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Expeditive assessment of Ionian Lucanian flooding coastal areas due to combined effects of sea level rising and ordinary and extreme storm surge events

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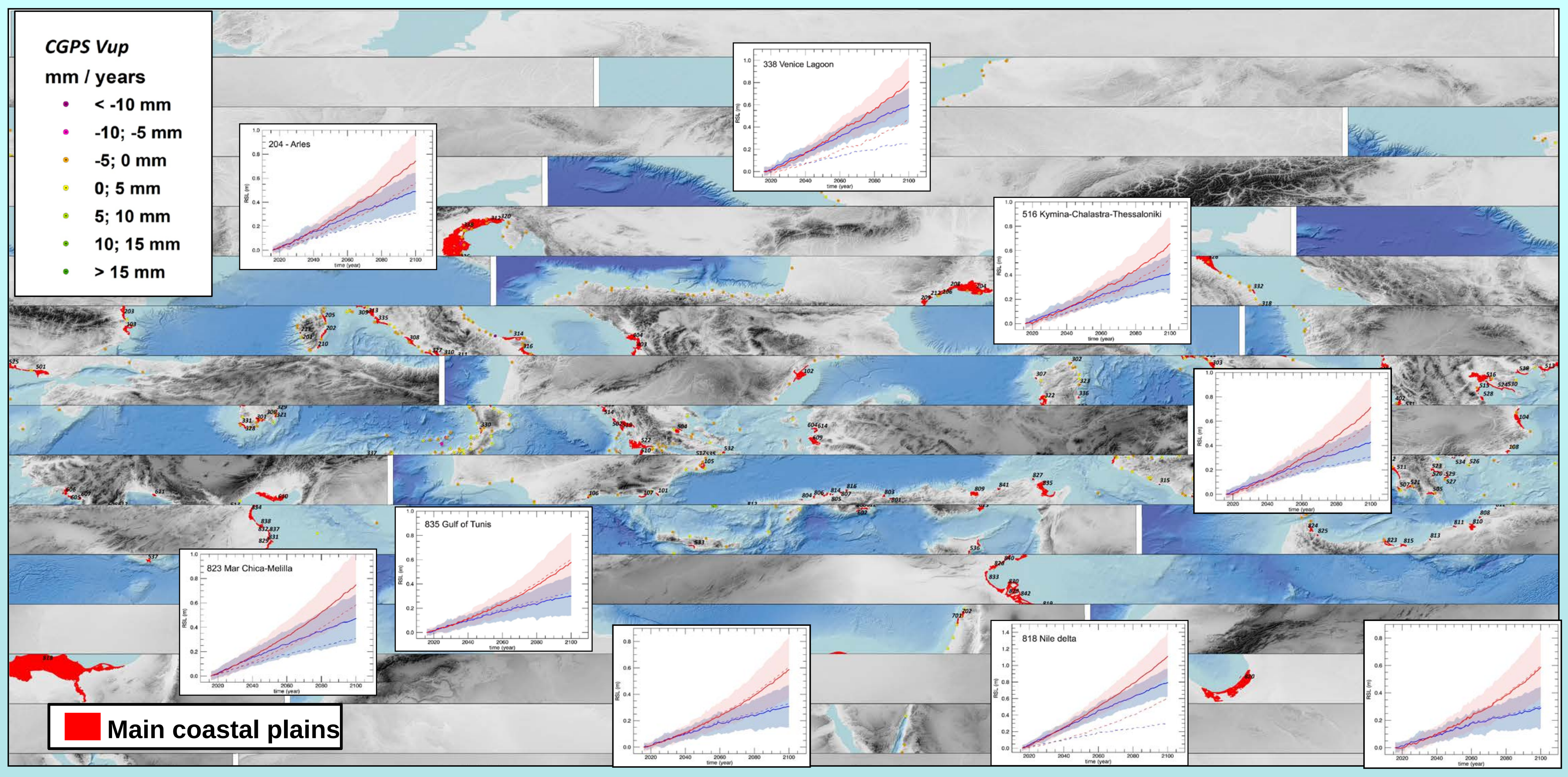
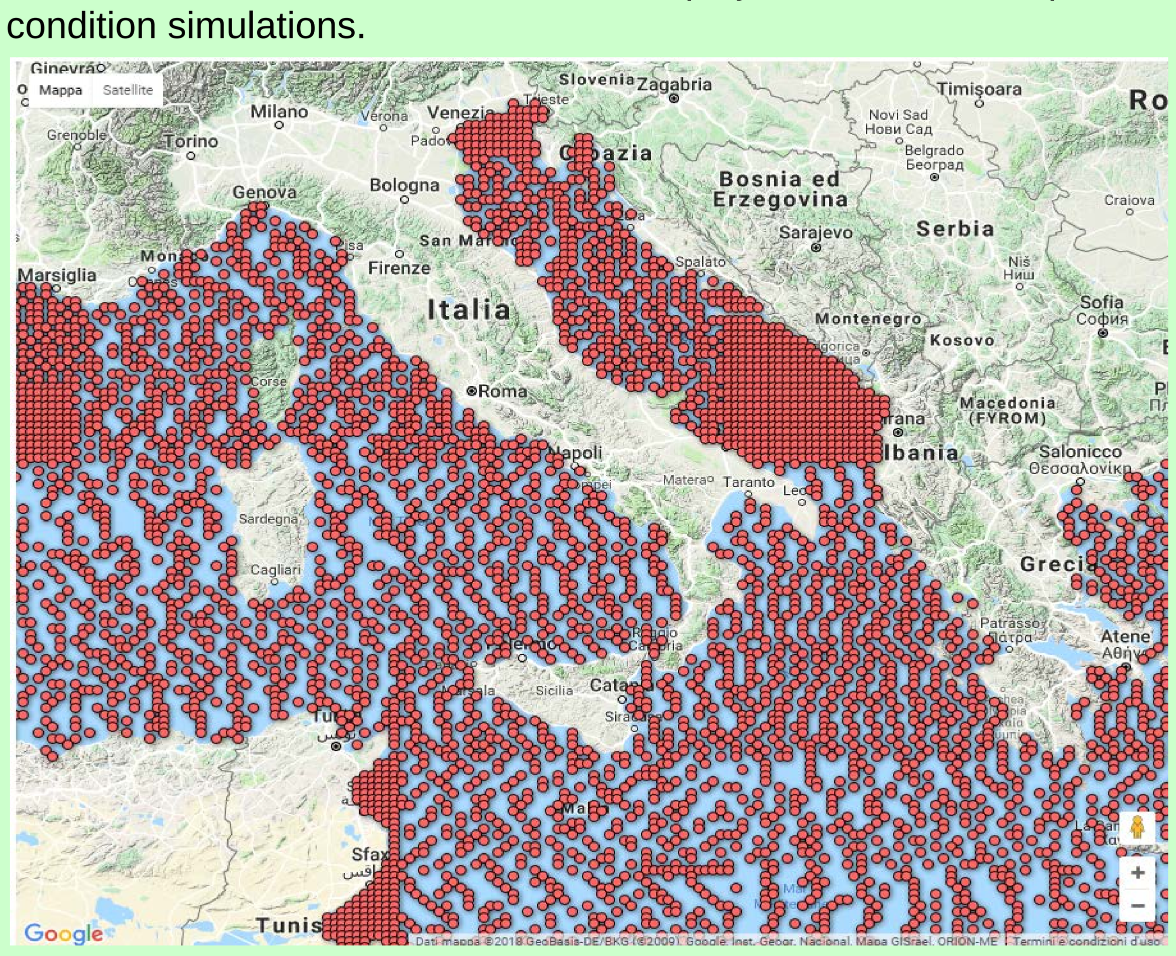
The work moves from the first results proposed by the SAVECOASTMED project (Sea level rise scenarios along the Mediterranean coasts – ECHO/SUB/2016/742473/PREV16) and deals with the implementation of e expeditive methodologies for maximum super-elevation level (MSL) assessment at 2100, due to combined effects of sea level rising (SLR) and vertical land motion (VLM) with ordinary and extreme storm surge events on the Lucanian littoral prone to erosion.
Such an assessment is of a great importance in coastal flooding areas extension forecasting in order to assess coastal risk and/or vulnerability.
Picture proposes the estimated relative sea level rise projections at 2100 for a set of coastal plains for different regions of the Mediterranean Sea based on the datum at 2016 and the regional IPCC AR5 sea level forecast as well as rates of vertical land movements estimated from instrumental or observational data. Blue and red full lines in the plots indicate the IPCC SSH projections, for RCP 2.6 and 8.5 respectively, adjusted with the mean rates of VLM. Dotted lines correspond to the pure IPCC projections. Color bands are the estimated uncertainties at 95% confidence level, obtained by combining lower and upper sea level bounds from IPCC projection with the uncertainty from VLM. (Anzidei et al., 2018)

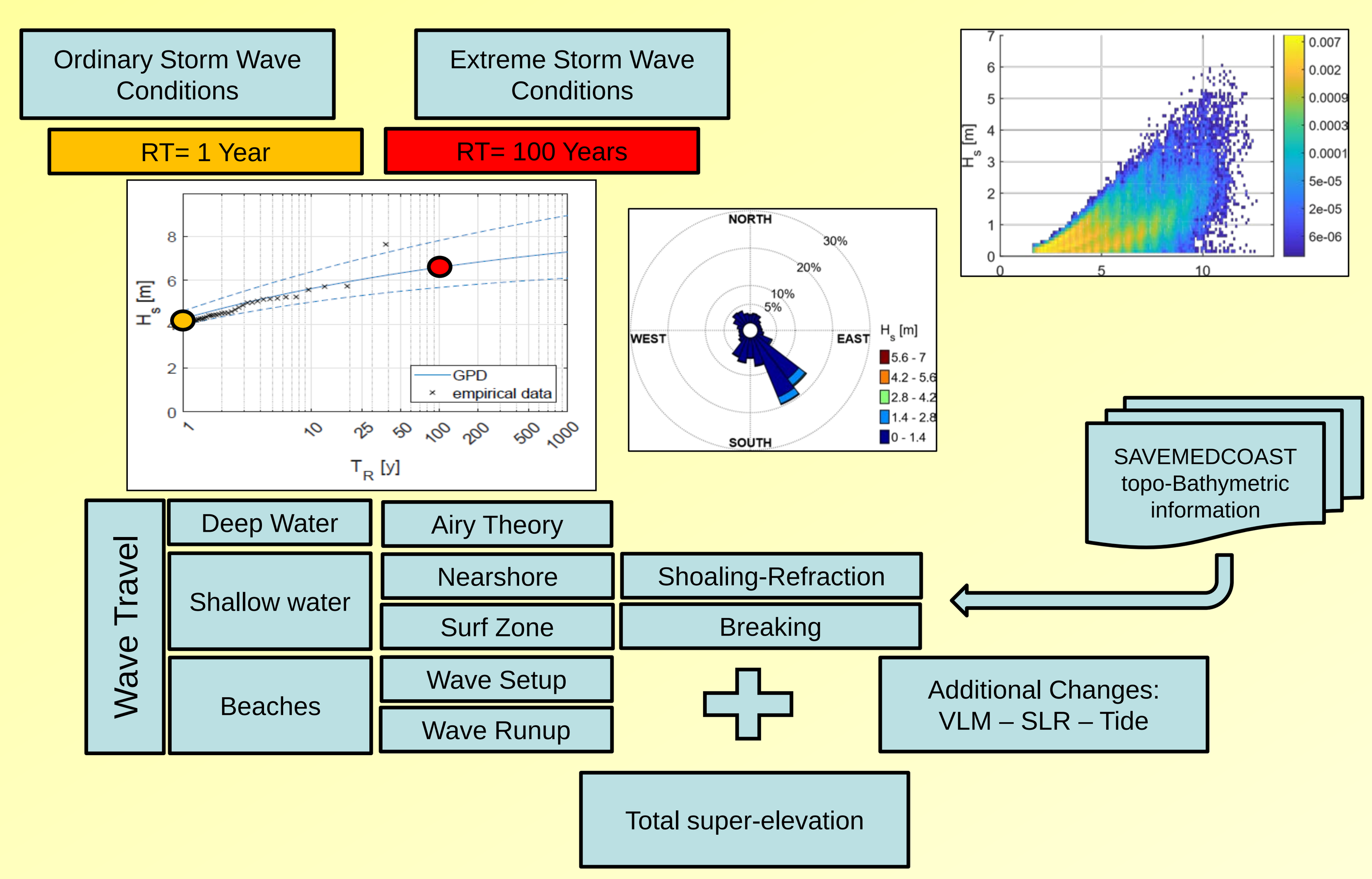


The maritime wave climate assessment and storm surge data for the study areas have been evaluated through the Forecast/hindcast system for the Mediterranean Sea developed by the Department of Environmental, Chemistry and Civil Engineering of University of Genoa (Mentaschi et al., 2013, 2015).
Wave climate assessment originates from a re-analysis of atmospheric and wave conditions, producing an hindcast database spanning from January 1979 till the end of December 2016 over the domain employed for the atmospherical and wave condition simulations.



Furthermore, an advanced open source complex numerical model was used and applied to simulate the potential scenarios induced by storm surge events coupled to sea level rise in the pilot sites. The approach is finalized to the strongly related to deliverables of the action E.3 - Assessment of coastal flooding risks scenario changes induced by severe storm events and erosion dynamics.
In such context, hydrodynamics and wave processes were simulated by Delft3D package with "online coupled wave-flow" model. This type of dynamic interaction takes into account the effect of wave on current and the effect of flow on waves. In detail, the flow field is repeatedly computed by the hydrodynamic module and is provided to the wave module at the coupling time steps.

In such a framework might be useful to outline that the reconstructed climate wave conditions and the methodology applied arise from a heterogeneous wave data availability due to a not uniformly spreading of wave gauges in Mediterranean Sea. That is, the wave data for the Lucanian coastal area and for each return time have been derived through the omni-directional analysis addressing to a quick assessment of the potential flooding areas for different return time and boundary condition induced by the cumulative effects of the different components of sea level rising and vertical land motion.



Finally, the potential flooding areas mapping due to the combined effect of sea level rising (SLR) and vertical land motion (VLM) with ordinary and extreme storm surge events have been proposed in order to define flooding risk scenarios for the Ionian Lucanian coast with respect to the scenarios:

- Tr= 1 year and RCP 2.6 and 8.5
- Tr= 100 years and RCP 2.6 and 8.5

RT = 1 Years

	Transect	H_0 [m]	T_p [sec]	η_s [m]	R_{max} [m]	VLM_{2100} [m]	SL_{2100} [m]	Tide [m]	RCP 2.6 (m)	MSL [m]	RCP 2.6 + subsidence (m)	MSL [m]	RCP 8.5 (m)	MSL [m]	RCP 8.5 + subsidence (m)	MSL [m]
Macroarea 1	Sx Bradano	4.34	9.80	1.06	3.13	0.00	0.41	0.27	0.31±0.15	3.71	0.38±0.15	3.78	0.58±0.21	3.98	0.64±0.22	4.04
Macroarea 2	Transect 1- Dx Bradano	4.34	9.80	0.98	1.32	0.00	0.41	0.27	0.31±0.15	1.90	0.38±0.15	1.97	0.58±0.21	2.17	0.64±0.22	2.23
	Transect 2- Metaponto Lido he	4.34	9.80	0.98	1.32	0.00	0.41	0.27	0.31±0.15	1.90	0.38±0.15	1.97	0.58±0.21	2.17	0.64±0.22	2.23
	Transect 3- Metaponto lido rot	4.34	9.80	0.98	1.32	0.00	0.41	0.27	0.31±0.15	1.90	0.38±0.15	1.97	0.58±0.21	2.17	0.64±0.22	2.23
	Transect 4- Metaponto lido Kat	4.34	9.80	0.98	1.32	0.00	0.41	0.27	0.31±0.15	1.90	0.38±0.15	1.97	0.58±0.21	2.17	0.64±0.22	2.23
	Transect 5- Sx basento	4.34	9.80	0.98	1.08	0.00	0.41	0.27	0.31±0.15	1.66	0.38±0.15	1.73	0.58±0.21	1.93	0.64±0.22	1.99
Macroarea 3	Transect 6- Dx Basento	4.34	9.80	1.00	1.84	0.00	0.41	0.27	0.31±0.15	2.42	0.38±0.15	2.49	0.58±0.21	2.69	0.64±0.22	2.75
	Transect 7- Sx Cavone	4.34	9.80	0.99	1.47	0.00	0.41	0.27	0.31±0.15	2.05	0.38±0.15	2.12	0.58±0.21	2.32	0.64±0.22	2.38
Macroarea 4	Transect 8- Dx Cavone	4.34	9.80	0.98	1.08	0.00	0.41	0.27	0.31±0.15	1.66	0.38±0.15	1.73	0.58±0.21	1.93	0.64±0.22	1.99
	Transect 9- Sx Agri	4.34	9.80	0.99	1.55	0.00	0.41	0.27	0.31±0.15	2.13	0.38±0.15	2.20	0.58±0.21	2.40	0.64±0.22	2.46
Macroarea 5	Transect 10- Dx Agri	4.34	9.80	0.98	1.08	0.00	0.41	0.27	0.31±0.15	1.66	0.38±0.15	1.73	0.58±0.21	1.93	0.64±0.22	1.99
Macroarea 6	Transect 11- Lido Policoro	4.34	9.80	0.99	1.40	0.00	0.41	0.27	0.31±0.15	1.98	0.38±0.15	2.05	0.58±0.21	2.25	0.64±0.22	2.31
	Transect 12- Sx Sinni	4.34	9.80	1.01	1.91	0.00	0.41	0.27	0.31±0.15	2.49	0.38±0.15	2.56	0.58±0.21	2.76	0.64±0.22	2.82
Macroarea 7	Transect 13- Dx Sinni	4.34	9.80	1.00	1.84	0.00	0.41	0.27	0.31±0.15	2.42	0.38±0.15	2.49	0.58±0.21	2.69	0.64±0.22	2.75

RT = 100 Years

	Transect	H_0 [m]	T_p [sec]	η_s [m]	R_{max} [m]	VLM_{2100} [m]	SL_{2100} [m]	Tide [m]	RCP 2.6 (m)	MSL [m]	RCP 2.6 + subsidence (m)	MSL [m]	RCP 8.5 (m)	MSL [m]	RCP 8.5 + subsidence (m)	MSL [m]
Macroarea 1	Sx Bradano	6.30	10.90	1.47	4.28	0.00	0.41	0.27	0.31±0.15	4.86	0.38±0.15	4.93	0.58±0.21	5.13	0.64±0.22	5.19
Macroarea 2	Transect 1- Dx Bradano	6.30	10.90	1.38	1.80	0.00	0.41	0.27	0.31±0.15	2.38	0.38±0.15	2.45	0.58±0.21	2.65	0.64±0.22	2.71
	Transect 2- Metaponto Lido he	6.30	10.90	1.38	1.80	0.00	0.41	0.27	0.31±0.15	2.38	0.38±0.15	2.45	0.58±0.21	2.65	0.64±0.22	2.71
	Transect 3- Metaponto lido rot	6.30	10.90	1.38	1.80	0.00	0.41	0.27	0.31±0.15	2.38	0.38±0.15	2.45	0.58±0.21	2.65	0.64±0.22	2.71
	Transect 4- Metaponto lido Kat	6.30	10.90	1.38	1.80	0.00	0.41	0.27	0.31±0.15	2.38	0.38±0.15	2.45	0.58±0.21	2.65	0.64±0.22	2.71
	Transect 5- Sx basento	6.30	10.90	1.37	1.47	0.00	0.41	0.27	0.31±0.15	2.05	0.38±0.15	2.12	0.58±0.21	2.32	0.64±0.22	2.38
Macroarea 3	Transect 6- Dx Basento	6.30	10.90	1.40	2.51	0.00	0.41	0.27	0.31±0.15	3.09	0.38±0.15	3.16	0.58±0.21	3.36	0.64±0.22	3.42
	Transect 7- Sx Cavone	6.30	10.90	1.38	2.01	0.00	0.41	0.27	0.31±0.15	2.59	0.38±0.15	2.66	0.58±0.21	2.86	0.64±0.22	2.92
Macroarea 4	Transect 8- Dx Cavone	6.30	10.90	1.37	1.47	0.00	0.41	0.27	0.31±0.15	2.05	0.38±0.15	2.12	0.58±0.21	2.32	0.64±0.22	2.38
	Transect 9- Sx Agri	6.30	10.90	1.39	2.11	0.00	0.41	0.27	0.31±0.15	2.69	0.38±0.15	2.76	0.58±0.21	2.96	0.64±0.22	3.02
Macroarea 5	Transect 10- Dx Agri	6.30	10.90	1.37	1.47	0.00	0.41	0.27	0.31±0.15	2.05	0.38±0.15	2.12	0.58±0.21	2.32	0.64±0.22	2.38
Macroarea 6	Transect 11- Lido Policoro	6.30	10.90	1.38	1.91	0.00	0.41	0.27	0.31±0.15	2.49	0.38±0.15	2.56	0.58±0.21	2.76	0.64±0.22	2.82
	Transect 12- Sx Sinni	6.30	10.90	1.40	2.61	0.00	0.41	0.27	0.31±0.15	3.19	0.38±0.15	3.26	0.58±0.21	3.46	0.64±0.22	3.52
Macroarea 7	Transect 13- Dx Sinni	6.30	10.90	1.40	2.51	0.00	0.41	0.27	0.31±0.15	3.09	0.38±0.15	3.16	0.58±0.21	3.36	0.64±0.22	3.42