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WAVETRISK-OCEAN: an adaptive dynamical core for ocean modelling

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This talk introduces WAVETRISK-OCEAN, an incompressible version of the atmosphere model WAVETRISK. This new model is built on the same wavelet-based dynamically adaptive core as WAVETRISK, which itself uses DYNAMICO's mimetic vector-invariant multilayer shallow water formulation. Both codes use a Lagrangian vertical coordinate with conservative remapping. The ocean variant solves the incompressible multilayer shallow water equations with a Ripa type thermodynamic treatment of horizontal density gradients. Time integration uses barotropic-baroclinic mode splitting via an implicit free surface formulation, which is about 15 times faster than explicit time stepping. The barotropic and baroclinic estimates of the free surface are reconciled at each time step using layer dilation. No slip boundary conditions at coastlines are approximated using volume penalization. Results are presented for a standard set of ocean model test cases adapted to the sphere (seamount, upwelling and baroclinic jet) as well as turbulent wind-driven gyre flow in simplified geometries. An innovative feature of WAVETRISK-OCEAN is that it could be coupled easily to the WAVETRISK atmosphere model, providing a simple integrated Earth system model using a consistent modelling framework.