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Multi-scale coupled modelling of waves and currents on the Catalan shelf.

M. Grifoll (1), J.C. Warner (2), M. Espino (1), and A. Sánchez-Arcilla (1)
(1) LIM/UPC, LIM, Spain (manel.grifoll@upc.edu), (2) US Geological Survey, Woods Hole (MA), USA.

Catalan shelf circulation is characterized by a background along-shelf flow to the southwest (including some mesoscale features) plus episodic storm driven patterns. To investigate these dynamics, a coupled multi-scale modeling system is applied to the Catalan shelf (North-western Mediterranean Sea). The implementation consists of a set of increasing-resolution nested models, based on the circulation model ROMS and the wave model SWAN as part of the COAWST modeling system, covering from the slope and shelf region ($\sim$1 km horizontal resolution) down to a local area around Barcelona city ($\sim$40 m). The system is initialized with MyOcean products in the coarsest outer domain, and uses atmospheric forcing from other sources for the increasing resolution inner domains. Results of the finer resolution domains exhibit improved agreement with observations relative to the coarser model results. Several hydrodynamic configurations were simulated to determine dominant forcing mechanisms and hydrodynamic processes that control coastal scale processes. The numerical results reveal that the short term (hours to days) inner-shelf variability is strongly influenced by local wind variability, while sea-level slope, baroclinic effects, radiation stresses and regional circulation constitute second-order processes. Additional analysis identifies the significance of shelf/slope exchange fluxes, river discharge and the effect of the spatial resolution of the atmospheric fluxes.