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UNION EUROPÉENNE
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SINAPSI

PRODOTTO C.1.4-II

Progetto

SINAPSI - asSIstenza alla Navigazione per l'Accesso ai Porti in SIcurezza

UNIVERSITÀ DEGLI STUDI DI GENOVA

ISMAR
CNR - Istituto di Scienze Marine

UNIVERSITÉ DE TOULON

AdSP MTS

CONSORZIO LaMMA

EUROPEAN RESEARCH INSTITUTE

CCI VAR

ATTIVITA' C.1: Piano di Comunicazione

PRODOTTO C.1.4: PUBBLICAZIONI E PARTECIPAZIONE A CONVEGNI

Partner responsabile : UNIGE

Partner contributori : CNR-ISMAR, UTLN, ADSP-MTS, LaMMA, ERI, CCI VAR

Nome del prodotto	Redatto da:	Validato da:
C.1.4 - Pubblicazioni e partecipazione a convegni	Anna Reboa (UNIGE), Laura Cutroneo (UNIGE)	Carlo Mantovani (CNR-ISMAR), Anne Molcard (UTLN), Giovanni Besio (UNIGE)

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PRODUIT C.1.4-II

Descrizione del prodotto

Nell'ambito del Progetto SINAPSI è prevista la pubblicazione di articoli scientifici e la partecipazione a convegni, workshop e conferenze nazionali e internazionali. In questo prodotto sono presentate le pubblicazioni scientifiche pubblicate grazie alle attività svolte dai Partners nell'ambito del Progetto.

Description du livrable

Dans le cadre du projet SINAPSI, la publication d'articles scientifiques et la participation à des symposiums, ateliers et conférences nationaux et internationaux sont prévues. Ce produit présente les publications scientifiques publiées à la suite des activités menées par les Partenaires dans le cadre du projet.

1. Introduzione

Nell'ambito delle attività di Comunicazione previste nel progetto, sono riportate di seguito le pubblicazioni scientifiche prodotte.

2. Coastal high-frequency radars in the Mediterranean – Part 1: Status of operations and a framework for future development

Il contributo in installazione di strumenti, acquisizione di dati e elaborazione e modellazione dei dati per il monitoraggio delle correnti marine e delle onde ottenuto dal Progetto SINAPSI è stato inserito in un rilevante articolo scientifico di Lorente et al. (2022), intitolato "*Coastal high-frequency radars in the Mediterranean – Part 1: Status of operations and a framework for future development*" e pubblicato sulla rivista *Ocean Science* (European Geosciences Union-EGU open-access journal). A questa pubblicazione hanno partecipato il CNR-ISMAR, il LaMMA e l'Università di Tolone, Partner del Progetto SINAPSI.

Questa recente pubblicazione tratta l'importanza dello sviluppo della rete di monitoraggio su larga scala della dinamica delle masse d'acqua del Mar Mediterraneo, e si occupa nel dettaglio dell'utilizzo di sistemi radar ad alta frequenza (high-frequency radar-HFR systems). Nell'articolo viene evidenziata l'importanza di monitorare la circolazione marina sia nell'ambito della sicurezza per la navigazione sia nello studio della dispersione di inquinanti, ma anche in relazione alle attività commerciali e di

pesca, nonché allo studio e alla previsione di fenomeni o eventi climatici estremi. Gli Autori evidenziano il fatto che l'obiettivo sarà perseguito espandendo e integrando la rete di monitoraggio transfrontaliera di strumenti tradizionali (correntometri profilatori acustici-ADCP, correntometri single point, drifter, ecc.) con strumenti innovativi come gli HFR costieri. Inoltre, vengono presentati i modelli numerici come strumento necessario alla previsione delle condizioni idrodinamiche nelle aree di accesso ai porti.

Vengono quindi presentati i sistemi HFR, il loro funzionamento e il loro impiego in diversi progetti internazionali e database di dati di monitoraggio. Nella creazione della rete radar del Mar Ligure ha avuto un ruolo fondamentale il Programma Interreg Italia-Francia Marittimo che ha finanziato diversi progetti con lo scopo di creare una forte cooperazione transfrontaliera nel monitoraggio e simulazione delle caratteristiche meteo-marine al fine di proteggere l'ambiente marino, garantire la sicurezza della navigazione e ampliare le conoscenze sui fenomeni oceanografici. Tra i progetti appartenenti al Programma Marittimo entrati a far parte di questa rete, insieme a Impact (IMpatto Portuale su aree marine protette: Azioni Cooperative Transfrontaliere) e SICOMAR plus (SIstema transfrontaliero per la sicurezza in mare COntro i rischi della navigazione e per la salvaguardia dell'ambiente MARino), c'è anche il Progetto SINAPSI, in qualità di progetto che mira al monitoraggio in tempo reale dello stato del mare per una navigazione sicura e per un supporto nel processo decisionale nelle aree di aree di accesso ai porti, riducendo così il rischio di incidenti.

Riferimento bibliografico:

Lorente P., Aguiar E., Bendoni M., Berta M., Brandini C., Caceres-Euse A., Capodic F., etc. (2022) Coastal high-frequency radars in the Mediterranean – Part 1: Status of operations and a framework for future development. Ocean Science 18: 761–795. https://doi.org/10.5194/os-18-761-2022

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Coastal high-frequency radars in the Mediterranean – Part 1: Status of operations and a framework for future development

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Abstract

Due to the semi-enclosed nature of the Mediterranean Sea, natural disasters and anthropogenic activities impose stronger pressures on its coastal ecosystems than in any other sea of the world. With the aim of responding adequately to science priorities and societal challenges, littoral waters must be effectively monitored with high-frequency radar (HFR) systems. This land-based remote sensing technology can provide, in near-real time, fine-resolution maps of the surface circulation over broad coastal areas, along with reliable directional wave and wind information. The main goal of this work is to showcase the current status of the Mediterranean HFR network and the future roadmap for orchestrated actions. Ongoing collaborative efforts and recent progress of this regional alliance are not only described but also connected with other European initiatives and global frameworks, highlighting the advantages of this cost-effective instrument for the multi-parameter monitoring of the sea state. Coordinated endeavors between HFR operators from different multi-disciplinary institutions are mandatory to reach a mature stage at both national and regional levels, striving to do the following: (i) harmonize deployment and maintenance practices; (ii) standardize data, metadata, and quality control procedures; (iii) centralize data management, visualization, and access platforms; and (iv) develop practical applications of societal benefit that can be used for strategic planning and informed decision-making in the Mediterranean marine environment. Such fit-for-purpose applications can serve for search and rescue operations, safe vessel navigation, tracking of marine pollutants, the monitoring of extreme events, the investigation of transport processes, and the connectivity between offshore waters and coastal ecosystems. Finally, future prospects within the Mediterranean framework are discussed along with a wealth of socioeconomic, technical, and scientific challenges to be faced during the implementation of this integrated HFR regional network.

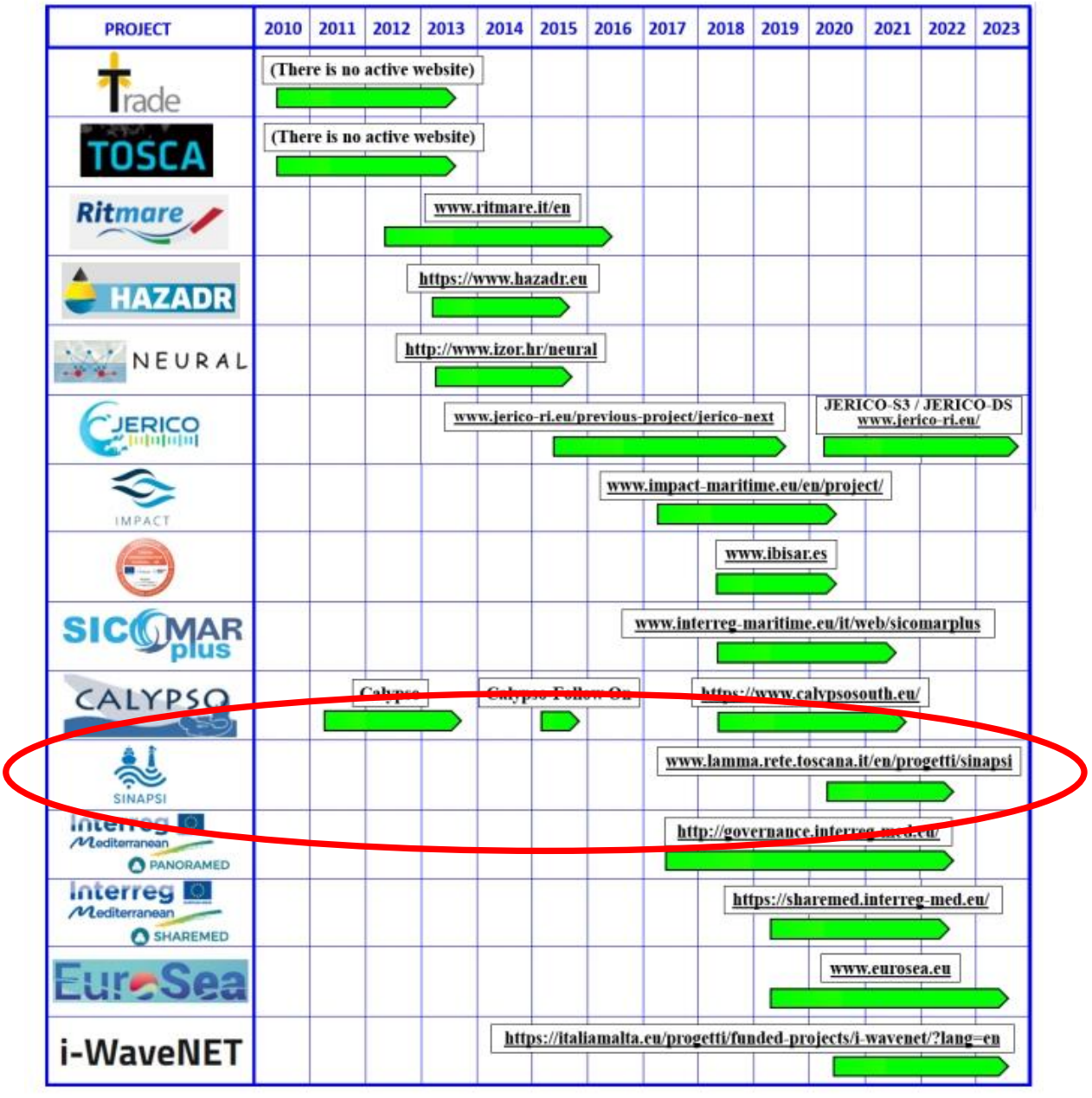

Diagramma che mostra la cronologia dei progetti passati e in corso relativi alla tecnologia HFR nel Mar Mediterraneo (Lorente et al., 2022).

3. Altre pubblicazioni

Il Progetto SINAPSI è stato di notevole importanza per lo sviluppo di altre pubblicazioni scientifiche, quali il lavoro di Molcard et al. (2021) intitolato *"Dynamics and transport from the boundary Northern Current toward the Toulon Bay: multi-platform observations and*

downscaling modelling approaches" e pubblicato sulla rivista scientifica *Ocean Dynamics*, lo studio di Casciaro et al. (2022) intitolato "*Increasing the skill of short-term wind speed ensemble forecasts combining forecasts and observations via a new dynamic calibration*" e pubblicato sulla rivista scientifica *Energy*, e lo studio di Lira-Loarca et al. (2022) intitolato "*Wave modeling with unstructured mesh for hindcast, forecast and wave hazard applications in the Mediterranean Sea*" pubblicato sulla rivista scientifica *Applied Ocean Research*.

Il primo studio ha affrontato il monitoraggio della circolazione costiera nell'area di Tolone grazie all'uso simultaneo di sistemi osservativi completi e di modelli numerici, come quelli applicati in SINAPSI, al fine di supportare la gestione delle coste e per comprendere l'elevata variabilità delle dinamiche costieri. Le altre due pubblicazioni scientifiche hanno trattato l'utilizzo di modelli numerici per la previsione del vento e del livello d'onda nel Mar Mediterraneo; lo sviluppo di modelli numerici previsionali portato avanti all'interno del Progetto SINAPSI ha infatti permesso anche il progredire di studi scientifici paralleli. Allo stesso tempo, i modelli implementati in tali studi sono stati sfruttati anche dallo stesso Progetto SINAPSI.

Riferimenti bibliografici:

Molcard A., Gramoullé A., Mazoyer C., Bourg N., Ourmières Y. (2021) Dynamics and transport from the boundary Northern Current toward the Toulon Bay: multi-platform observations and downscaling modelling approaches. Ocean Dynamics 71: 993-1009. https://doi.org/10.1007/s10236-021-01479-4

Casciaro G., Ferrari F., Lagomarsino-Oneto D., Lira-Loarca A., Mazzino A. (2022) Increasing the skill of short-term wind speed ensemble forecasts combining forecasts and observations via a new dynamic calibration. Energy 251: 123894. https://doi.org/10.1016/j.energy.2022.123894

Lira-Loarca A., Caceres-Euse A., De Leo F., Besio G. (2022) Wave modeling with unstructured mesh for hindcast, forecast and wave hazard applications in the Mediterranean Sea. Applied Ocean Research 122: 103118. https://doi.org/10.1016/j.apor.2022.103118

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Dynamics and transport from the boundary Northern Current toward the Toulon Bay: multi-platform observations and downscaling modelling approaches

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Abstract
Coastal regions are vulnerable areas with often high population density, as well as tourism and maritime activities that may have negative impact on the environment. From a physical point of view, coastal areas may be characterized by high gradient topography and irregular coastline shapes resulting in complex dynamic systems. The monitoring of coastal circulation becomes necessary to support coastal management and to understand the high variability of the dynamics. The simultaneous use of comprehensive observational systems and numerical models may compensate the drawback of each method used separately. The Toulon coastal area is under investigation in this paper by means of HF RADAR and ADCP observations coupled with nested models. The integration of the different data sets allows the monitoring of the coastal ocean continuum from regional oceans and shelf areas. Summer and winter 2018 data are analyzed to depict the seasonal variability of the regional circulation mainly characterized by the geostrophic Northern boundary Current, the wind-driven bay circulation and the connectivity between the bay, the surrounding Marine Protected Area and the open sea.

Keywords HF RADAR · Model nesting · Transport · Coastal continuum

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Increasing the skill of short-term wind speed ensemble forecasts combining forecasts and observations via a new dynamic calibration

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ABSTRACT

All numerical weather prediction models used for the wind industry need to produce their forecasts starting from the main synoptic hours 00, 06, 12, and 18 UTC, once the analysis becomes available. The 6-h latency time between two consecutive model runs calls for strategies to fill the gap by providing new accurate predictions having, at least, hourly frequency. This is done to accommodate the request of frequent, accurate and fresh information from traders and system regulators to continuously adapt their work strategies. Here, we propose a strategy where quasi-real time observed wind speed and weather model predictions are combined by means of a novel Ensemble Model Output Statistics (EMOS) strategy. The success of our strategy is measured by comparisons against observed wind speed from SYNOP stations over Italy in the years 2018 and 2019.

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Wave modeling with unstructured mesh for hindcast, forecast and wave hazard applications in the Mediterranean Sea

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Mediterranean Sea
Wave model
Unstructured mesh
Risk assessment
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ABSTRACT

A wave model based on an unstructured grid in the Mediterranean Sea is presented, which provides high-resolution in near-shore regions using the wave model WAVEWATCH III v6.07. The hindcast comprises hourly time series of integrated wave parameters and 2D directional spectra in selected locations, from January 1st 1979 until December 31st 2020, whereas a daily forecast simulation provides predictions for the following 5 days. The hindcast is validated against buoys and several satellite missions. Results show that the model provides a good performance for storm events and mean conditions in the Mediterranean Sea with normalized mean absolute error (NMAE) lower than 15% in 70% of the basin, spatial index of agreement (d_1) above 0.6, and the model under/overestimations are below 35% compared with in-situ data. Next, a methodology for coastal risk assessment is developed, leveraging the detailed information provided by the model in shallow waters and relying on a Storm Power Index (SPI), Coastal Vulnerability Index (CVI) and Risk Index (RI). The methodology is applied to the coast of Liguria, Italy, as a region with a high social, economical and touristic value which has experienced catastrophic coastal flooding episodes in recent years. Results of risk assessment were presented for the storm event of October 2018, known to have caused severe damages in the Ligurian coastline. The results provide a SPI of 3 and 5 at the beginning and peak of the storm, respectively, leading to RI of 3–5 depending on the characteristics and socioeconomic importance of the coastal stretches. Therefore, it is concluded that the methodology estimates the risk in an efficient and adequate way for its implementation in an operational risk forecasting system.