Water2Adapt

Resilience enhancement and water demand management for climate change adaptation

Water2Adapt Project

Water2Adapt (September 2010-August 2012) is an applied-research project which seeks to produce policy-relevant knowledge and recommendations for water management and the implementation of the EU Water Framework Directive. In particular, the project will contribute to the economic analysis of water uses, efforts to set up efficient and socially equitable prices for water and water services, and to assess programmes of measures in the river basins. In addition, capacity workshops will be organised in the case study regions to increase awareness of the topics to which this project seeks to contribute.

Water2Adapt aims to:

- identify 'social drivers' of water scarcity - i.e., the practices which lead to unsustainable consumption and inefficient allocation of water;
- assess the magnitude and mediating factors of water scarcity- and drought-induced impacts;
- revisit the performance and wider impacts of the water demand management policies.

Resilience and adaptive capacity, that is the ability to withstand and recover from significant disruptions (or to absorb and cushion against damage), will be translated into practical management tool applicable at river basin scale.

www.feem-project.net/water2adapt/

Fondazione Eni Enrico Mattei

ISPRA Istituto Superiore per la Protezione e la Ricerca Ambientale

Analysis of extraordinary flood events in the river Po

DISCHARGE REGIMES

The Po hydrologic basin extends from southern Alps to northern Apennines of Emilia-Romagna. Because of this, the Po river shows a mixed discharge regime: part alpine, with spring/summer floods and winter droughts, and part Apennine, with spring/autumn floods and summer droughts. But since minimal discharge occurs more often during summer (especially August), we can say that Apennine regime prevails over alpine regime.

Po river have two maximal river discharges during spring and autumn, and two minimal discharges in winter and summer. Average discharge rates shows great variability, but regular outflow when meteorological conditions are normal. Average discharges measured at Pontelagoscuro station are 400 m3/sec during lean discharge, 1,540 m3/sec during normal discharge, and 9,750 m3/sec during full discharge. (deltadelpo.net)

When heavy and prolonged precipitation occurs from upstream to downstream, the river can flood over the banks running from Valenza Po to Adriatic sea (450 km). Floods are more intense in the last section of the river, where the water pressure is stronger and the river is partially pensile over the surrounding area, with a difference in level around 7-8 mt.

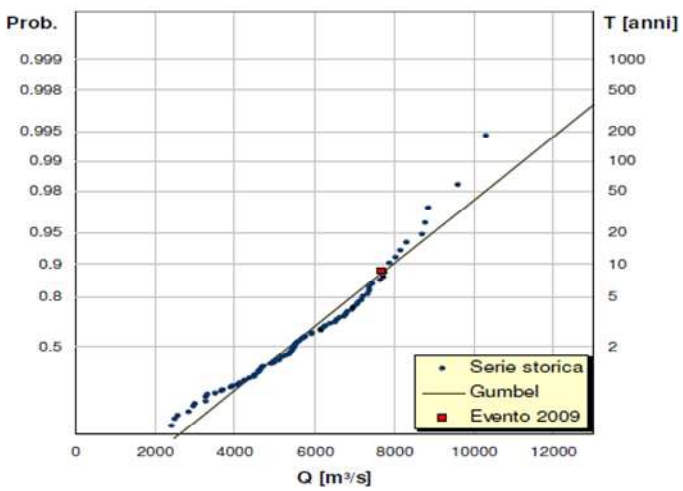


Figure 1. Gumbel distribution for discharge registered at Pontelagoscuro Po station. (source: ARPA, 2009)

FLOOD EVENTS

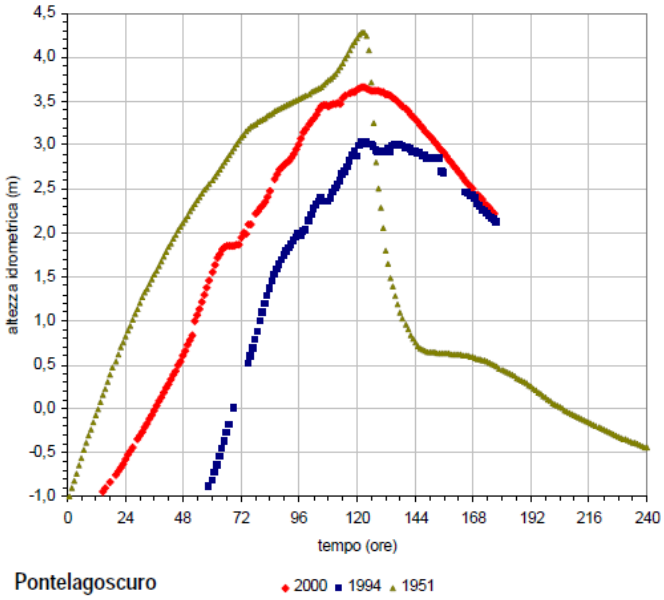


Figure 2. Compared time trend for some flood events. (source: Colombo, 2004)

In the last decades, while the total amount of water flowing from the Po tributaries is decreased, values of discharges during flood events are increased compared to the past. This tendency seems to be caused by the regulation of the basin hydrological network itself, more than by the effects of climate change.
The IPCC *4th Assessment Report* includes the Po valley in between the European continental zones that will be more affected by variation of rainfall regimes, with an amplification of hydrological extreme events. (Naldi et al., 2008)

The most important contributes to flood events come from tributaries Dora Baltea, Sesia and Tanaro in Piemonte and Ticino in Lombardia. In November 1994, Po river had a discharge amount over 11,000 m3/s after Tanaro input confluence, comparable to the amount measured in the last section of the river.

Likewise, in October 2000, due to massive contributes from Dora Baltea and Sesia, the river reached 10,000 m3/s just after Valenza (Wikipedia, 2011).

These events were caused by abnormal weather conditions, with rainfall amounting to 600 mm in few hours in some areas and a total amount reaching over 700 mm from 13th to 17th October, discharging around 1,000,000,000 m3 of water in the Adriatic sea (ilfiumepo.net).

This flood caused 23 deaths, 11 missing people e 40,000 homeless.

Some of the most important maximal discharges of the last 100 years (ARPA, 2009):

- 1917, June: 8,900 m3/sec (Pontelagoscuro)
- 1951, November: 10,300 m3/sec (Pontelagoscuro)
- 1994, November: 8,700 m3/sec (Pontelagoscuro)
- 2000, October: 9,600 m3/sec (Pontelagoscuro)
- 2002, November: 8,100 m3/sec (Pontelagoscuro)
- 2009, April: 7,700 m3/sec (Pontelagoscuro)
- 2010, December: 5,000 m3/sec (Pontelagoscuro)

Figure 3. Pontelagoscuro, Po station.

TIME SERIES ANALYSIS

A recent study (Zanchettin et al., 2008) has evaluated the river discharge time series from 1917 (measured at Pontelagoscuro station).

Considering human intervention on the run-off process (albeit with inevitable approximation), data of precipitation, evaporation and river discharge give a coherent picture of the basin hydrological dynamics for the 1831-2003 period.

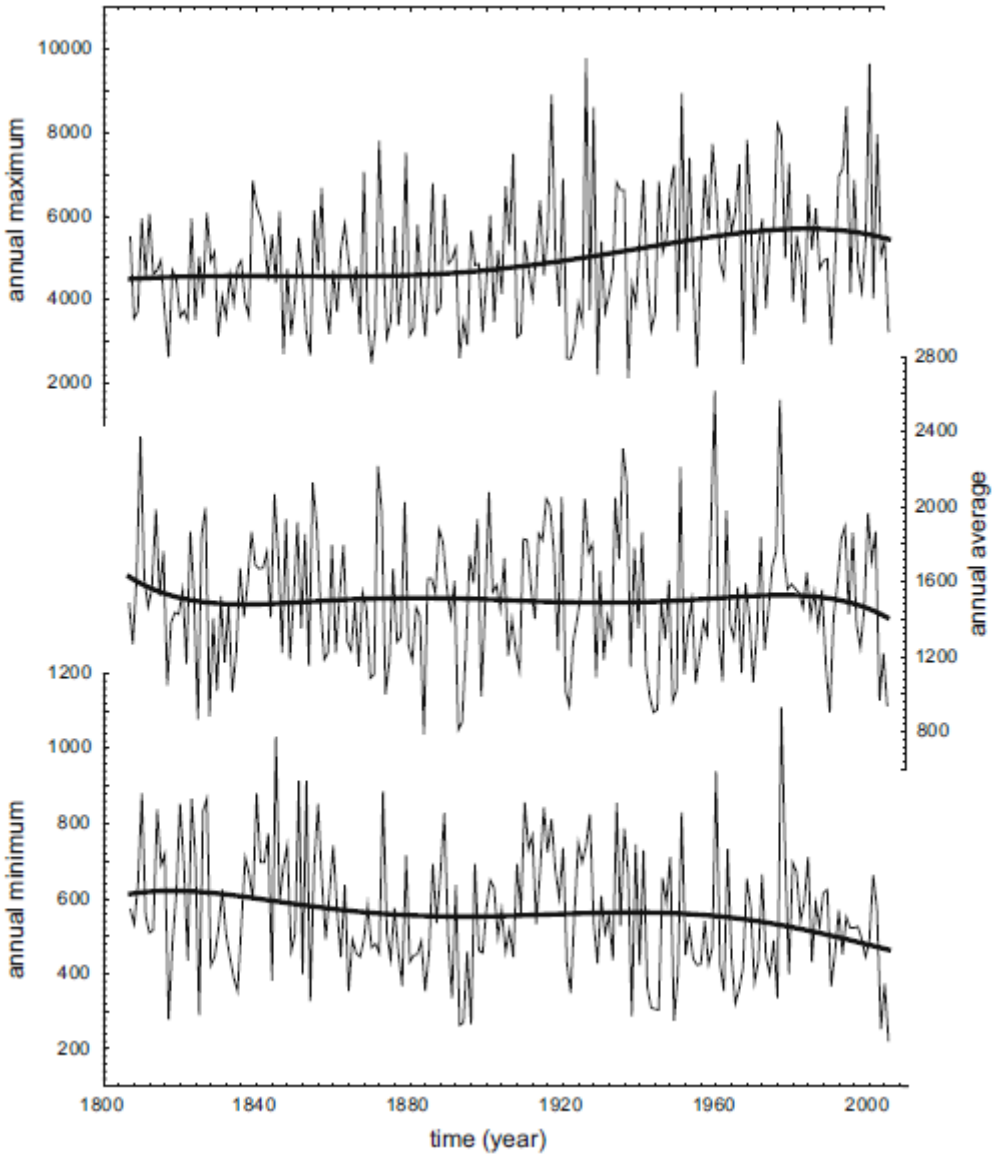
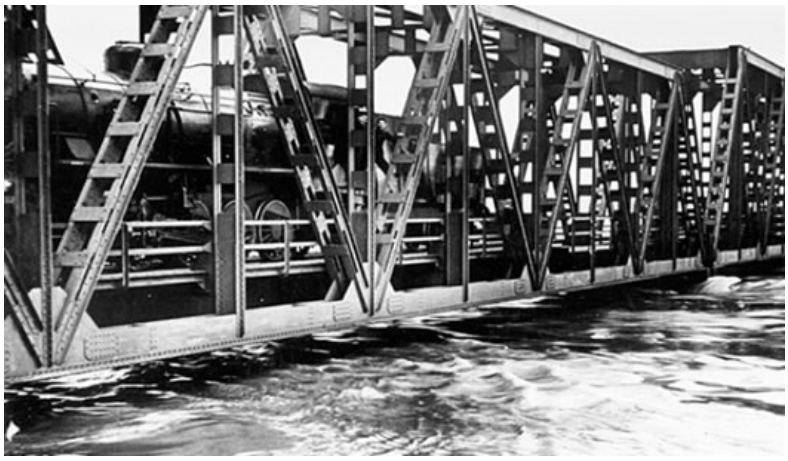


Figure 4. Maximal, average and minimal annual discharge for 1807-2005 period. (source: Zanchettin et al, 2008)

The most noticeable aspect from the observation of discharge time (fig. 4) is the increasing relevance of extreme events in the last decades, primarily caused by river embankments completed in the '60s rather than climate change. On a bigger time scale, the river flow variations mainly reflect the changing in the precipitation trend, especially regarding seasonal peeks.



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The results contained in this policy brief were produced within the project Water2Adapt "Resilience enhancement and water demand management for climate change adaptation", funded under the IWRM-net funding initiative by the German Federal Ministry of Education and Research, Ministerio de Ciencia e Innovación (Spain), ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale (Italy), and Foundation for Science and Technology (Portugal).

Water2Adapt

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- Basque Centre For Climate Change (BC3), Spagna
- Chamber of Agriculture Lower Saxony, Germania
- Fundação da Faculdade de Ciências e Tecnologia Universidade Nova de Lisboa (FFCT-CENSE), Portogallo

Duration
September 2010 – August 2012

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Funded by:
- Bundesministerium fuer Bildung und Forschung , Germania
- Ministerio de Ciencia e Innovación, Spagna
- ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale, Italia
- Fundação da Faculdade de Ciências e Tecnologia, Portogallo