Anticipando la crecida – Anticipating the flood

Presented in this occasion by Federico Robledo

Departamento de Ciencias de la Atmósfera y los Océanos. FCEN/UBA. UMI-IFAECI/CNRS, Buenos Aires, Argentina,
Centro de Investigaciones del Mar y de la Atmósfera. CONICET.UBA,, UMI3351-IFAECI/CNRS-CONICET-UBA Buenos Aires, Argentina
federico.robledo@cima.fcen.uba.ar

Montevideo, Uruguay 17-21 March, 2014

In Argentina, traditionally the scientific question are performed by the researcher

As an alternative and looking for a paradigm change, we may think that the scientific question could be perform from the state / government and from the society

For what?

To guide research issues towards solving specific problems

So, researchers, along with neighbors and a local government of a district the province of Buenos Aires, pose the question:

How anticipate the flood?

That question is addressed by an interdisciplinary and intersectorial work:

- Anthropologists,
- physical geographers,
- meteorologists,
- oceanographers,
- hydraulic engineers,
- computers
- architects,
- territorial referents

and so is “born” ....

19 july, 2013, Club Pejerrey, La Ribera. Interdisciplinary and intersectorial workshop

Anticipando la crecida – Anticipating the flood

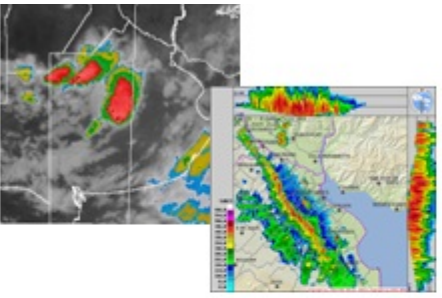
Robledo, Federico 1(*); Moreira, Diego 1 ; Falco, Magdalena 1 ; Murgida, Ana 2 ; Cad, María 2 ; Partucci, Hugo 2; Gatti, Ignacio 2; Duvielle, Mariano 3; Re, Mariano 4; Lecertura, Emilio 4; Kazimierski, Leandro 4; Etala, Paula 5; Briche, Elodie 6; Campetella, Claudia 7; Ruiz, Juan 1; Vera, Carolina 1 ; Saulo, Celeste 1; Simionatto, Claudia 1; Saraceno, Martin 1; Luz Clara, Moira 1; D Onofrio, Enrique 8; Dragani, Walter 9; Bertolotti, Matias 10; Saucedo, Marcos 1; Vidal, Ricardo 1 Juan José Mateos 8; Gustavo Pol 9, Raul Oviedo 9, Néstor Guglielmino 8

1 Departamento de Ciencias de la Atmósfera y los Océanos, Facultad de Ciencias Exactas y Naturales, UBA.; 2 Centro de Investigaciones del Mar y la Atmósfera (CONICET-UBA). ; 3 Programa de Investigación en Recursos Naturales (PIRNA), Departamento de Antropología, Facultad de Filosofía y Letras, UBA.; 4 Departamento de Geografía, Facultad de Filosofía y Letras, UBA.; 5 Instituto Nacional del Agua (INA), Facultad de Ingeniería, UBA.; 6 Servicio de Hidrografía Naval (SHN), Ministerio de Defensa.; 7 Servicio Meteorológico Nacional (SMN), Ministerio de Defensa; 8 Defensa Civil Quilmes; 9 Municipio de Quilmes.

How to anticipate the flood?

The main goal of the project is to contribute to the improvement of the disaster risk management associated with intense rain events and southeasterly wind driven floods, at local level in Quilmes city.

Components of an early warning system



monitoring and alerting

knowledge of risk

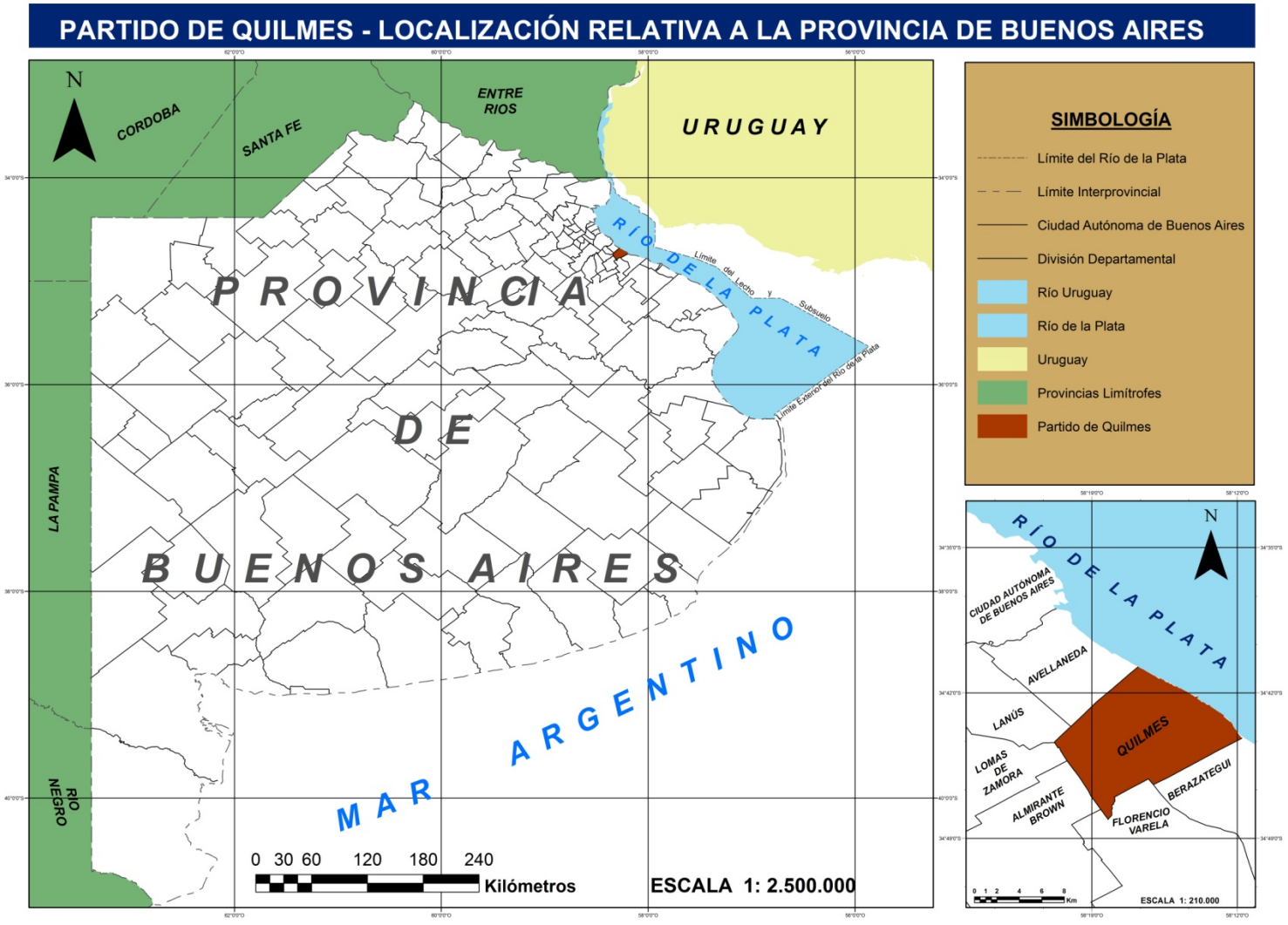
Coordination and collaboration

Communication and dissemination

Responsiveness

Where is Quilmes? (Study area)

20 km south of Buenos Aires



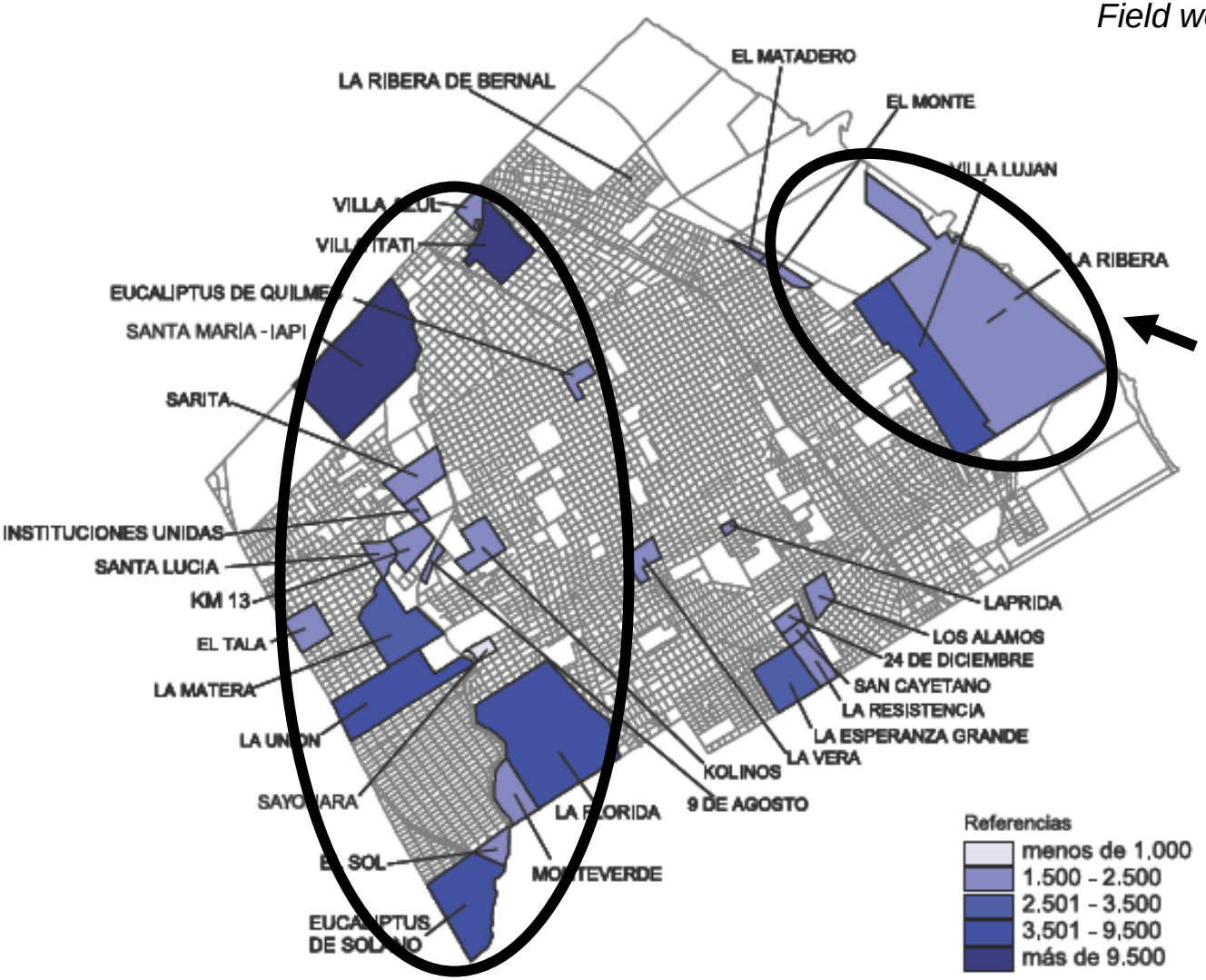
Population 2010 ⟶ 582.943

101.028 people in socially vulnerable. They live in 24,087 households according according to the 2010 census ⟶ 17% of the local population

Spatial distribution of neighborhoods in social vulnerability condition.

Neighborhoods located in low lying areas and near small rivers and / or Río de la Plata. Are flooded with rain and / or flooding with the growth of the Río de la Plata

Field work June 8, 2013



Study area of "Anticipando la crecida" project : "**La Ribera**"

Spatial distribution of neighborhoods in social vulnerability condition.

Neighborhoods located in low lying areas and near small rivers and / or Río de la Plata. Are flooded with rain and / or flooding with the growth of the Río de la Plata

Field work June 8, 2013

Contributions to Flood Monitoring and Early Warning

Small rivers discharge in the Río de Plata

What causes flooding in “La Ribera”?

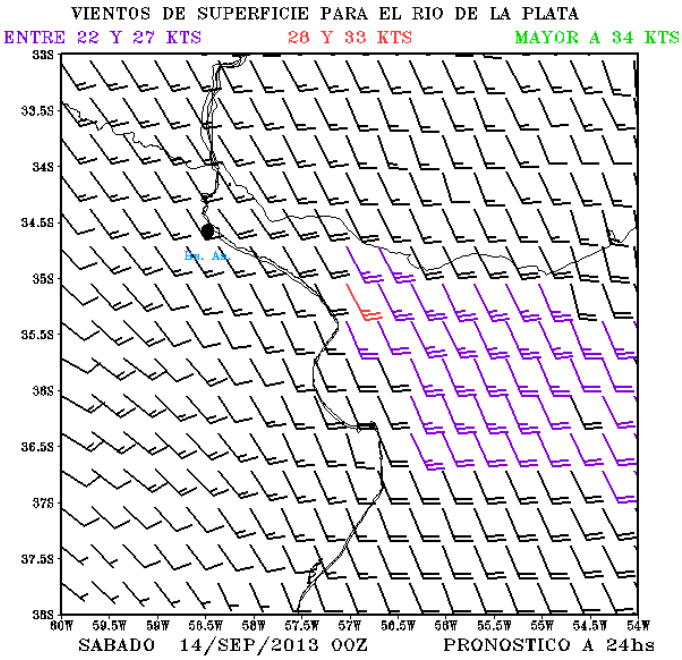
(hypothesis co-produced between neighbors, researchers and decisionmakers)

1) persistent strong wind from Southeast ("Sudestada“)

2) Heavy rains

3) Persistent rain + weak / moderate winds

4) Winds weak to moderate + waves



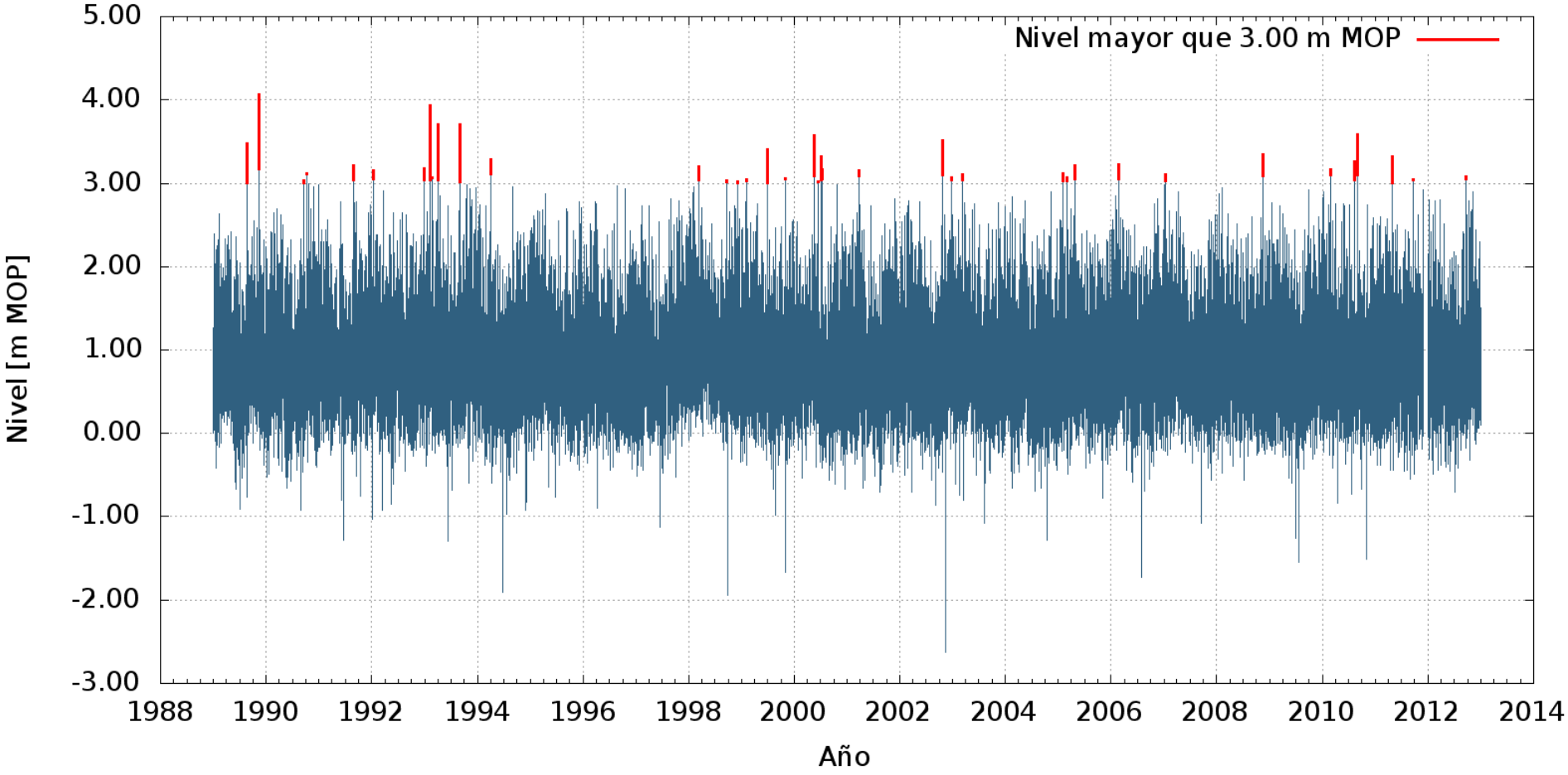
What is the “Sudestada?”

Local phenomenon in Río de Plata characterized by the persistent and moderate to strong winds from the south/southeast usually induce floods along the southern coast of the river; a phenomenom locally known as “sudestada”

1) persistent strong wind from Southeast ("Sudestada")

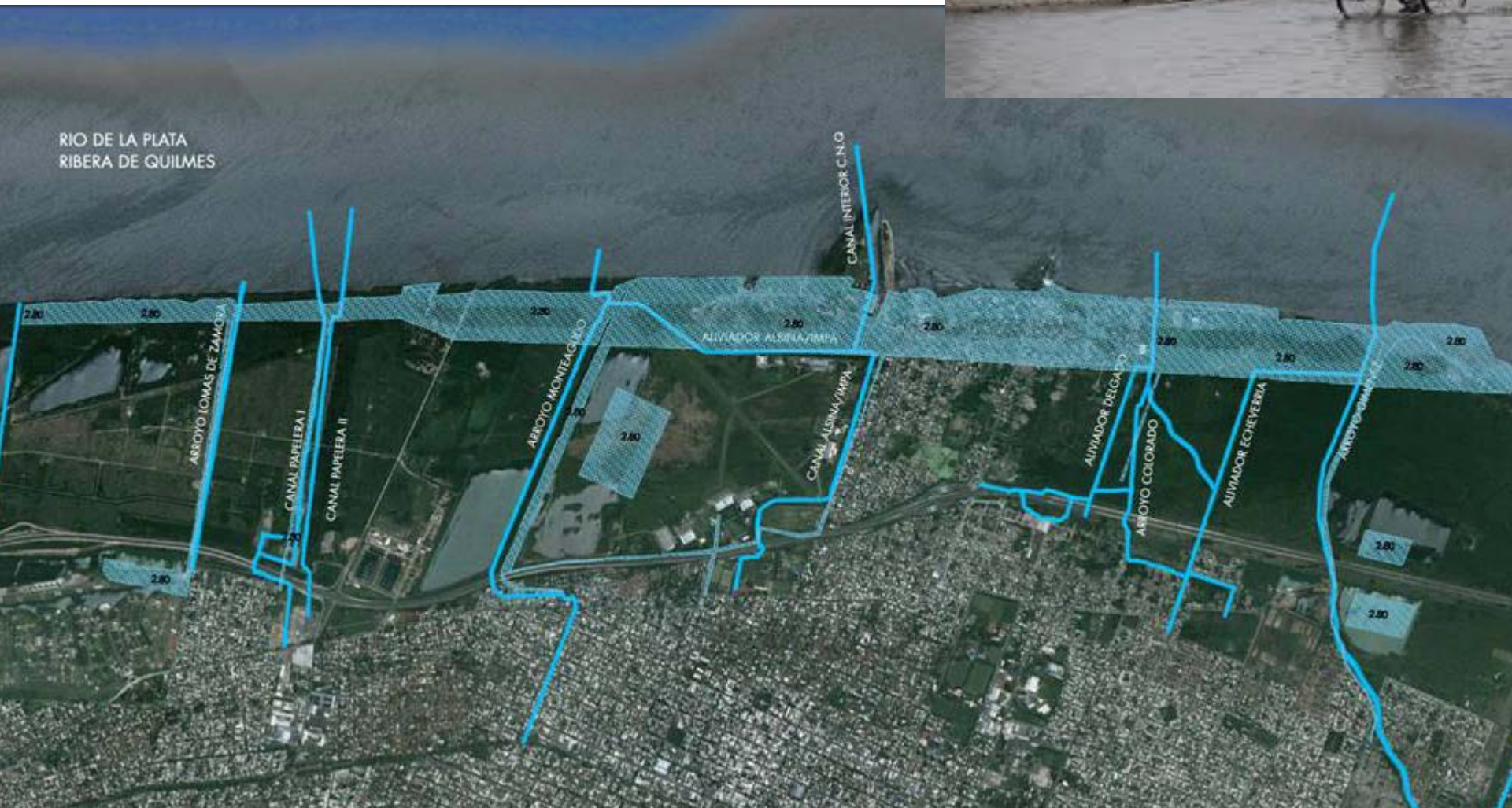
The river rises and enters the territory

Red bars are events exceeding 3meters, those that exceed the coastal defense of La Ribera

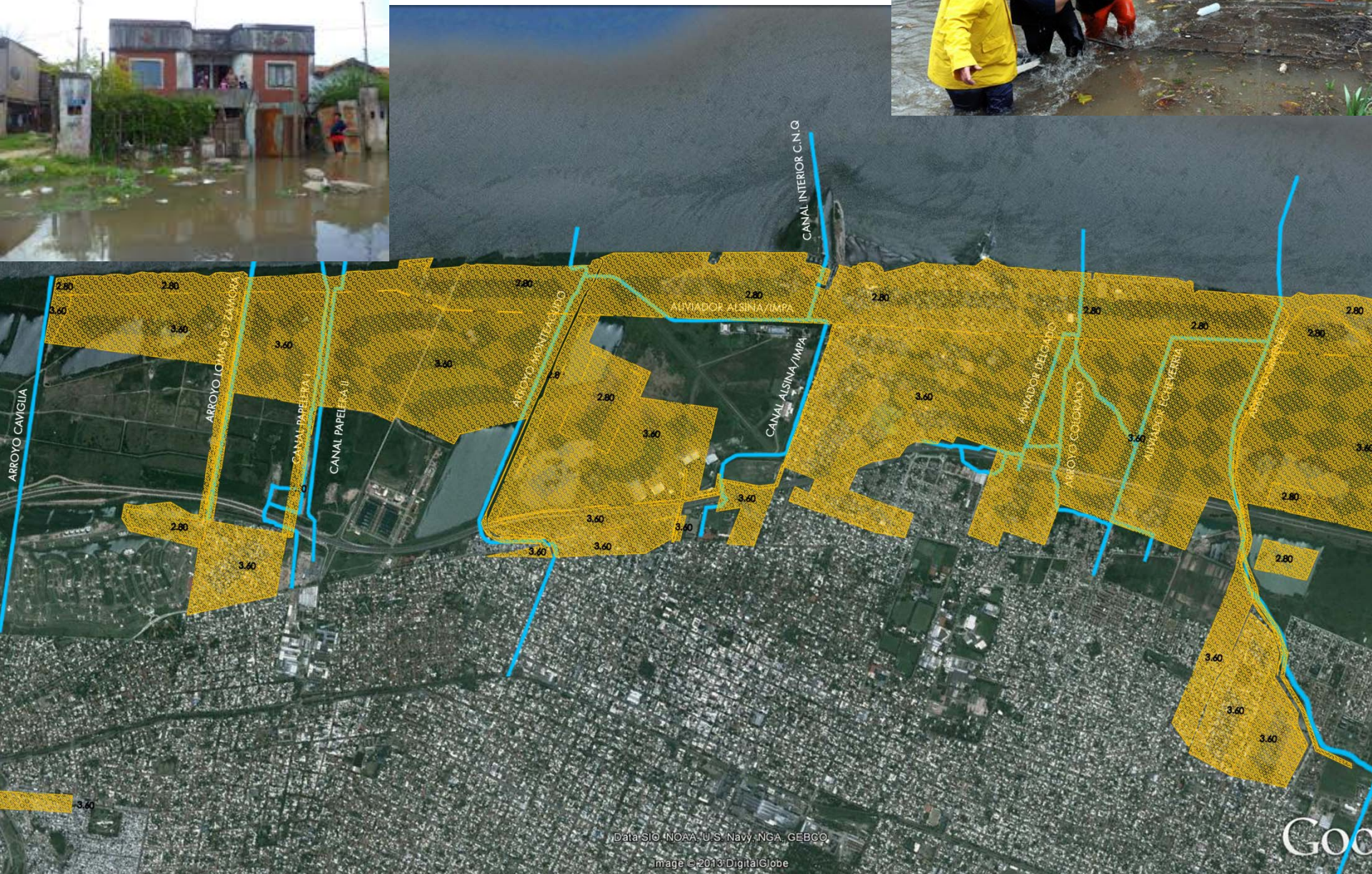


River level. Series1989 - 2012 / / data: Palermo (SHN)

Flooded area. River level: 2.8 m



Flooded area. River level: 3.6 m



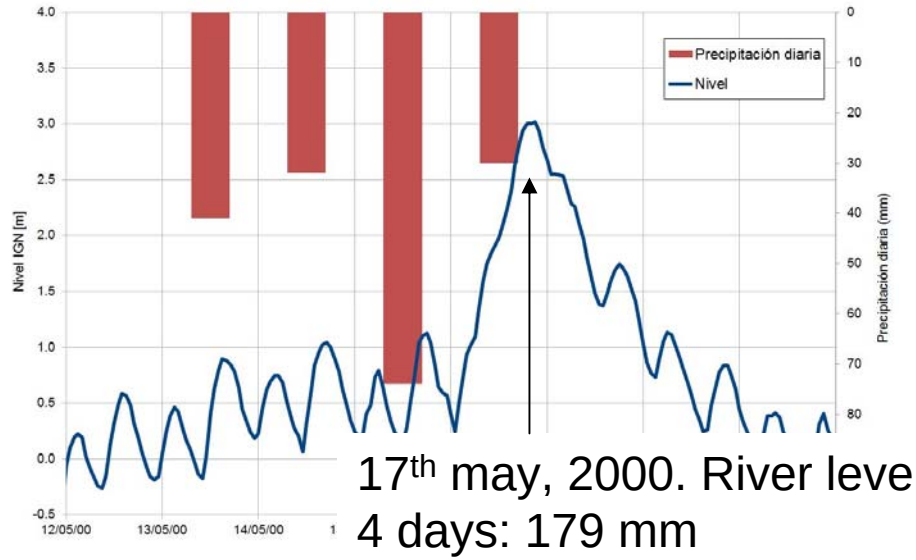
Flooded area. River level: 4.2m // November 12, 1989

3) Rain persistent + winds

Ranking of major floods between 1989-2012 and linked with the occurrence or nonoccurrence of rainfall in the region over a period of five days before to the occurrence.

Orden	Fecha	Hora	Nivel MOP [m]	Nivel IGN [m]	Total 5 dias	Día 0	Día -1	Día -2	Día -3	Día -4
1	12/11/89	15:00	4,07	3,51	26,4	S/P	S/P	25,6	0,8	S/P
2	07/02/93	19:00	3,93	3,37	98,3	52,3	24,9	21,1	0,0	S/P
3	03/04/93	13:00	3,70	3,14	87,2	9,3	60,9	17,0	S/P	S/P
4	30/08/93	18:00	3,70	3,14	39,2	4,0	21,3	8,8	0,1	5,0
5	01/09/10	22:00	3,59	3,03	S/D	S/D	S/D	S/D	S/D	S/D
6	16/05/00	21:00	3,57	3,01	177,0	0,0	30,0	74,0	32,0	41,0
7	20/10/02	05:00	3,51	2,95	15,0	10,0	5,0	S/P	S/P	S/P
8	20/08/89	09:00	3,48	2,92	154,2	107,2	14,3	32,7	S/P	S/P
9	29/06/99	06:00	3,40	2,84	9,2	5,0	S/P	0,0	4,2	S/P
10	15/11/08	21:00	3,34	2,78	S/D	S/D	S/D	S/D	S/D	S/D
11	08/07/00	12:00	3,32	2,76	8,6	7,0	0,6	1,0	S/P	S/P
12	01/05/11	19:00	3,32	2,76	S/D	S/D	S/D	S/D	S/D	S/D
13	06/04/94	17:00	3,29	2,73	157,7	S/P	16,6	42,3	62,4	36,4
14	13/08/10	09:00	3,26	2,70	S/D	S/D	S/D	S/D	S/D	S/D
15	24/02/06	16:00	3,23	2,67	96,6	1,0	67,5	28,1	S/P	S/P
16	31/08/91	10:00	3,21	2,65	37,1	8,6	0,0	S/P	28,5	0,0
17	24/04/05	19:00	3,21	2,65	2,9	S/P	1,7	1,2	S/P	S/P
18	10/03/98	19:00	3,20	2,64	0,2	S/P	S/P	S/P	S/P	0,2
19	31/12/92	22:00	3,18	2,62	1,0	S/P	1,0	S/P	S/P	S/P
20	25/02/10	01:00	3,16	2,60	S/D	S/D	S/D	S/D	S/D	S/D

In May 2000 it was the worst combination for "La Ribera"



3) Rain persistent + strong winds

17th may, 2000. River level 3 meters.
4 days: 179 mm

104 people evacuated for 3 days

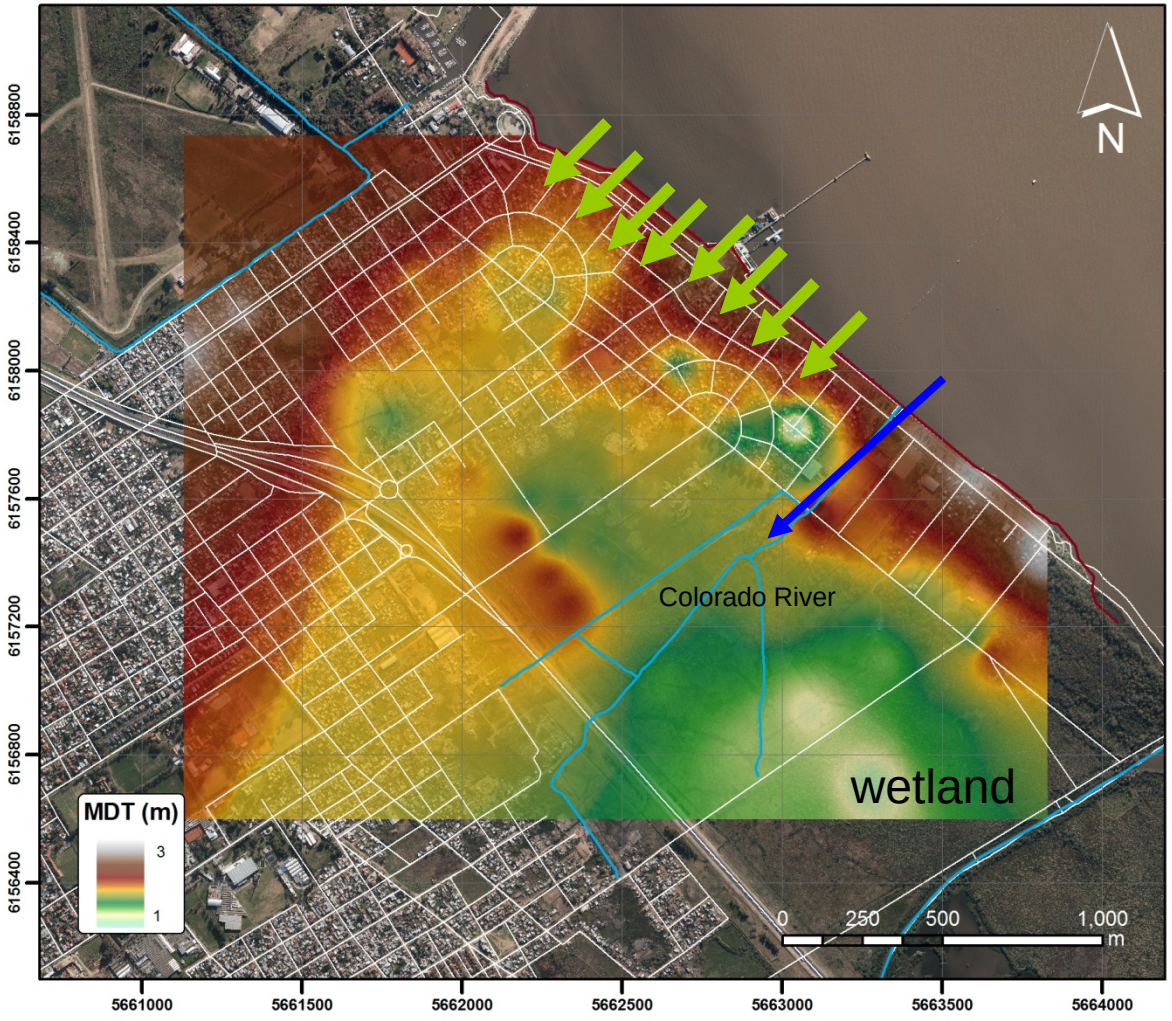
*Image Landsat – **May 18, 2000***

Image Landsat – June 3, 2000

At which points the water enters “La Ribera"?

Which is the residence time of the water in the area?

From level dimensions provided by the Municipality of Quilmes were able to build this first version of the **digital terrain model**.



Hypothesis to be tested once completed the digital terrain model

A) Weak or moderate Sudestada (less 2.5 meters)

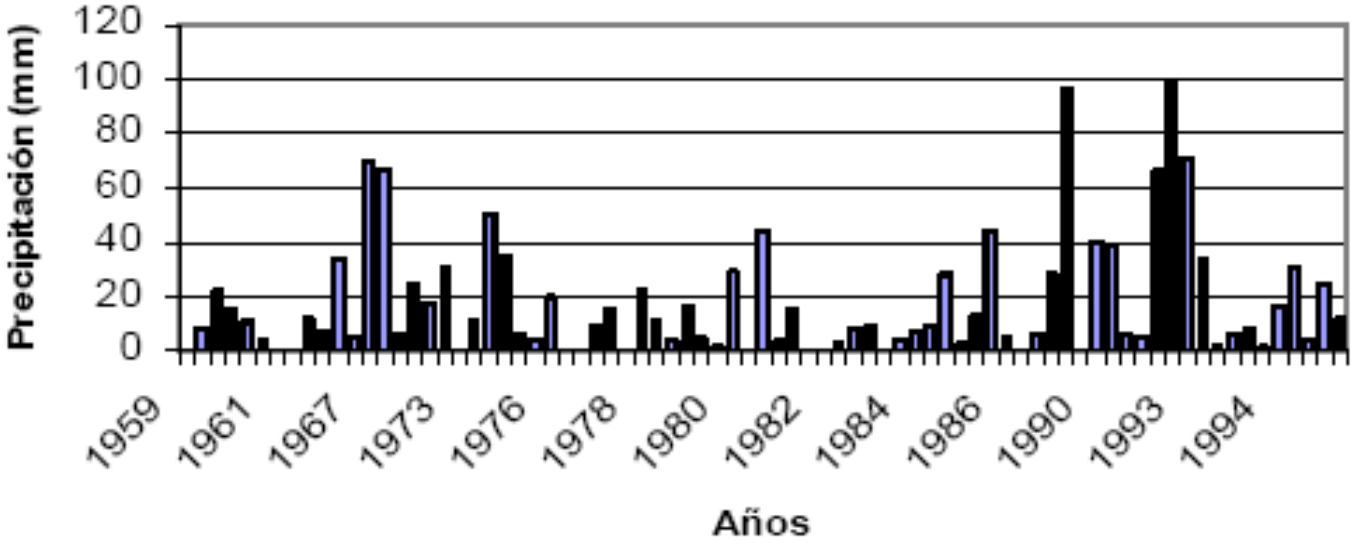
1) Water enters from the “Río de la Plata” through the “Colorado” river
2) It located in the wetland
3) Households impacted depends on rainy days before, during and after the sudestada

B) Strong Sudestada (more than 2,5meters)

Water exceeds coastal defense

3) Rain persistent + strong winds

Interannual and interdecal variability detected



Total precipitation during Sudestadas. 1959 - 1995

Sudestadas en el Río de la Plata asociadas a precipitación en la Ciudad de Buenos Aires. ***Bischoff, S. y Berman, A.*** Anales del IX Congreso de Meteorología - **2005**

Meteorol. Appl. 10, 87–99 (2003) DOI:10.1017/S1350482703005097

A diagnostic analysis of the Río de la Plata Superstorm, May 2000

Norma Possia, S. Bibiana Ceme and Claudia Campetella
Departamento de Ciencias de la Atmósfera y losOcéanos, Centro de Investigaciones del Mar y la Atmósfera, UBA/CONICET, Pab. II Ciudad Universitaria, Buenos Aires, Argentina
Email: possia@at1.fcen.uba.ar

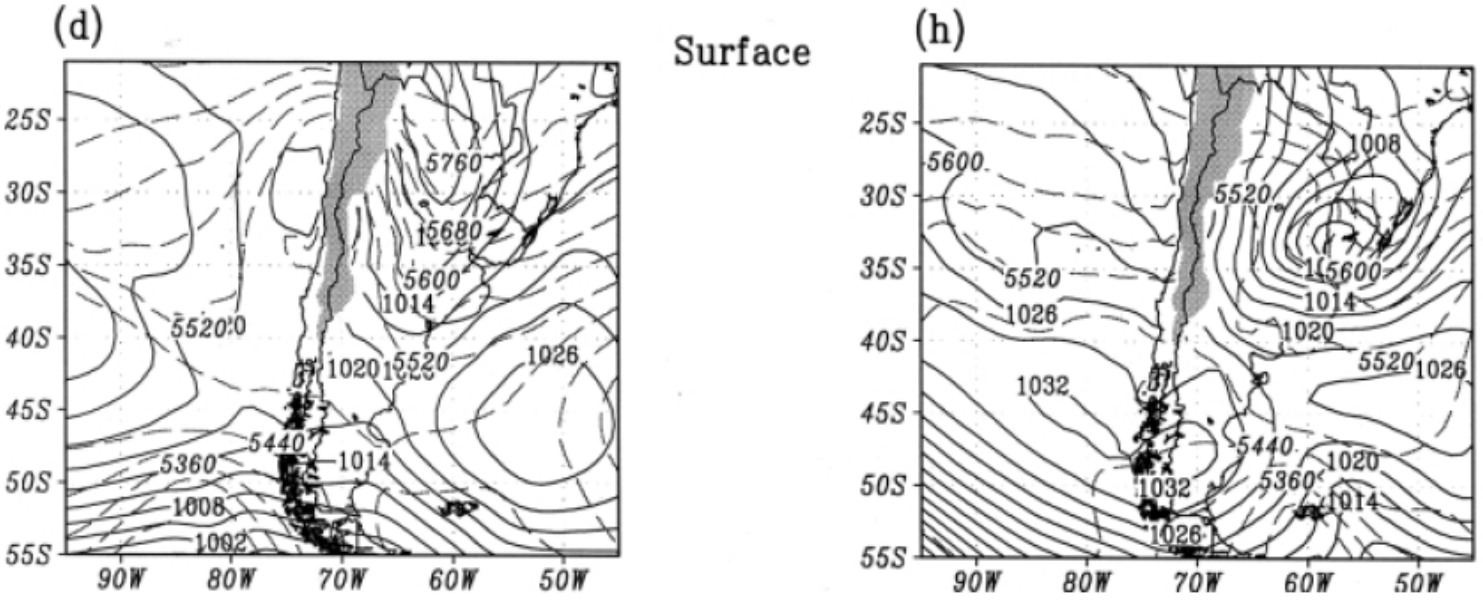


Figure 4. *As for Figure 2 but at 1200 UTC on 15 May (left) and 16 May (right).*

Low pressure system produced very intense winds over the Río de la Plata, the intensification of the system with a closed isobar of 999 hPa.

1) Strong winds

November 2008 can also be seen through a Landsat image, in this case November 16 (half day after the occurrence of peak Sudestada). In this case no rainfall was recorded in the days of storm wave.

Image Landsat – 16 november, 2008

Cold Front east province of Buenos Aires:

1. Wind SSE or SE in Mar del Plata city
2. Persistency > 36hs
3. Mean wind > 20 kts and gusts> 30kts

3) Rain persistent + strong winds

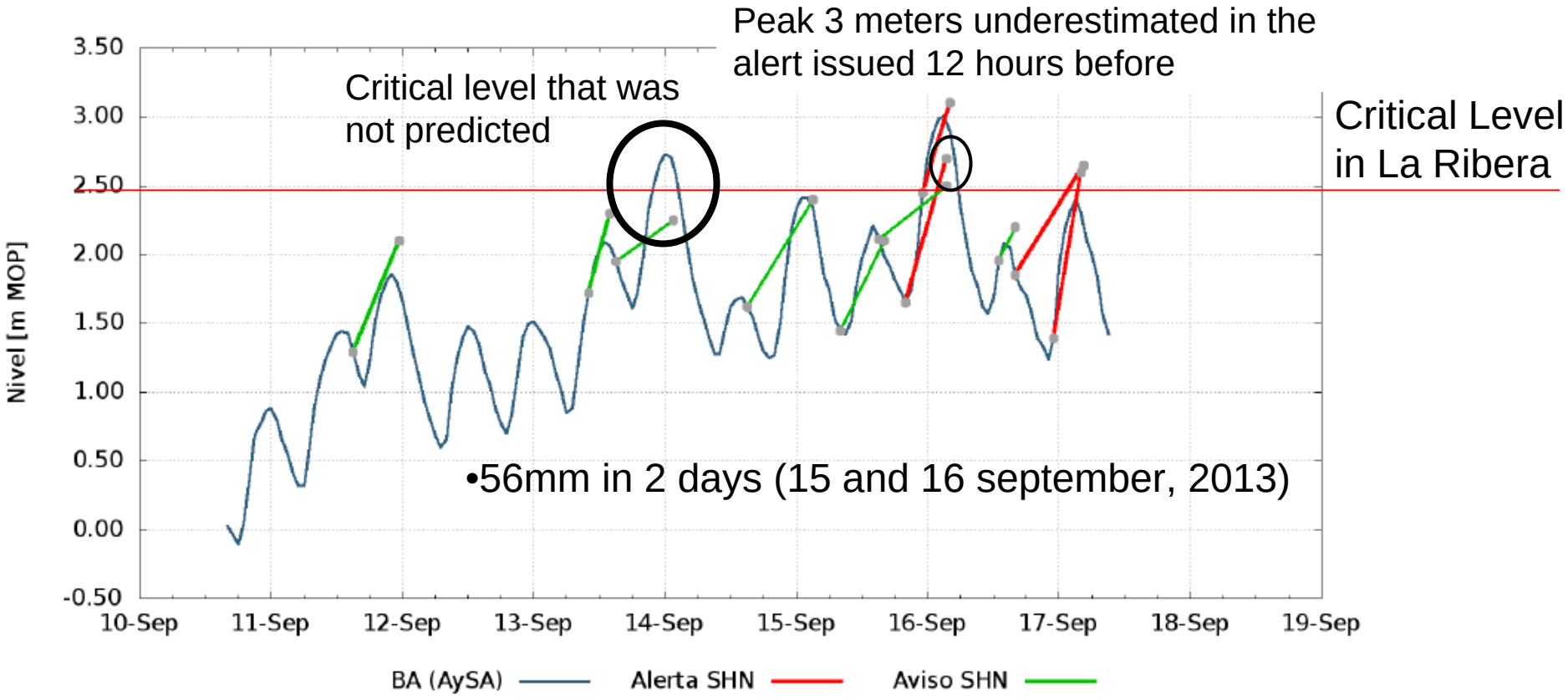
Image Landsat – 18 may, 2000

Cyclogenesis in the east of Argentina or Uruguay:

1. Low pressure centered between 30° and 35° S and between 52° and 58° O

Technical and social monitoring during the project

Warnings and alerts issued by the Naval Hydrographic Service (SHN)



Quilmes Civil Defense reported 27 people evacuated:

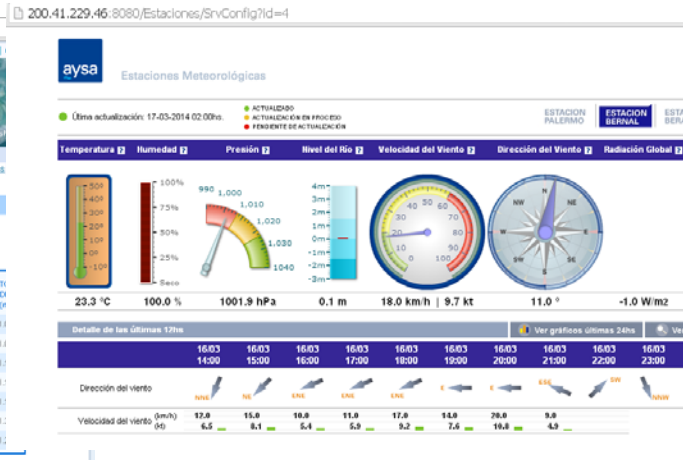
1. 2 families evacuated
2. 4 families evacuated itself
3. Enabled one evacuation center for 48 hours
4. Outage in the area during 10hs
5. Suspension of classes in the local school

<u>Social validation</u> of the flood on September 2013 (talking with neighbors and local goverment)

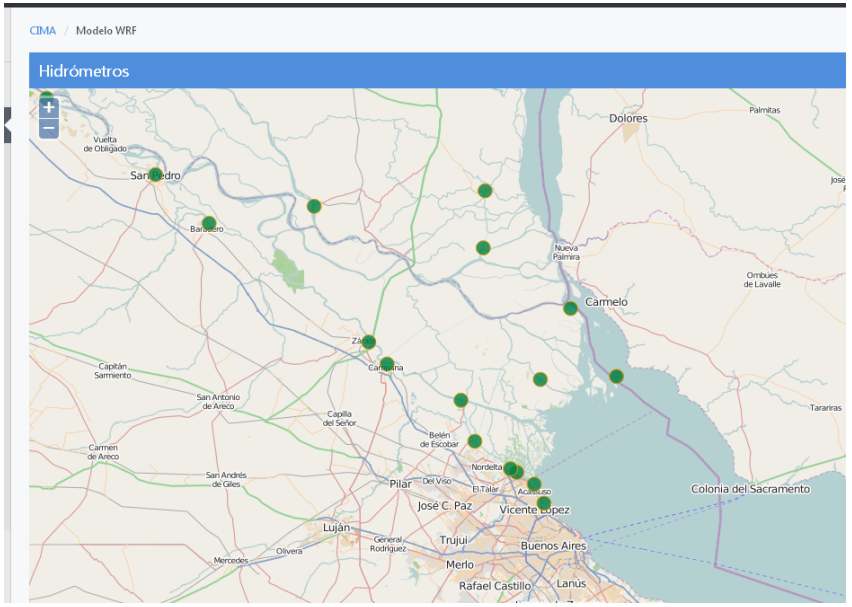
- Water enters from the “Río de la Plata” through the “Colorado” river and then enters from waterfront
- Rain water could not drain to the Rio de la Plata.

Communication and dissemination

River level information is scattered and not georeferenced, is presented in tables



Anticipating the flood centralizes and georeference information available from river level

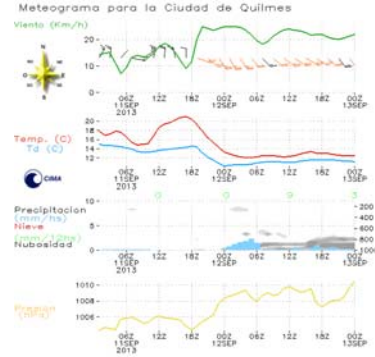


Colors depending on level of river, warning alert and evacuation georeferenced and online.

CIMa-Geoserver Tool (work in progress)

We generated operating meteogram for Quilmes with the WRF CIMA

Staff training of civil defense of Quilmes to interpret a meteogram

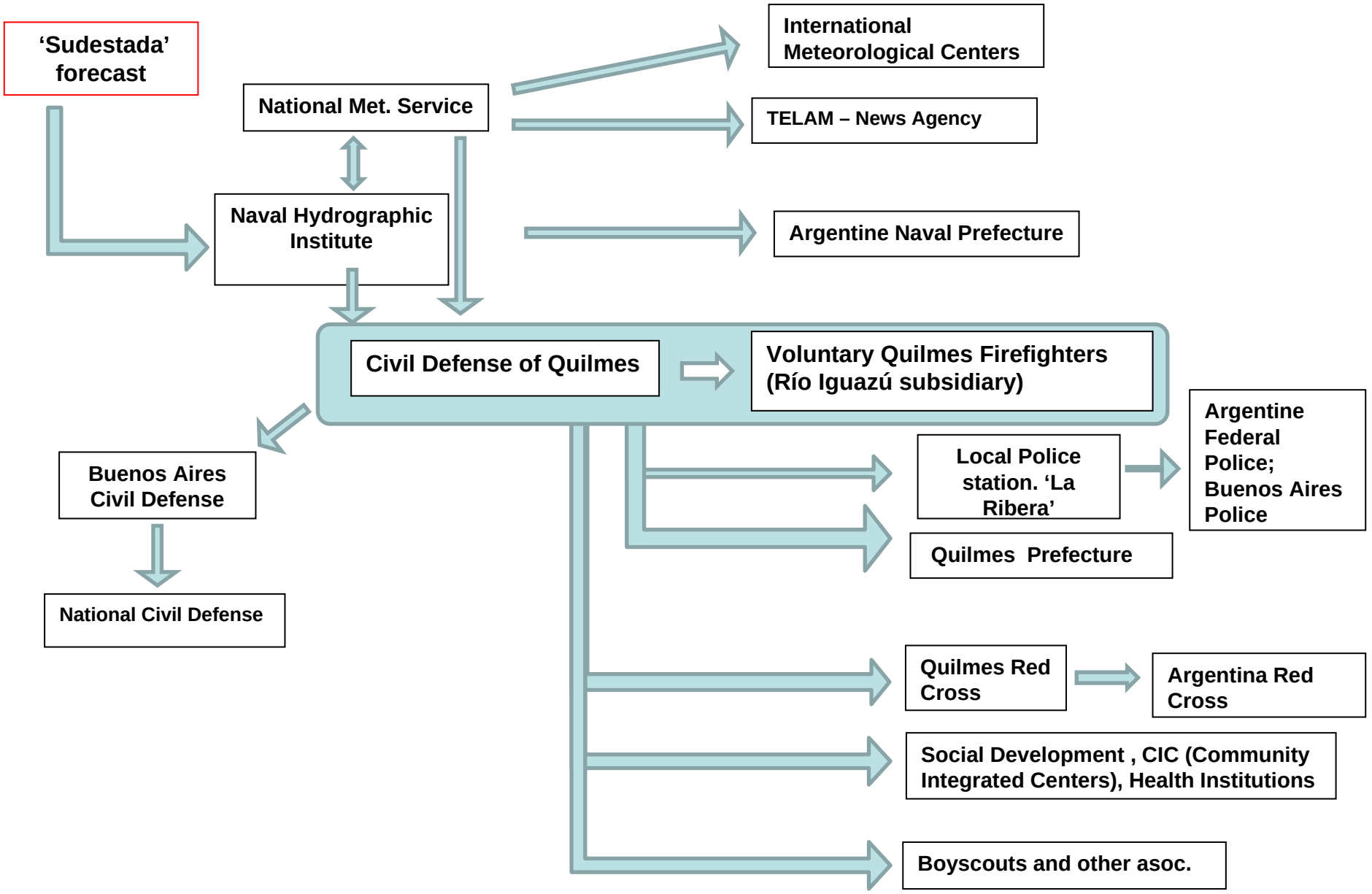


During the field trip of June 8, 2013 with civil defense staff of Quilmes f at they did not receive pre-alerts from the National Weather Service.
Anticipating the Flood managed Civil Defense personnel of Q receive weather pre-alerts from National Weather Service

Simple communication problem solved

Quilmes has only one weather station. We acquired an automatic weather station which will be on Civil Defense Quilmes for contribute with social monitoring

ACTUAL EMERGENCY ACTION PLAN IN QUILMES



Knowledge of risk *(work in progress, Scheduled for April-June 2014*

1. Incorporate information of infrastructure systems georeferencing, data provided from the local government.

2. Interviews with neighbors of La Ribera.

3. Participatory map for building a social map of risk at “La Ribera”.

4. Activities at local school. Installation of weather station at the local school

Research issues and work to develop:

1. Validation of waves model and river level of the National Weather Service in Buenos Aires. (Potential MS thesis)

2. Devise forecasts using wind data over the Río de la Plata and height data of past events to improve warning time of Sudestada. 2 hours to 12 hours. Generating algorithms. (Potential MS or PhD thesis)

3. Complement synoptic studies of “sudestadas” and characterization of extreme rainfall affecting La Ribera from the registration of dates with evacuated and future scenarios. (Potential MS thesis)

4. Improve information display system for monitoring (CIMA-geosever).

5. To make maps of vulnerability and risk of La Ribera (using GIS and field work with neighbors)

6. Devise and implement a tool for **social validation** of the flood through pictures and the use of online social networks, supported by the Municipality of Quilmes.

Challenges:

1. Replicate these studies in other quarters at Metropolitan Buenos Aires Area. Example: La Matanza (around 2 million people). So… we will need more people working!... and founding

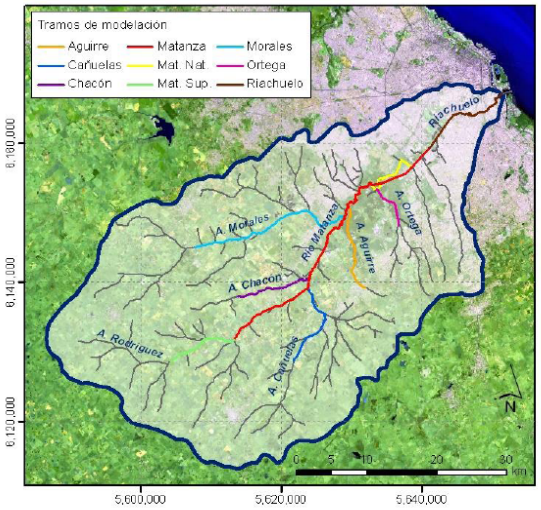


Figura 3: Cursos de agua modelados

2. Ensure that the products of nowcasting forecast (heavy rain alerts or other phenomena) to help decision makers and local residents in a timely manner.

3. Concrete a colaborative project with geographers from Niza, France, focun on georeferenced issues

“Philosophical / political / managment” Challenge

1. How is evaluated these kind of results by the Argentine scientific system? Only with paper production?

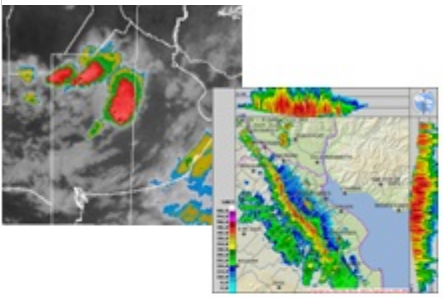
To conclude…

How to anticipate the flood?

We look for responses of the research question (co produced between neighbors, local government and scientists) with concrete actions

We look for to contribute to the improvement of the local disaster risk management in a participatory manner to advance the social appropriation.

Components of an early warning system



monitoring and alerting

knowledge of risk

Coordination and collaboration

Responsiveness

Communication and dissemination

Thanks!
Questions?

http://anticipandolacrecida.cima.fcen.uba.ar/
federico.robledo@cima.fcen.uba.ar

Anticipando la crecida is founding by University of Buenos Aires and the Facultad de Ciencias Exactas y Naturales de la UBA

Río de la Plata, La Ribera, Quilmes 8 June, 2013