Operational Marine Weather Forecast Systems in Coastal Scales for Safe Navigation and Environmental Awareness of the General Public

Theofanis KARAMBAS[1], Christos MAKRIS[1], Vasilis BALTIKAS[1]

[1] School of Civil Engineering, Aristotle University of Thessaloniki, Greece, emails: karambas@civil.auth.gr, cmakris@civil.auth.gr, vmpaltik@civil.auth.gr

ABSTRACT

In this keynote speech, novel Research and Development (R&D) initiatives for reliable, high-resolution, marine weather forecasts in coastal scales are presented. The research goal is to reliably predict the prevailing sea states over the continental shelf in coastal areas surrounding very important ports worldwide (*e.g.*, Accu-Waves; http://accuwaves.eu/). The development goal is to: a) support safe navigation processes, in terms of unobstructed vessel approaching to busy harbored areas and secure ship maneuvering in ports; b) enhance both the authorities' and the general public's environmental awareness in terms of marine water conditions in engineered coastal areas. These initiatives are based on coupled and nested, high-resolution, ocean and coastal modeling suites that integrate data from global scale, open-sea forecasts as boundary conditions (*e.g.*, Copernicus Marine Service). Freely available outputs by regional-scale atmospheric weather forecasts (*e.g.*, NOAA, ECMWF, *etc.*) are also used as meteorological forcing to the models. The latter's calibration and verification are based on available field data and conducted *in situ* observations concerning areas near and inside globally important port basins and regionally significant coastal zones. The details of the automated operational setup for these marine services are presented.

1. Introduction

Several services of open-sea oceanographic forecasts in global and/or regional scales are either freely or proprietarily provided by various platforms worldwide, however, they lack the necessary spatial resolution in coastal and harbored areas for reliable marine weather predictions to *e.g.*, increase port navigation safety and enhance public environmental awareness of end-users (local authorities, stakeholders, and broader society).

2. Methodology

2.1. Available field and model input data

Available field measurements of oceanographical parameters (wave characteristics, currents, temperature, salinity, *etc.*) and Copernicus, NOAA, and ECMWF are used to force, drive, run, calibrate, and validate wave propagation and ocean circulation models in selected coastal areas around the world with ports and environmentally sensitive or protected regions.

2.2. Modelling of coastal processes

The coastal wave, sea-level, and circulation processes are implemented with the use of a diverse integrated model suite, *i.e.*, Telemac-TOMAWAC, WAVE-L, HiReSS, and Delft3D modeling systems. The details of the coupled and nested models' setups (*e.g.*, initial, boundary, forcing conditions) are thoroughly discussed.

3. Results

Characteristic 2-D horizontal maps and point-specific timeseries, derived from the automated marine weather forecast simulations, are presented. The integrated models' operational prediction performance capabilities are discussed in terms of accuracy and robustness. The current availability and infrastructure of software and hardware upgrade needed relevant to computational resources and technology innovations are also analyzed.

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