STREAM presentation at the EGU General Assembly 2022

Vienna 23-27 May, 2022

Follow-up report

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PP name and nr	CNR-ISMAR - PP6
Type of event	Local Workshop (D.2.5.1) □ Info day (D.2.5.2) □ External event (D.2.5.3) X Education of stakeholder (D.4.4.1-2-3-4-5-6) □
Date	23-27 May 2022
Location	Vienna
Number and type of participants:	100 in presence and 60 on line

CNR-ISMAR researchers Dr. Christian Ferrarin and Dr. Marco Bajo participated in presence at the EGU General Assembly 2022 in Vienna, the largest European conference on geosciences. Both researchers presented their work related to the STREAM project on extreme marine events, coastal sea levels, their prediction and coastal flooding.

The EGU22 conference was organized in several parallel sessions.

Dr. Christian Ferrarin had a speech entitled "Sea-level modelling in the Mediterranean Sea using data assimilation" in conference session OS4.7 "Data assimilation techniques and applications in coastal and open seas" on Wed, 25 May, 10:20–11:50 (CEST). Approx. participants: 40 in presence and 20 online.

Dr. Marco Bajo had a speech entitled "Assessing the coastal impact of medicane Ianos through a wave-current model forced by a multi-model atmospheric ensemble" in conference session NH5.4 "Natural hazards and climate change impacts in coastal areas" on Wed, 25 May, 15:10–18:16 (CEST). Approx. participants: 60 in presence and 40 online.

More information on EGU22 can be found at the link https://egu22.eu/.

Attachments:
Marco Bajo's abstract
Christian Ferrarin's abstract

EGU22-844
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EGU General Assembly 2022

Assessing the coastal impact of medicane Ianos through a wave-current model forced by a multi-model atmospheric ensemble

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The Mediterranean basin occasionally hosts small intense vortices that evolve in tropical-like cyclones, also called "medicanes". Although they are more intense over the sea, their landfall may be associated with destructive extreme events, such as heavy precipitation, windstorms, flooding, and marine storminess. On 18 September 2020, medicane Ianos hit the western coast of Greece resulting in flooding and severe damages at specific coastal locations. In this work, we aim at evaluating the impact of medicane Ianos on the sea state and water level through the use of numerical simulations. We applied a coupled wave-current model to an unstructured mesh representing the whole Mediterranean Sea, with a grid resolution varying from 15 km in the open sea to 2 km along the predetermined cyclone path, and up to 500 m along the landfall area (the western Greek coast). In order to investigate the uncertainty of the ocean model derived by the atmospheric modelling of such an intense event, we performed an ensemble of simulations using several coarse (10 km) and high-resolution (2 km) meteorological forcings from different mesoscale models. Also, results obtained using ERA5 reanalysis or IFS analysis are considered as a benchmark. The multi-model approach allows us to assess how the uncertainty propagates from meteorological fields to the ocean quantities and the subsequent coastal impact. The model performance was evaluated against observations retrieved from fixed monitoring stations and satellites. The numerical results show a large spread of the simulated sea conditions. Due to the rugged and complex coastline, extreme sea levels are localized at specific coastal sites. The ensemble results were combined for proving a set of indicators of the potential impact of such an intense event, in order to assess the effectiveness of this multi-model ensemble approach. This work is part of the COST action CA19109 MEDCYCLONES (European Network for Mediterranean Cyclones in weather and climate) and of the Interreg Italy-Croatia STREAM project (Strategic development of flood management, project ID 10249186).

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Sea-level modelling in the Mediterranean Sea using data assimilation

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The correct reproduction of sea-level dynamics is crucial for forecasting floods and managing the associated risk. On the other hand, sea-level monitoring through observations can provide a description only of past events and it is challenging and costly, both of time and money. In this context, oceanographic models are increasingly used to describe the sea dynamics, providing a spatial/temporal extension to the observations. The best solution, which merges the observation accuracy and the model spatial/temporal resolution, is the data assimilation analysis, which is particularly important in coastal regions with scarce monitoring resources. In this study, we investigate the benefits of assimilating sparse observations from tide gauges in an unstructured hydrodynamic model for simulating the sea level in the Mediterranean Sea. We use the Ensemble Kalman filter, both to obtain an analysis of the past and to produce accurate forecasts. In the analysis we tested the assimilation in storm-surge simulations, only-tide simulations, and total-level simulations, using the observations in the stations. The results of storm-surge simulations were compared with those of total-level simulations, by adding the tide obtained from harmonic analysis of the observations. RMSE and correlation show improvements for all the components of the sea level and all the stations considered (not assimilated). The averaged-over-station RMSE reduces from 9.1 to 3.4 cm for the total level. The greatest improvements happen when the model without assimilation, due to an error of the wind-pressure forcing, did not reproduce some barotropic free modes of oscillation triggered by an initial surge. The preliminary forecast simulations of storm surge show improvements due to the data assimilation extending up to 5 days of forecasting. Even in this case, the longer improvements seem to happen when a free mode of oscillation is triggered. The results of this study will be used to improve the sea level forecasting system in the Adriatic Sea, developed within the framework of the Interreg Italy-Croatia STREAM project (Strategic development of flood management, project ID 10249186).