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JPI Climate

JPI OCEANS

Knowledge Hub on Sea Level Rise
Black & Mediterranean Sea Scoping Workshop

Scenarios, Vulnerability and Adaptation Strategy for the Emilia-Romagna coastal area

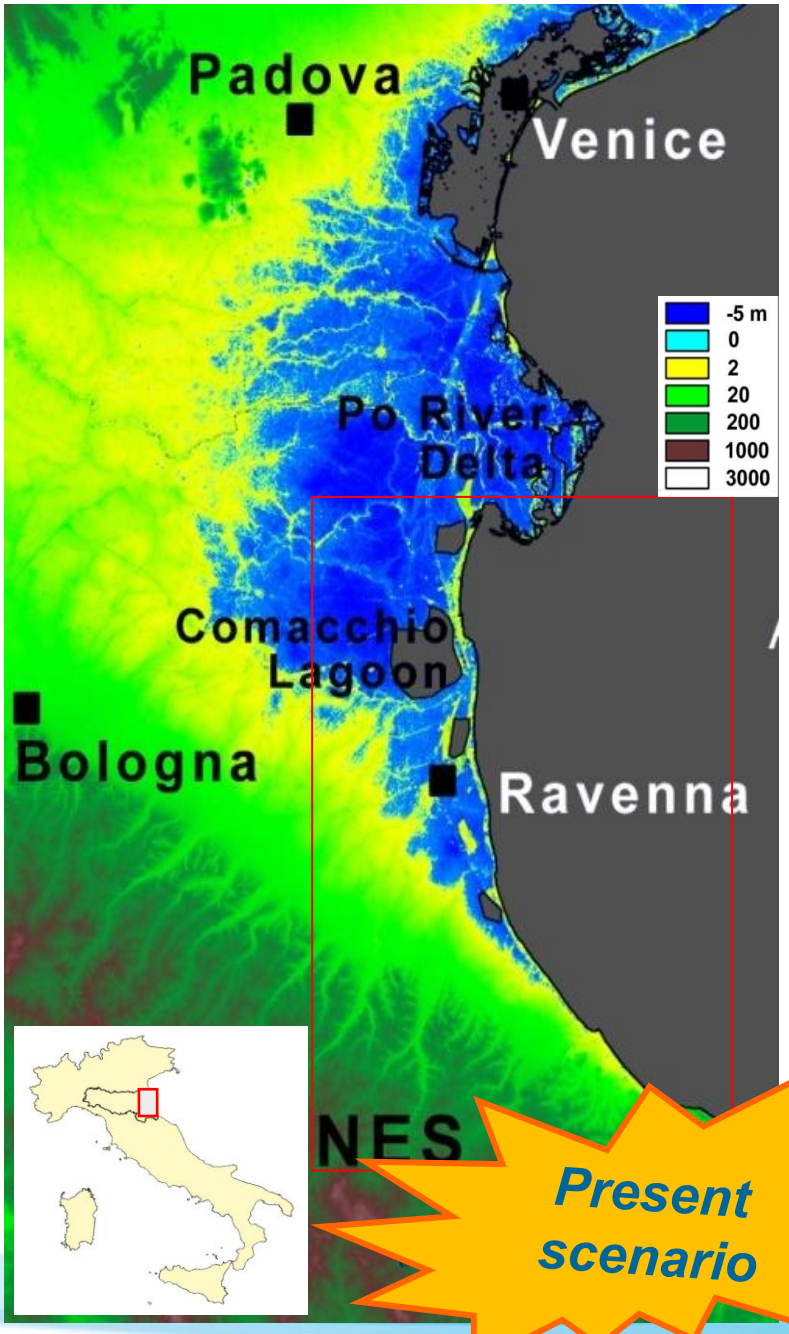
Andrea Valentini, Luisa Perini, Roberto Montanari

online workshop
5 May 2022

AdriaClim project

European Regional Development Fund

Coastal Vulnerability & risk factors



Coastal morphology: large areas of the coastal plain are below mean sea level; natural/anthropogenic subsidence locally reaches rates of 15-20 mm/y
Coastal dunes are still present along less than 30% of the coastline and the frontal beaches are low (52% of them $H_{mean} < 1.5$ m)

Beach erosion and **seabed lowering** affects around the 47% of the shoreline

Very high **Anthropic Pressure** within the 300 m wide coastal strip from the shoreline; around the 57% of the shoreline protected with 'hard defense' systems

high urbanization (over 400% in 65 years) increases the level of exposure/risk

Present scenario

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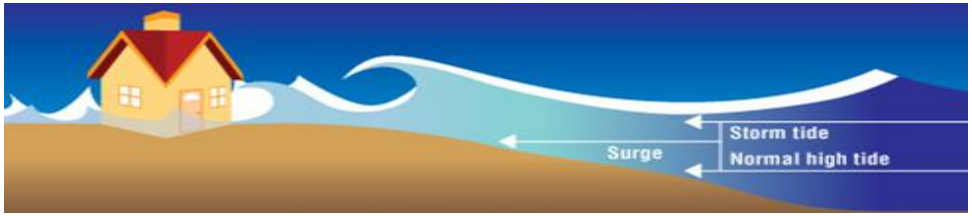
Sea storm impacts

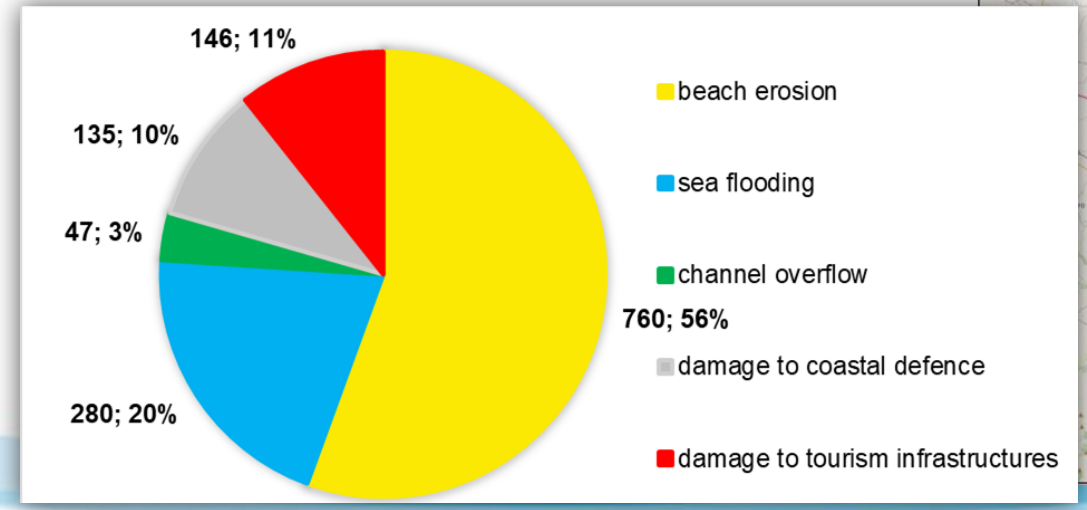
1946-2021

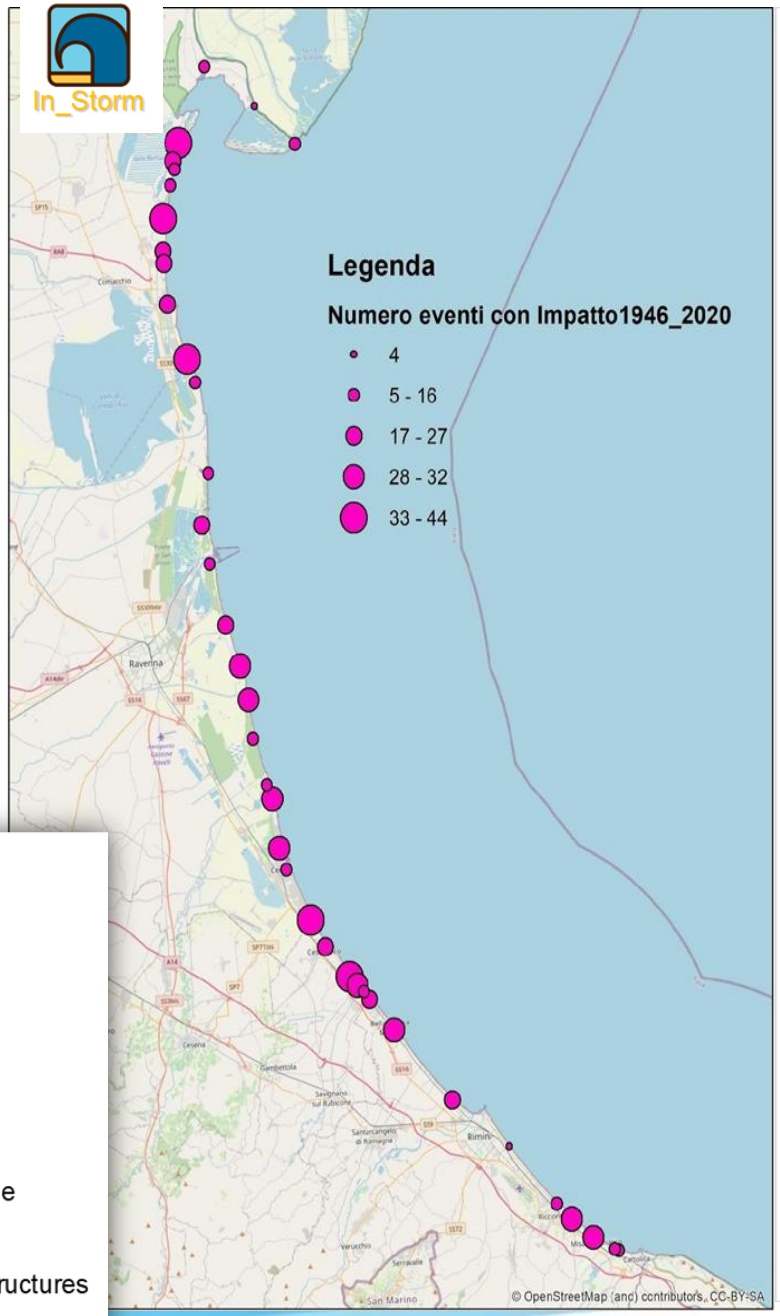
Bora (NE) winds

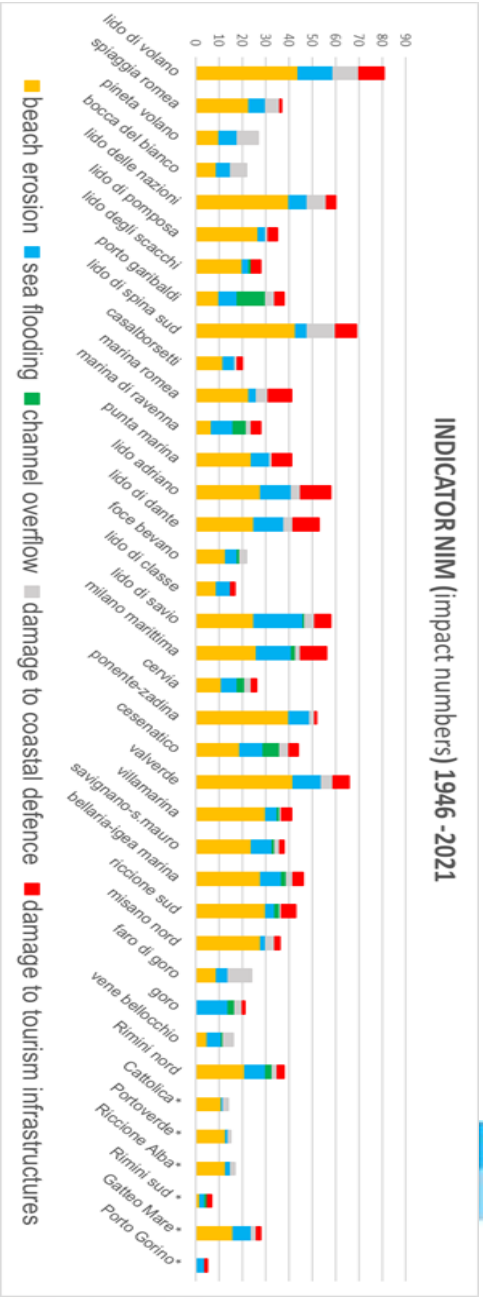
Scirocco (SE) winds, frequently characterized by high total water level



beach erosion represents the major class of impact, followed by sea flooding







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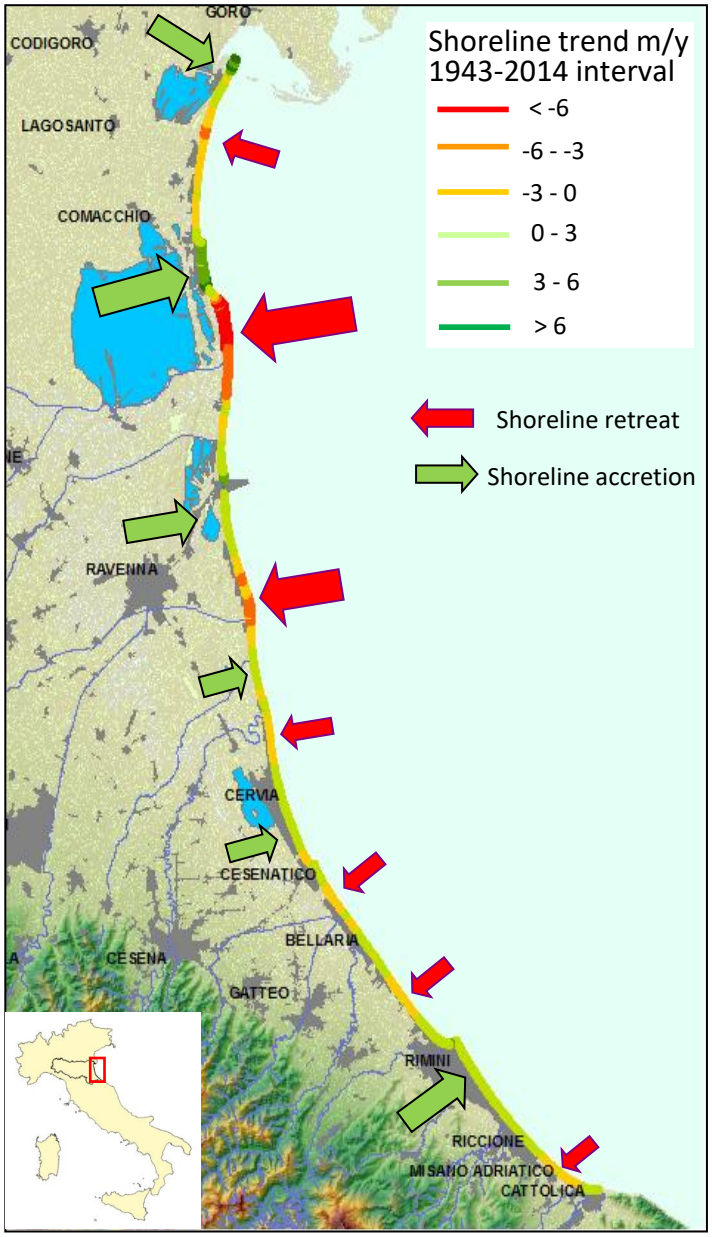
Shoreline and seafloor medium term evolution

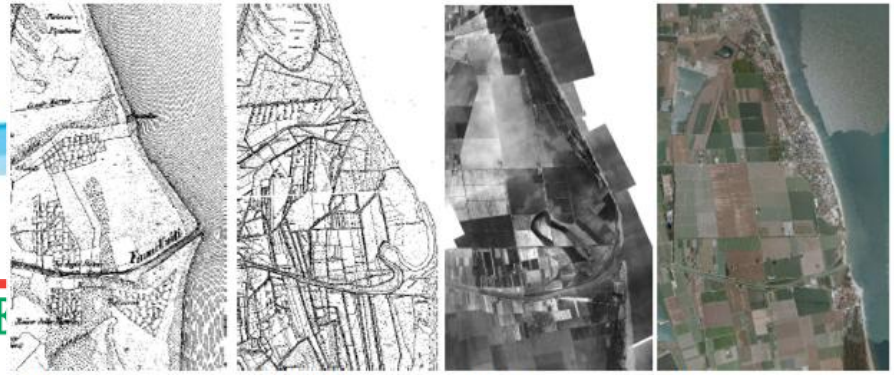


mapped historical and recent shorelines
1810-21 1893-94, 1943-45, 1953, 1982, 1998, 2005, 2008, 2011, 2014, 2019
Seafloor bathymetry
1900 , 1950, 1968, 1984, 1994, 2000, 2006, 2012, 2018

the coastline change from the end of XIX century and the seabed lowering quantified starting from 1900, demonstrate the existence of a **shoreline straightening process** and **river mouths dismantlement**, which mainly depends on sediment lacking due to the reduced bedload from the river

Foce del Reno

FOCE FIUMI UNITI



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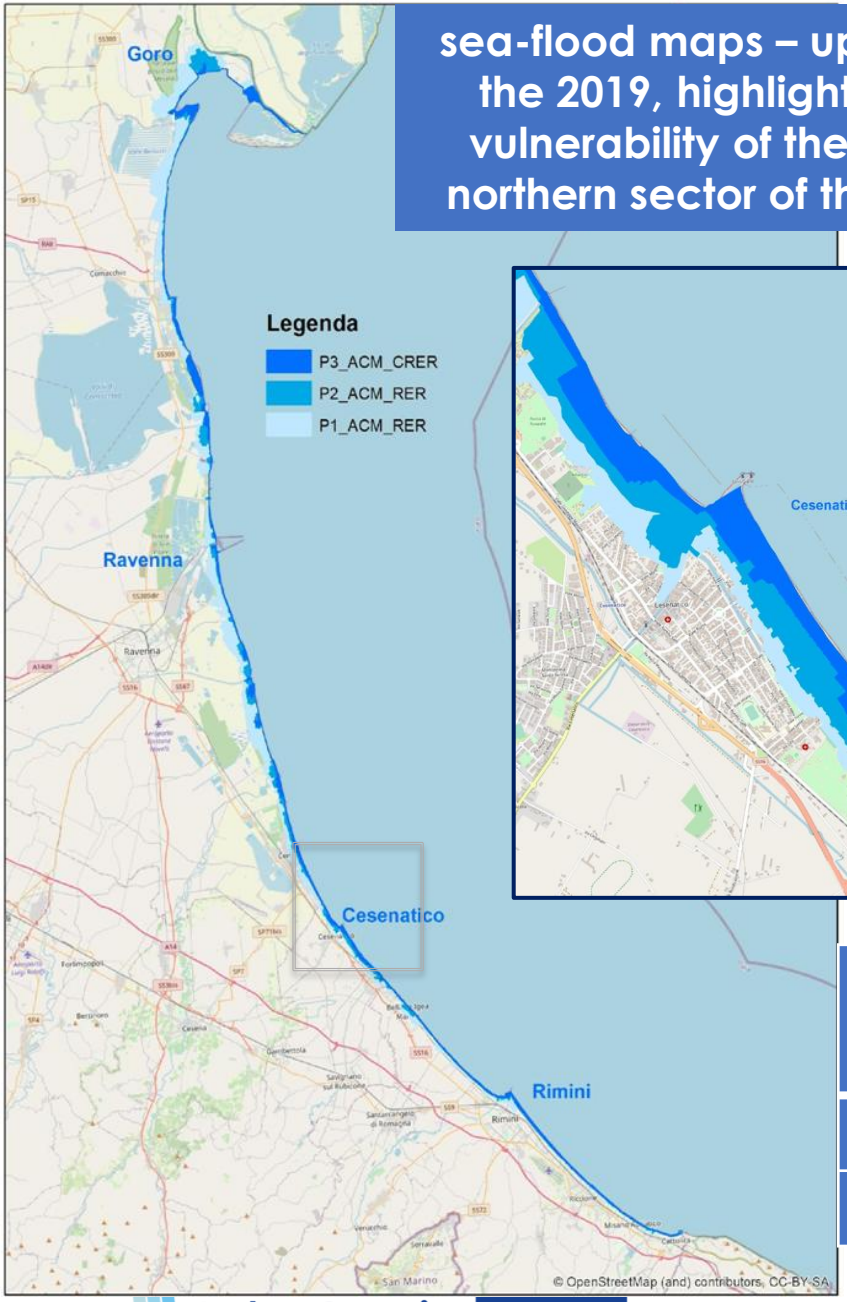
Sea flood hazard maps

sea-flood maps – updated in the 2019, highlight higher vulnerability of the central northern sector of the region



The sea flooding risk has been analyzed using a simplified model by RER-SGSS according to **EU Flood Directive 2007/60**

	High frequent event P3 Tr =10 years	low frequent event P2 Tr =100 years	Rare event P1 Tr >>100 years
Total sea level rise	+1.5 m	+ 1.8 m	+ 2.50 m
Floodable surface – maps 2019	**15.5 km²**	**29.5 km²**	**78.9 km²**

22 Km² are urban areas

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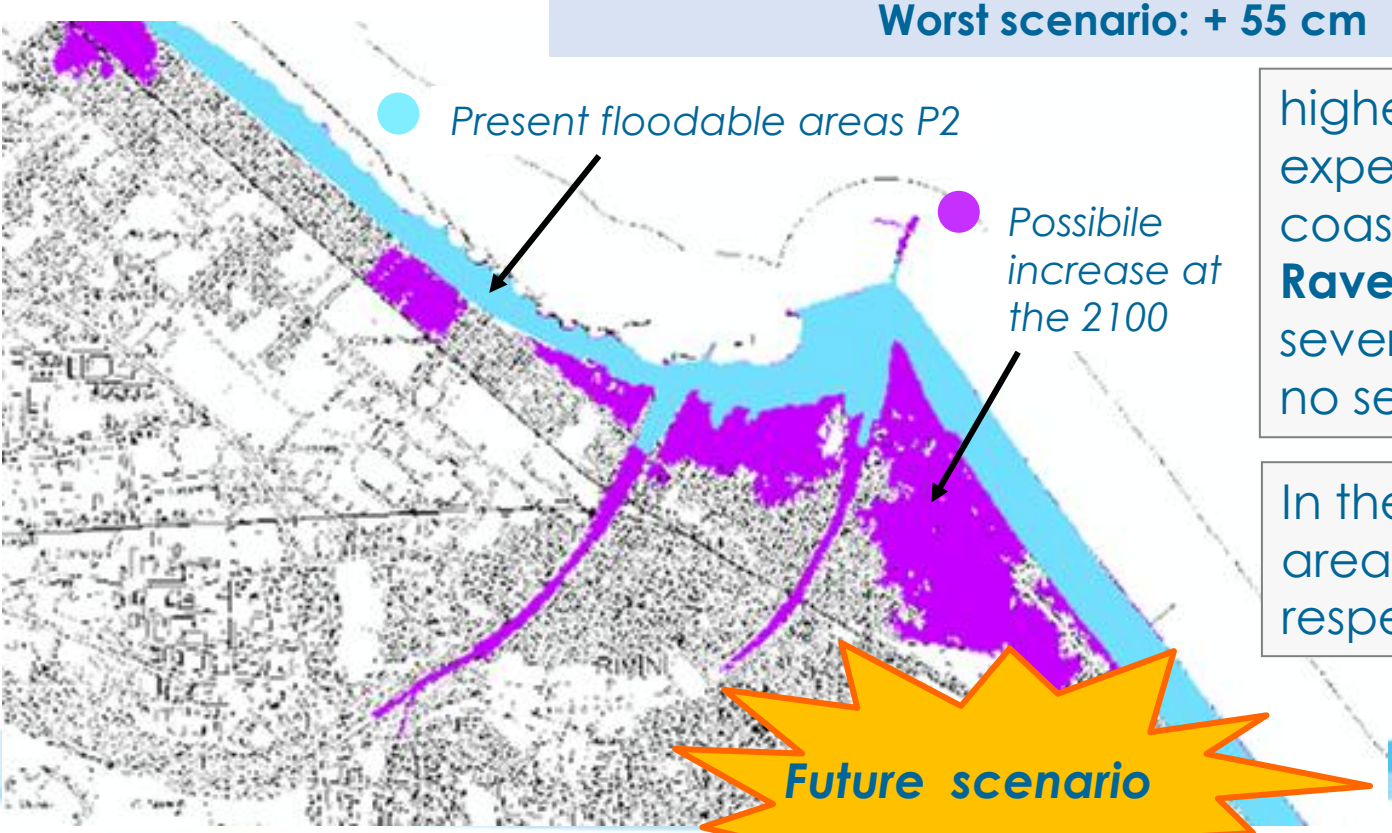
Analysis of scenario at the 2100: increase of areas floodable areas

According to the requirements of **flood directive (EU 2007/60)**, of considering the **climate changes effects in the 'Flood management plans'**, it was assessed the impact of the **'low frequent' sea-storm (P2) at the 2100** taking into account the **combined effects of storm surge + sea level rise + subsidence**

Considered SLR as from IPCC-AR5 values for the northern Adriatic are:
Best scenario + 23 cm
Worst scenario: + 55 cm



higher increase of floodable areas is expected in the central sector of coastal plain: in the provinces of **Ravenna and Forlì-Cesena** where several areas are close to sea level and no sea-walls have been erected

In the **worst case scenario the** floodable areas will **increase 3.5 times** with respect to the present

Future scenario

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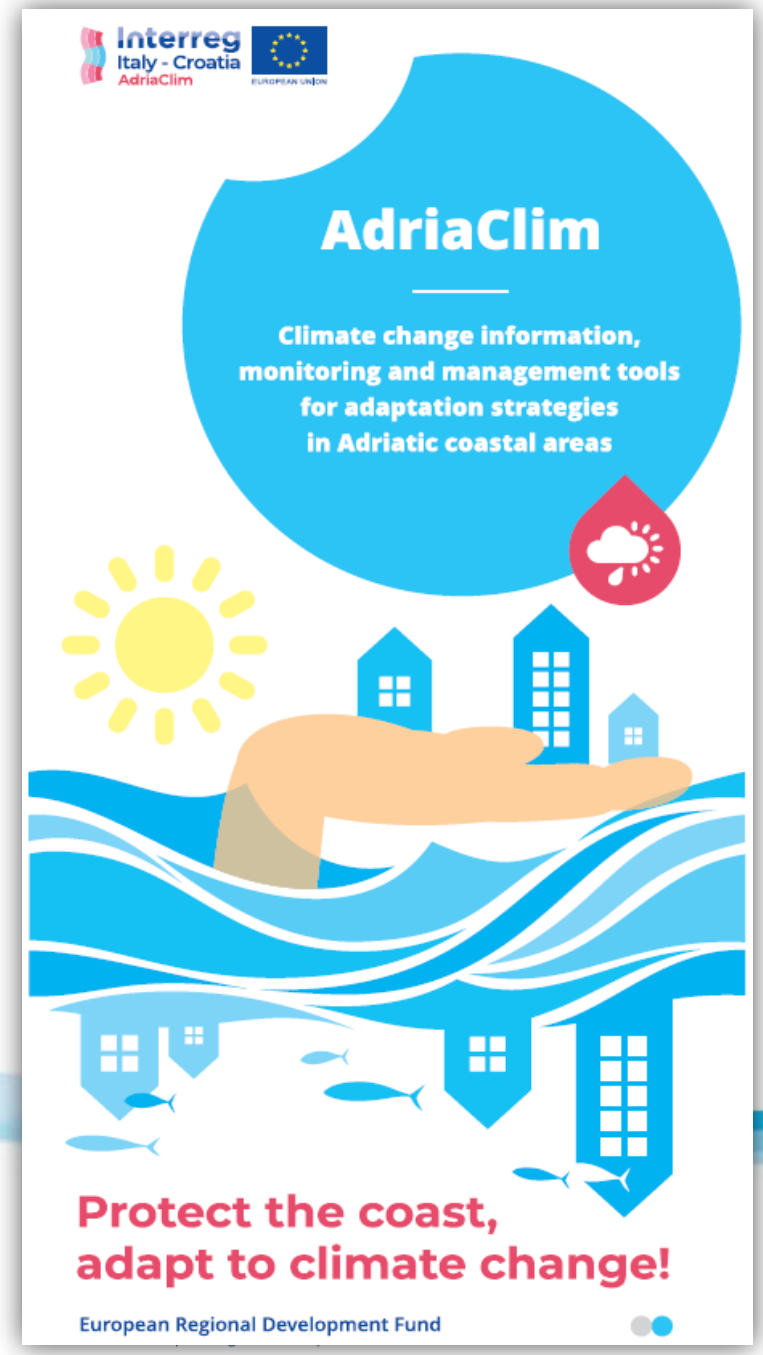
AdriaClim

a European project supporting Coastal Adaptation Strategies in the Adriatic basin



19 partners: 14 Italian + 5 Croatian

Scopri di più su AdriaClim

www.italy-croatia.eu/adriaclim

KEY PROJECT NUMBERS

PROJECT DURATION
01/01/2020 - 31/12/2022

TOTAL BUDGET
8.823.415,00 €

NATIONAL CO-FINANCING
1.323.000,00 €

ERDF
7.499.902,75 €

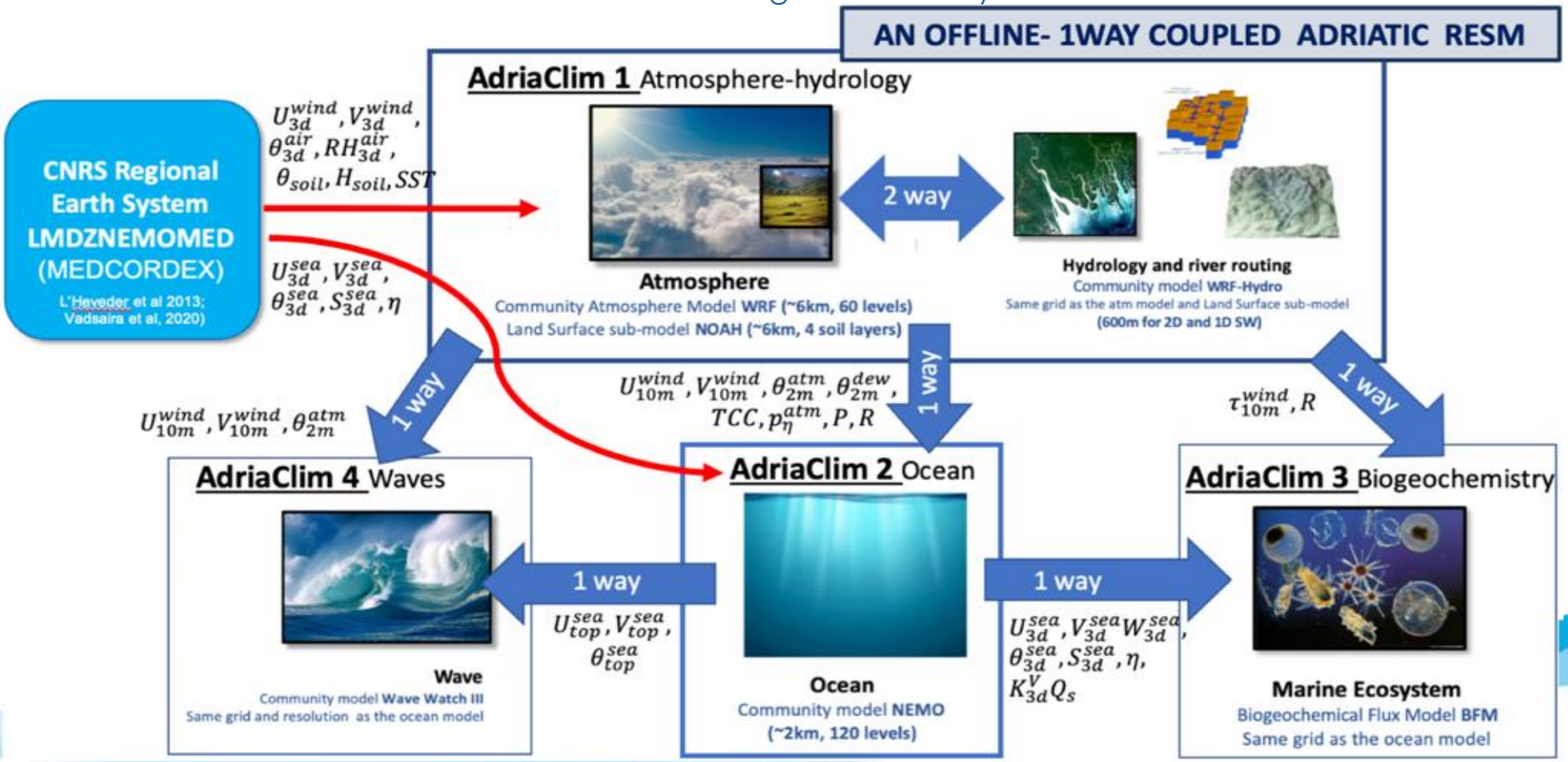
AdriaClim MAIN OBJECTIVES

- **Develop accurate information** for promoting the **development of regional and local plans for adaptation to climate change**
- **Plan a revision of coastal areas** for a sustainable **blue economy**, based on **accurate and reliable information**
- **Contribute to fill the gaps in existing observation systems** and improve modeling capability by **developing integrated high resolution models**
- **Consolidate planning of measures to strengthen adaptation capacity** in Italy and Croatia **by building cross-border cooperation** that continues even after the end of the project

AdriaClim regional to sub-regional scale Climate Downscaling: AdriaClim Regional Earth System

- **atmospheric component:** LMDZ4-regional (Li et al., 2012)
- **ocean component:** NEMOMED8 (Beuvier et al., 2010; Herrmann et al., 2010)
- **Land surface and near surface component:** ORCHIDEE LSM (Krinner et al., 2005)

CNRS Med-CORDEX RESM downscaled from the global earth system IPSL-CM5A-MR



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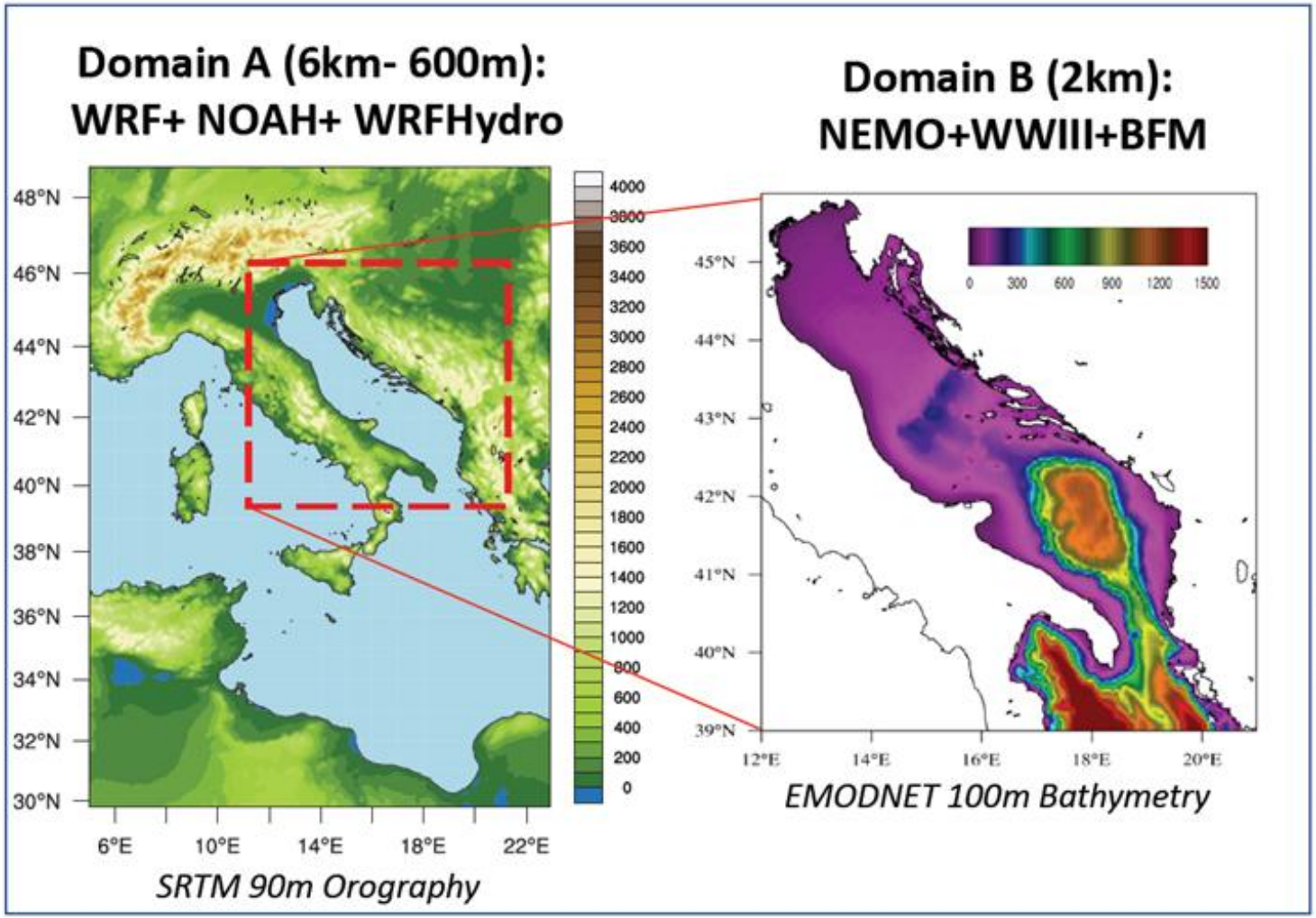
By Giorgia Verri et al.

cmcc Centro Euro-Mediterraneo sui Cambiamenti Climatici

ALMA MATER STUDIORUM A.D. 1088

MODELING GOAL: A step forward with respect to the state-of-art of the multi-physics and multi-scale earth system modeling



AdriaClim atm-land Domain A vs marine Domain B

- ✓ horiz. res. ratio **1:3**

MEDCORDEX to AdriaClim downscaling ratios

- ✓ Atm downscaling horiz. res. ratio **1:5** (30km to 6km)
- ✓ Ocean downscaling horiz. res. ratio **1:5** (10km to 2km)

Climate Simulations

- ✓ Historical: 1991-2020
- ✓ RCP 8.5 Scenario: 2021-2050

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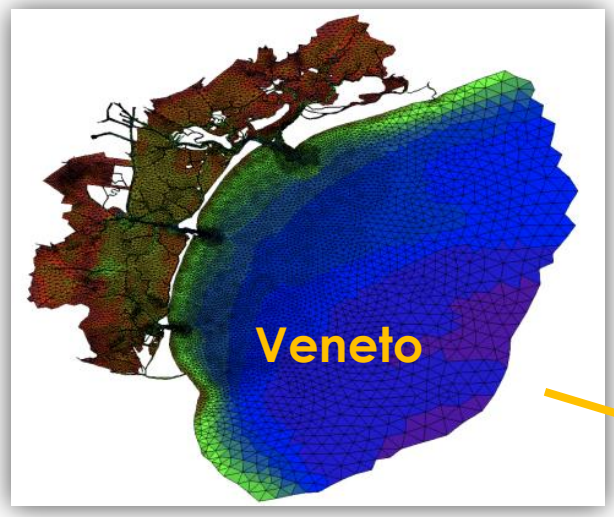
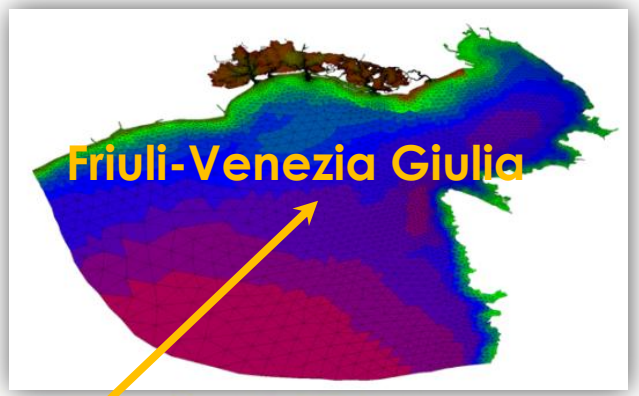
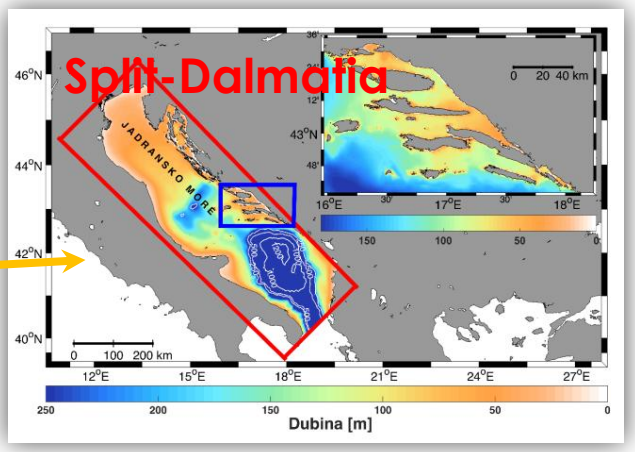
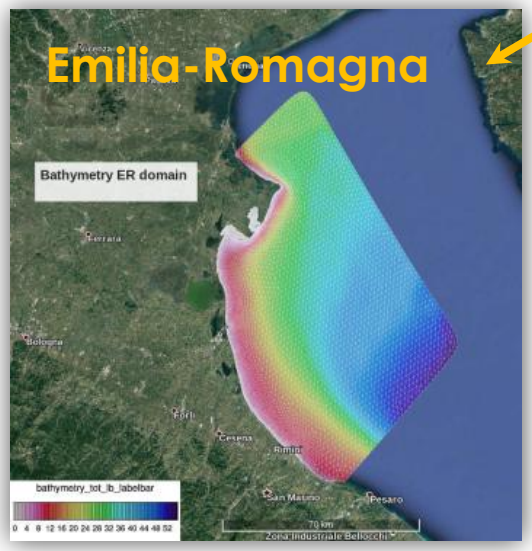
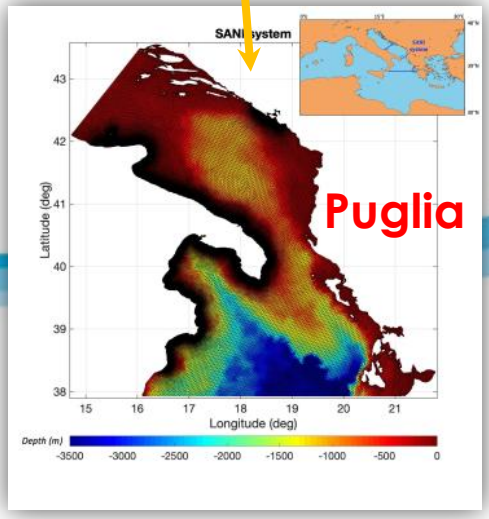
5 modelling Pilots











PS1 Grado and Marano Lagoon and Gulf of Trieste

PS2 Venice lagoon and Veneto coastal area

PS3 Emilia-Romagna coastal area

PS4 Apulia coastal area

PS5 Dubrovnik Neretva-estuary area

PS6 Split – Dalmatia coastal area

PS7 Northern-Eastern Adriatic Sea

PS8 Molise coastal area

PS9 Marche coastal area

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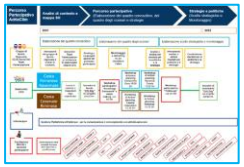
Development of the GIDAC Strategy process within AdriaClim project

(GIDAC - Integrated Management for the Protection and Adaptation of the Coast to Climate Change)



Start Activities AdriaClim 06/2020 ✓

Participation Team constitution ✓

?

Design Participatory Process ✓

Launching **INFODAY** 23/04 ✓

Restitution **Workshop** Draft Strategy 16/11 ✓

We're here

Public consultation 5/04-31/05

Detailed scenarios Strategy tuning-up

Final Document GIDAC

2020 | **2021** | **2022**

Regional Working Group constitution ✓

?

Draft Preliminary Document ✓

?

Preliminary Document Guidelines for the Strategy ✓

6 Participated Laboratories May 2021 ✓

Detailed scenarios on ER coast

INFODAY Strategy Presentation

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from shared Vision to Strategy construction

GIDAC Strategic GUIDELINES and OBJECTIVES

- **Free up space and maintain a beach free from structures and infrastructures**, as a "respect belt" for the unfolding of the sea dynamics, promoting the reorganization of critical coastal stretches, review of coastal protection works, retreat of anthropogenic structures and infrastructures where necessary. **Reducing vulnerability & risk exposure, enhancing resilience**

- **Ensure an adequate supply of sediments to the coastal system**, from the various internal and external sources, for the purpose of restoring and maintaining the sedimentary balance considering current and expected climatic conditions. **Feeding the coastal system**

- **Promote the integration of costs/benefit and coastal dynamics risk factors assessment within decision-making processes** in spatial planning and investments on the coast, through an integrated approach and shared working method by competent authorities and public and private stakeholders. **Decision-making coherence in relation to environment and risk conditions**

- **Maintain and further develop the Knowledge System** on coastal and rivers dynamics, internal and external sediment sources, coastal erosion management and interventions, present and expected coastal risks by climate scenarios, spatial and urban planning and implementation of interventions on the coastal territory. **Knowledge framework constantly updated**

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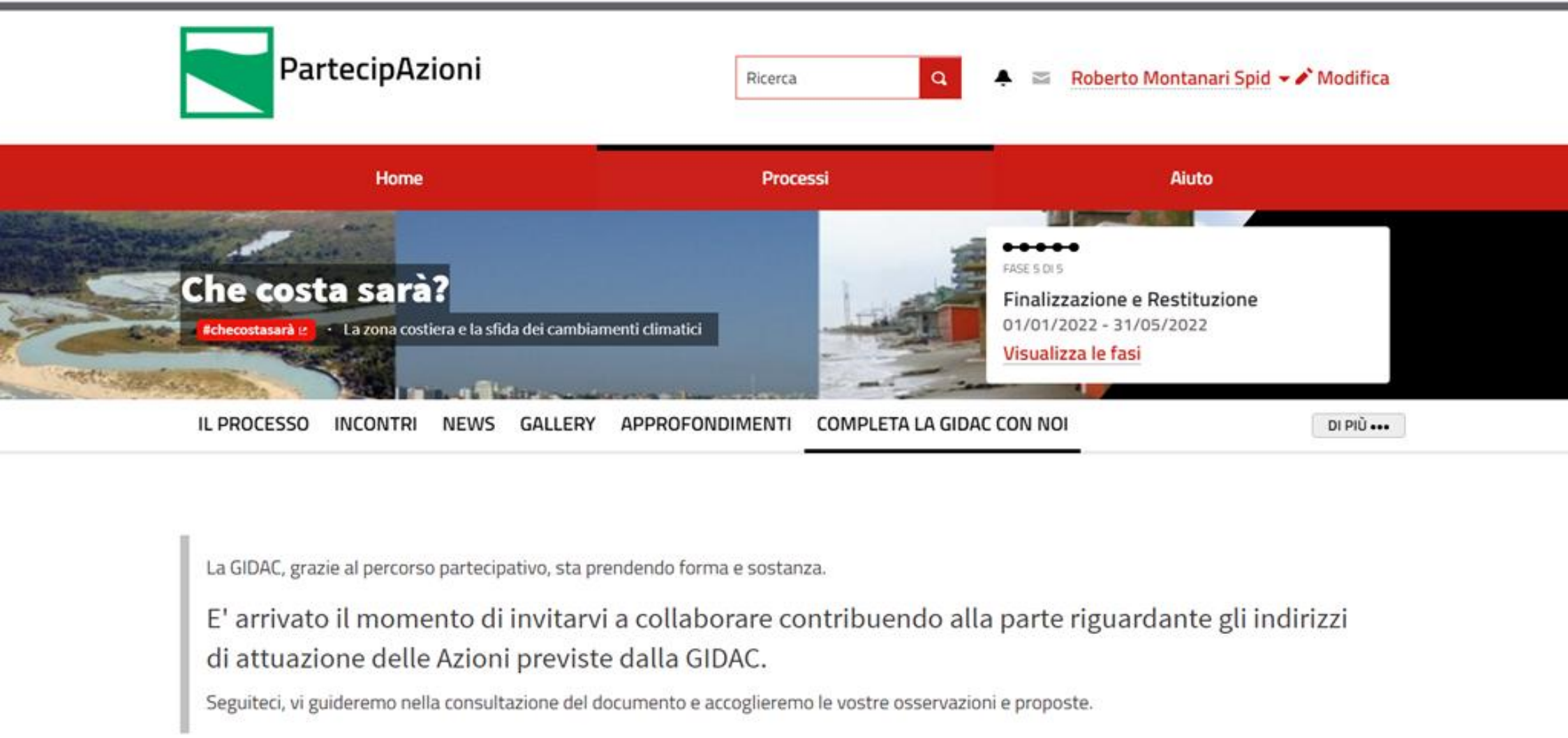
Public consultation of the GIDAC Strategy document

DOCUMENT PUBLISHED ON THE REGIONAL E-DEMOCRACY PLATFORM «PARTECIPAZIONI»

https://partecipazioni.emr.it/processes/che-costa-sara/f/311/

- CONSULTATION PHASE STARTED ON 5 APRIL ENDING ON 31 MAY 2022 -



La GIDAC, grazie al percorso partecipativo, sta prendendo forma e sostanza.

E' arrivato il momento di invitarvi a collaborare contribuendo alla parte riguardante gli indirizzi di attuazione delle Azioni previste dalla GIDAC.

Seguiteci, vi guideremo nella consultazione del documento e accoglieremo le vostre osservazioni e proposte.

the GIDAC Strategy document - Main parts and contents of the draft

PART A)
REFERENCE FRAMEWORK & AIMS
KNOWLEDGE FRAMEWORK
PARTICIPATORY PROCESS

PART B)
STRATEGIC VISION
OBJECTIVES
ACTIONS /MANAGEMENT OPTIONS
SUSTAINABLITY

PART C)
ACTIONS & GUIDELINES FOR IMPLEMENTATION

PART D)
COMMUNICATION
AWARENESS-RAISING
PARTICIPATION

PART E)
MONITORING & EVALUATION (implementation, efficacy of actions and interventions)

PART F)
MONOGRAPHS OF PROVINCIAL COASTAL STRETCHES (criticalities, interventions, management)

Part C is the core of the Strategy

System Actions
- **Coastal sediment integrated management**
- **Improvement of river and long-shore solid transport**
- **Management and sustainable use of offshore sediment deposits**
- **Further reduction of anthropogenic component of subsidence**
- **Management and use of sediments from building excavations**

Adaptation Actions
- **Urban regeneration and transformations of the urbanized fabric**
- **Planning for the reduction of vulnerability in the coastal area**
- **Strengthening of the coastal early warning system**
- **Enlargement and altimetric adaptation of the beach system**

Maintenance Actions
- **Maintenance of the beaches with nourishment**
- **Maintenance and remodulation of detached protection works**
- **Maintenance and adaptation of seawalls and internal embankments**
- **Altimetric adequation of port fronts and docks and port channels**

Cross-cutting Actions
- **Construction of a "Pact for the Emilia-Romagna Coast"**
- **Updating and further development of the Knowledge Framework**
- **Cost-benefit and environmental sustainability assessment of interventions in the coastal area**

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