Geophysical Research Abstracts
Vol. 19, EGU2017-16740, 2017
EGU General Assembly 2017

Challenges and potential solutions for European coastal ocean modelling

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Coastal operational oceanography is a science and technological platform to integrate and transform the outcomes in marine monitoring, new knowledge generation and innovative technologies into operational information products and services in the coastal ocean. It has been identified as one of the four research priorities by EuroGOOS (She et al. 2016). Coastal modelling plays a central role in such an integration and transformation. A next generation coastal ocean forecasting system should have following features: i) being able to fully exploit benefits from future observations, ii) generate meaningful products in finer scales e.g., sub-mesoscale and in estuary-coast-sea continuum, iii) efficient parallel computing and model grid structure, iv) provide high quality forecasts as forcing to NWP and coastal climate models, v) resolving correctly inter-basin and inter-sub-basin water exchange, vi) resolving synoptic variability and predictability in marine ecosystems, e.g., for algae bloom, vi) being able to address critical and relevant issues in coastal applications, e.g., marine spatial planning, maritime safety, marine pollution protection, disaster prevention, offshore wind energy, climate change adaptation and mitigation, ICZM (integrated coastal zone management), the WFD (Water Framework Directive), and the MSFD (Marine Strategy Framework Directive), especially on habitat, eutrophication, and hydrographic condition descriptors. This presentation will address above challenges, identify limits of current models and propose correspondent research needed.

The proposed roadmap will address an integrated monitoring-modelling approach and developing Unified European Coastal Ocean Models. In the coming years, a few new developments in European Sea observations can expected, e.g., more near real time delivering on profile observations made by research vessels, more shallow water Argo floats and bio-Argo floats deployed, much more high resolution sea level data from SWOT and on-going altimetry missions, contributing to resolving (sub-)mesoscale eddies, more currents measurements from ADCPs and HF radars, geostationary data for suspended sediment and diurnal observations from satellite SST products. These developments will make it possible to generate new knowledge and build up new capacities for modelling and forecasting systems, e.g., improved currents forecast, improved water skin temperature and surface winds forecast, improved modelling and forecast of (sub) mesoscale activities and drift forecast, new forecast capabilities on SPM (Suspended Particle Matter) and algae bloom. There will be much more in-situ and satellite data available for assimilation. The assimilation of sea level, chl-a, ferrybox and profile observations will greatly improves the ocean-ice-ecosystem forecast quality.