REGIONAL FORUM ON SUSTAINABLE DEVELOPMENT: ADAPTATION TO CLIMATE CHANGE

Assessment of current and future coastal risk in Liguria

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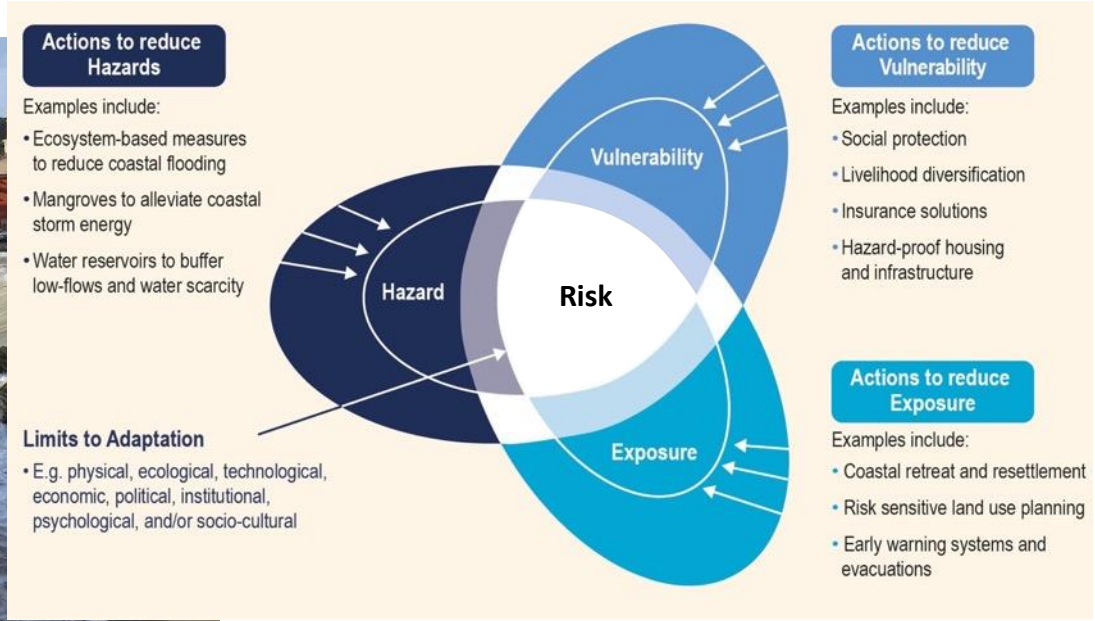
Coastal risk in Liguria



RISK INDEX FOR THE LIGURIAN REGION

Mediterranean wave modelling

WAVEWATCH III

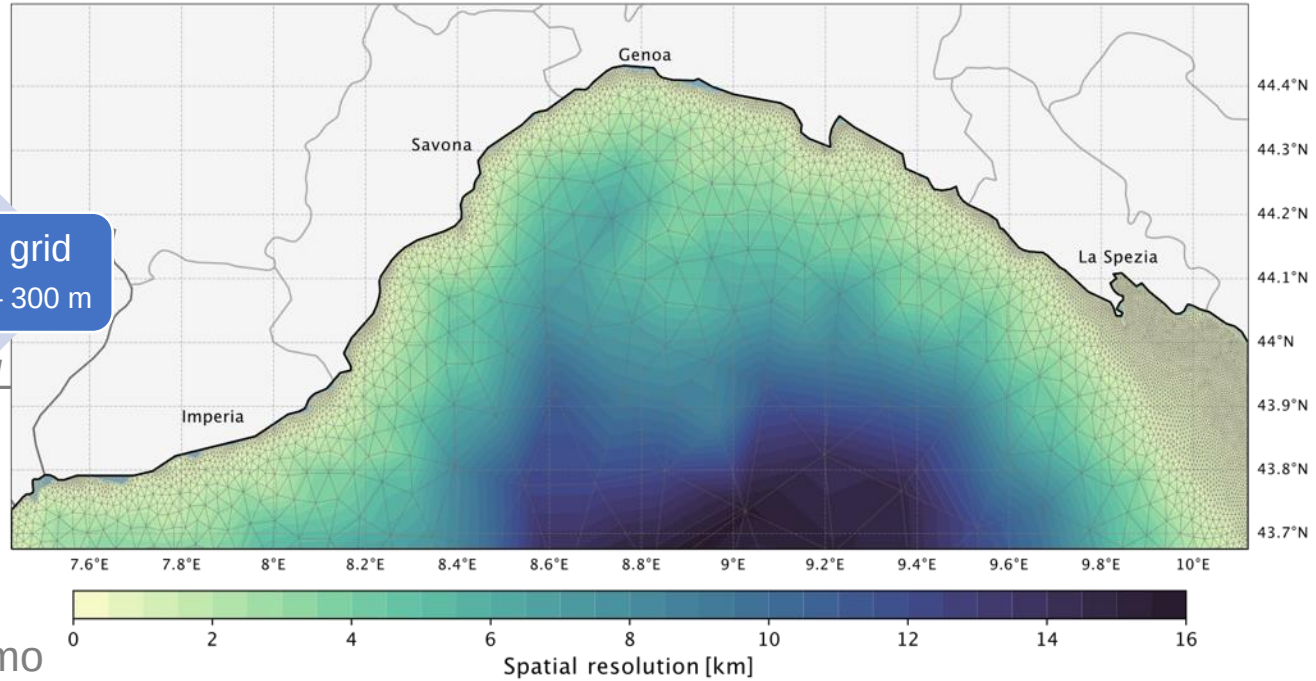
wave model

Regular grid	Unstructured grid
10 km x 10 km	25 km – 10 km – 300 m

ARPAL

Hindcast 1979 - 2020

Forecast – 5-days every day



SICOMAR+

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A. Lira-Loarca et al. Mediterranean Sea unstructured wave modeling for hindcast, forecast and wave hazard applications. Applied Ocean Research. Under-review

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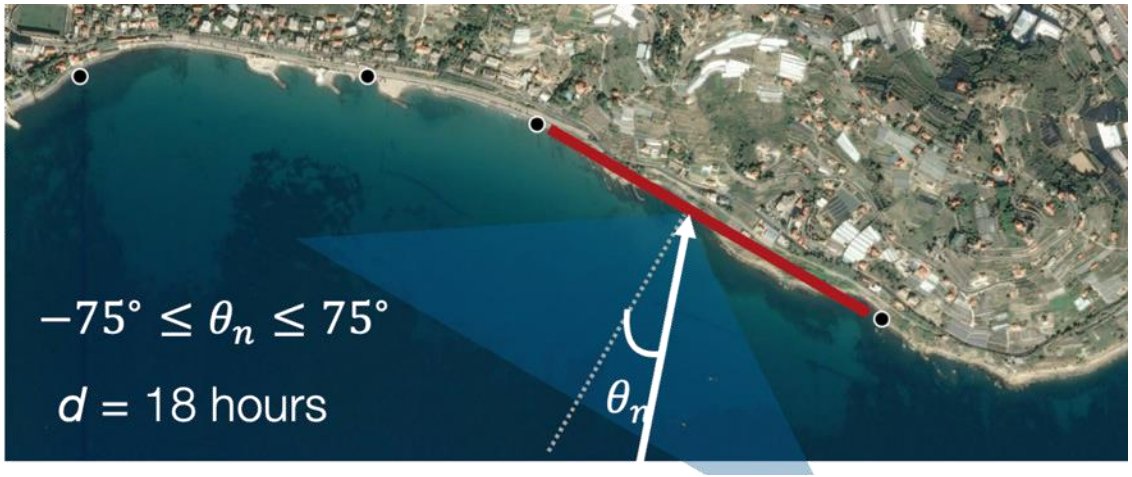
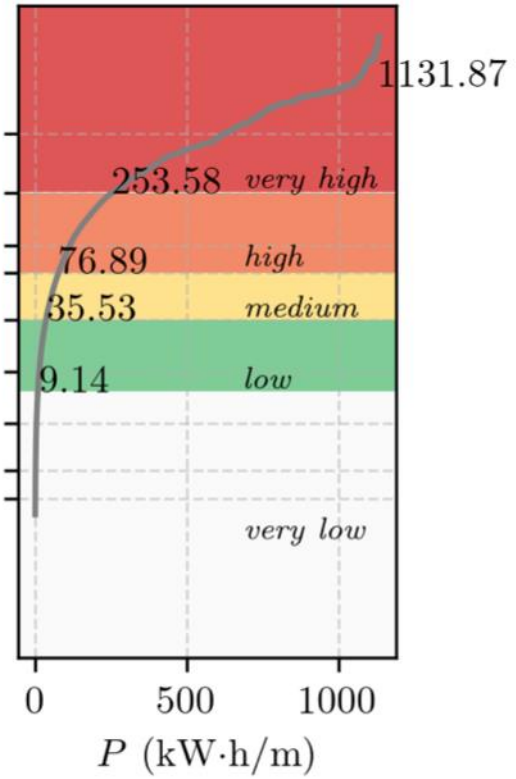
Wave power → Storm Power Index

$$P = \int_0^d E(t) \cdot c_g(t)\, dt = \int_0^d \left(\frac{1}{16}\rho g H_s(t)^2\right) \frac{gT_p(t)}{4\pi} \cos(\theta_n)\, dt$$



Probability	≤ 0.4	$(0.4 - 0.75]$	$(0.75 - 0.9]$	$(0.9 - 0.99]$	$(0.99 - 1]$
SPI	1 *very low*	2 *low*	3 *medium*	4 *high*	5 *very high*



Coastal Vulnerability Index

CVI	Description
1 *Very low*	Cliffed coast Natural coastal plain i.e. absence of transportation infrastructure (highway/railway), urban areas and/or seaside resorts.
2 *Low*	Protected littoral transportation infrastructure (highway/railway) with hard protection infrastructure (breakwaters, revetments) or artificial gravel beaches. This level does not consider the presence of urban areas and/or seaside resorts.
3 *Medium*	Unprotected littoral transportation infrastructure (highway/railway). This level does not consider the presence of urban areas and/or seaside resorts.
4 *High*	Analogous to level 2 with presence of urban areas and/or seaside resorts.
5 *Very high*	Analogous to level 3 with presence of urban areas and/or seaside resorts.

Risk Index = CVI * SPI

ARPAL → GIAS project

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Risk Index		*SPI*				
(*RI*)		1	2	3	4	5
CVI	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

very low
low
medium
high
very high

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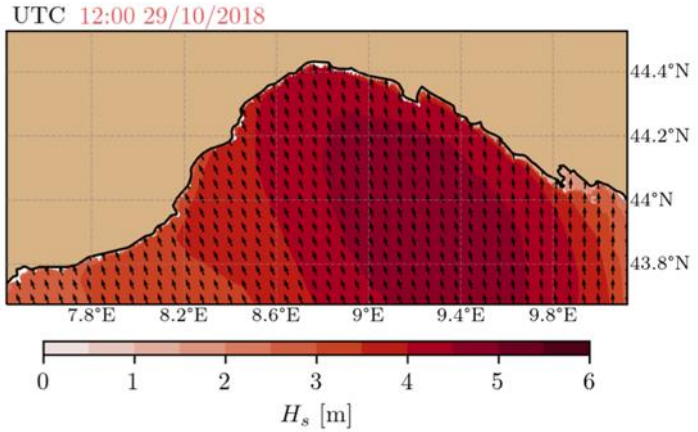
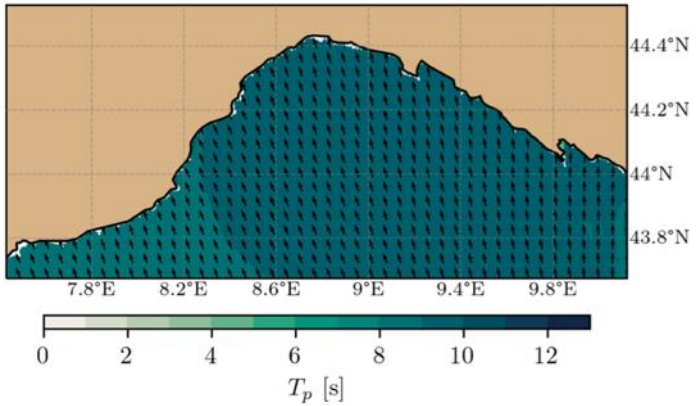
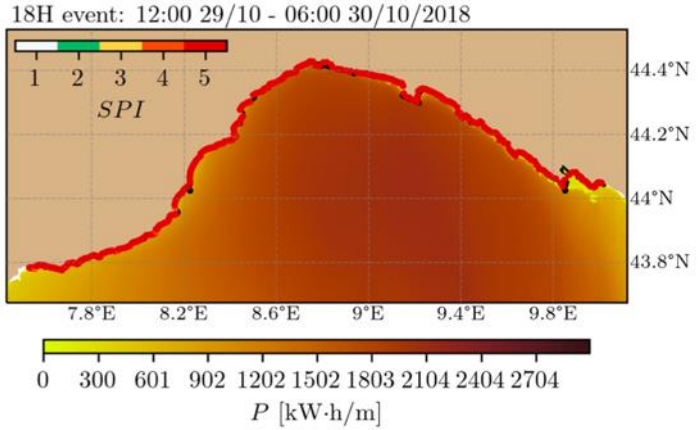
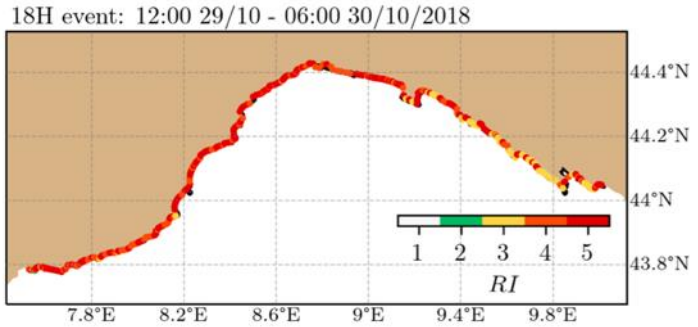
Storm event October 2018









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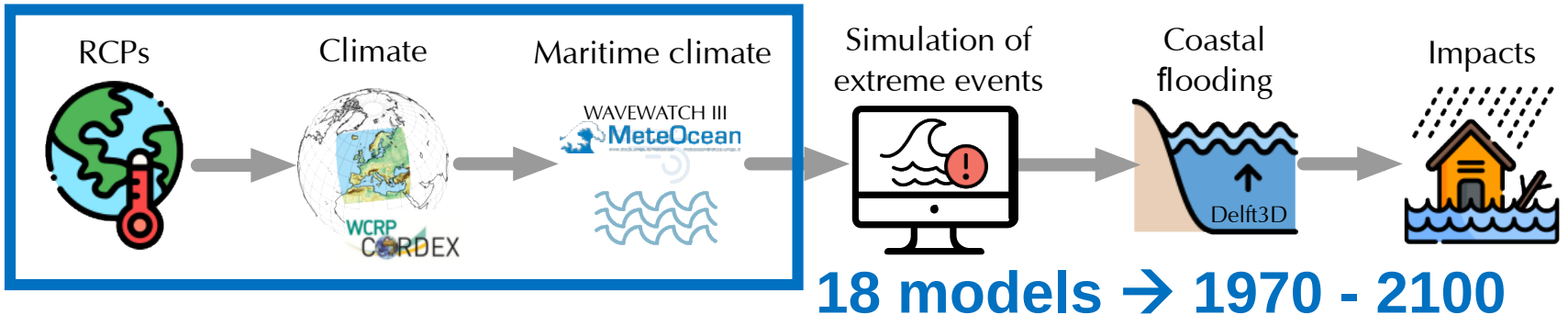
Future coastal risk



18 models → 1970 - 2100

- ✓ Understaing future changes in wave climate and extremes
- ✓ Temporal variability → seasonal changes
- ✓ Extreme Coastal Water Levels (ECWL):
  Relative Sea Level Change + Waves + Runup (Storm Surge + Swash)
- ✓ Coastal Infrastructure Exposure and Vulnerability

Future coastal risk

Trends and variability *of ocean waves under RCP8.5 emission scenario in the Mediterranean Sea*. Ocean Dynamics. 2021.

Future ***wind and wave energy resources*** *and exploitability in the Mediterranean sea by 2100.* Applied Energy, 302. 2021.

Performance *evaluation of bias adjustment methods for* ***wave climate projections*** *in the Mediterranean Sea.* EGU 2021.

Projected wave climate ***temporal variability*** *due to climate change. Stochastic.* Environmental Research and Risk Assessment, 1-17. 2021

Future changes and seasonal variability of the ***directional wave spectra*** *in the Mediterranean Sea for the 21st century.* Earth's Future (under-review).

H2020-MSCA-IF-2020 Seal of Excellence
FORESEA: Quantifying compound regional sea-level changes and extreme coastal water levels
→ HORIZON-TMA-MSCA-PF-GF

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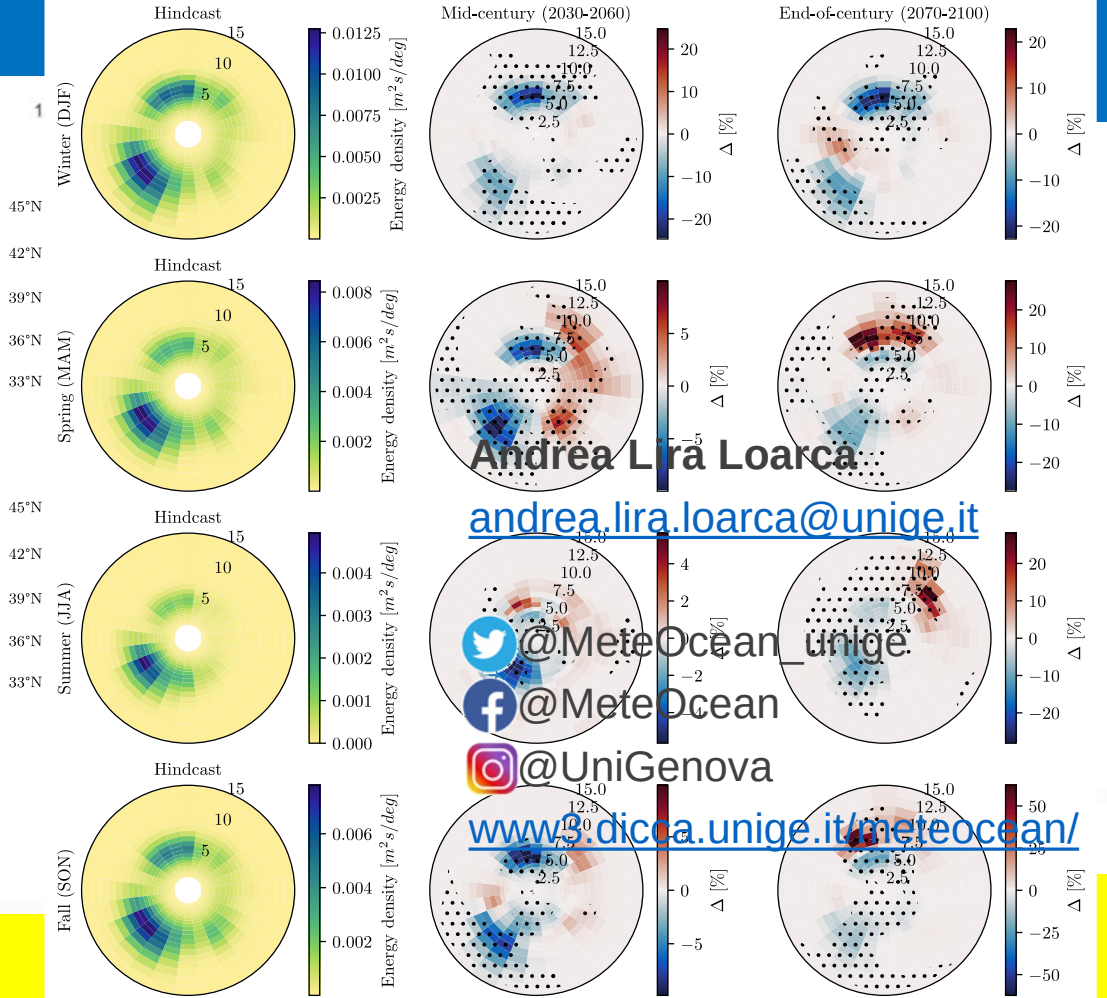

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