ISEO: Improving the lake Status from Eutrophy towards Oligotrophy

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Welcome in Brescia

Project Executive Summary: Work-Packages

1. WP1 - Quantification of the P load entering the lake from the main tributaries.
2. WP2 - Quantification of the P load from overflows of the combined sewer along the lake
3. WP3 - Quantification of the P fluxes from the sediments
4. WP4 – Remote monitoring of the lake surface
5. WP5 - Sewage modelling
6. WP6 – Lake modelling
7. WP7 - Project dissemination
8. WP8 - Project management

	Università di Brescia	IREA	Università di Parma	IGB
WP1	R			
WP2			R	
WP3				R
WP4		R		
WP5	R			
WP6	R			
WP7	R			
WP8	R			

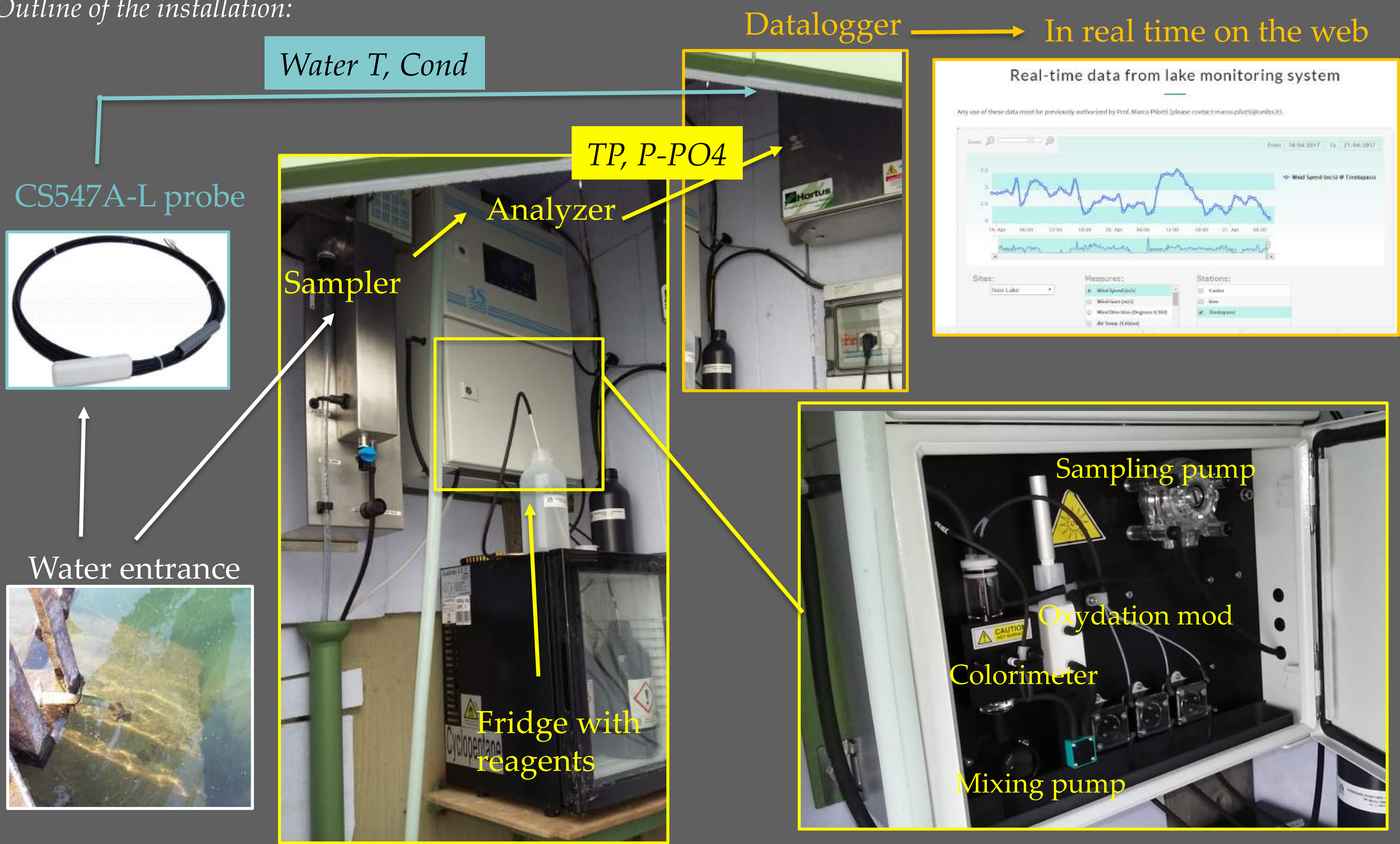
UniBS Activities

Experimental Activities: WP1 - Quantification of the P load from the tributaries

✓ Real time monitoring of P, conductivity and temperature at the entrance of Oglio river in Lake Iseo

Experimental Activities: WP1 - Quantification of the P load from the tributaries

Outline of the installation:



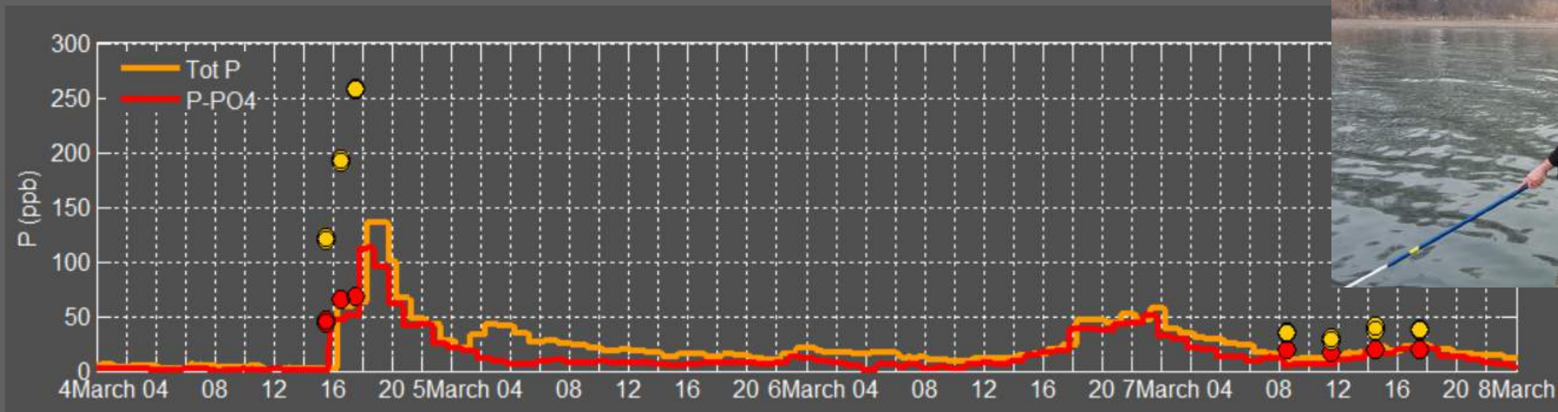
Experimental Activities: WP1 - Quantification of the P load from the tributaries

Measured data
(soon in the web…)

Measured variables	P-PO_4 and Tot P
Sampling rate	1/hour
Accuracy	± 3 ppb (0 -150 ppb)

Measured variables	Water temperature and conductivity
Sampling rate	1/10 min
Accuracy	T: 0.1°C – Cond: ±5% of reading

- Calibration with manual samples (in progress, together with Parma)

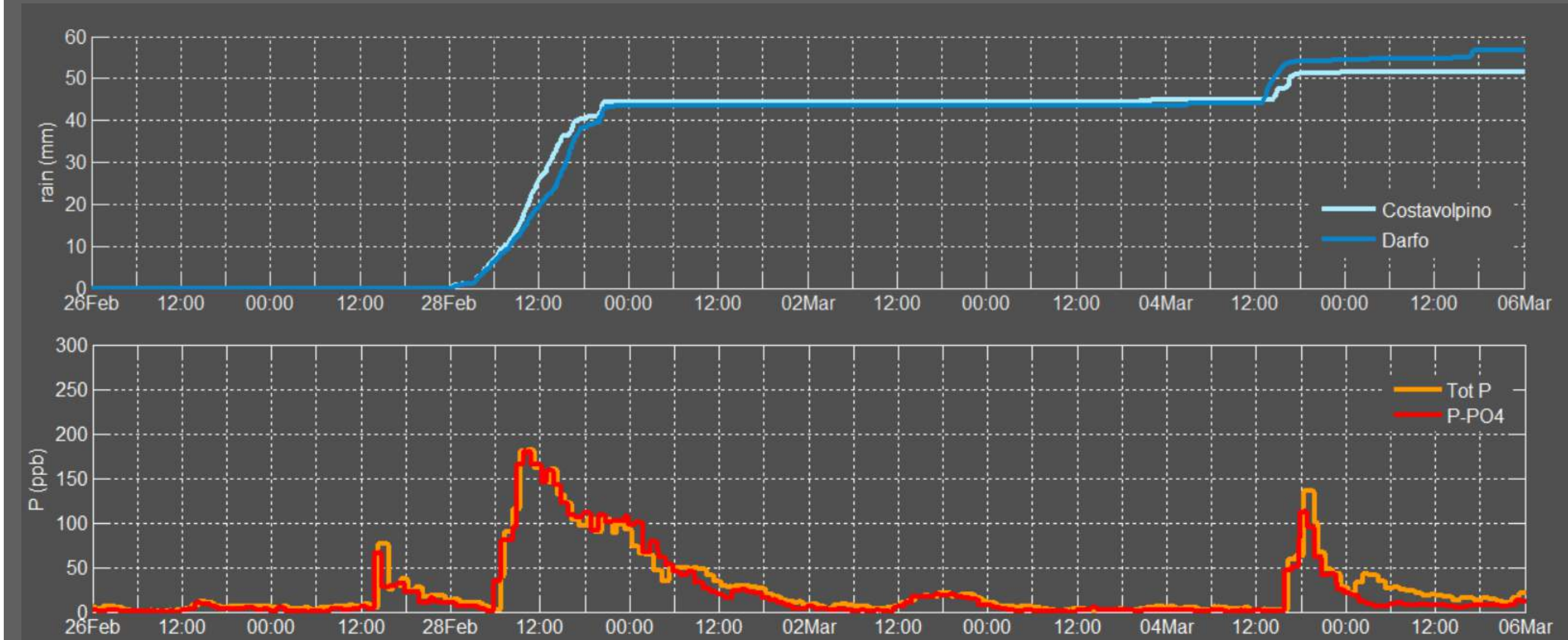


- Future studies aimed at investigating relationships among the measured variables (Q, Rainfall, Temp, Cond, P …)

Experimental Activities: WP1 - Quantification of the P load from the tributaries

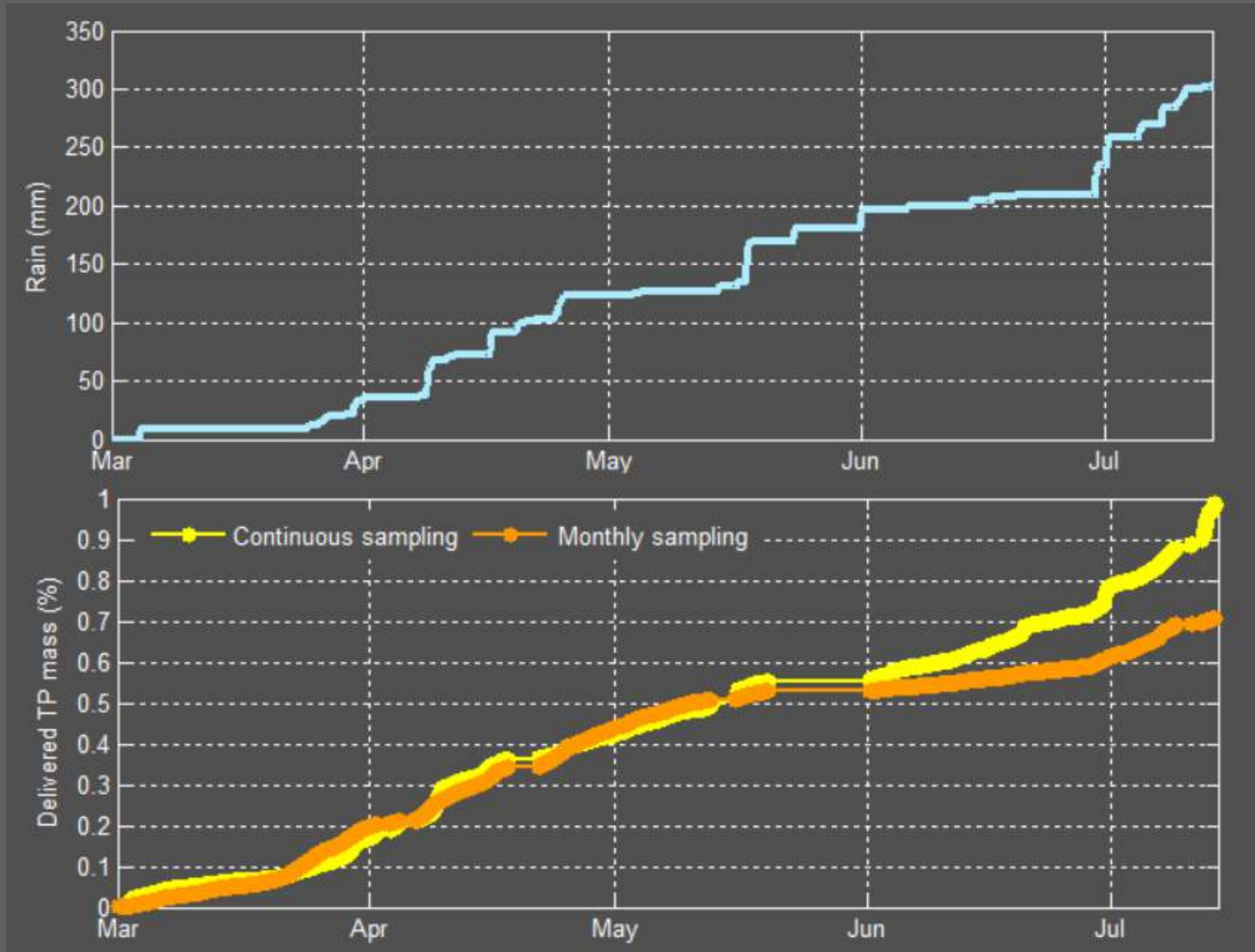
- Future studies aimed at understanding the P temporal variability, exp. during flood

Interesting trends measured at the end of February



Experimental Activities: WP1 - Quantification of the P load from the tributaries

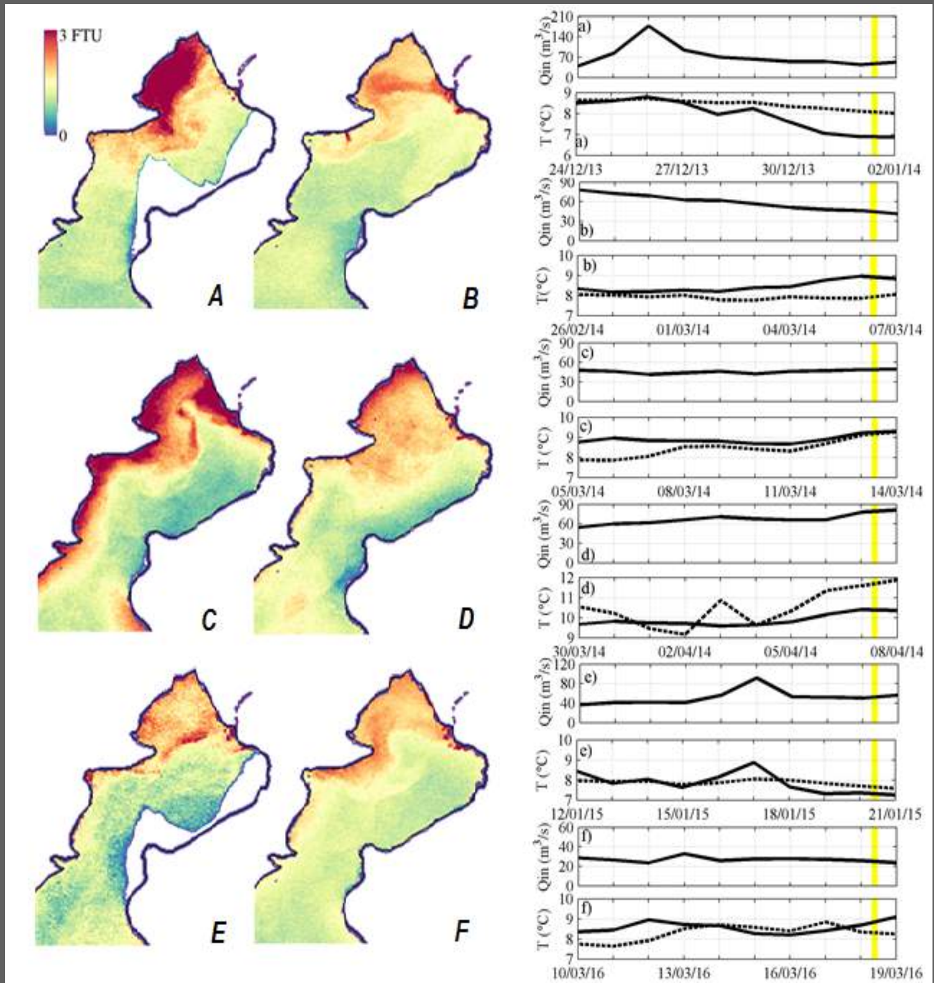
Preliminary studies based on the 3 months time series measured by ARPA (2005)

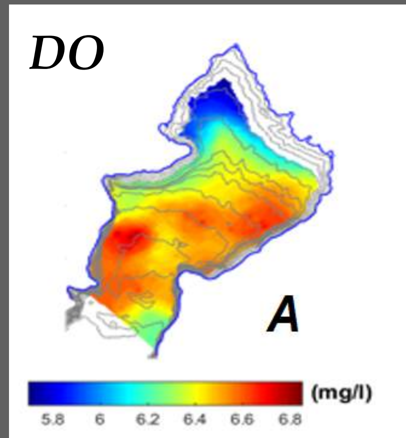


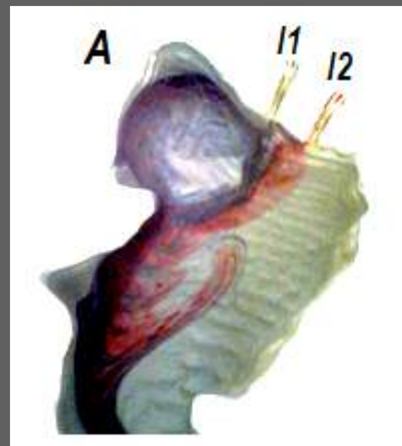
Sentinel 2 project:
Q, TP, NH4, NO3, Tu, Cond., PH, DO

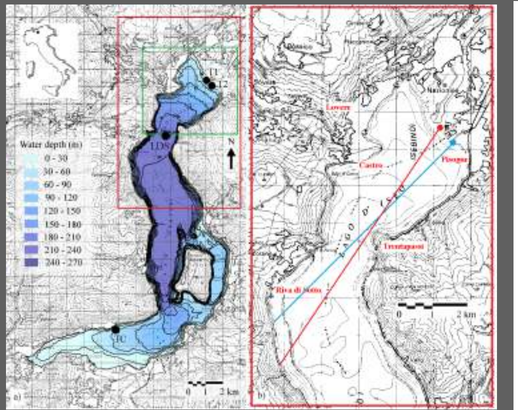
Experimental Activities: WP4 - Remote monitoring of the lake

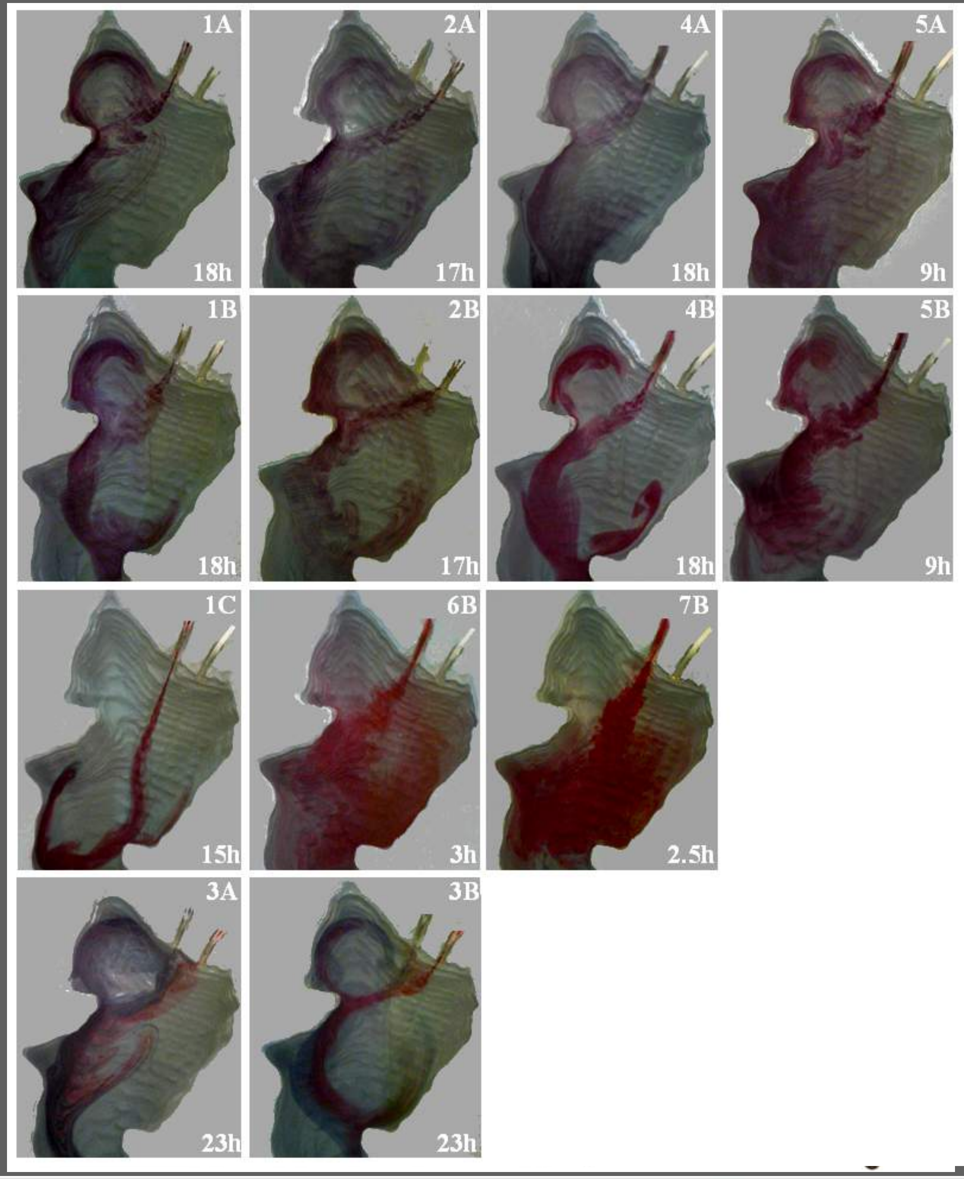
- ✓ Use of the satellite images in the northern part of the lake to identify the path of Oglio river and Industrial canal (together with IREA)











Froude and Rossby Similitude

length scale ratios X_R and Y_R,

$X_R = \frac{l_p}{l_m}$; $Y_R = \frac{h_p}{h_m}$; X_R/Y_R ratio of 16; X_R ratio of 8000; $Y_R = 500$

velocity ratio

$$V_R = \frac{v_p}{v_m} = \sqrt{\frac{h_p}{h_m}} = Y_R^{1/2} = 22.36$$

time ratio

$$T_R = \frac{t_p}{t_m} = \frac{X_R}{V_R} = \frac{X_R}{Y_R^{1/2}} = 358$$

discharge ratio

$$Q_R = \frac{Q_p}{Q_m} = X_R Y_R^{3/2} = 89442719$$

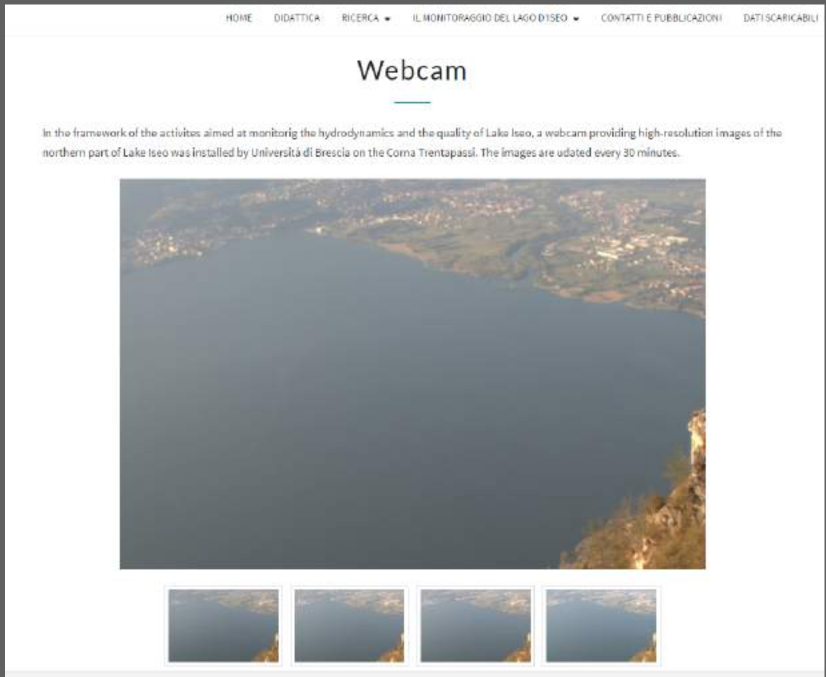
Rossby similarity

$\omega_R = \frac{\omega_p}{\omega_m} = \frac{Y_R^{1/2}}{X_R \sin\varphi}$ =0.0039; a prototype day lasts 241 s.

Experimental Activities: WP4 - Remote monitoring of the lake

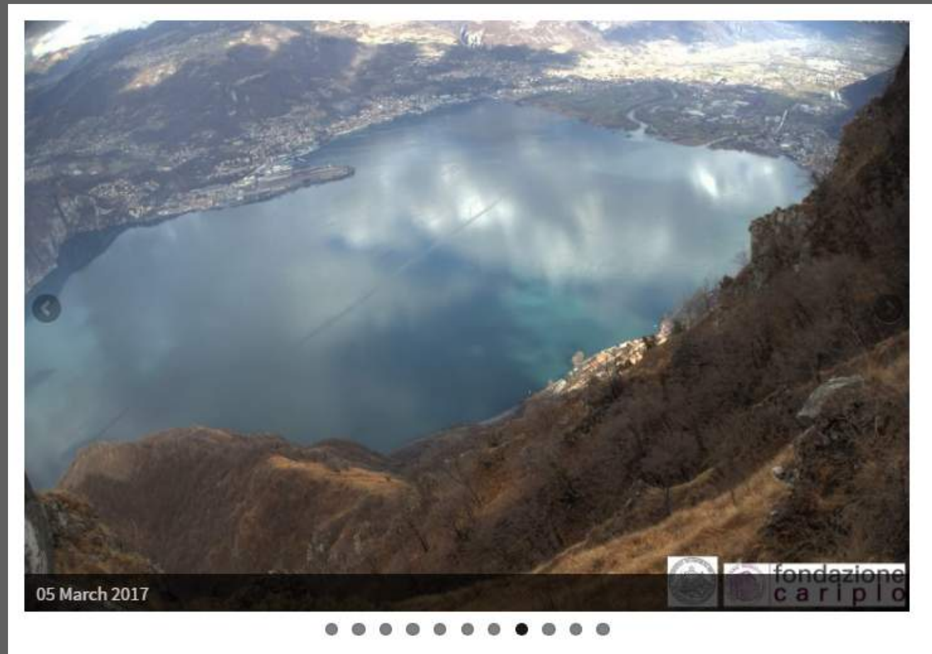
✓ Installation of the webcam on Corna Trentapassi

- Real-time images on the web site



http://hydraulics.unibs.it/hydraulics/il-monitoraggio-del-lago-diseo/webcam/

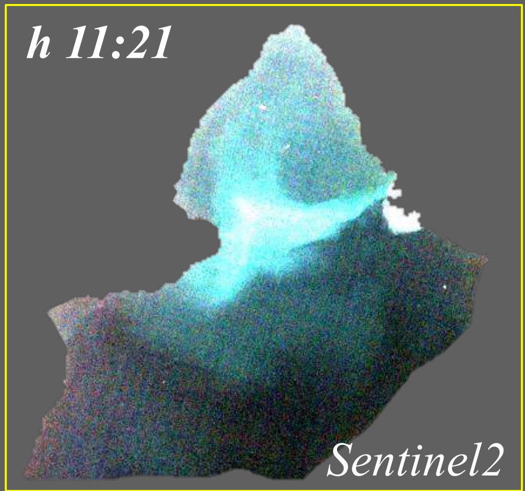
- Selection of pictures on the web site

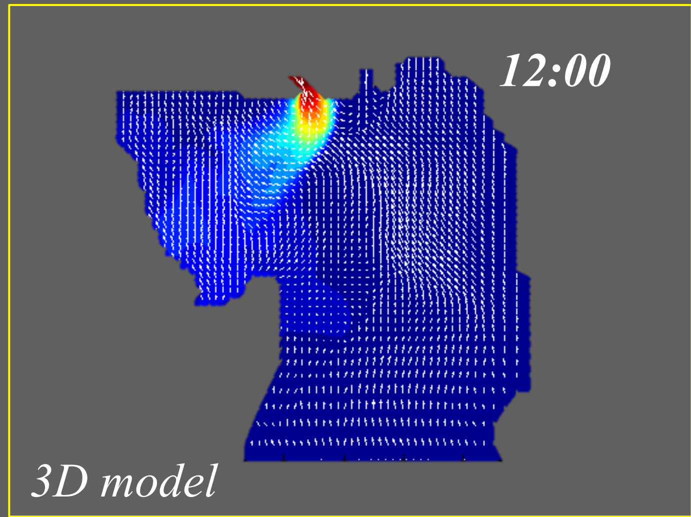


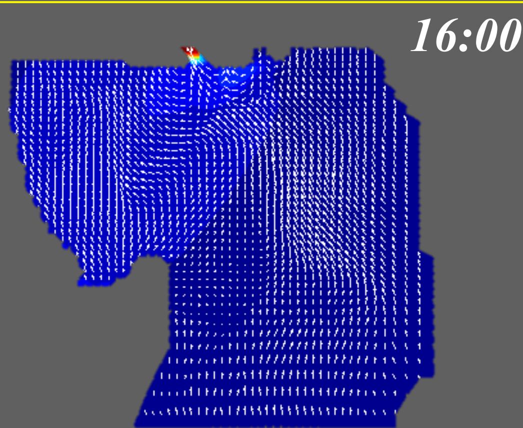
Experimental Activities: WP4 - Remote monitoring of the lake

- Future studies on the temporal-spatial dynamics of the river's plume

16Feb2017



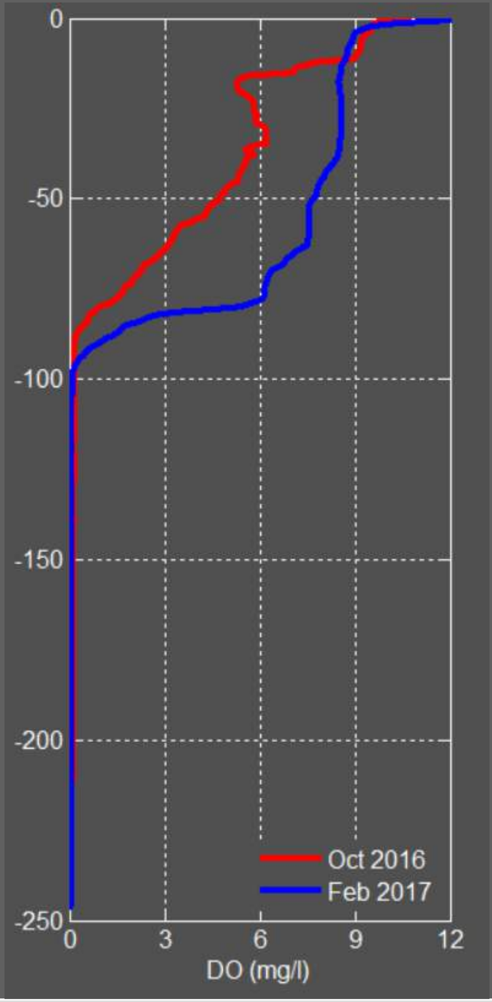


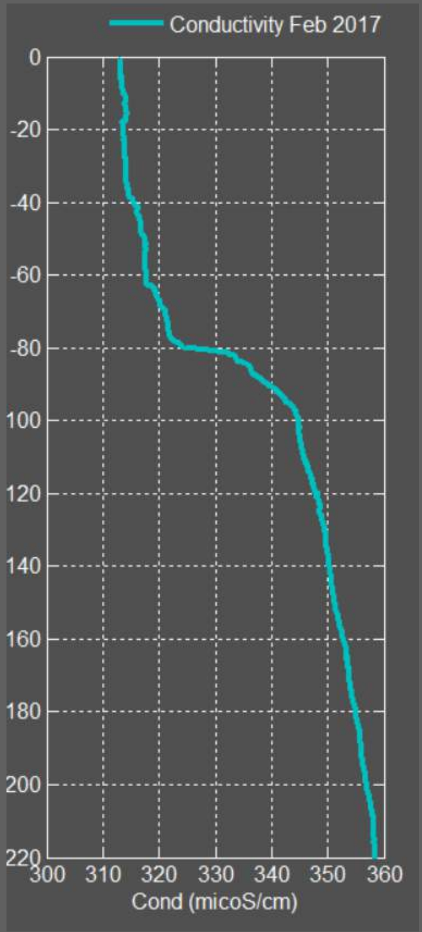


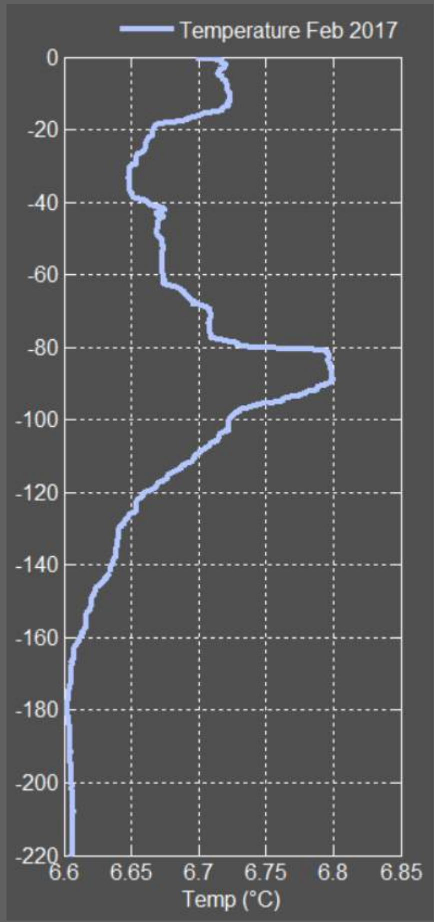
Lake modeling: WP6 – Lake Modeling

✓ Continuous monitoring of the lake

- interesting to follow the deoxygenation process after Feb 2017
- mixing depth controlled by salts

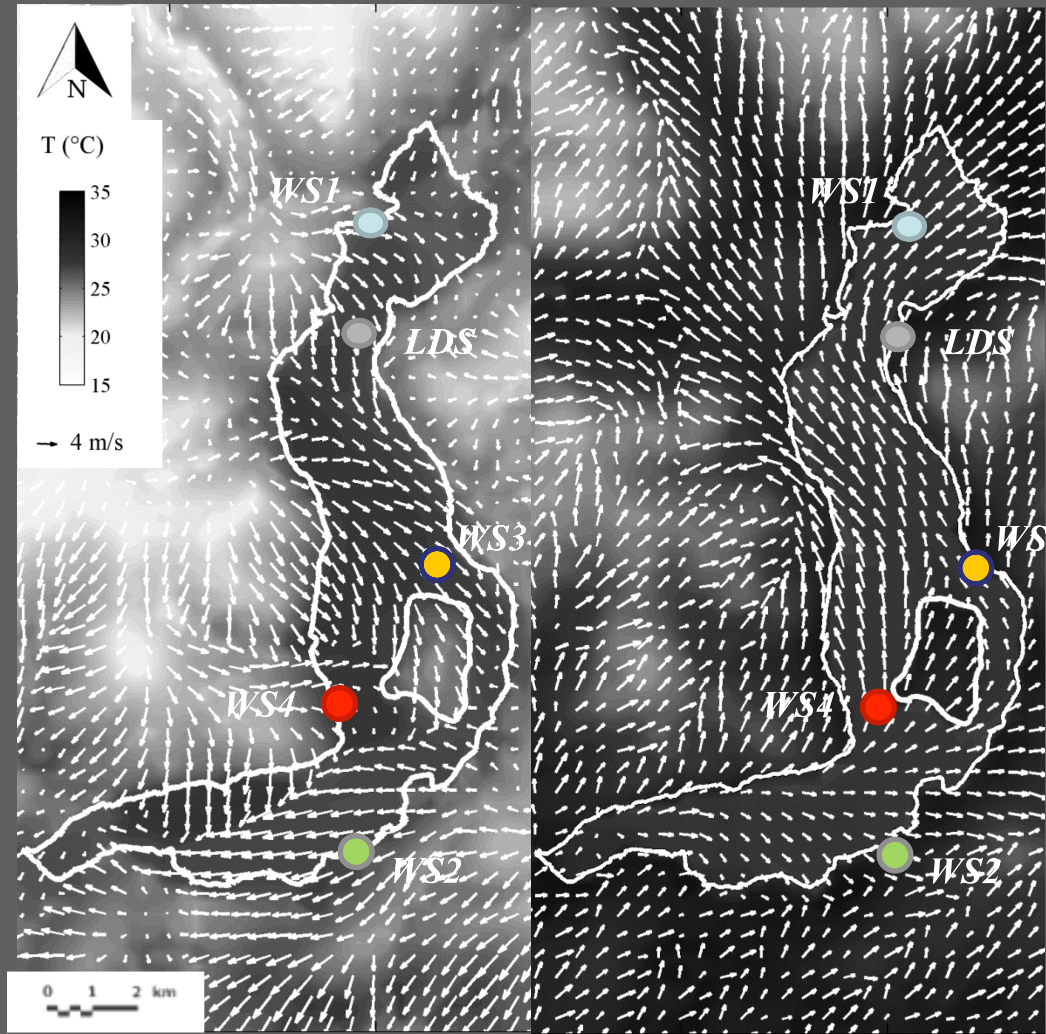


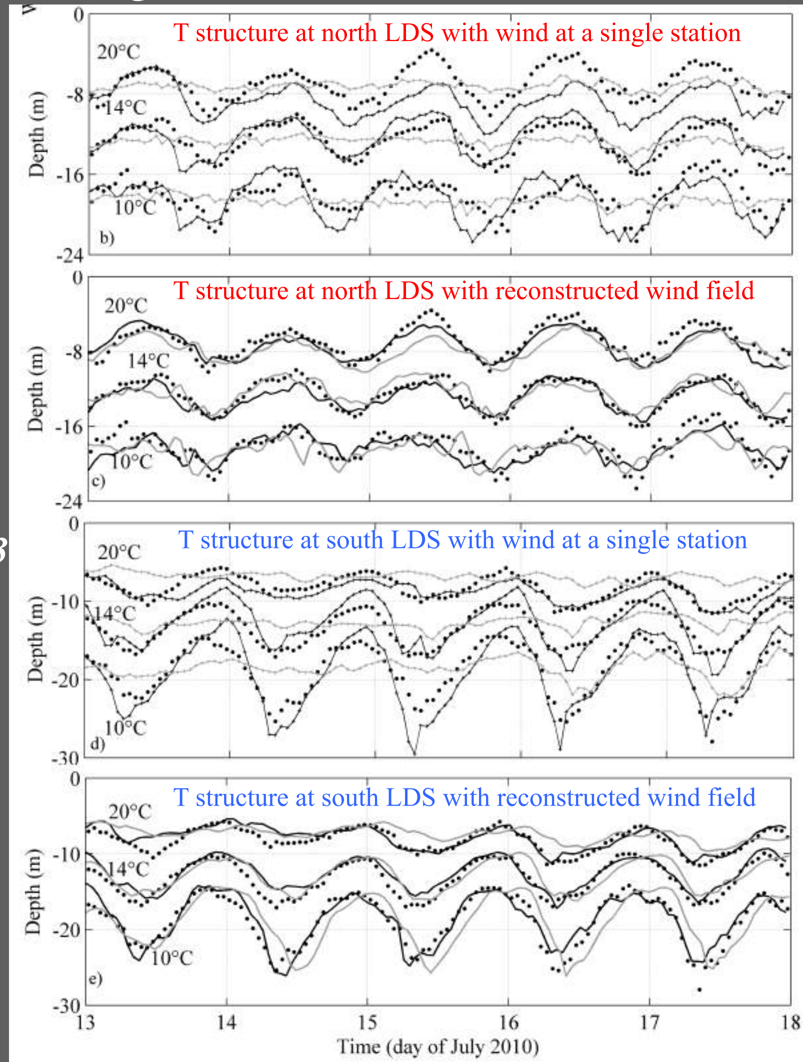




Lake modeling: WP6 – Lake Modeling

✓ Definition of the proper wind forcing by 3D modeling: WRF + ELCOM

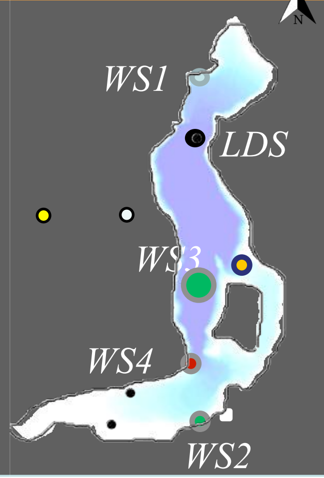




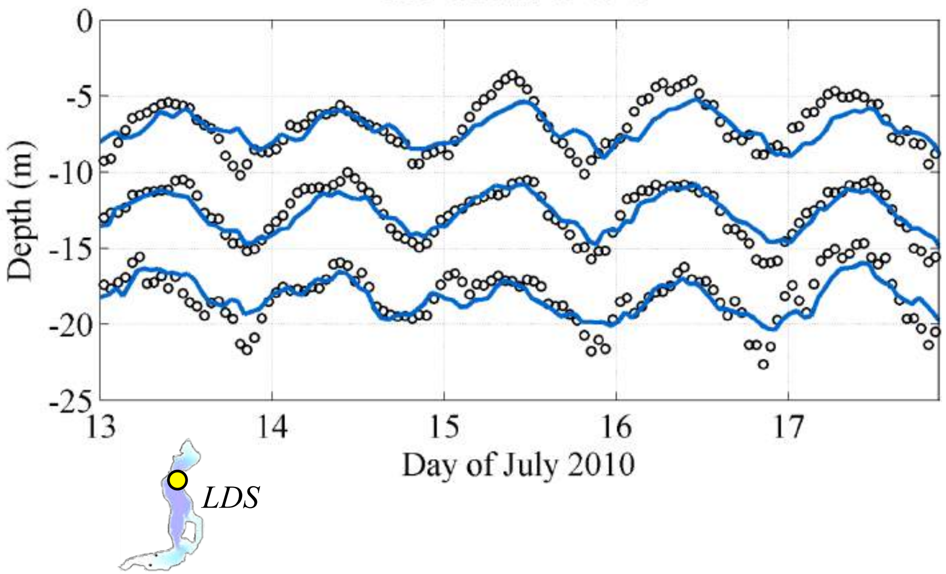
Lake modeling: WP6 – Lake Modeling

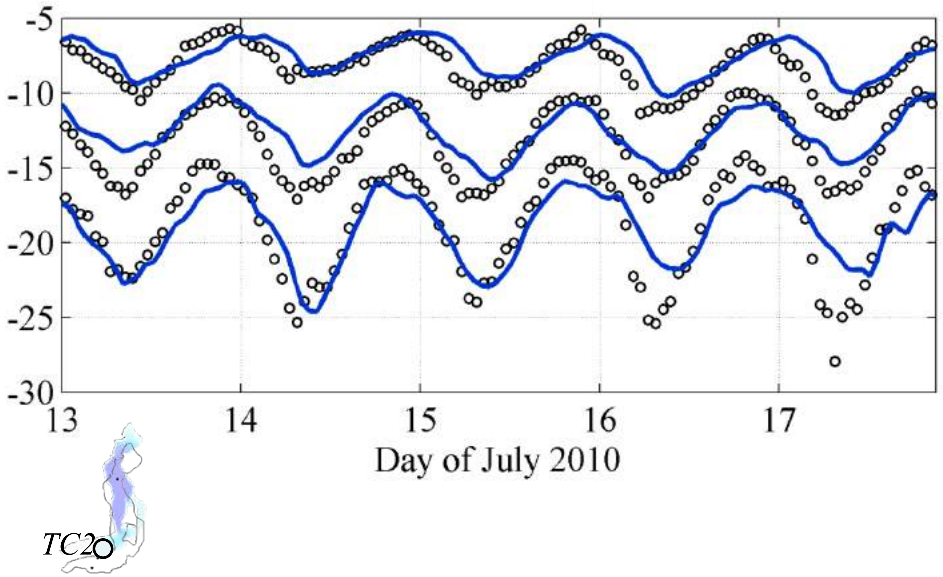
Most suitable station: location that minimizes the absolute value of

$$D = \int_T \int_A \tau \cdot v dAdt - \int_T \tau(i,j) \cdot v(i,j) Adt = 0$$



Use the wind speeds measured at LDS during the night; use the wind speeds measured at WS4 during the day





Valerio, G., Cantelli, A., Monti, P., and Leuzzi, G. (2017). A modeling approach to identify the effective forcing exerted by wind on a pre-alpine lake surrounded by a complex topography. Accepted for publication in Water Resources Research.

Project dissemination: WP7

✓ Web-site of the project

✓ Public presentations in the municipalities of Iseo, Tavernola, Provaglio d'Iseo

✓ We planned the dissemination activities to be developed in the High school 'I.I.S. "Antonietti"

60 hours course for 2 classes, including seminars, physical experiments, numerical classworks and field activity. It will be framed within the obligation of "alternanza scuola-lavoro" by the schools.

✓ We Tightened relationships with all the sewer system managers on the lake's area (stage)

Modeling Activities: WP5

1) Sewer modeling

☑ Collection of the data regarding the hydrologic and hydraulic data needed for the hydraulic model (extended rainfall series; hydraulic parameters of the network and of the drained areas; pumping stations functioning...)

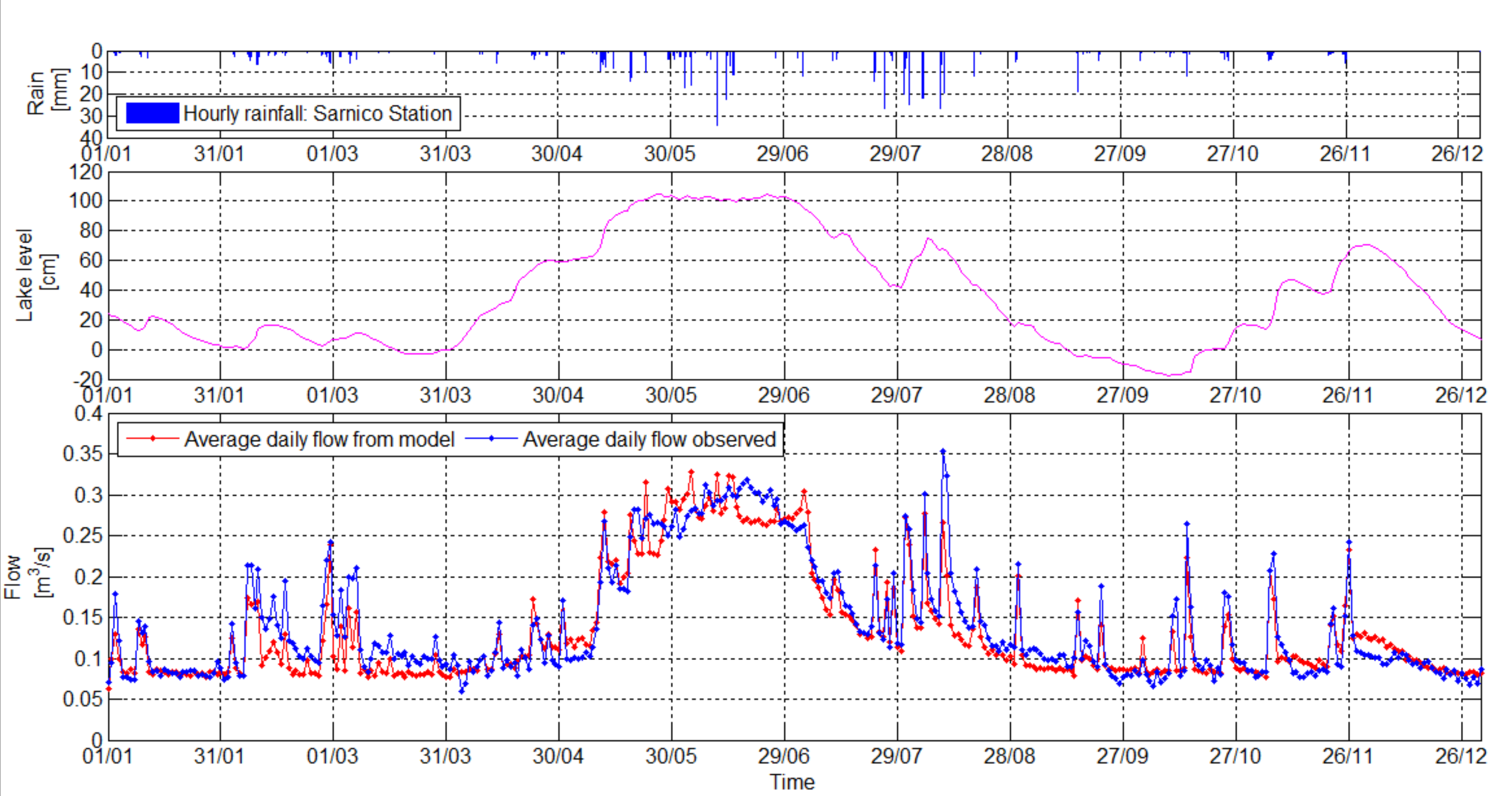
☑ Sewer network modeling: model calibration of the hydraulic and hydrologic parameters with respect to measured discharges in subbasins

☑ Implementation of the quality model to simulate pollutant build-up

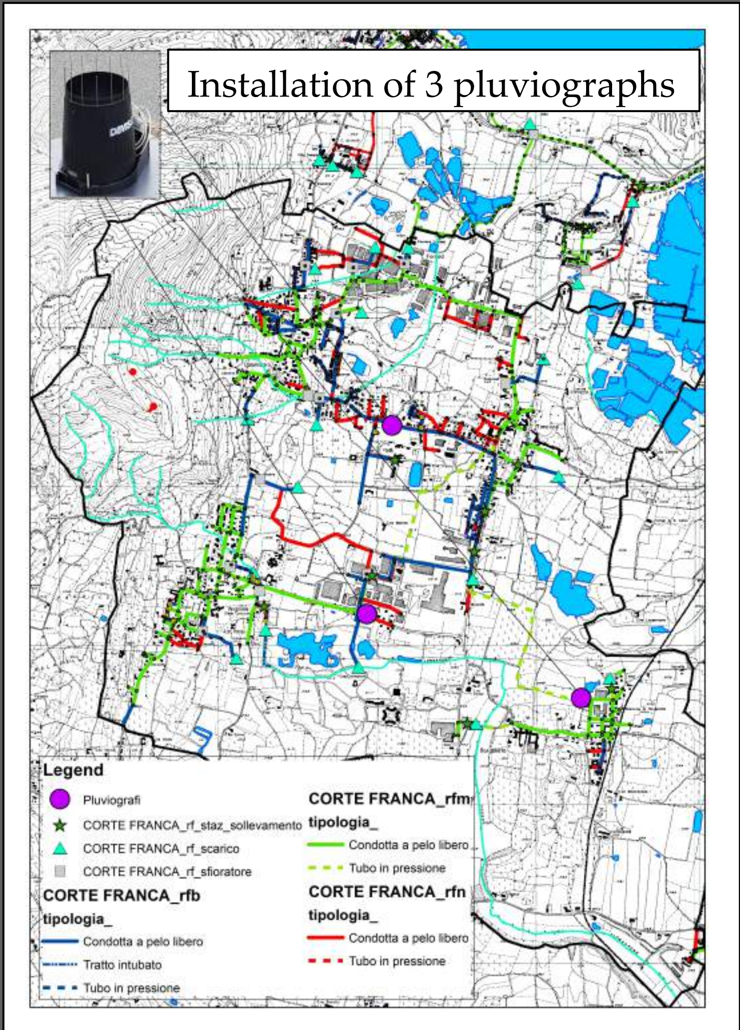
☑ Long term continuous simulations to identify the overall efficiency of the sewer network.

☑ Problem of water transfer to/from the lake

Calibration and validation of the hydraulic model of the main sewer collector, using data of 2016 rainfall/discharge measured at the outlet of the collector (Paratico)

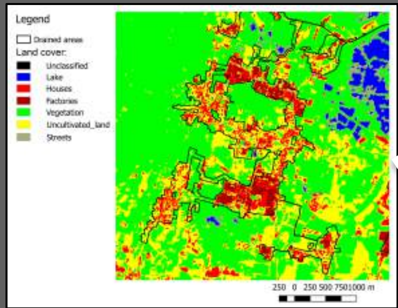


2) Detailed hydraulic and hydrologic modeling of the municipal sewer system of Corte Franca

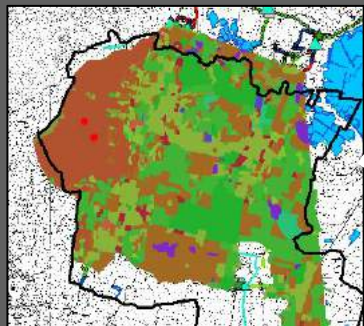


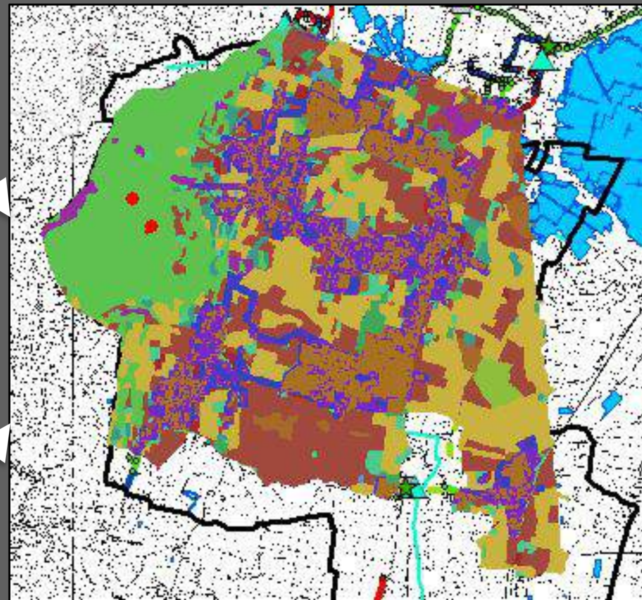
CN map: integration of information of Dusaf with land cover from satellite images analysis

CN map: satellite images



CN map: Dusaf





3) Quantification of the P load entering from CSOWs

☑ Identification of number, location and functioning of the sewer overflows devices, on the eastern side (AOB2) of the lake.

☐ Identification of number, location and functioning of the sewer overflows devices, on the western (UNIACQUE) of the lake.

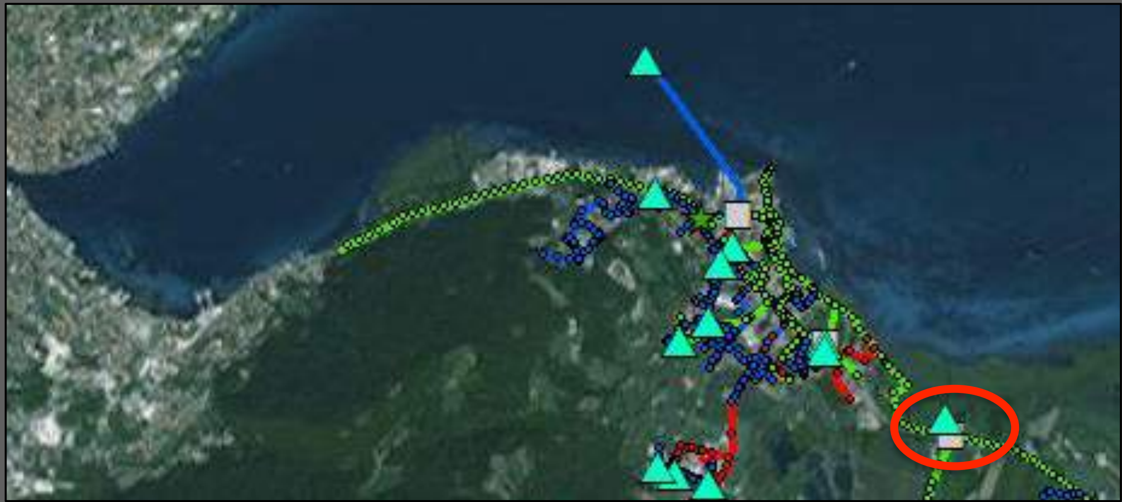
☐ Two automatic samplers will be put in operation and triggered by a water level probe. At the same location, a stage-discharge relationship will be computed in order to obtain the discharge in the sewer as a function of the level in the sewer.

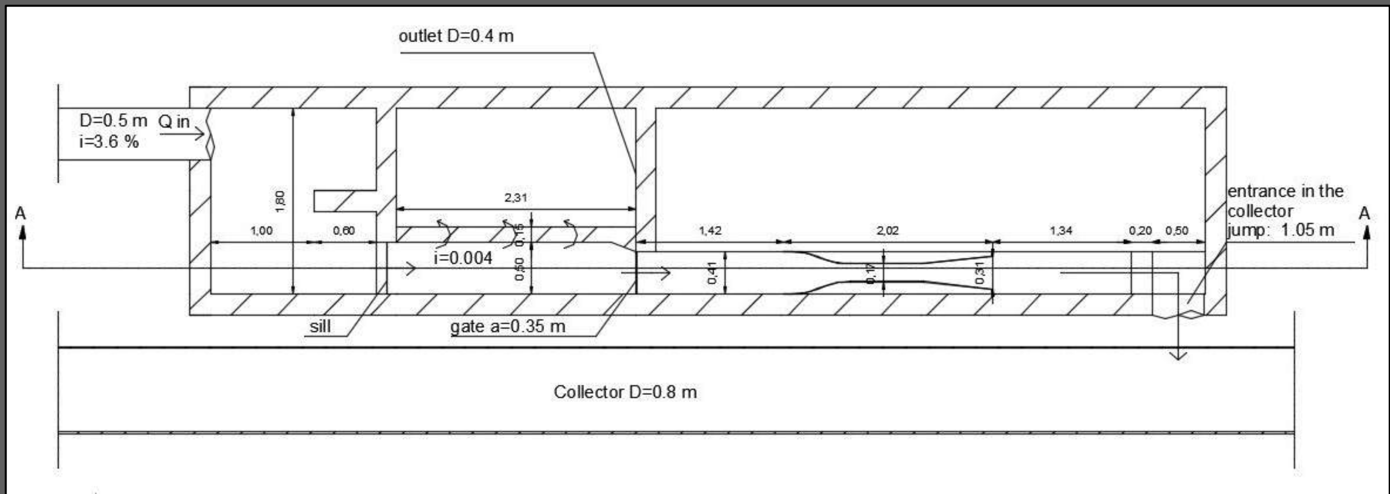
☑ Monitoring of rainfall in the drained watershed

☐ Quantitative/Qualitative analysis of first flush, for retention basin design.

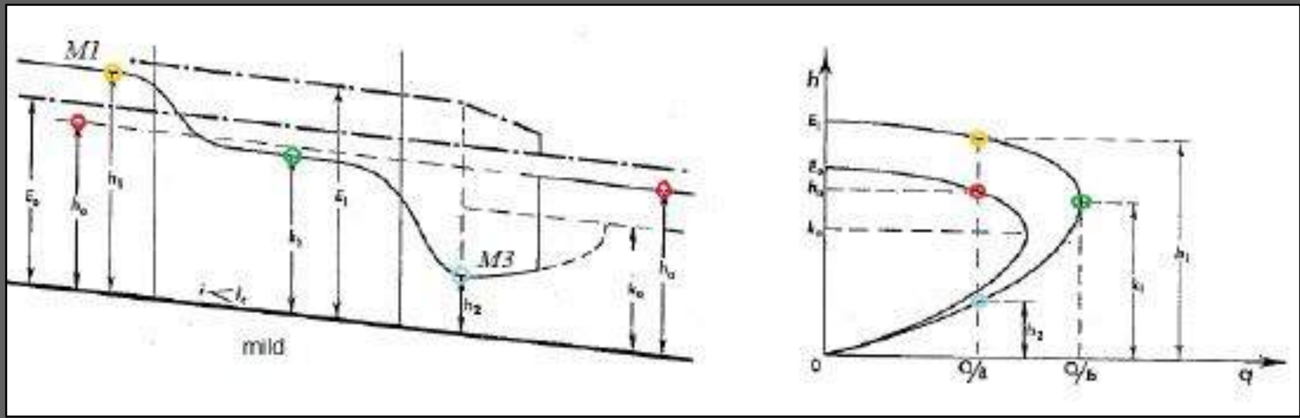
☐ Quantitative characterization of the volumes delivered to the lake, for retention basin design.

CSO of Corte Franca, immediately upstream the entrance of municipal line in the main collector

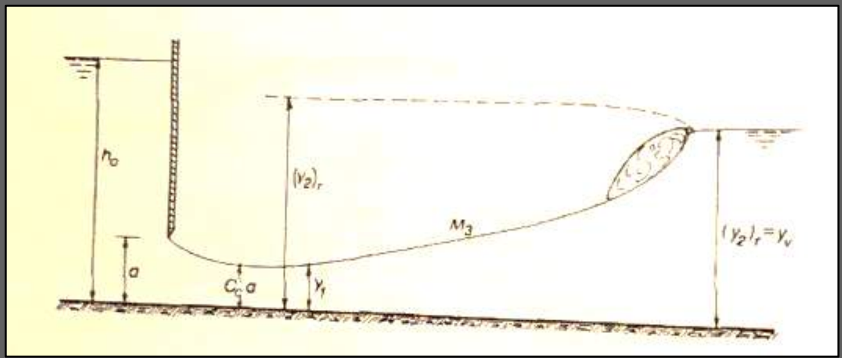




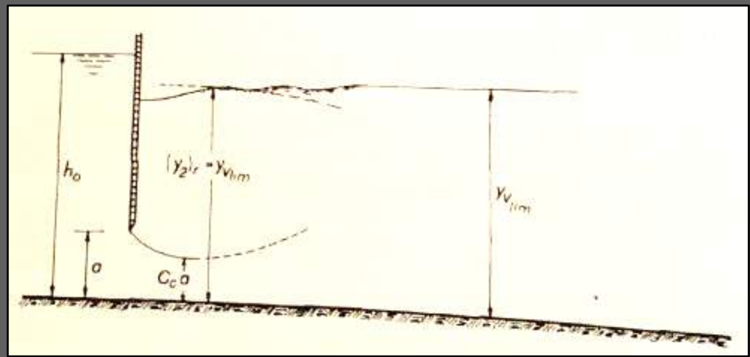
Modeling of the lateral weir with sluice gate and Venturi



Not submerged sluice gate

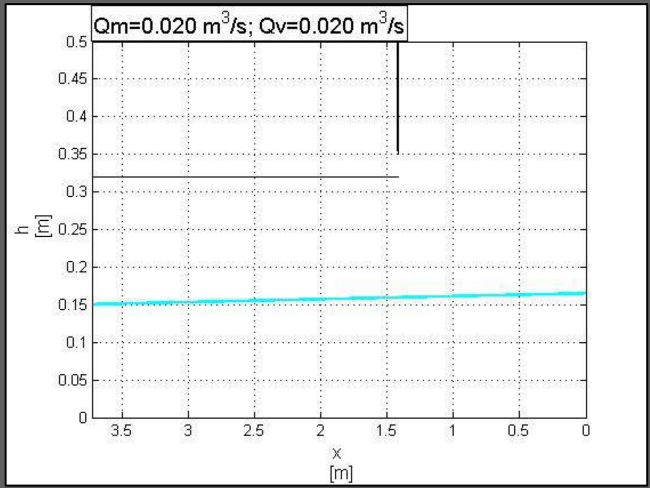


Submerged sluice gate

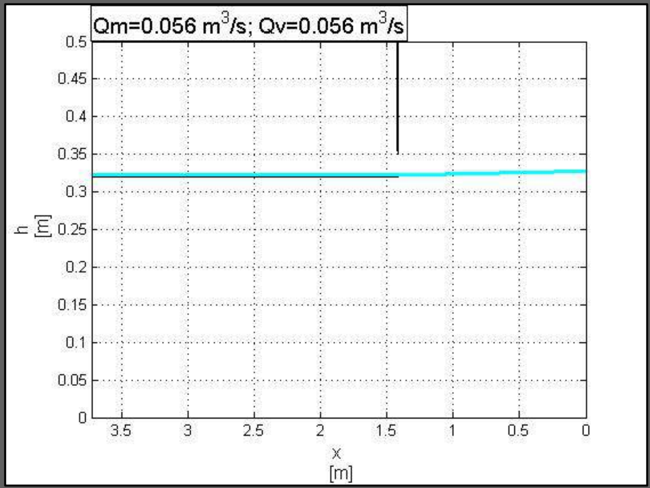


Experimental Activities: WP2

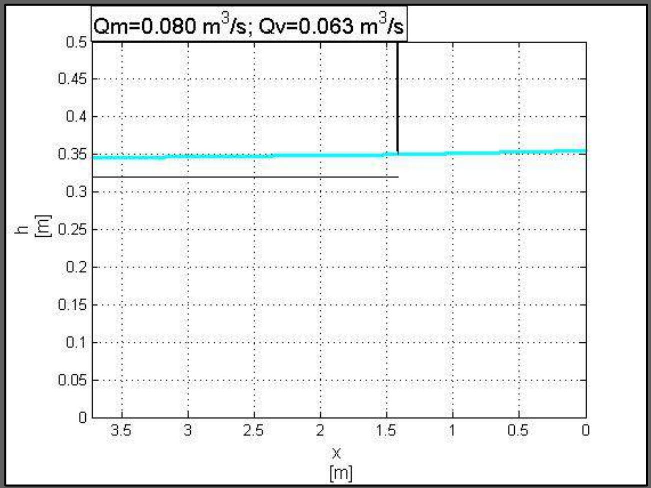
Discharge during dry weather



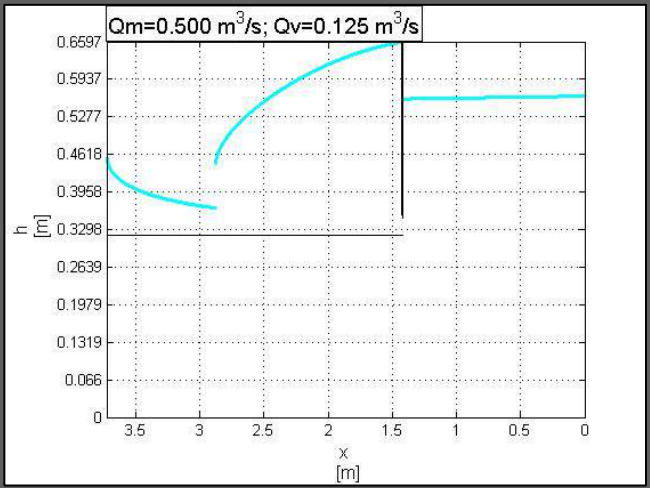
Discharge that activates the overflow weir



Overflow weir activated, h weir > critical depth

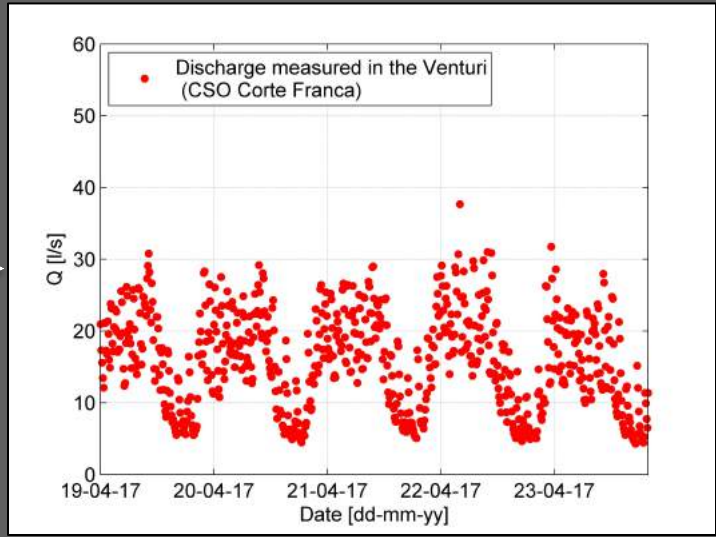


Overflow weir activated, h weir < critical depth



Measured data: CSO of Corte Franca

2 ultrasonic sensors for level measurement



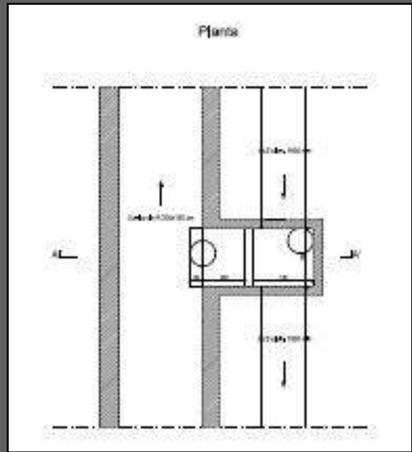
1 portable discharge measurement device (Doppler sensor) for stage-discharge curve calibration

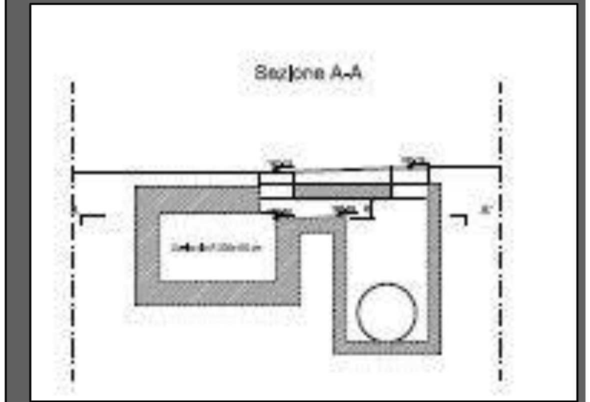
1 portable sampler (to be installed)

1 tracimation sensor CSV

Experimental Activities: WP2

Measured data: CSO of Paratico





1 ultrasonic sensors for level measurement with tracimation sensor

1 portable sampler (to be installed)

1 portable discharge measurement device (Doppler sensor) for stage-discharge curve calibration