PRODUIT C.1.4-II

Projet

SINAPSI

assistance à la navigation pour un accès sûr aux ports

ACTIVITÉ C.1 : PLAN DE COMMUNICATION

PRODUIT C.1.4 : PUBLICATIONS ET PARTICIPATION À DES CONFÉRENCES

Partenaire responsable: UNIGE

Partenaires contributeurs: CNR-ISMAR, UTLN, ADSP-MTS, LaMMA, ERI, CCI VAR

Nom du produit	Édité par :	Validé par :
Produit C.1.4 - Publications et participation à des conférences	Anna Reboa (UNIGE), Laura Cutroneo (UNIGE)	Carlo Mantovani (CNR-ISMAR), Anne Molcard (UTLN), Giovanni Besio (UNIGE)

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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.

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.

1. INTRODUCTION

Dans le cadre des activités de communication du projet, les publications scientifiques réalisés sont listés ci-dessous.

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

La contribution en matière d'installation d'instruments, d'acquisition de données, de traitement des données et de modélisation pour la surveillance des courants marins et des vagues obtenue par le projet SINAPSI a été incluse dans un article scientifique pertinent de Lorente et al. (2022), intitulé " *Coastal high-frequency radars in the Mediterranean – Part 1: Status of operations and a framework for future development* " et publié dans la revue *Ocean Science* (revue à accès libre de l'Union européenne des géosciences-EGU). Le CNR-ISMAR, le LaMMA et l'Université de Toulon, Partenaires du projet SINAPSI, ont participé à cette publication.

Cette publication récente traite de l'importance du développement d'un réseau de surveillance à grande échelle de la dynamique des masses d'eau dans la mer Méditerranée, et aborde en détail l'utilisation des systèmes radar-HFR à haute fréquence. L'article souligne l'importance du suivi de la circulation marine à la fois dans le contexte de la sécurité de la navigation et de l'étude de la dispersion des polluants,

mais aussi en relation avec les activités commerciales et de pêche, ainsi que l'étude et la prévision de phénomènes ou d'événements climatiques extrêmes. Les Auteurs soulignent le fait que cet objectif sera poursuivi par l'expansion et l'intégration du réseau de surveillance transfrontalier des instruments traditionnels (courantomètres profileurs acoustiques-ADCP, courantomètres à point unique, dériveurs, etc.) avec des instruments innovants tels que les HFR côtiers. En outre, les modèles numériques sont présentés comme un outil nécessaire pour prévoir les conditions hydrodynamiques dans les zones d'accès aux ports.

Les systèmes HFR, leur fonctionnement et leur utilisation dans divers projets internationaux, et bases de données de surveillance sont ensuite présentés. Un rôle clé dans la création du réseau de radars de la mer Ligure a été joué par le programme Interreg Italie-France Maritime, qui a financé plusieurs projets dans le but de créer une forte coopération transfrontalière dans le suivi et la simulation des caractéristiques météorologiques et marines afin de protéger l'environnement marin, de garantir la sécurité de la navigation et d'élargir la connaissance des phénomènes océanographiques. Parmi les projets du programme Maritime qui ont été intégrés à ce réseau, citons Impact (Port IMpact on Marine Protected Areas : Cross-Border Cooperative Actions) et SICOMAR plus (Cross-Border Scheme for Safety at Sea COntra-navigation Risks and the Protection of the Marine Environment), il y a aussi le projet SINAPSI, en tant que projet visant à la surveillance en temps réel de l'état de la mer pour une navigation sûre et une aide à la décision dans les zones d'accès aux ports, réduisant ainsi le risque d'accidents.

Référence bibliographique :

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.

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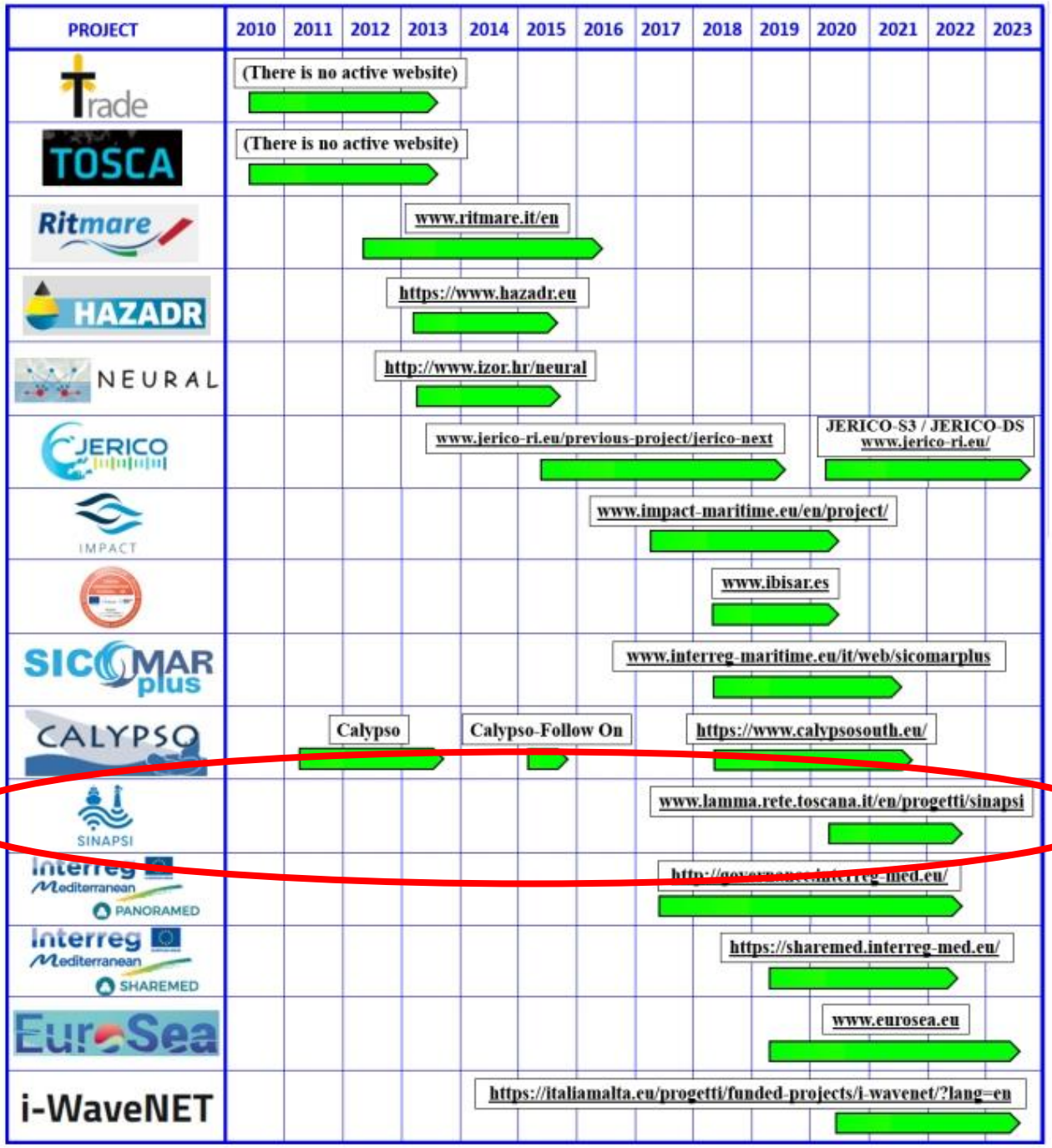

Diagramme montrant la chronologie des projets passés et en cours liés à la technologie HFR en mer Méditerranée (Lorente et al., 2022)

3. Autres publications

Le projet SINAPSI a été d'une importance considérable pour le développement d'autres publications scientifiques, comme le travail de Molcard et al. (2021) intitulé "*Dynamics and transport from the boundary Northern Current toward the Toulon Bay : multi-platform observations and downscaling modelling approaches*" et publié dans la revue scientifique *Ocean Dynamics*, l'étude de Casciaro et al. (2022) intitulée "*Increasing the skill of short-term wind speed ensemble forecasts combining forecasts and observations via a new dynamic calibration*" et publiée dans la revue scientifique *Energy*, et l'étude de Lira-Loarca et al. (2022) intitulée "*Wave modelling with unstructured mesh for hindcast, forecast and wave hazard applications in the Mediterranean Sea*" publiée dans la revue scientifique Applied Ocean Research.

La première étude portait sur la surveillance de la circulation côtière dans la région de Toulon grâce à l'utilisation simultanée de systèmes d'observation complets et de modèles numériques, tels que ceux appliqués dans SINAPSI, afin de soutenir la gestion côtière et de comprendre la grande variabilité de la dynamique côtière. Les deux autres publications scientifiques portaient sur l'utilisation de modèles numériques pour la prévision du vent et du niveau des vagues en mer Méditerranée. Le développement de modèles numériques de prévision réalisé dans le cadre du projet SINAPSI a également permis l'avancement d'études scientifiques parallèles. En même temps, les modèles mis en œuvre dans ces études ont également été exploités par le projet SINAPSI lui-même.

Références bibliographiques :

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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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.