Development of a near real-time demonstrator based on a very high-resolution global ocean model

In the framework of the Copernicus Marine Environment Monitoring Service, Mercator Ocean International operates a global high-resolution forecasting systems at the resolution of 1/12°. Increasing resolution appears necessary to improve the quality of service and to satisfy the users' needs in the operational application (Le Traon, 2019). Resolving scales below 100 kilometers, and in particular sub mesoscale processes (1-50 km), appears to be essential to better represent the circulation in the open ocean (Chassignet, 2017), and, to improve the large-scale representations thanks to a more explicit energy transfers between finer and larger scales (Fox-Kemper Baylor, 2019). A deeper understanding of their various contributions (geostrophic flows, tidal motions, waves, inertial currents) and their role in the global ocean kinetic energy budget will improve the knowledge of these energy transfers between different scales. In 2019, it has been decided to go towards higher resolution and develop a new global sub mesoscale-permitting model. Benefiting from the context of the European H2020 IMMERSE project, a new 1/36° global configuration (2 to 3 km resolution), based on the NEMO 4.2 OGCM, has been developed. Thanks to the resolution increase, this model can resolve the Rossby radius in almost all open oceans areas at global scale quite everywhere and to span a large part of the internal wave spectrum. In 2022, a hierarchy of multi-year simulations at 1/4°, 1/12° and 1/36° resolution and with/without explicit tide representation has been performed: for each resolution, after a 3-years spin up without tidal forcing, 2 twin 3-years runs have been realized: one without tidal forcing and one forced by the 5 tidal components K1, O1, S2, M2, N2. These models are driven at the surface by the 8km/1hour ECMWF IFS system. Atmospheric pressure forcing has been activated. In 2023, in the framework of the EDITO-Model Lab project, the development of a near real-time demonstrator has been started. The system is based on the new 1/36° global configuration and constrained by a spectral nudging to the CMEMS/MOI global 1/12° real-time system (for temperature, Salinity, horizontal velocities and sea ice concentration). We propose a first evaluation of the benefits due to the resolution increase and tidal forcing. Circulation, energy, tidal representation and mixing of the experiments are compared to each other's.

Clément Bricaud, Jérome Chanut, Romain Bourdalle, Mercator Ocean International