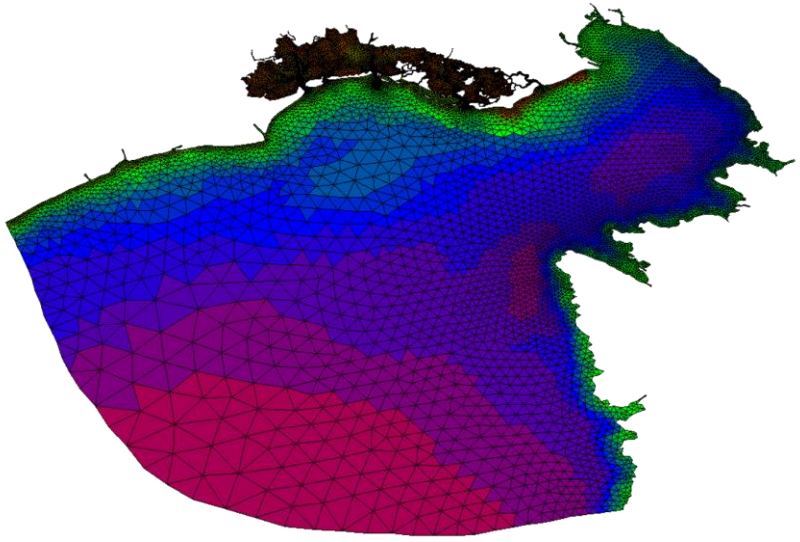
STATE OF PROGRESS OF THE MODELING ACTIVITIES

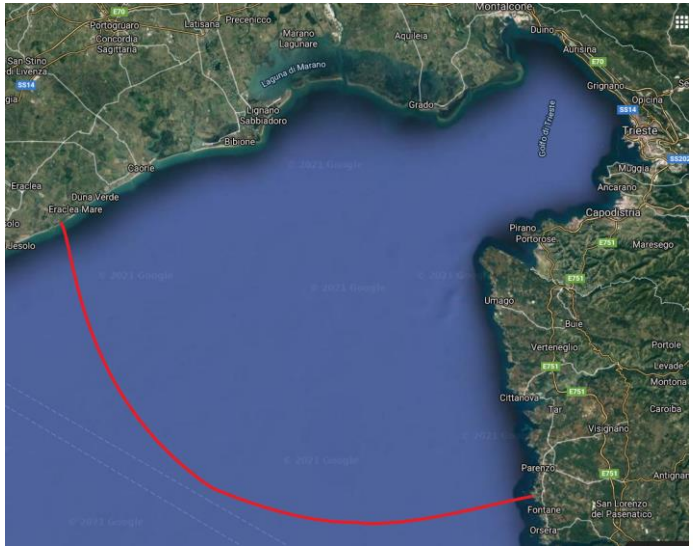
AdriaClim| PP11 | ARPA FVG

Internal, Web Meeting | 05 August 2021

European Regional Development Fund

Introduction





Scalability Test of SHYFEM

Current Level of Parallelization

Two ways for **parallelizing** SHYFEM (**7.5.70 - 2020-12-18** version):

1) **MPI** (Open MPI)

2) **OMP** (OpenMP)

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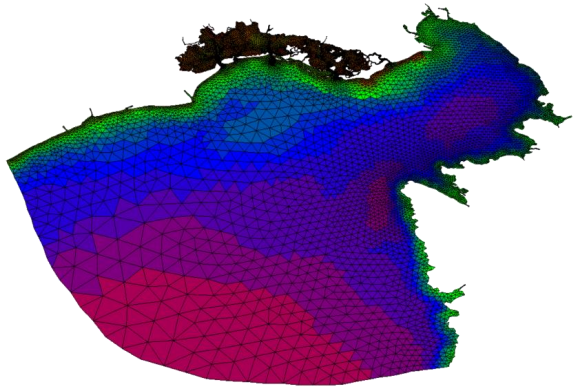

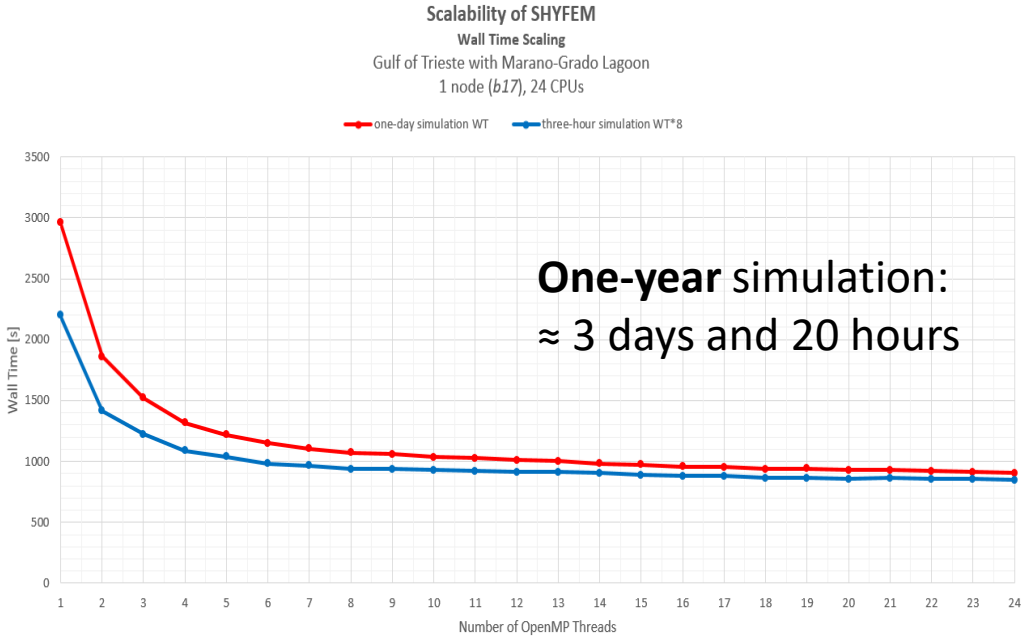

Inputs for SHYFEM

Rivers: Available Data

	CNR-ISMAR	Civil Protection of FVG*
Time period	2015 (start) – 2021 (start)	2015 (end) – 2021 (start)
Resolution time discharge	 12/24 h 10^{-2} m^3 s^{-1}	 1 h 10^{-2} m^3 s^{-1}
Rivers	Aussa, Cormor, Corno, Isonzo, Lemene, Livenza, Piave, Stella, Turgnano	Isonzo, Tagliamento

*Assimilation between observations and numerical models

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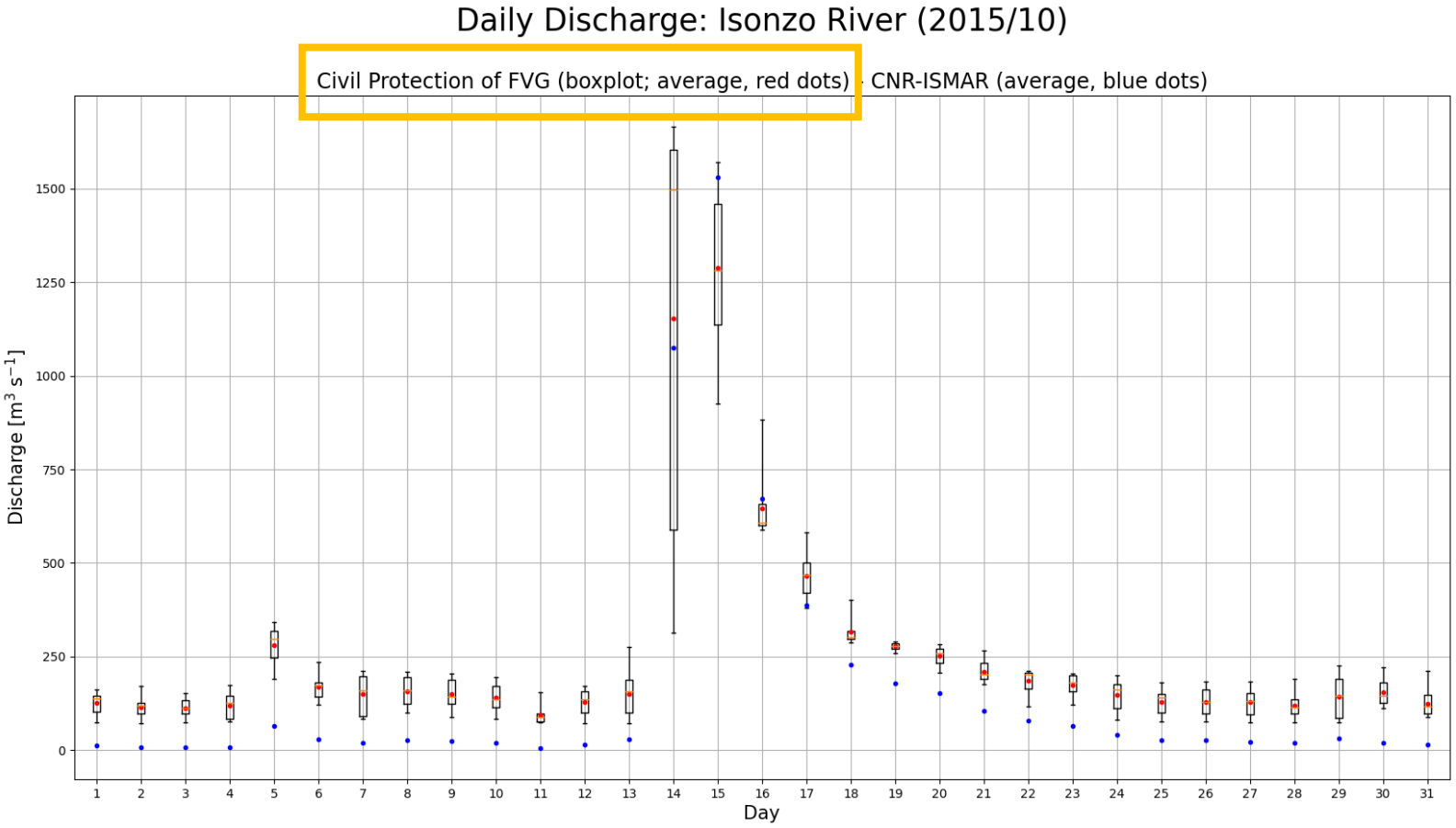
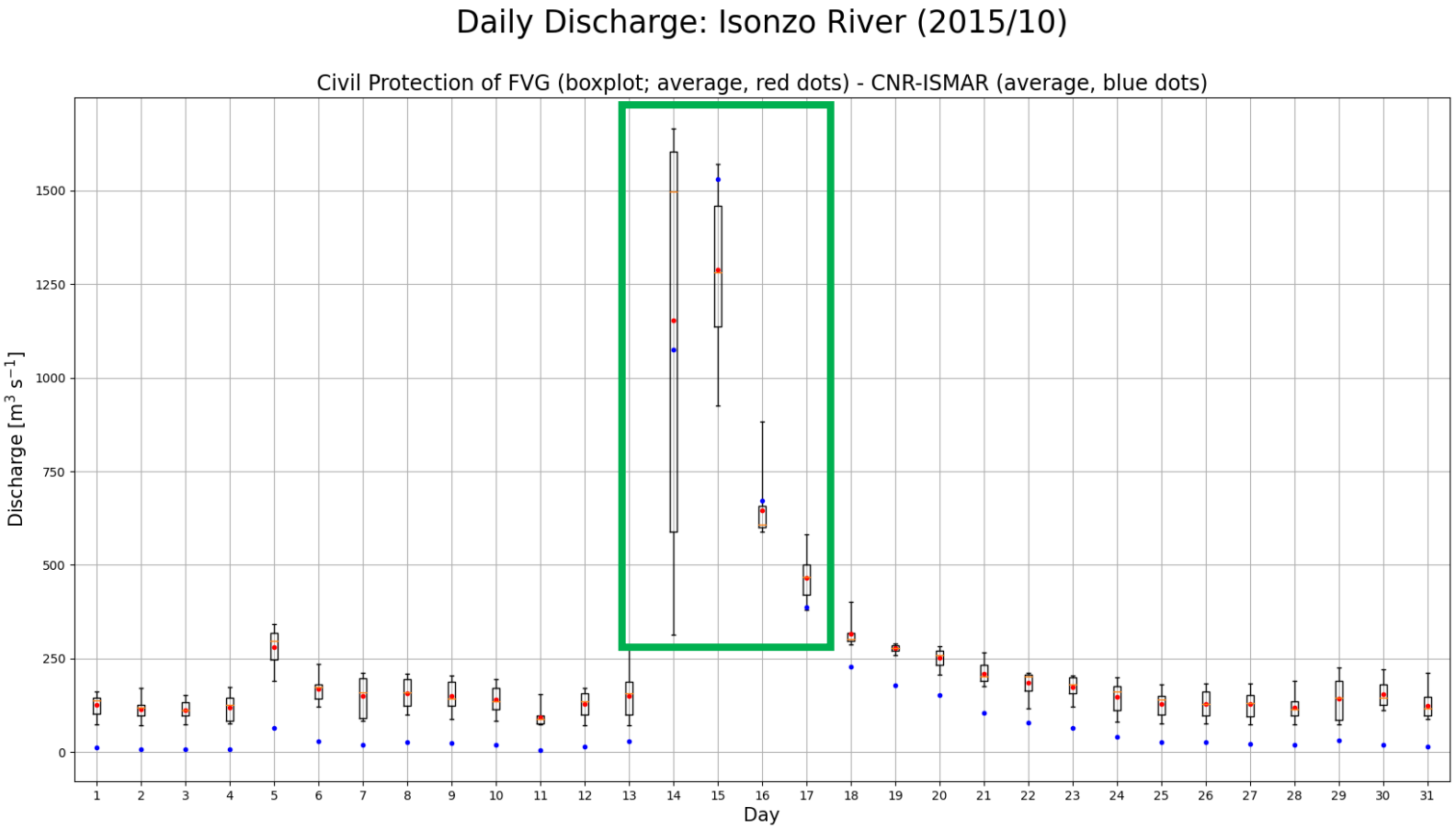
*Assimilation between observations and numerical models

Rivers: Civil Protection Data – Bias-affected



Civil Protection of FVG river discharge **data**:

Rivers: Civil Protection Data – Bias-affected



Civil Protection of FVG river discharge **data**:

- **accurate** during **floods**

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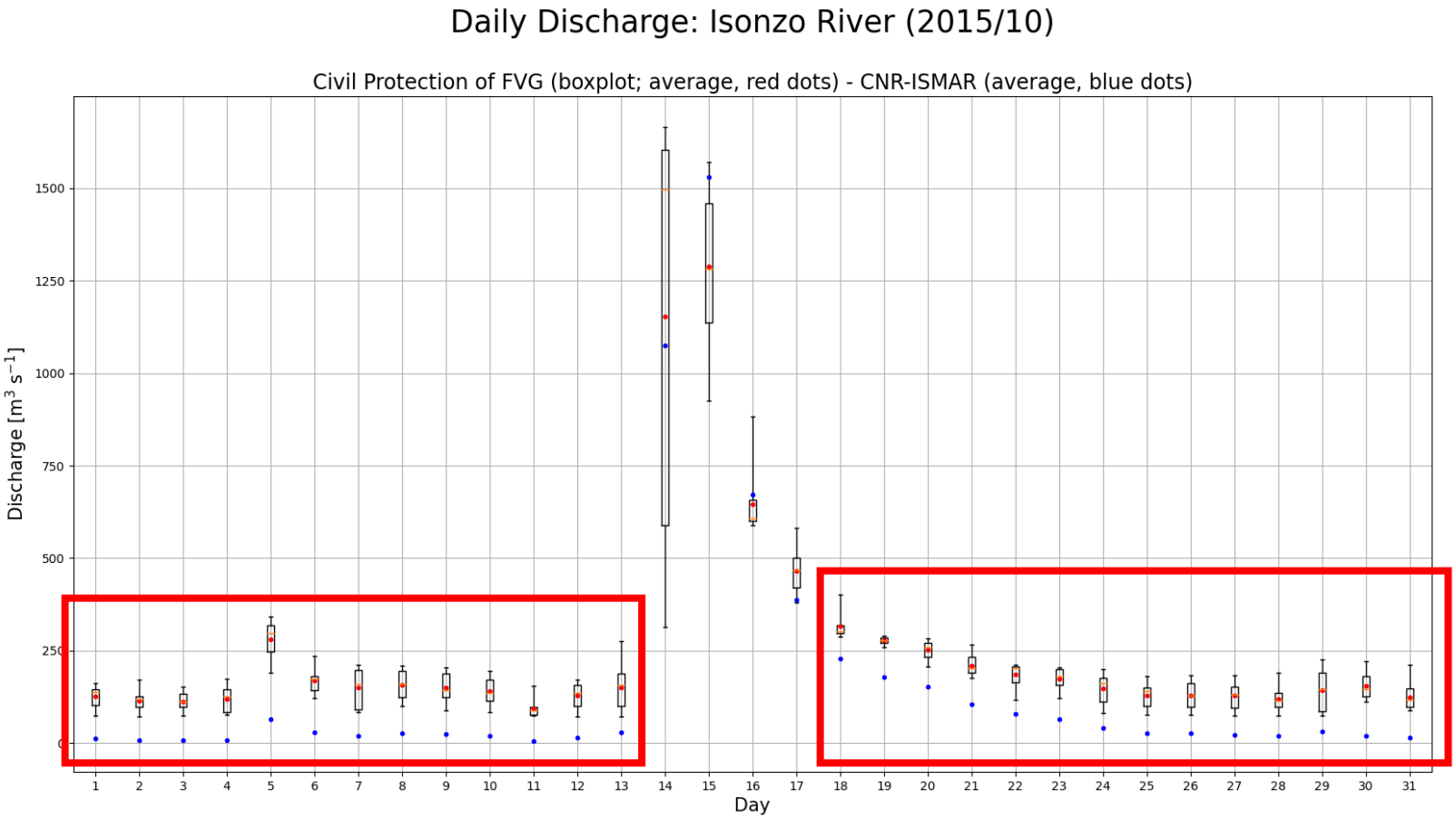
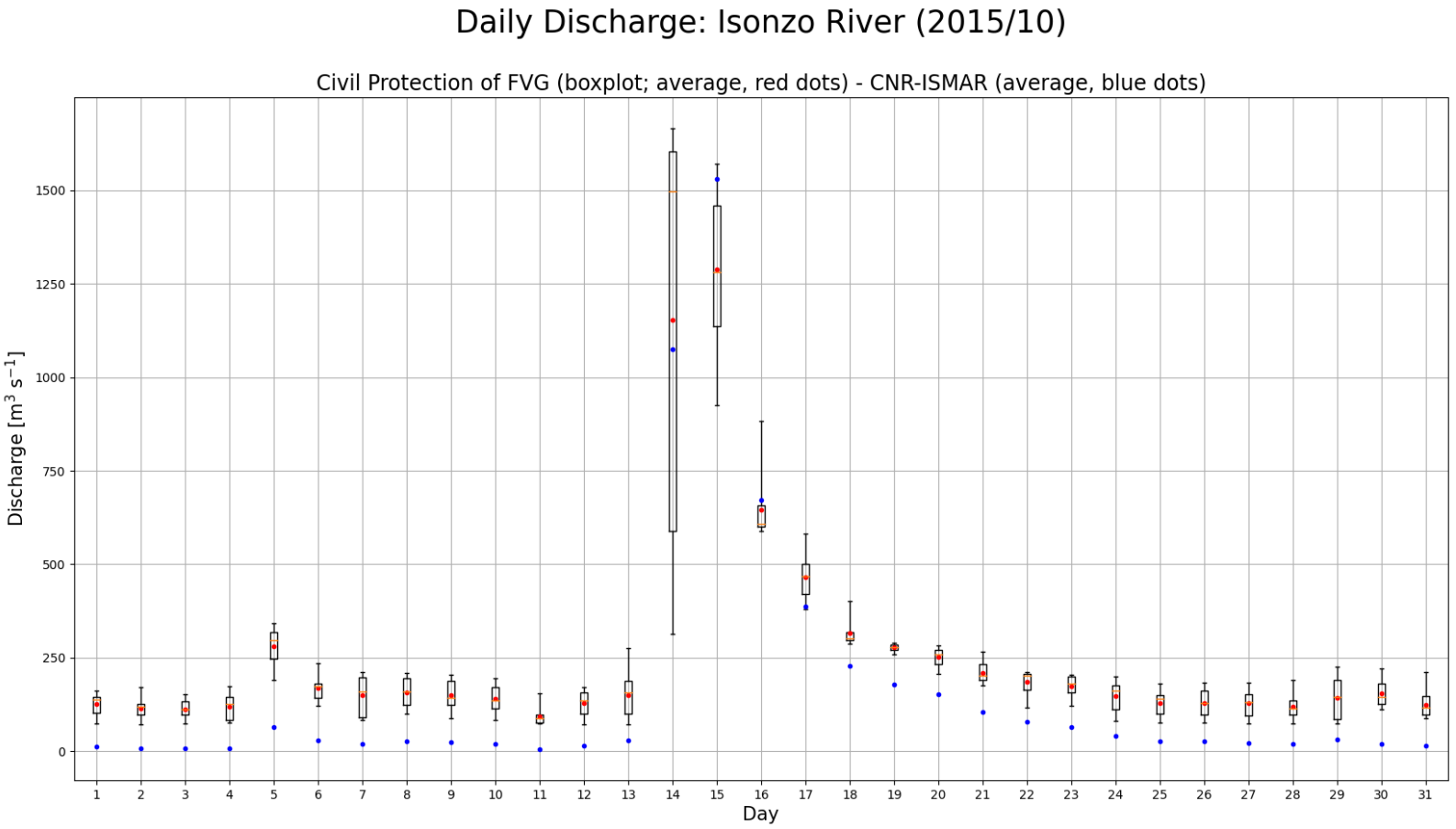


Civil Protection of FVG river discharge **data**:

- **accurate** during **floods**
- **overestimated** otherwise

Rivers: Civil Protection Data – Bias-affected

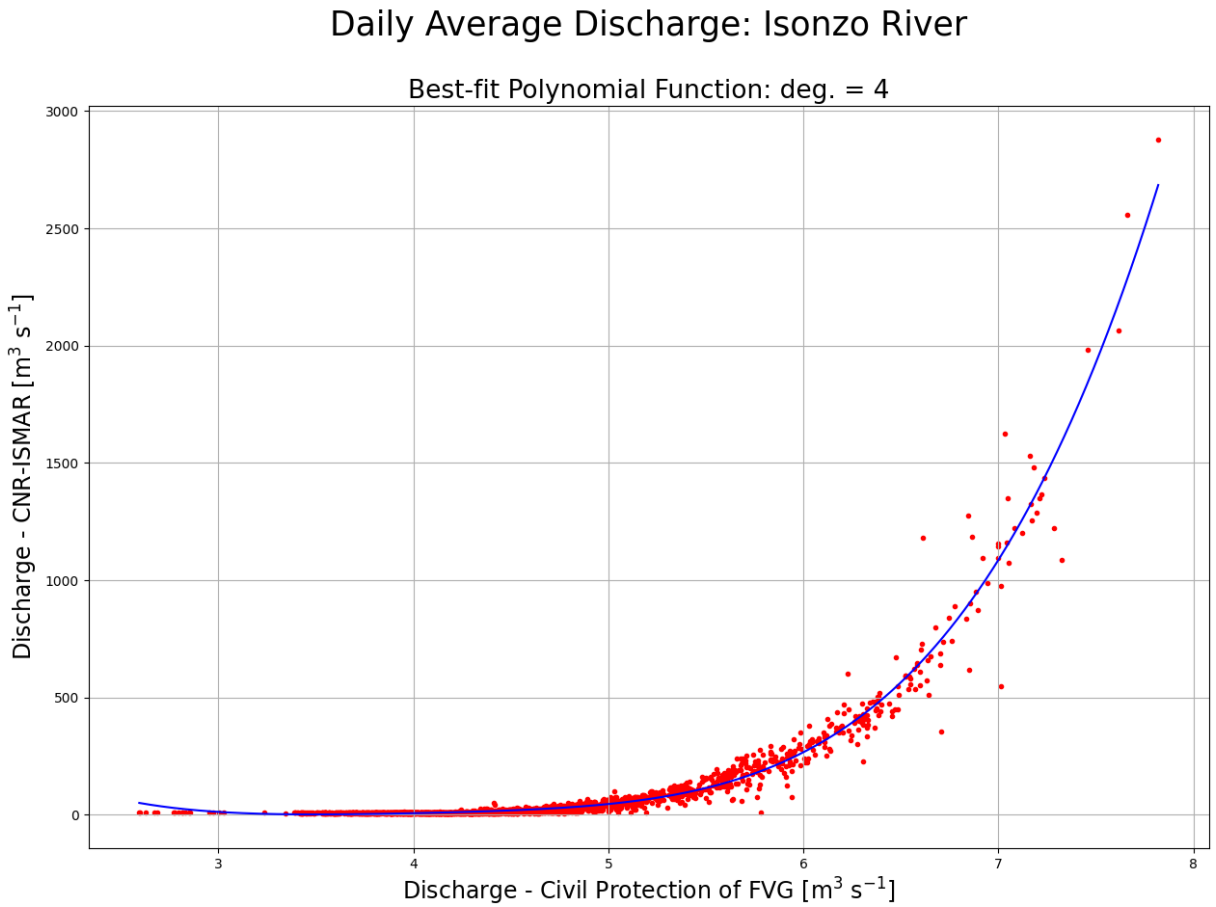


Civil Protection of FVG river discharge **data**:

- **accurate** during **floods**
- **overestimated** otherwise

Bias-correction needed

Rivers: Civil Protection Data – Corrective Function

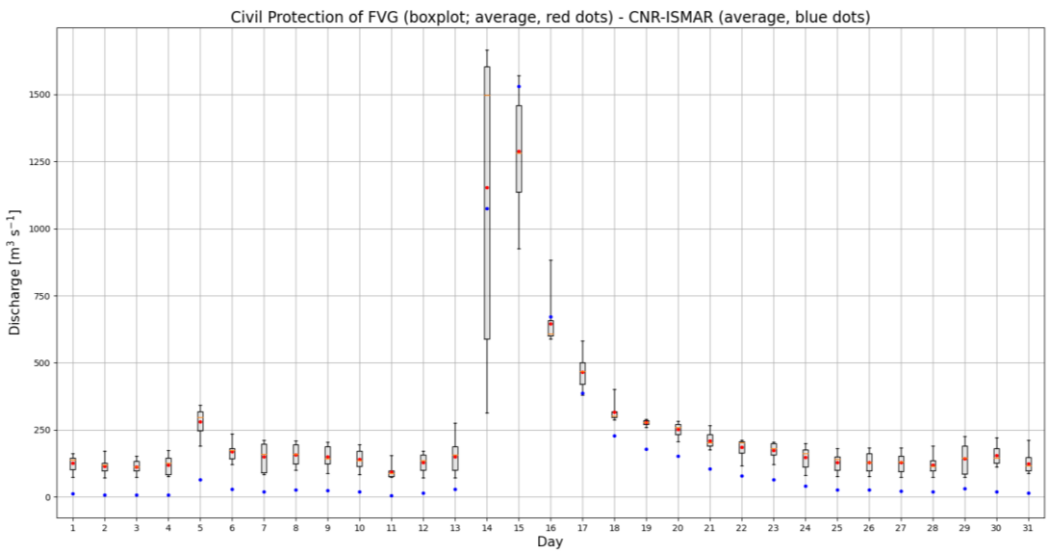


September 21, 2015 - February 27, 2021

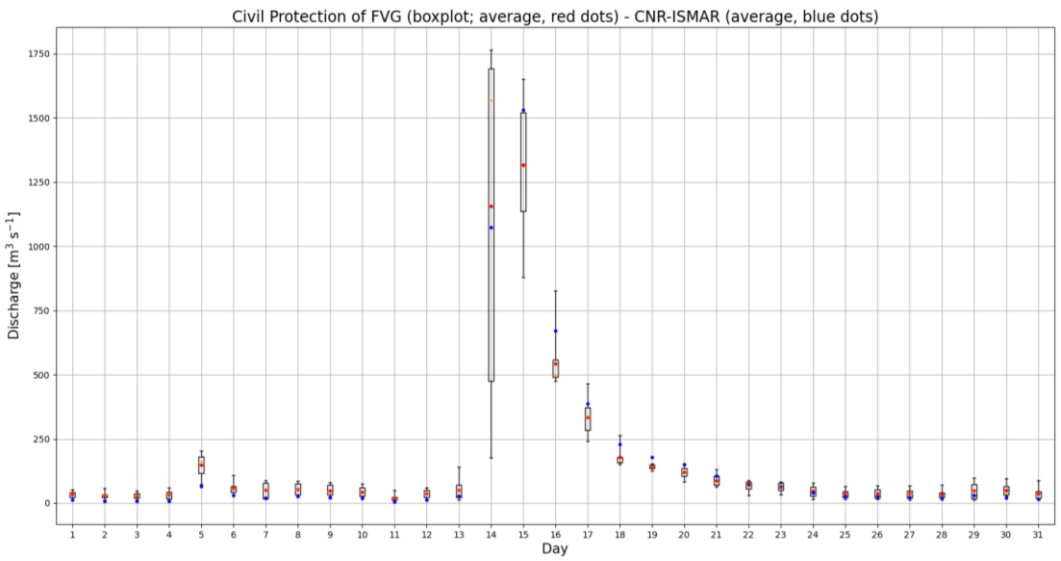
- **Minimum** Kolmogorov-Smirnov ***D*** statistic…
- …among **physical solutions** ($Q \geq 0 \; \forall t$)

Rivers: Civil Protection Data – Bias-correction

Before bias-correction



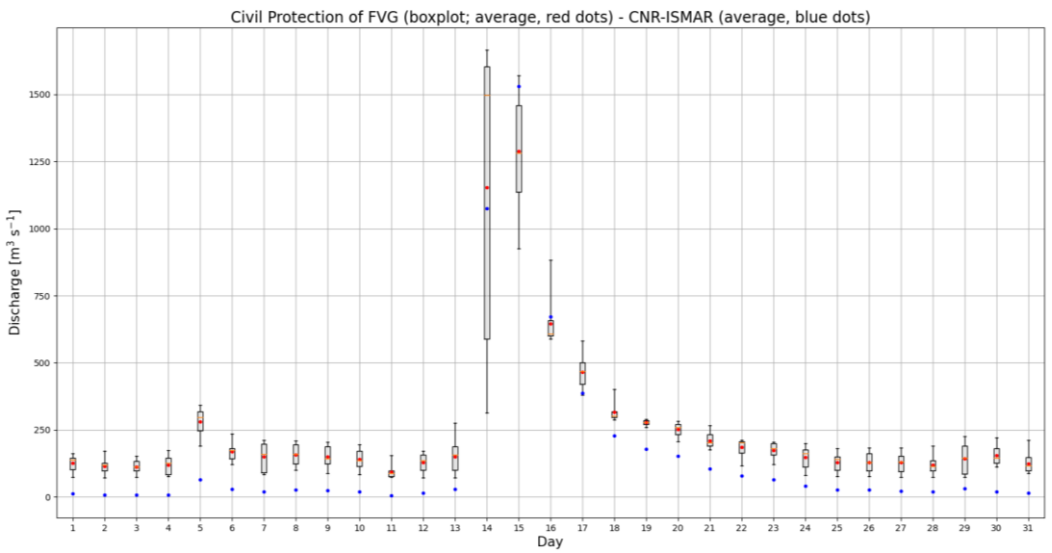
After bias-correction



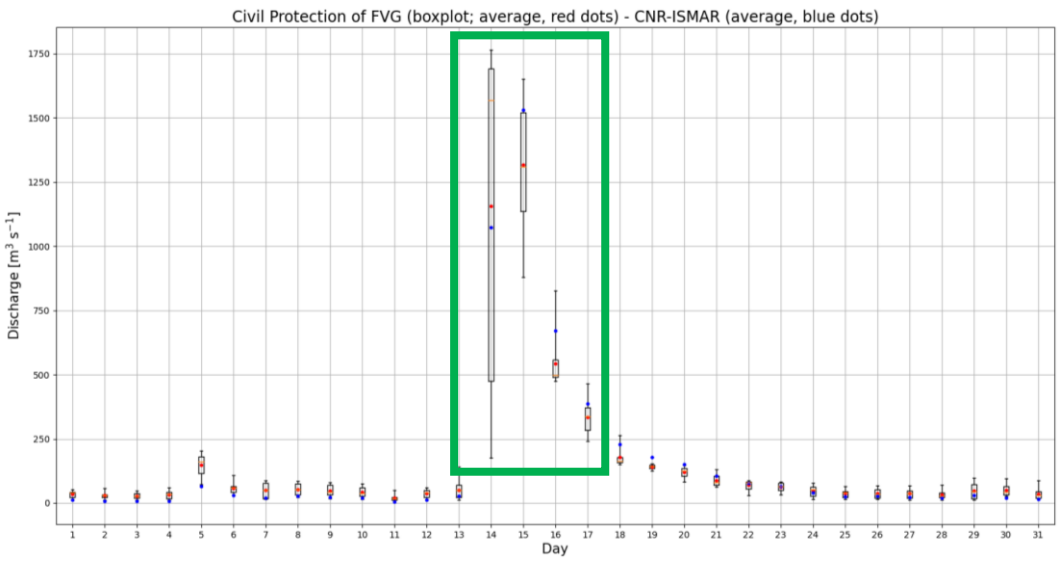
Modulated correction:

Rivers: Civil Protection Data – Bias-correction

Before bias-correction



After bias-correction

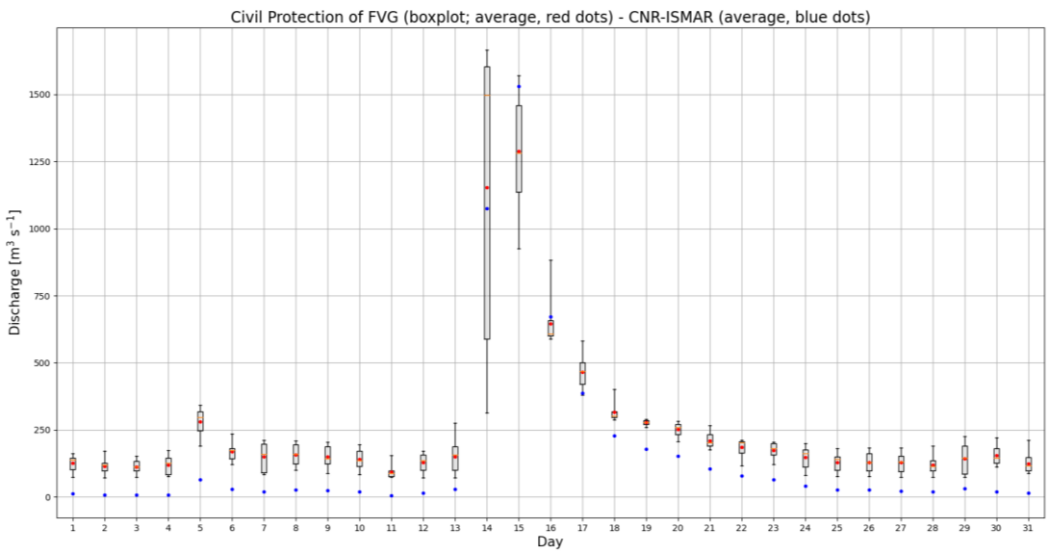


Modulated correction:

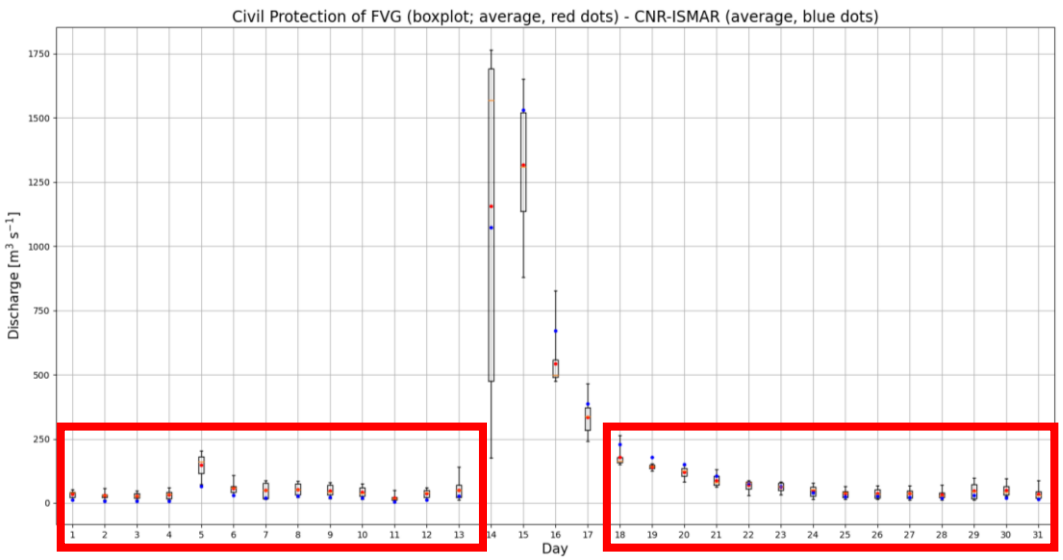
- **lighter** during **floods**

Rivers: Civil Protection Data – Bias-correction

Before bias-correction



After bias-correction



Modulated correction:

- **lighter** during **floods**
- **heavier otherwise**

Marine IC & BC: Available Data

	CNR-ISMAR	CMEMS
Time period	2018	Since 1987
Source	SHYFEM	MFS (CMCC)
Resolution time space	 1 h 0.02°	 * 0.04°
Strengths	Resolution Tide	Continuity Forecast
Weaknesses	Discontinuity Limited period	No tide Hindcast

*Dependent on the data type

Meteorological Forcing: Available Data

	CRMA – ARPA FVG
Time period	2017 (end) – 2019 (start)
Source	WRF
Resolution time space	 1 h 2 km (Alpe Adria)

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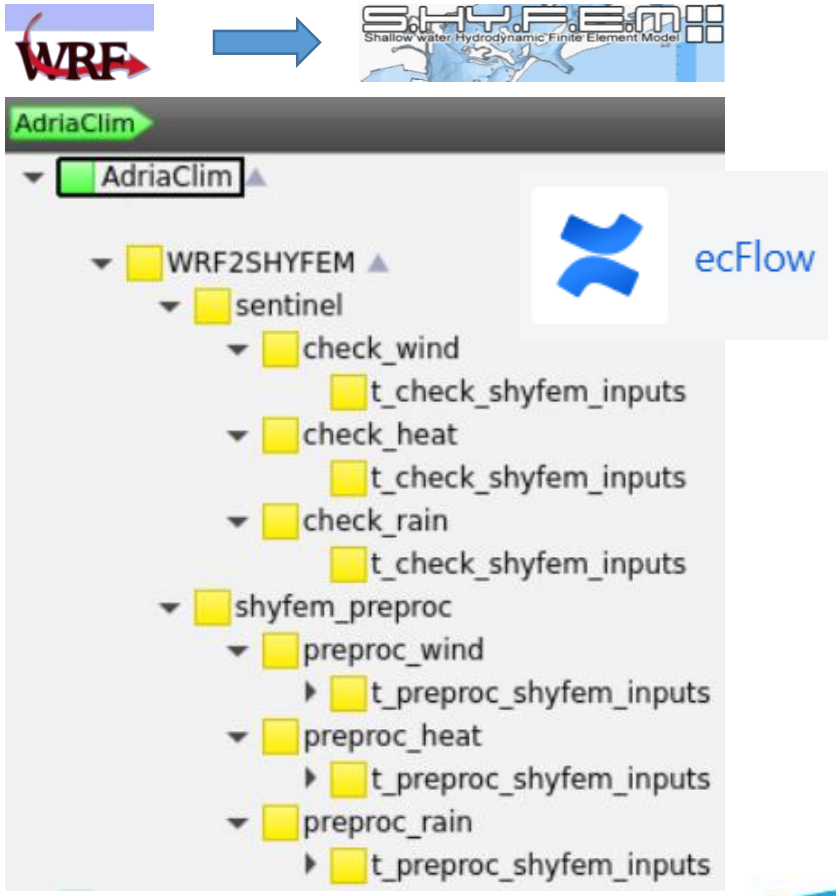


Sensitivity Tests of the Marano and Grado Lagoon to Riverine Freshwater Inputs

Simulation Setups

SSA (reference setup)

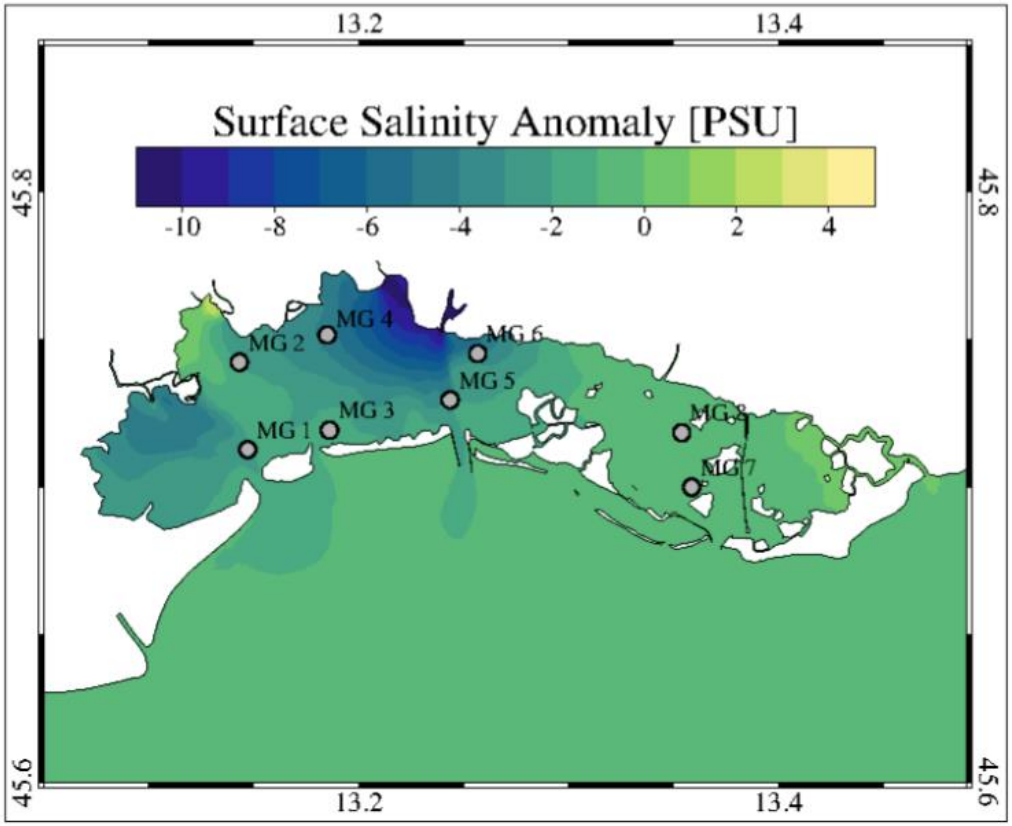
River/Torrent	Time Resolution	$\langle Q \rangle \pm \sigma_{\langle Q \rangle}$ [$m^3 s^{-1}$]	$\langle z \rangle$ [cm]	Data Source
Aussa	two daily	2.01 ± 0.16	-	CNR-ISMAR
Cormor	two daily	8.30 ± 2.07	-	CNR-ISMAR
Corno	two daily	3.59 ± 0.27	-	CNR-ISMAR
Stella	two daily	31.13 ± 1.78	-	CNR-ISMAR
Turgnano	climatological	-	0.5	CNR-ISMAR
Zellina	climatological	-	1.0	CNR-ISMAR

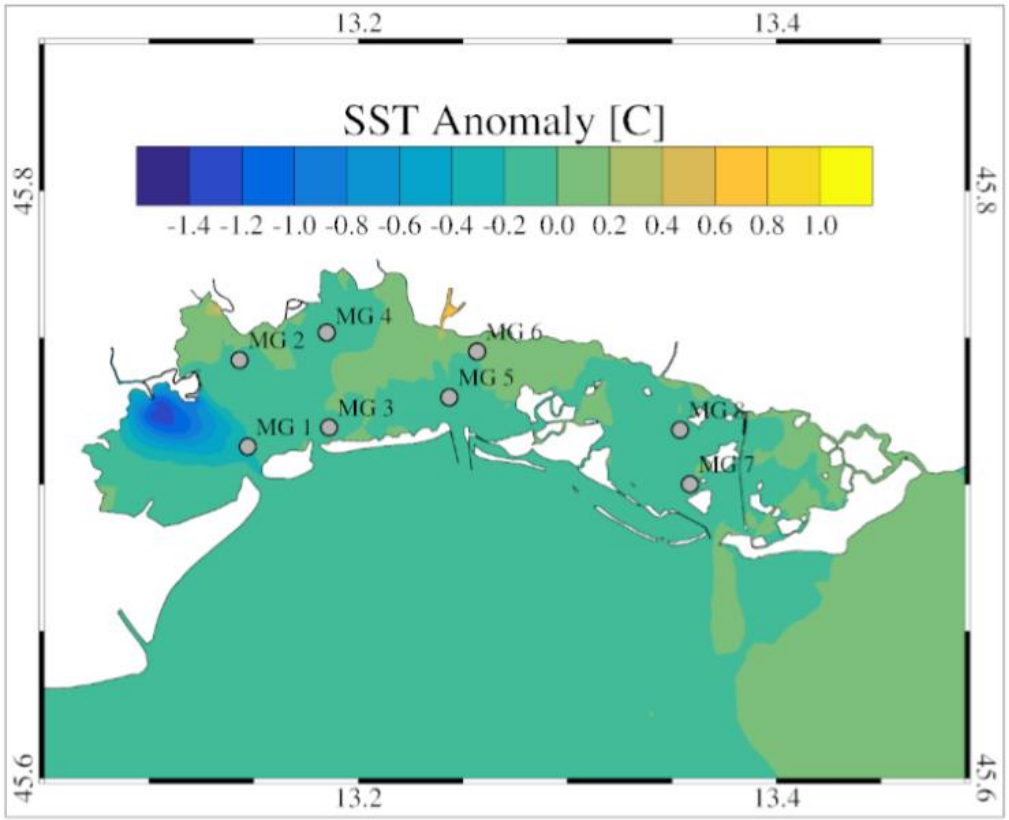
SSB

River/Torrent	Time Resolution	$\langle Q \rangle \pm \sigma_{\langle Q \rangle}$ [$m^3 s^{-1}$]	$\langle z \rangle$ [cm]	Data Source
Aussa	climatological	15	-	ERSA (1976)
Cormor	climatological	5	-	ERSA (1976)
Corno	climatological	12	-	ERSA (1976)
Stella	climatological	50	-	ENEA (1989)
Turgnano	climatological	1	-	Visentini F. (1962)
Zellina	climatological	2	-	ERSA (1976)

Surface Temperature and Salinity Anomalies

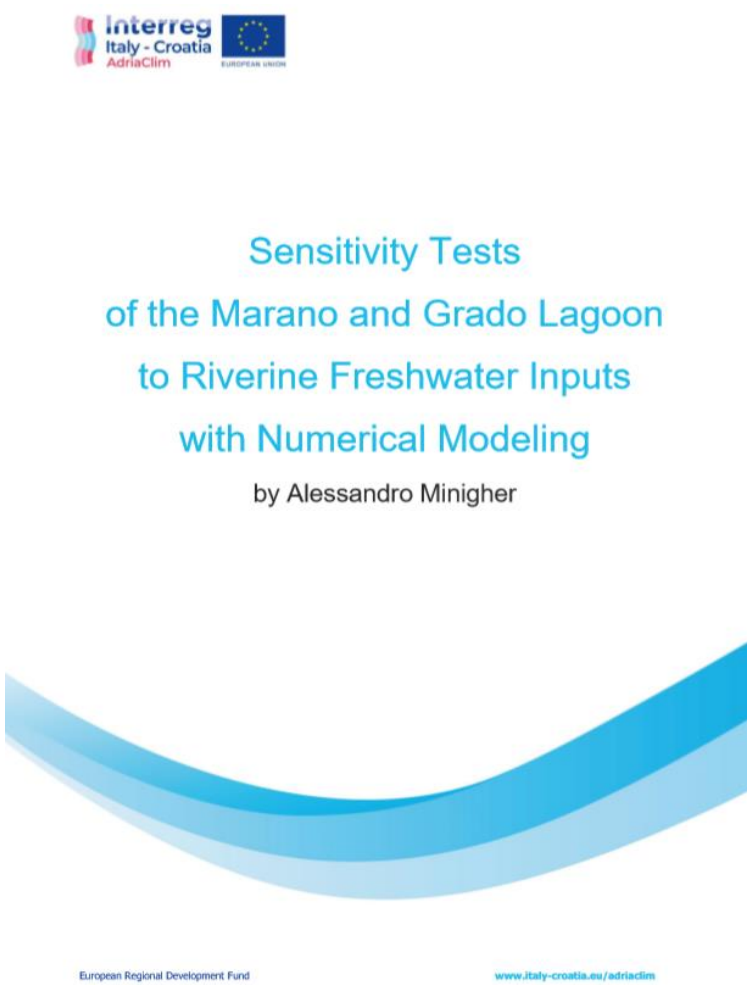
SSB - SSA





Time averages over the period 2020-08-01 - 2020-08-31

The Full Study



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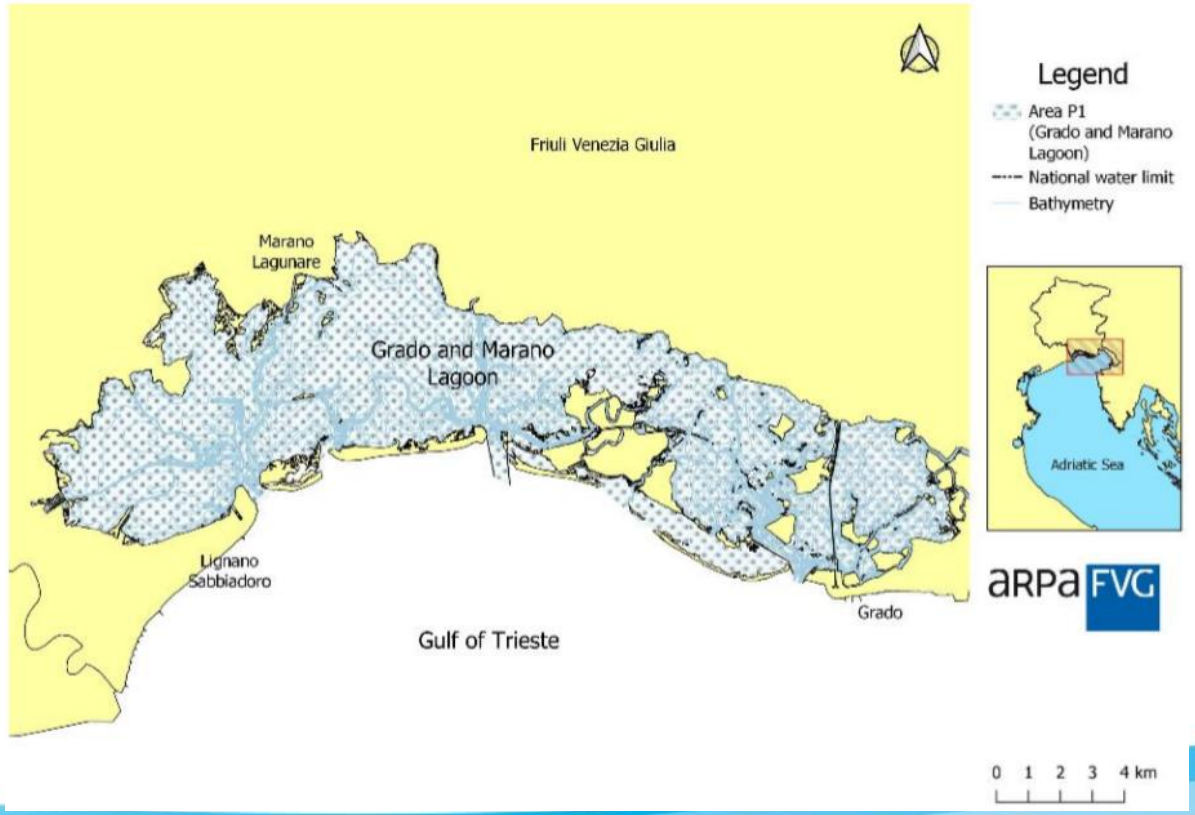
EUROPEAN UNION

ARPA FVG agenzia regionale per la protezione dell'ambiente del Friuli Venezia Giulia

AdriaClim-CASCADE Interaction

Installation of Buoys for Validating SHYFEM

Thanks to the **first modelling results** (thermohaline and current fields) and the **QMT – STA CRMA cooperation**, the positions of **three buoys** have been defined, in order to **support** the **validation** of the **modeling** activities



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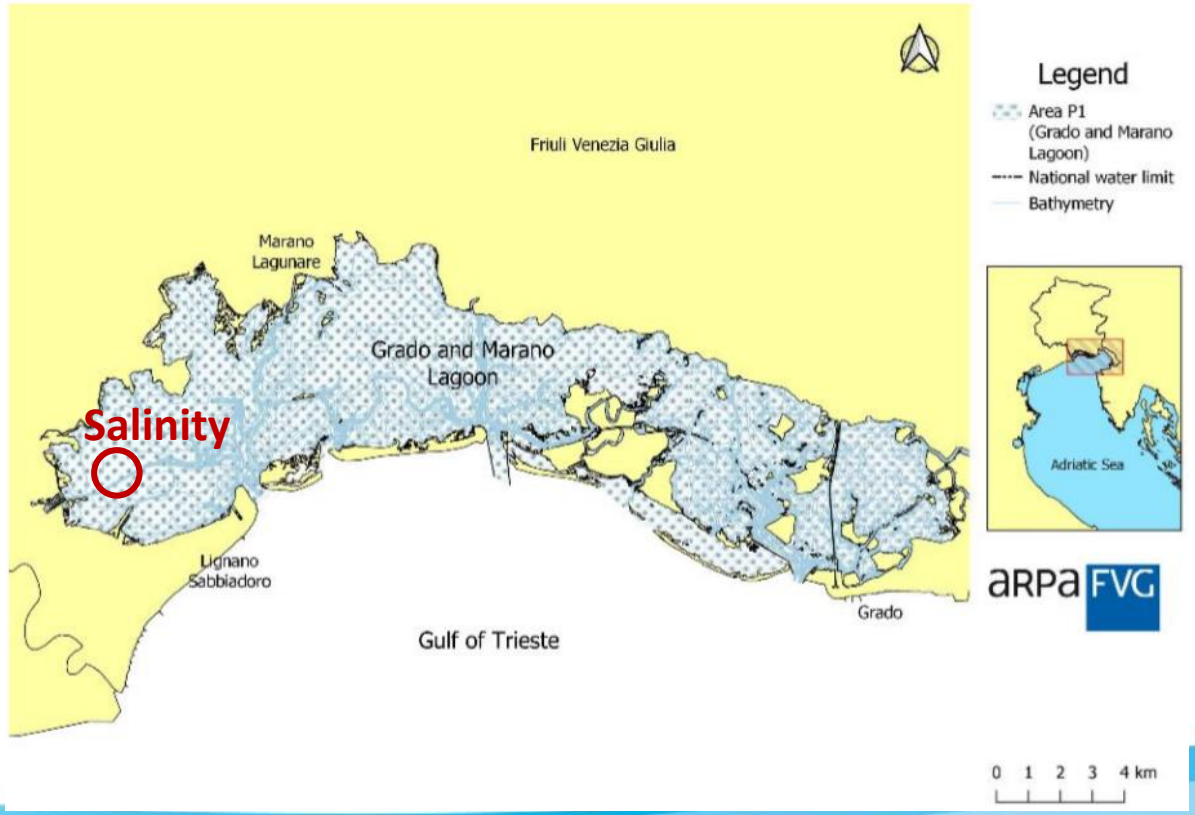

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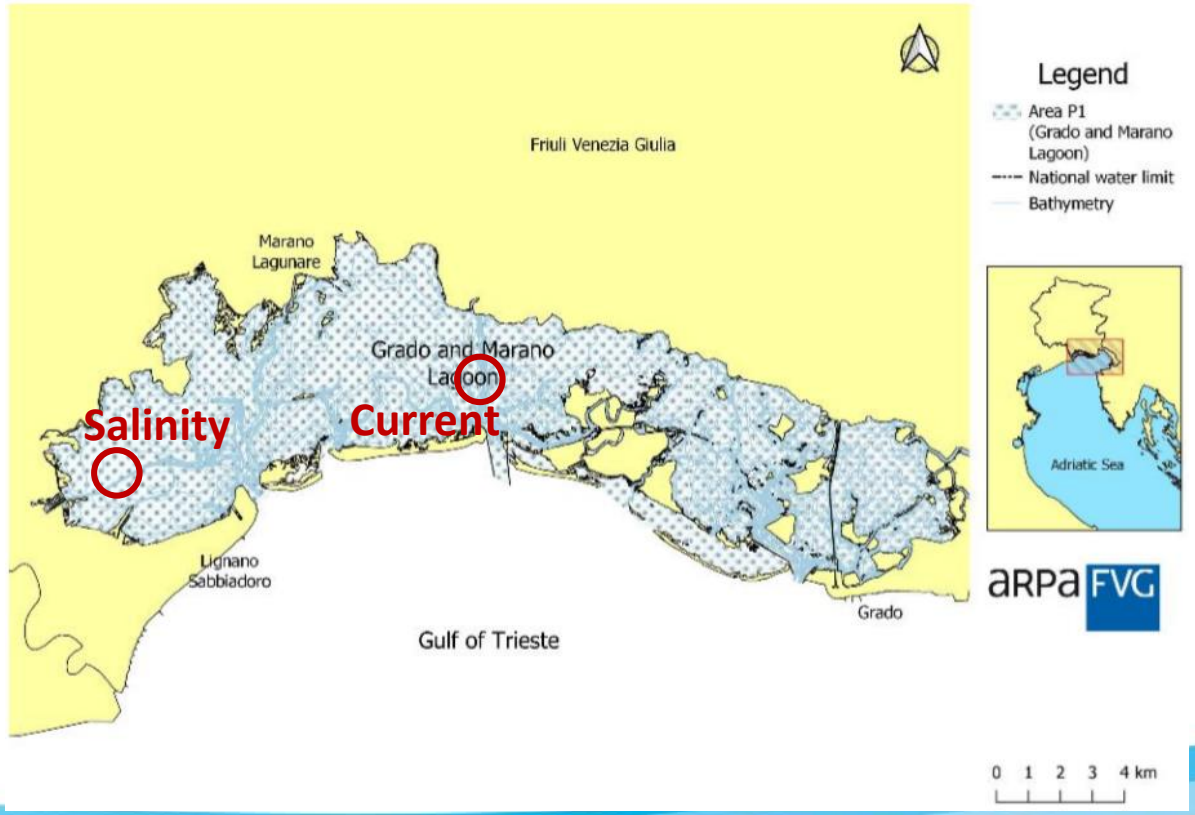

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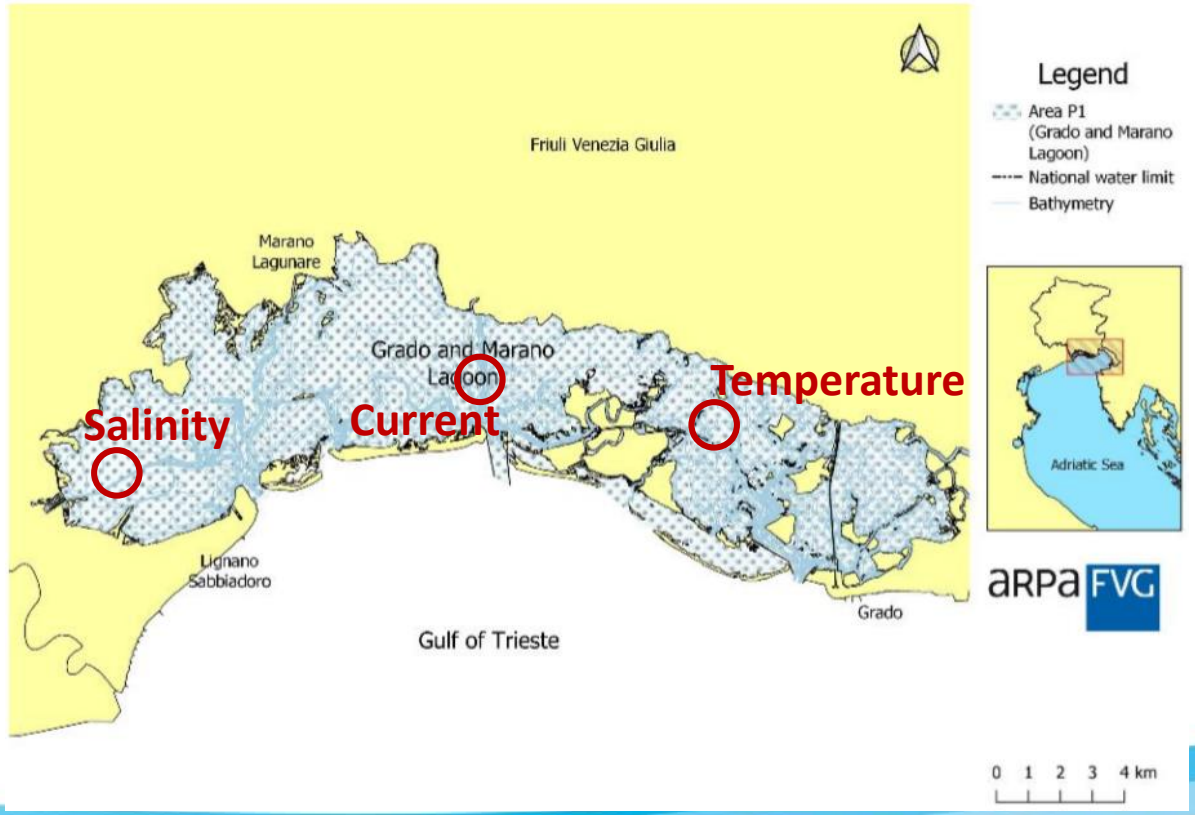


AdriaClim-FIRESPILL Interaction

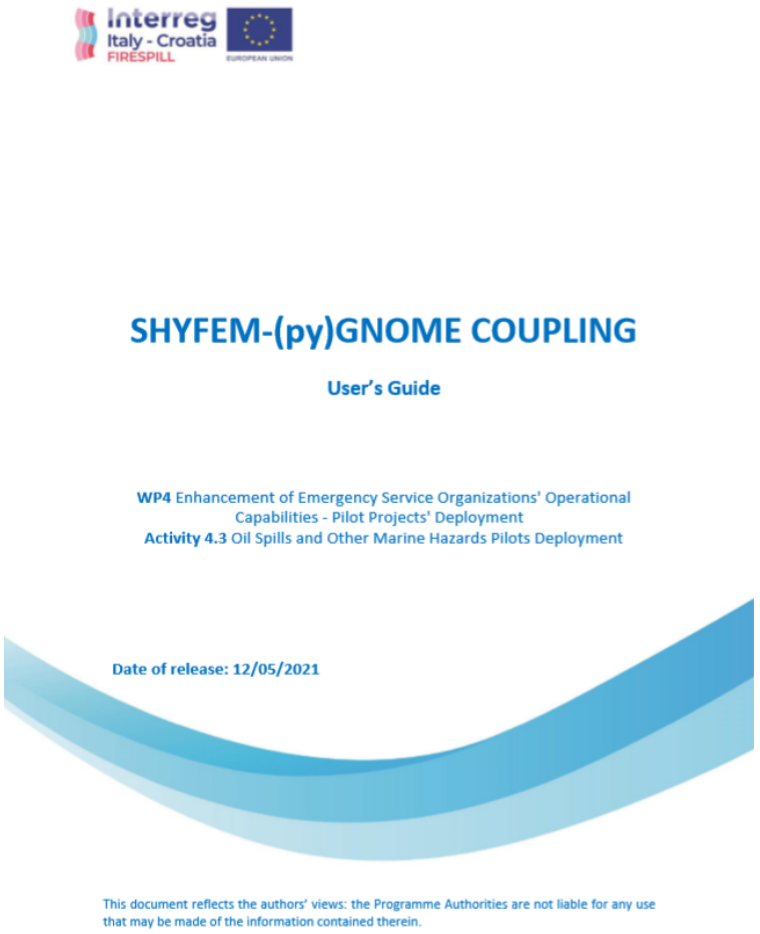
SHYFEM-(py)GNOME Coupling

+ GNOME

High-resolution numerical simulations for the **Pilot Area**

More **accurate assessment** of the **oil spill** marine **hazard**

User's Guide



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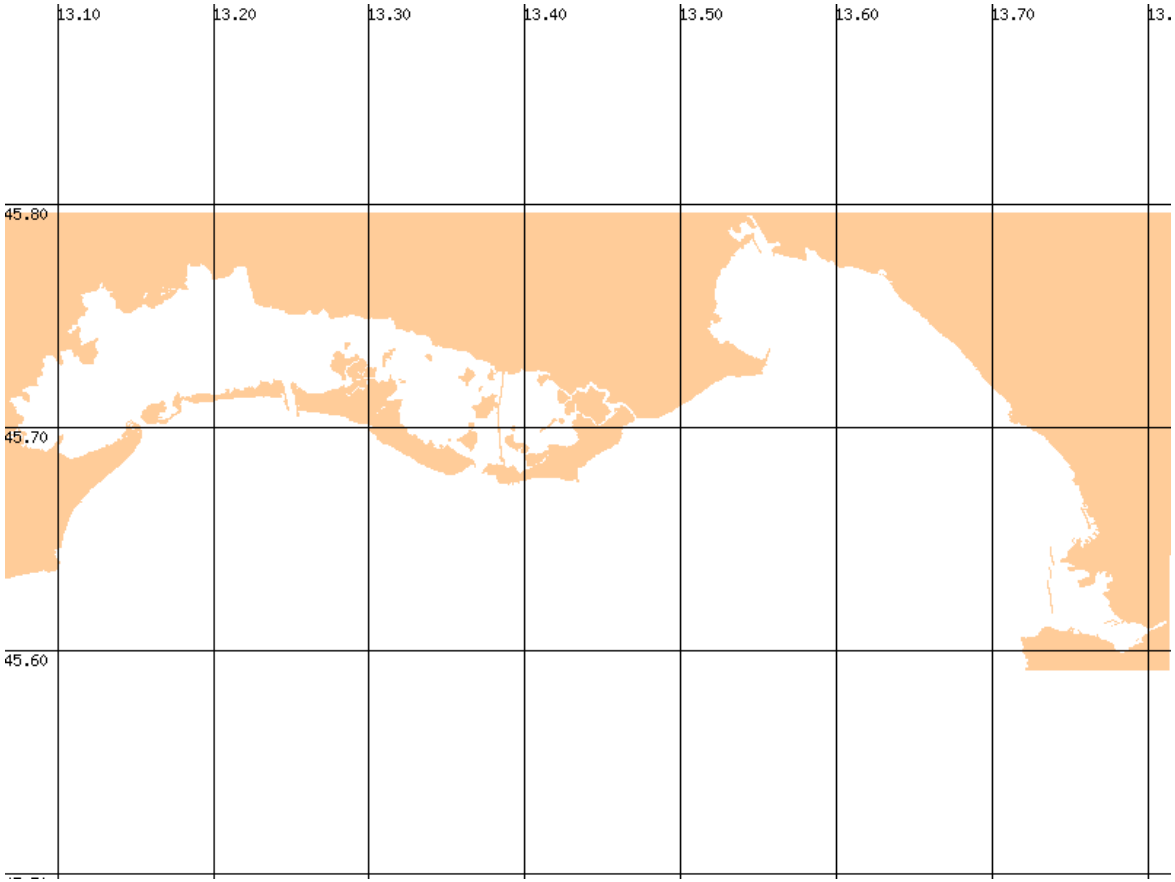
1 How to Couple the SHYFEM and (py)GNOME Models

This Chapter is dedicated to the description and explanation of all the steps to be carried out to couple the SHYFEM and (py)GNOME models, hence to use the hydrodynamic output produced by the former as inputs for the latter.

First Simulation



#FIRESPILL: Accoppiati con successo i modelli SHYFEM e pyGNOME

17/05/2021

In ARPA FVG, nell'ambito del progetto INTERREG IT-HR **FIRESPILL [1] [2]**, lo strumento per la **modellizzazione di oil spill pyGNOME [3]** è stato accoppiato con successo al **modello idrodinamico SHYFEM [4]**.

L'elevata risoluzione spaziale, della configurazione adottata per il modello SHYFEM, permette di simulare lo scambio delle masse d'acqua tra la laguna di Marano e Grado ed il mare aperto.

Pertanto, le **simulazioni numeriche** ad **alta risoluzione** del modello SHYFEM possono, ora, essere utilizzate come input per il modello dispersivo pyGNOME.

Questo consentirà di effettuare una **più accurata valutazione del rischio** derivante dal **rilascio di inquinanti oleosi in mare**, soprattutto nell'**ambiente lagunare**, contribuendo al raggiungimento degli obiettivi della **Deliverable 4.3.1** del progetto.

*In ARPA FVG, as part of the INTERREG IT-HR **FIRESPILL project [1] [2]**, the **pyGNOME oil spill modelling tool [3]** has been successfully coupled with the **SHYFEM hydrodynamic model [4]**.*

The high spatial resolution, of the implemented SHYFEM configuration, allows the simulation of water masses exchange between Marano and Grado Lagoon and the open sea.

*Therefore, the results of **high-resolution numerical simulations** of the SHYFEM model can, now, be used as inputs for the pyGNOME model.*

*This will allow for a **more accurate assessment of the oil spill marine hazard**, especially in the **lagoon environment**, contributing to the achievement of the objectives of the **Deliverable 4.3.1** of the project.*

Riferimenti - References

[1] INTERREG IT-HR FIRESPILL
[2] ARPA FVG - FIRESPILL
[3] PyGnome Git repository website
[4] SHYFEM model

http://www.arpa.fvg.it/cms/istituzionale/servizi/progetti_europei/news/firespill_2021_0005.html

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AGENZIA REGIONALE PER LA PROTEZIONE DELL'AMBIENTE DEL FRIULI VENEZIA GIULIA

Recent Activities: Contribution to WP 2

Participation to “NanoValbruna”

Future Developments

- Computation of the **spin-up** time of SHYFEM for the Pilot Area
- **Validation** and **calibration** of SHYFEM
- **Installation** of a marine **forecasting system** for the Pilot Area

CONTACT INFORMATION

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