Approccio integrato tra monitoraggio di campo e modellistica CFD per la gestione del territorio fluviale

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Workshop finale, 22 – Marzo – 2018

Tecnopolo CNR Area della Ricerca Via Gobetti, Bologna

POR FESR EMILIA-ROMAGNA 2014/2020
UNIONE EUROPEA Fondo europeo di sviluppo regionale
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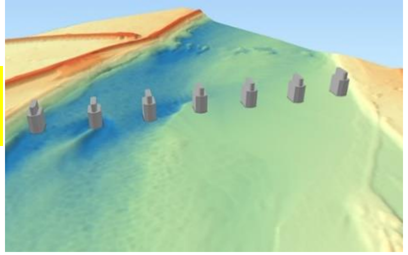
Numerical models are necessary to forecast future evolution of rivers, but requires:

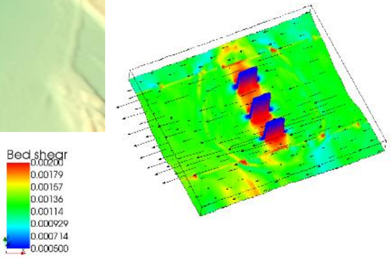
- initial conditions for calibration/validation
- continuous monitoring to realignment between numerical outcomes and field data

Coupling monitored data with modelling tools to create **Early Warning Systems** and **Decision Support Systems**

Integrated monitoring

Real-time modelling

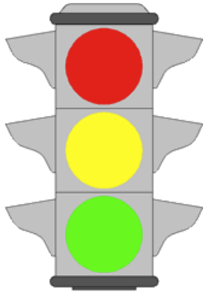




Synthetic parameters to forecast future trends

Early Warning System

Decision Support System



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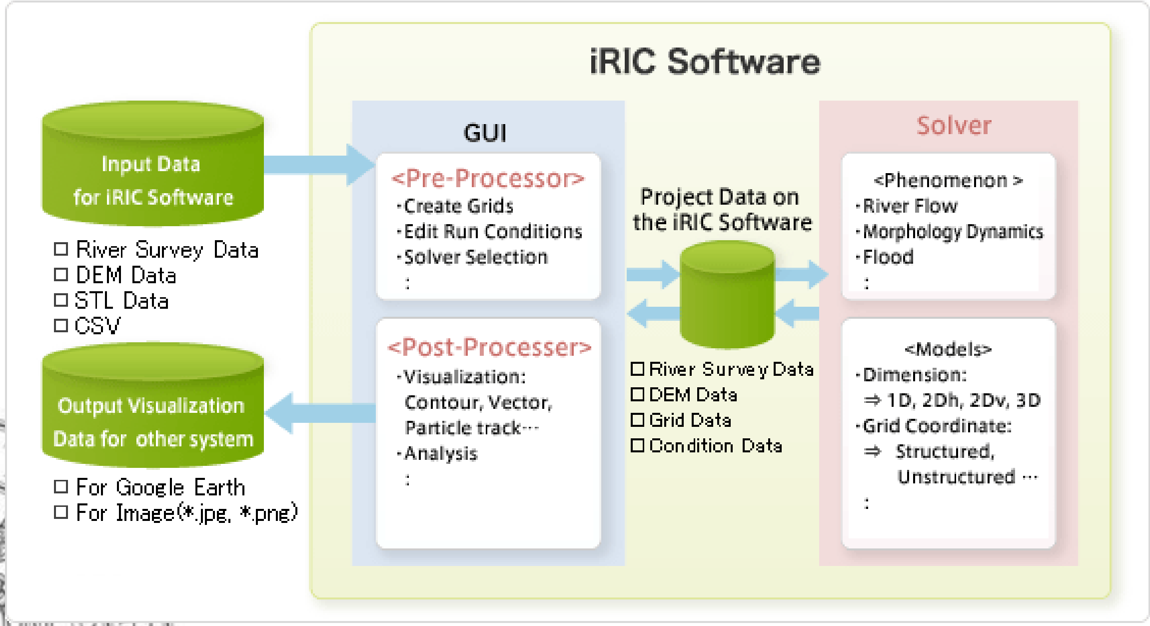
For this application 2D and 3D freeware codes were applied.

The 2D codes simulate the large scale domain, while the 3D models evaluate the local hydro-morphodynamics.

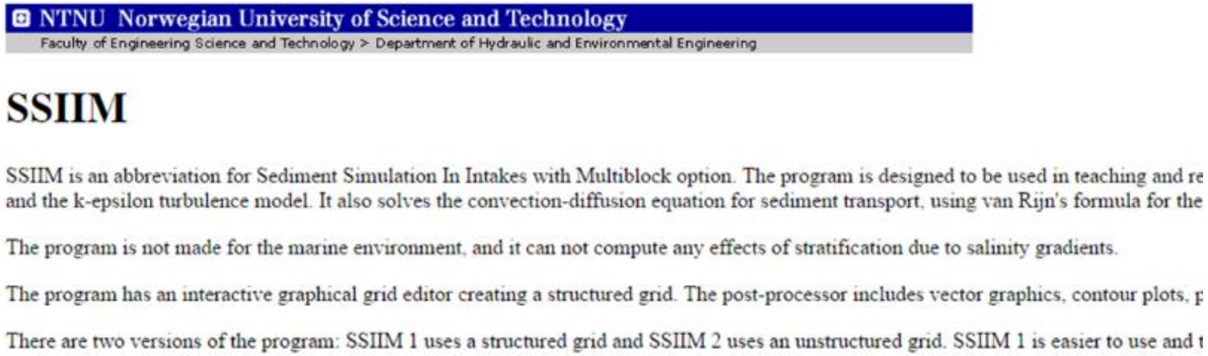
iRIC Software
Changing River Science

i-ric.org



SSIIM

http://folk.ntnu.no/nilsol/ssiim/


NTNU Norwegian University of Science and Technology
Faculty of Engineering Science and Technology > Department of Hydraulic and Environmental Engineering

SSIIM

SSIIM is an abbreviation for Sediment Simulation In Intakes with Multiblock option. The program is designed to be used in teaching and re
and the k-epsilon turbulence model. It also solves the convection-diffusion equation for sediment transport, using van Rijn's formula for the

The program is not made for the marine environment, and it can not compute any effects of stratification due to salinity gradients.

The program has an interactive graphical grid editor creating a structured grid. The post-processor includes vector graphics, contour plots, p

There are two versions of the program: SSIIM 1 uses a structured grid and SSIIM 2 uses an unstructured grid. SSIIM 1 is easier to use and t

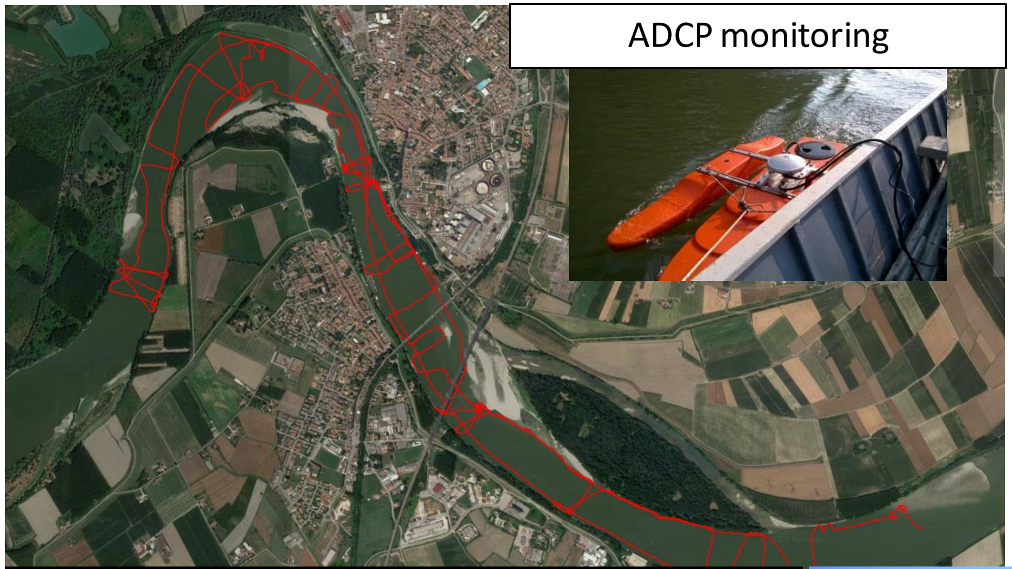
case studies

Po River at Revere-Ostiglia (Mn)

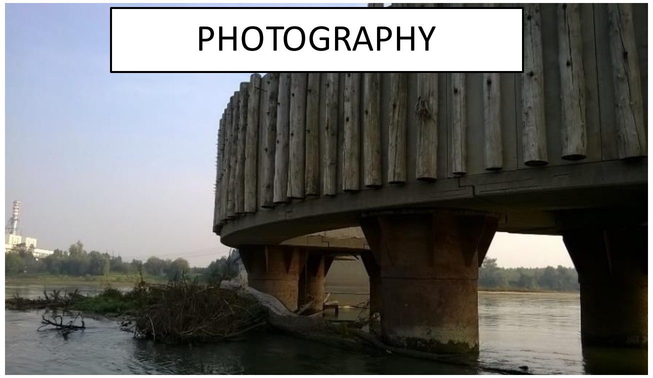
Secchia River at Ponte Motta (Mo)

Application of the iRIC model on the Po River at Revere-Ostiglia

ADCP monitoring

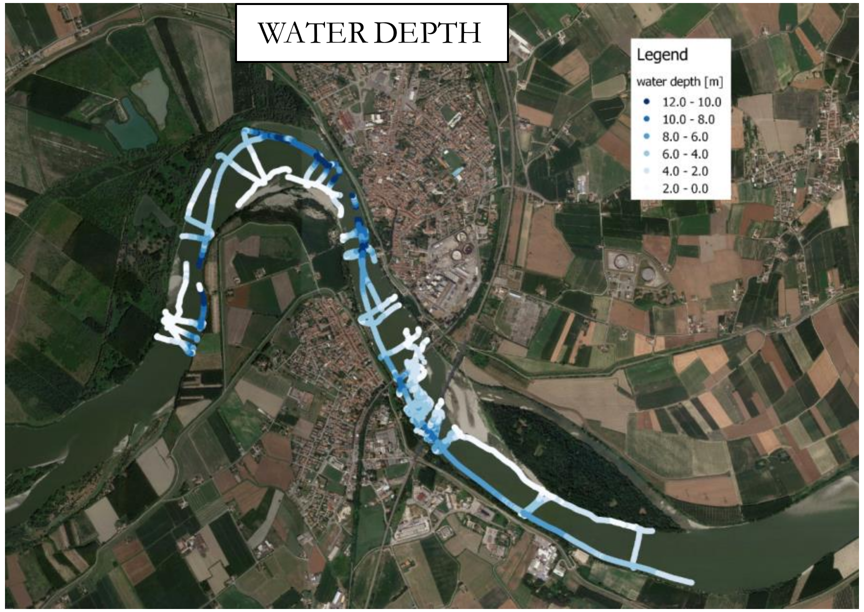


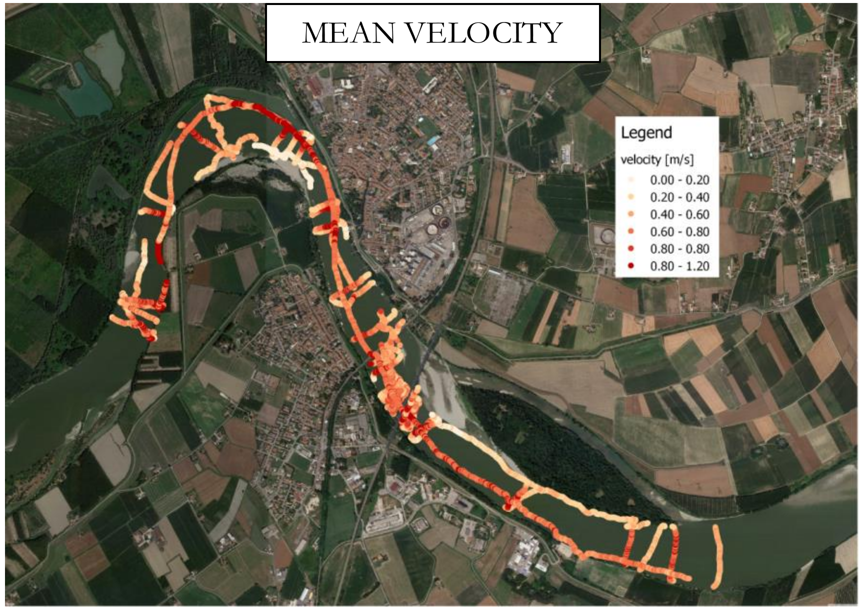
PHOTOGRAPHY



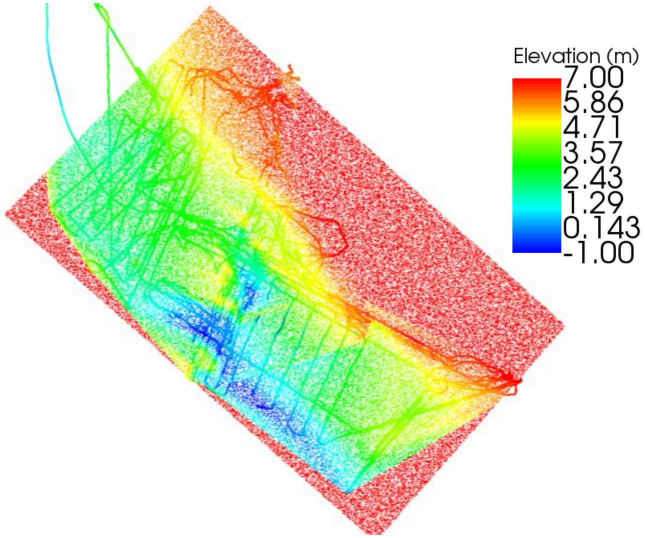
SATELLITE

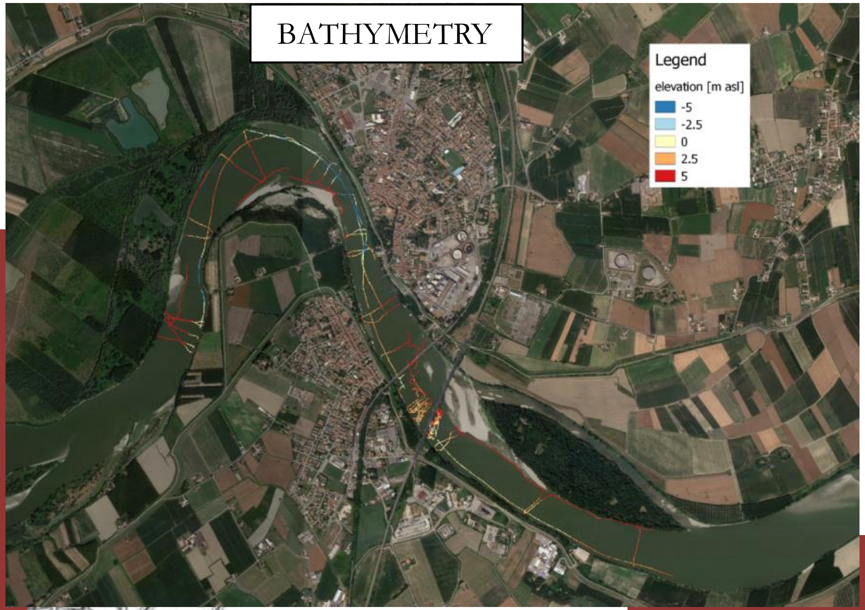
VIDEOGRAPHY



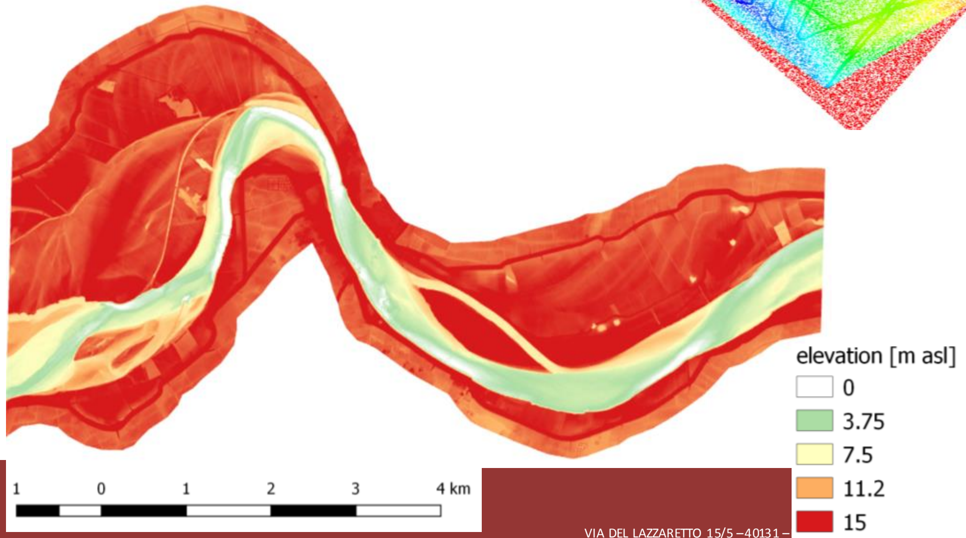


DIGITAL ELEVATION MODEL



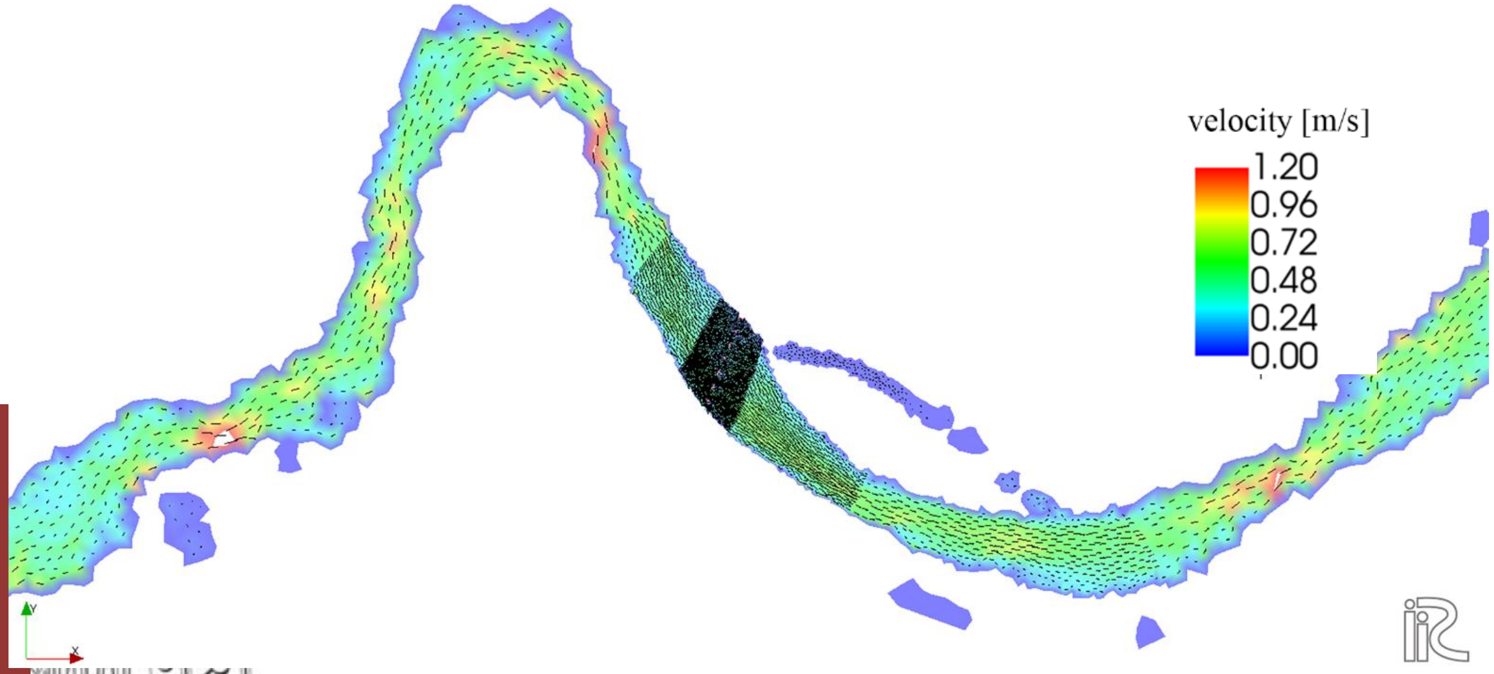


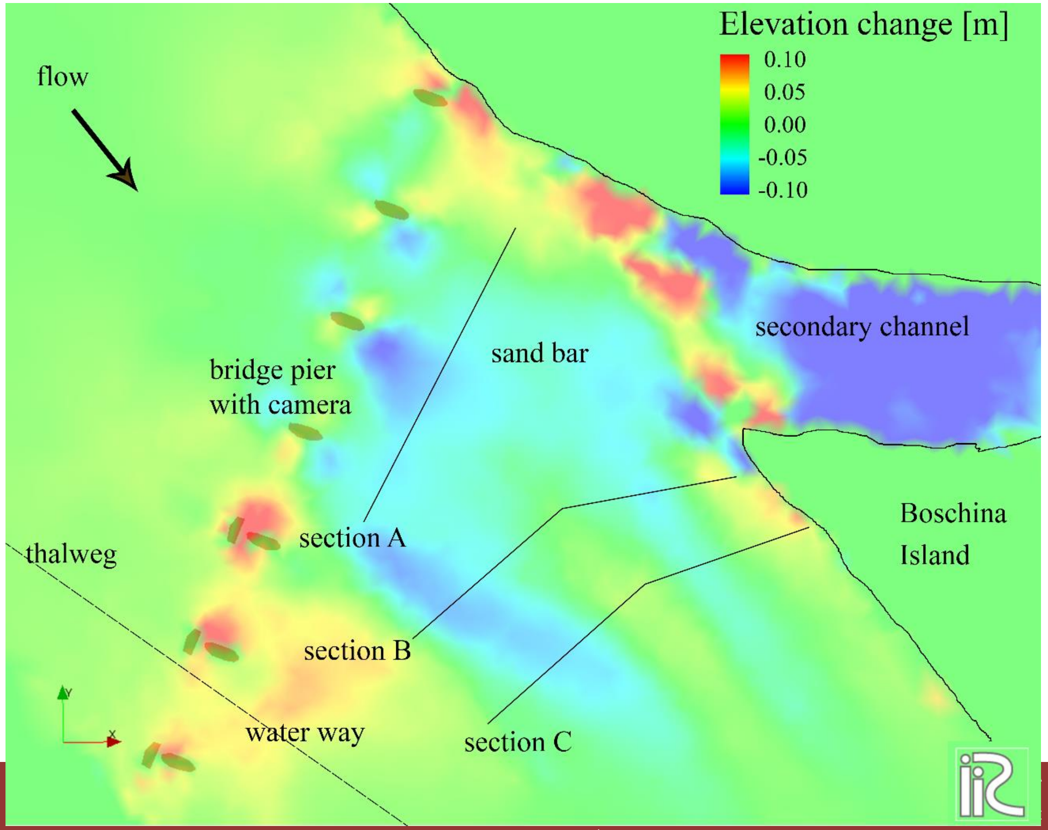
data processing



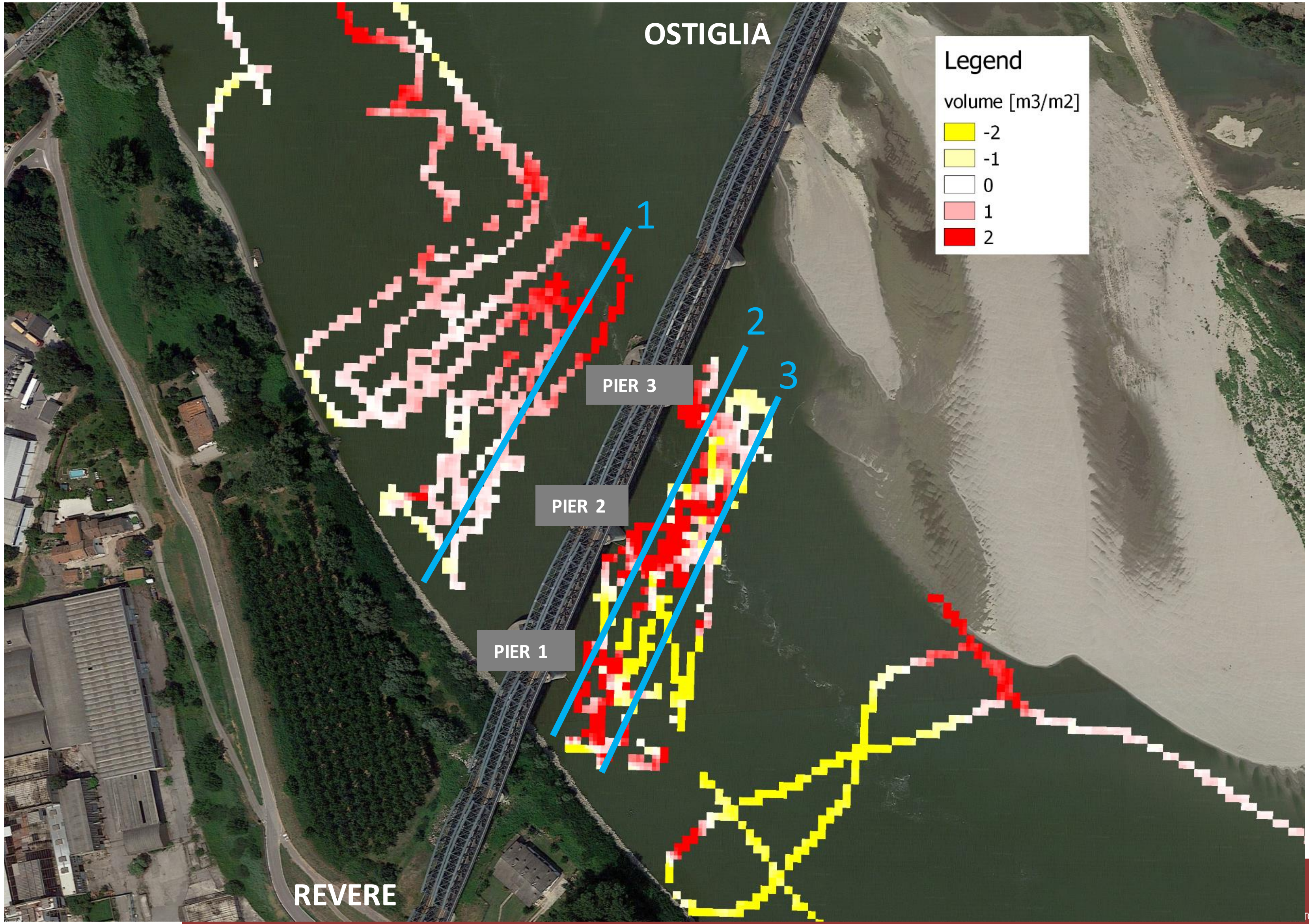
Using the data acquired from field (ADCP) and remote (satellite, videography) surveys, coupled with hydrological (discharges, water levels) data, the model can be calibrated on:

- hydrodynamics
- morphodynamics

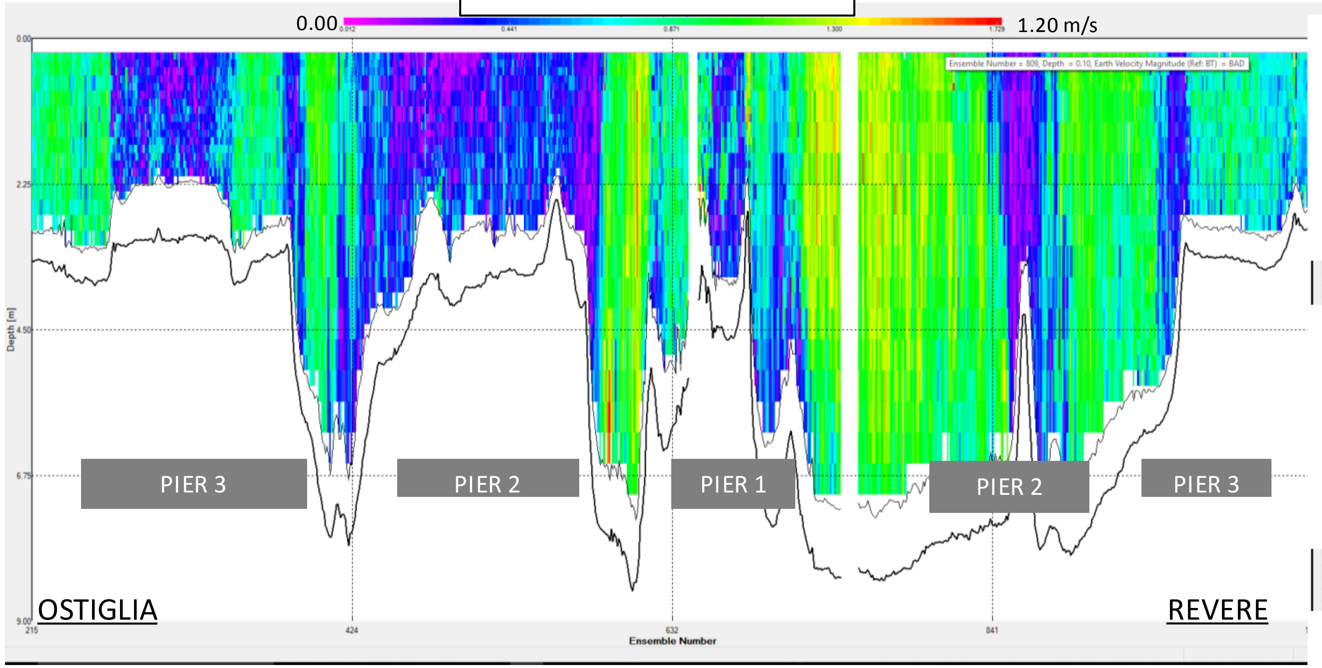




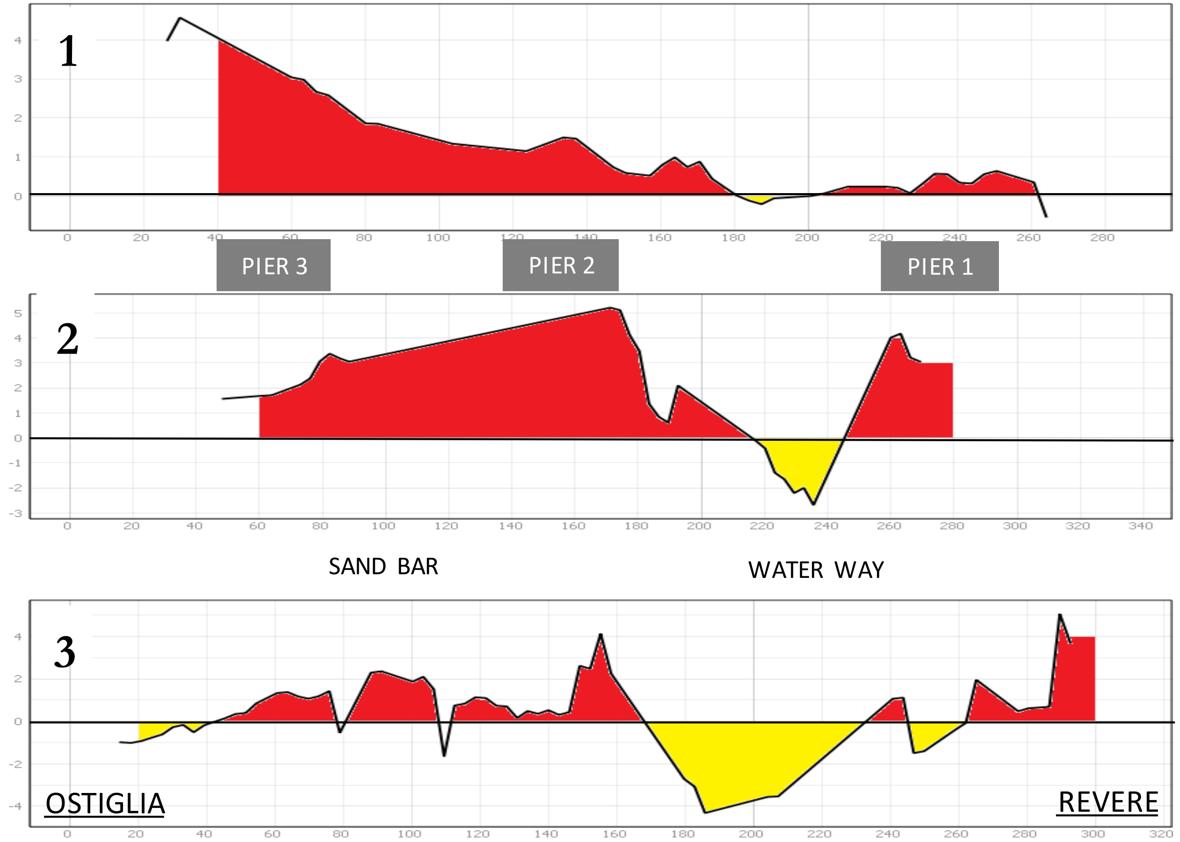
Comparison between 2005 and 2017



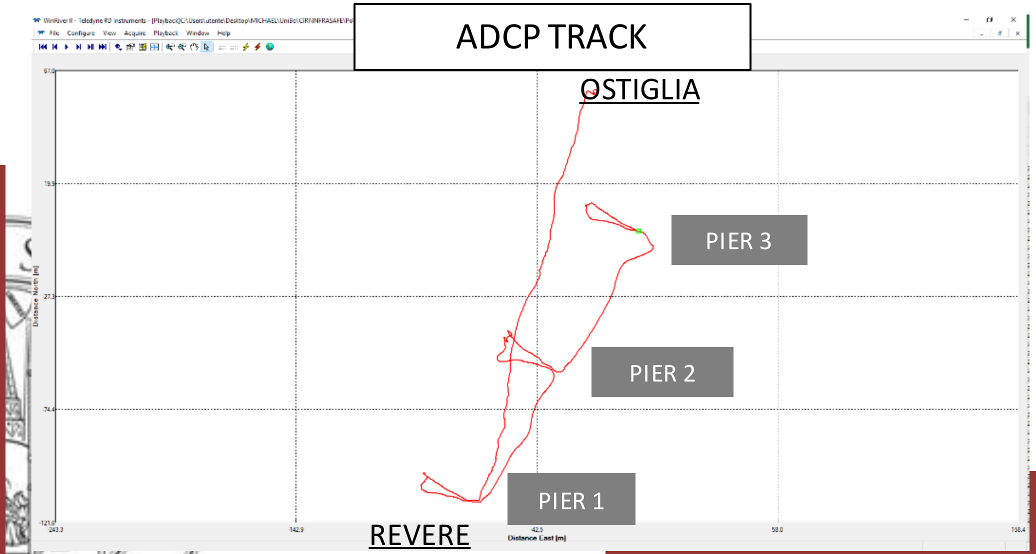
ADCP VELOCITY FIELD



ALTIMETRIC VARIATIONS



ADCP TRACK



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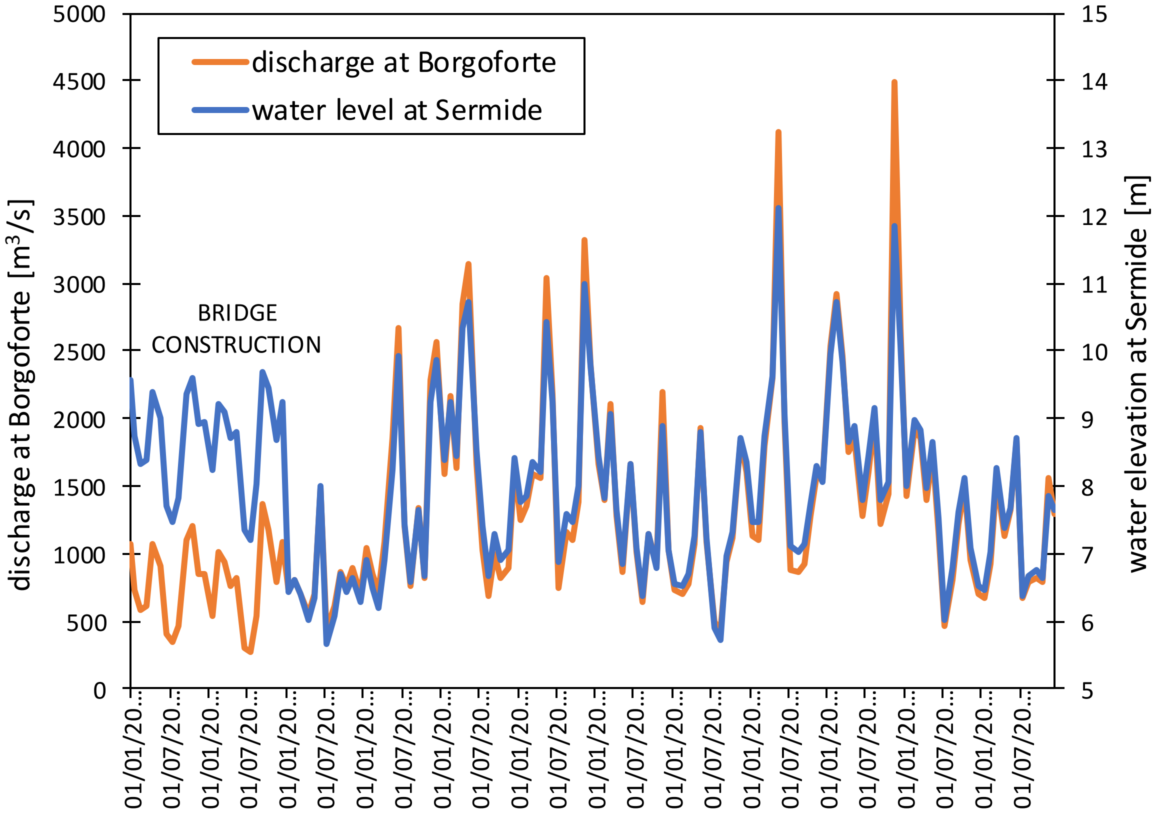
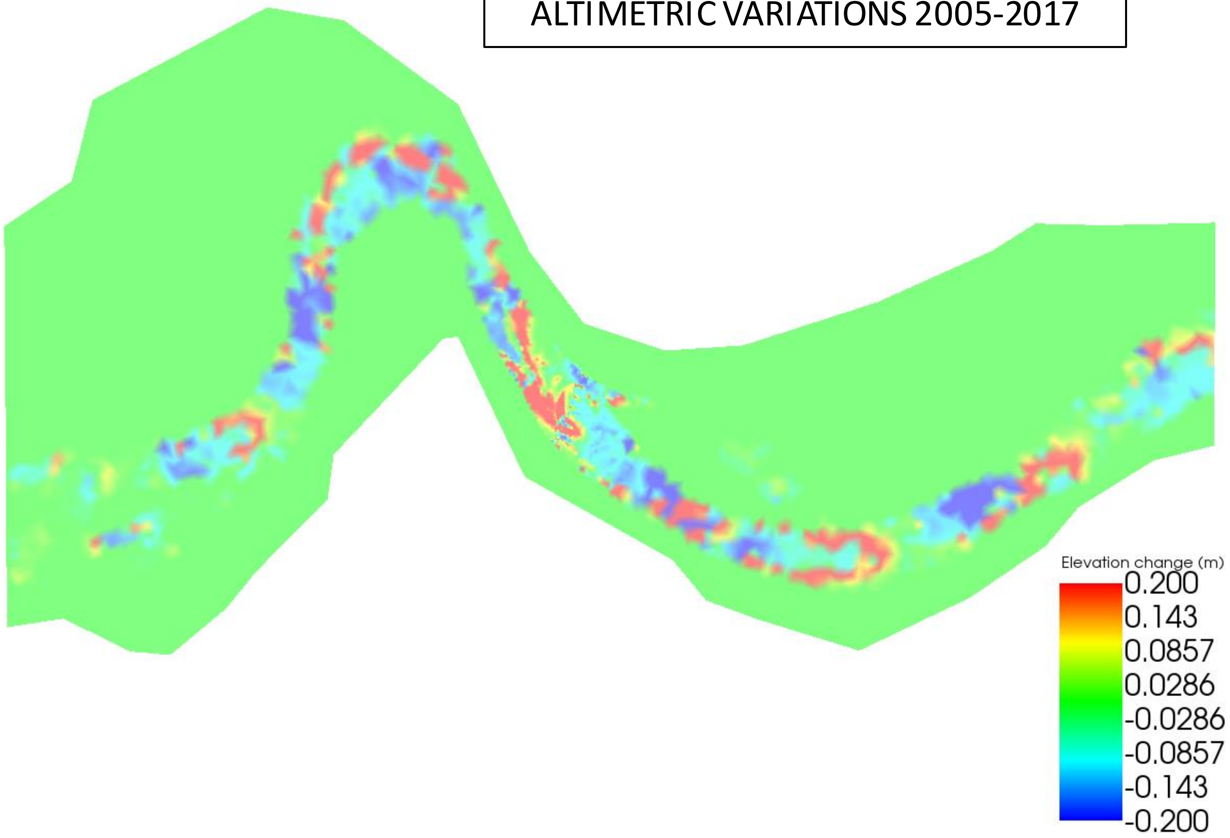
Several simulations are performed depending on the boundary conditions (hydrology) and the temporal horizon.

MONTHLY BOUNDARY CONDITIONS

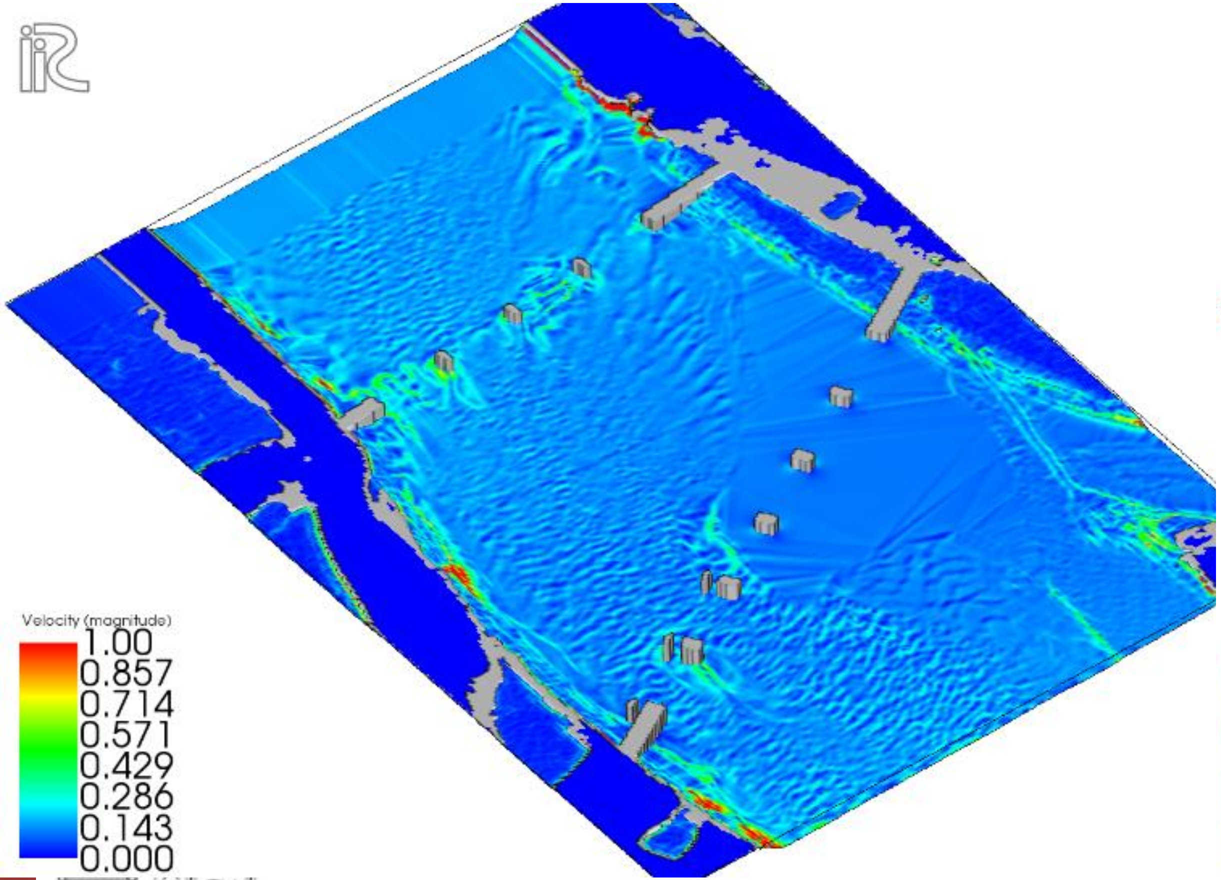


ALTIMETRIC VARIATIONS 2005-2017

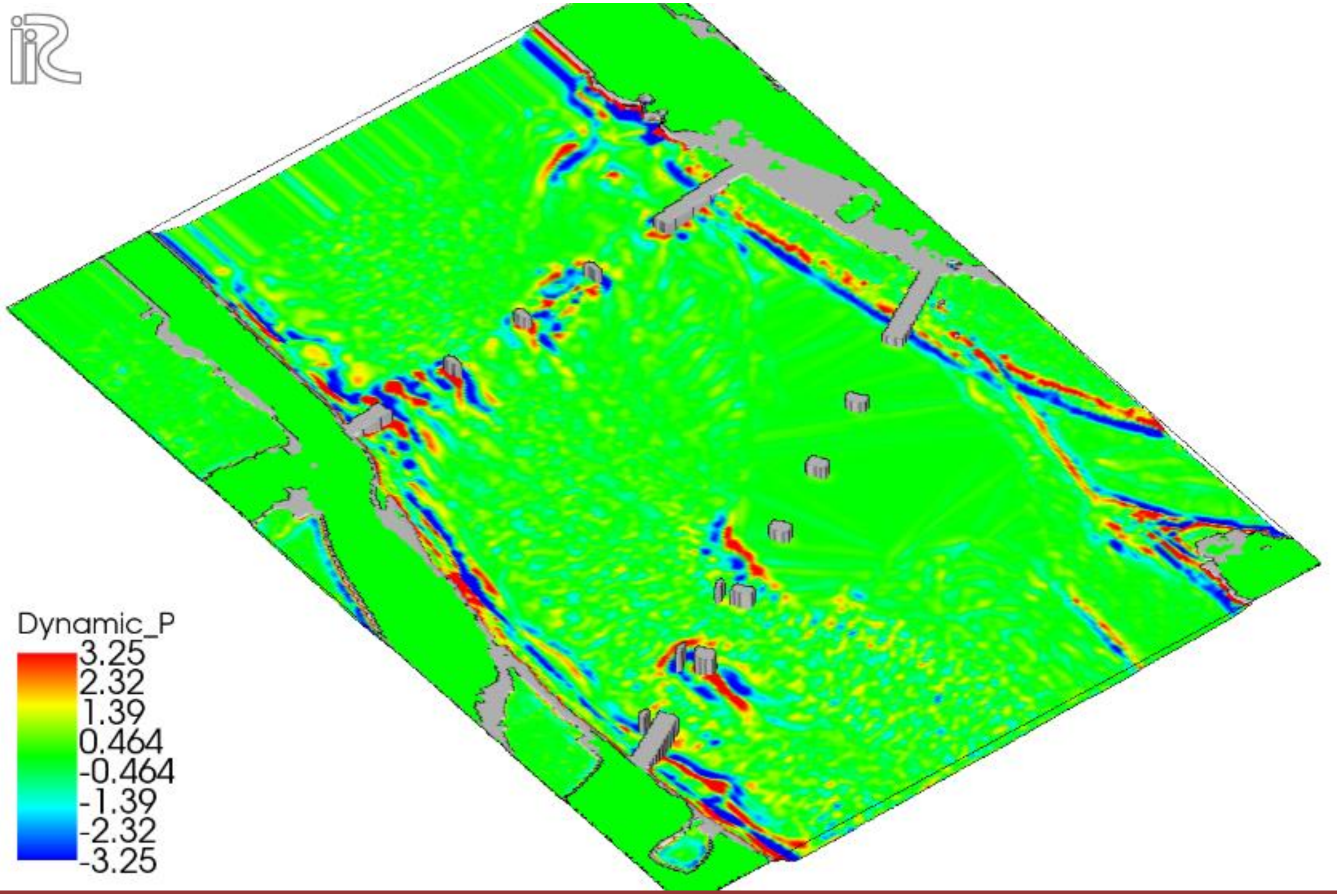


2D runs give the boundary conditions for 3D models.

MEAN VELOCITY



DYNAMIC PRESSURE



CONCLUSIONS

- high and low flow conditions operate in a counteracting way: for low discharges, sediments are deposited on bars and the main channel eroded, for high discharges, sediments are redistributed across the channel reducing the erosive trend
- migrating bars are moved by flooding waves, which are rare in the last years
- the main channel is eroded, especially between the bridge piers
- local erosion and increased current velocity (dynamic pressure) affect the stability of the bridge piers

FUTURE WORKS

- calibration of the emerged regions, accounting for additional contributions like riparian vegetation
- integration with monitoring data for real-time **Early Warning Systems** and **Decision Support Systems**

INFRASAFE Project

Thank you for your attention

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