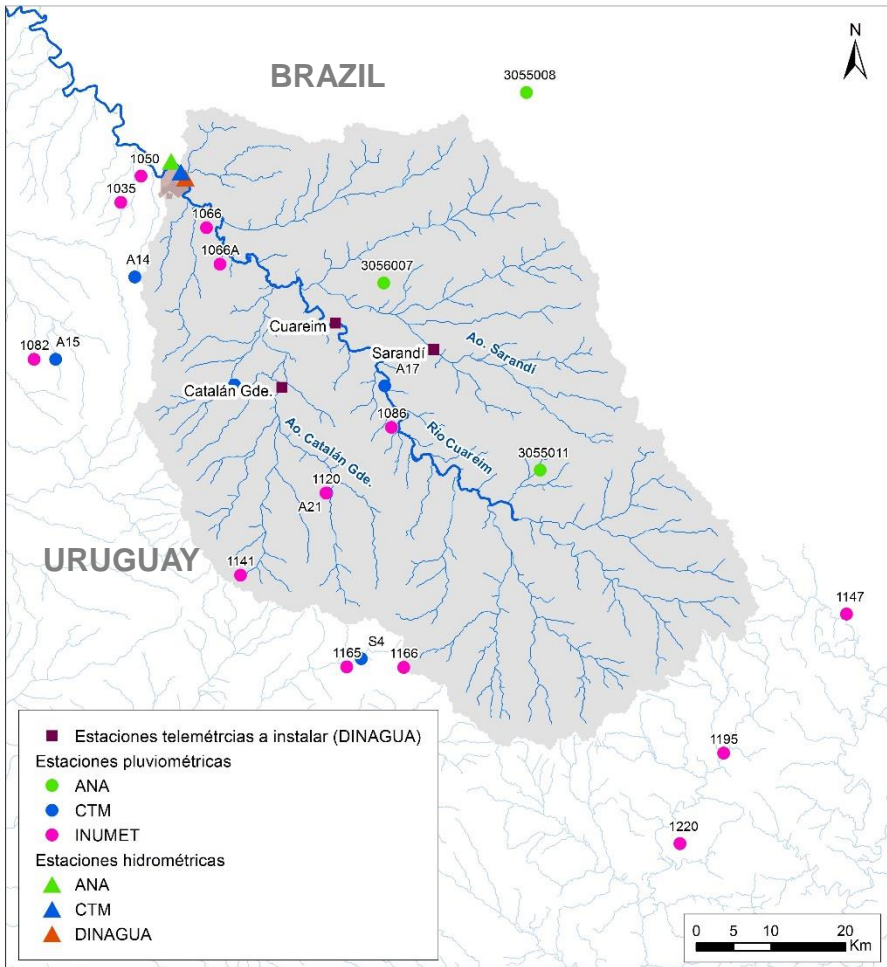
Rainfall and water level stations

Coordinated effort DINAGUA-UdelaR to select proper locations and installing telemetric stations donated by ANA-Brasil

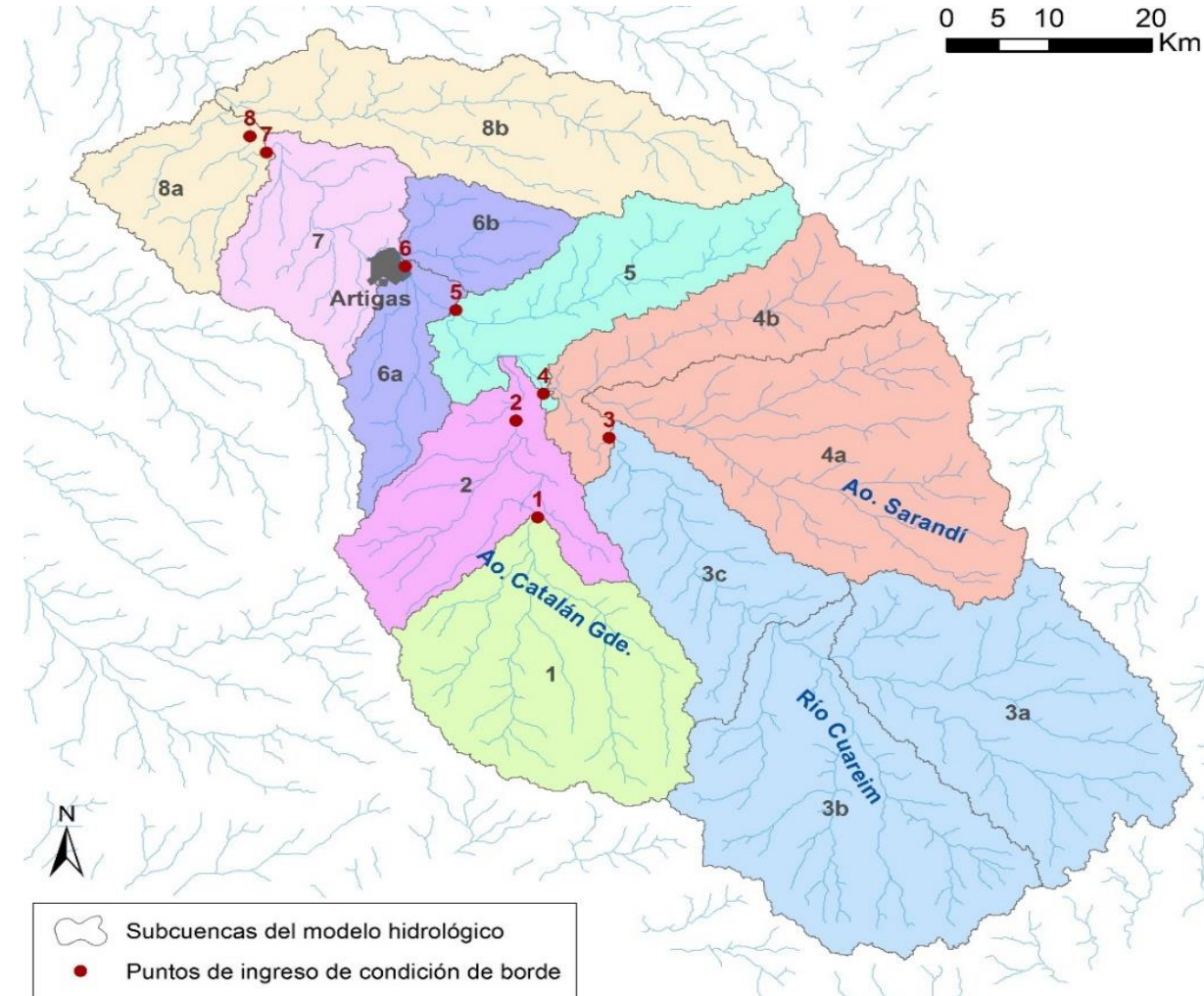


Artigas

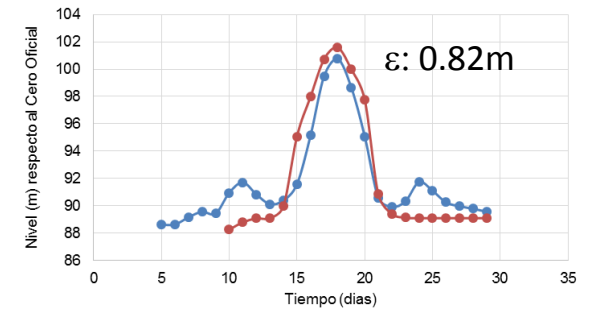
Treinta y Tres



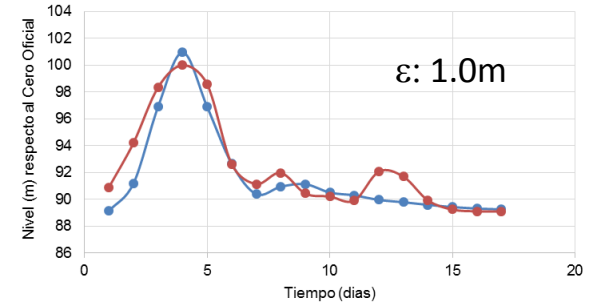
Coupled hydrologic-hydrodynamic model



One of the calibration events (April, 1991)

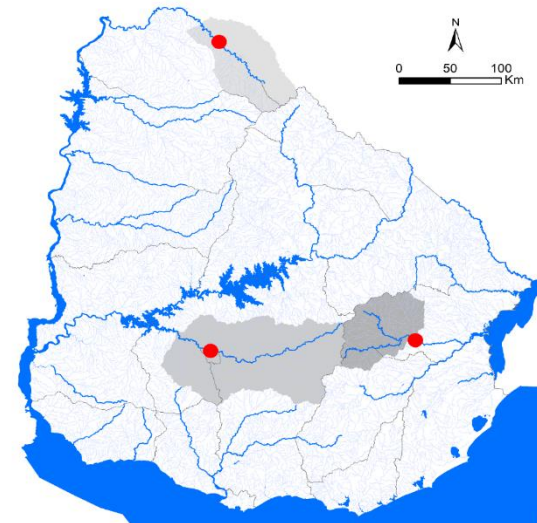


One of the validation events (June, 1991)



Conclusions

- EWS provides sufficient information on maximum water level and permanence, with sufficient lead time for the local authorities and civil forces to plan and manage the emergency (tents, food, clothing, medical attention).
- After its successful operation in Durazno the EWS earned the trust of local authorities first and national authorities after, who adopted the EWS nationwide (Artigas, Treinta y Tres... Rio Branco?)
- Strengthened institutional collaboration : SINAIE - INUMET - DINAGUA – UDELAR. As a result a it will establish a operation or "situation" room with facilities for the duty staff (meteorologist, hydrologist), to support decision -making of local authorities, or national if necessary.
- Institutional involvement will also ensure the continuous improvement of the EWS.



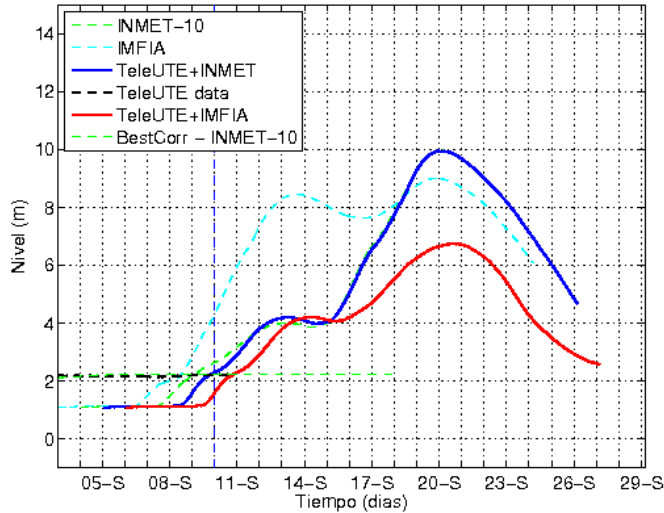
An aerial photograph showing a residential neighborhood that has been almost completely submerged in dark floodwater. A multi-lane highway with a green median runs along the left side of the image. The houses and trees are visible as small islands of land in the sea of water. The text "THANK YOU!!" is superimposed in the center of the image in a bright yellow, bold, sans-serif font.

THANK YOU!!

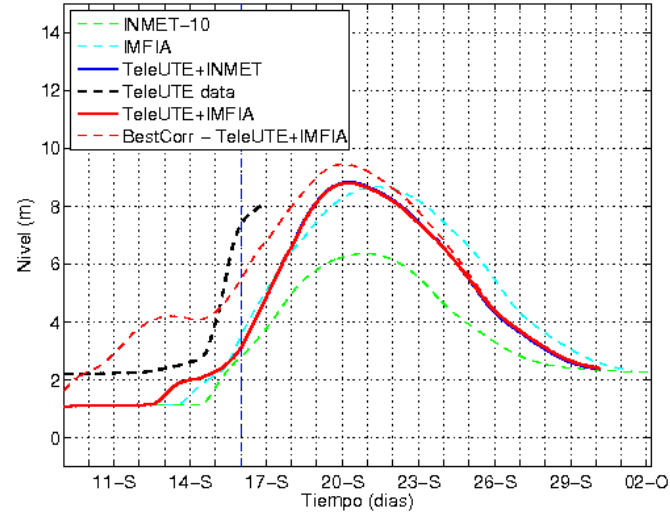
EWS Durazno: September 2013 flooding



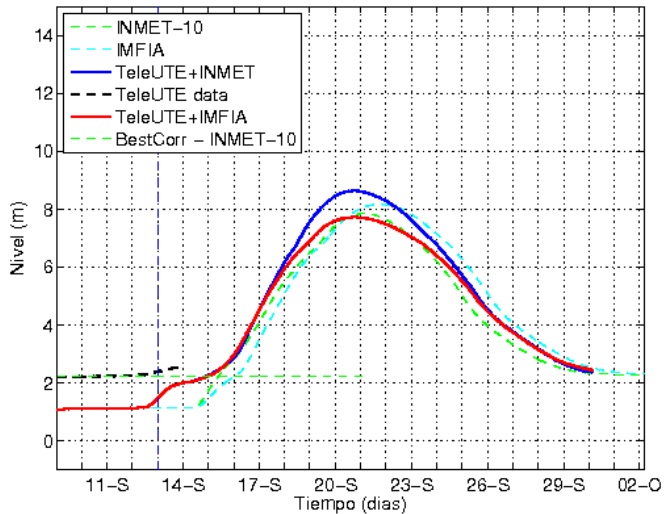
09/10/2013



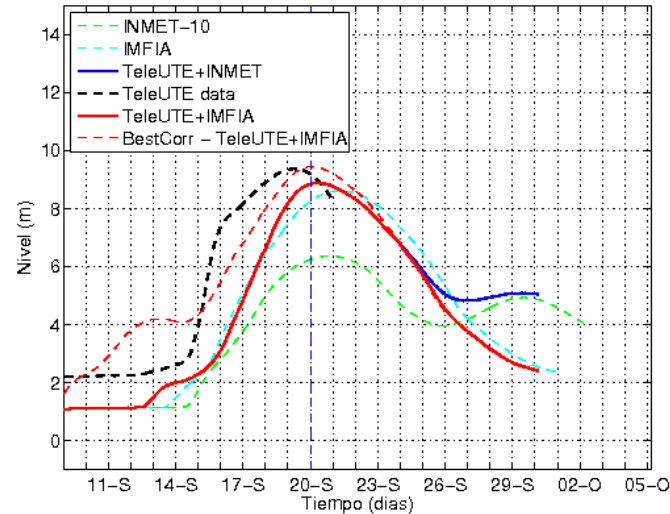
09/16/2013



09/13/2013



09/20/2013



Recorded
rainfall:
88 mm

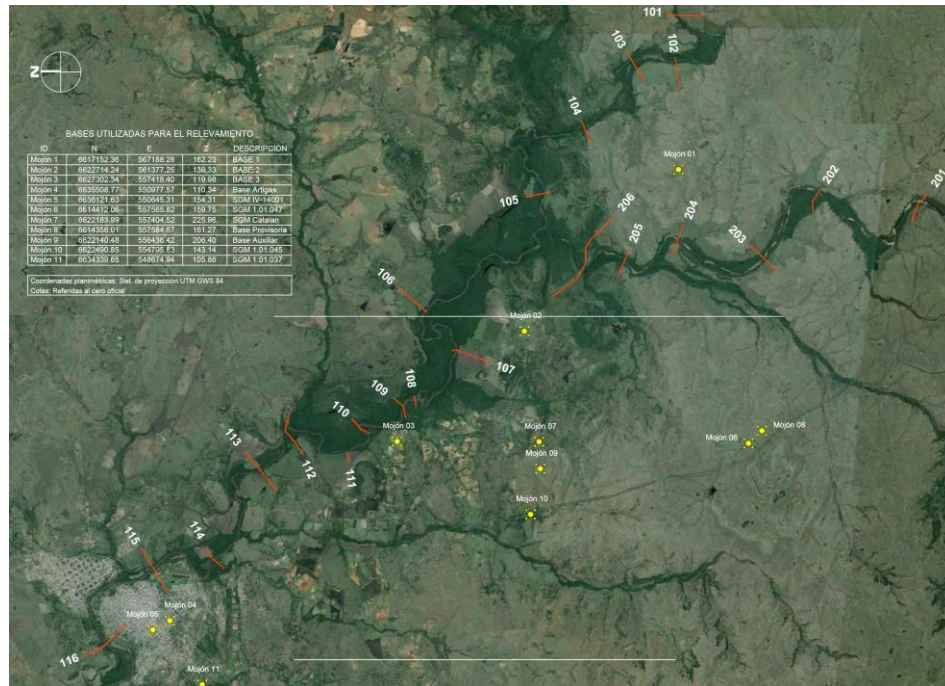
Survey of river's cross sections



Artigas



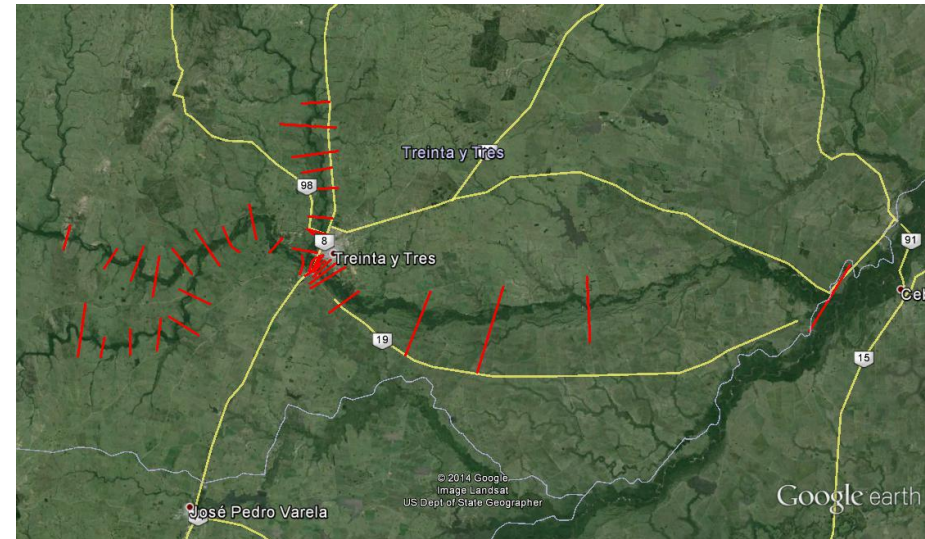
Treinta y Tres



16 sections on Cuareim river (aprox 3km apart)

6 sections on Catalán stream

(aprox 3km apart)



24 sections on Olimar Grande river

6 sections on Olimar Chico river

9 sections on Yermal stream