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Wave-current interactions: model development and preliminary results

Clement Mayet (1), Florent Lyard (1), and Fabrice Ardhuin (2)
(1) LEGOS, CNRS, Toulouse (France), (2) IFREMER, Brest (France)

The coastal area concentrates many uses that require integrated management based on diagnostic and predictive tools to understand and anticipate the future of pollution from land or sea, and learn more about natural hazards at sea or activity on the coast. The realistic modelling of coastal hydrodynamics needs to take into account various processes which interact, including tides, surges, and sea state (Wolf [2008]). These processes act at different spatial scales. Unstructured-grid models have shown the ability to satisfy these needs, given that a good mesh resolution criterion is used.

We worked on adding a sea state forcing in a hydrodynamic circulation model. The sea state model is the unstructured version of WAVEWATCH III c (Tolman [2008]) (which version is developed at IFREMER, Brest (Ardhuin et al. [2010])), and the hydrodynamic model is the 2D barotropic module of the unstructured-grid finite element model T-UGOm (Le Bars et al. [2010]). We chose to use the radiation stress approach (Longuet-Higgins and Stewart [1964]) to represent the effect of surface waves (wind waves and swell) in the barotropic model, as previously done by Mastenbroek et al. [1993]and others. We present here some validation of the model against academic cases : a 2D plane beach (Haas and Warner [2009]) and a simple bathymetric step with analytic solution for waves (Ardhuin et al. [2008]). In a second part we present realistic application in the Ushant Sea during extreme event.

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