Wave-flow coupling of SWAN with an unstructured model

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Wave-flow coupling of the spectral wave model SWAN with the unstructured coastal model COMPAS is presented. The unstructured model passes sea level, currents, wind and bathymetry to the wave model, which returns wave amplitude, period, direction, Stokes drift and non-conservative wave processes. Tight coupling of these models is achieved by exploiting several factors. Firstly, COMPAS operates on a C-grid Voronoi tessellation, the dual of which is a Delaunay triangulation. SWAN can operate on a triangulation, where variables are computed on triangle vertices. Therefor a 1:1 correspondence exists between the SWAN computation nodes and the location of scalars in the ocean model, such that no interpolation is required when transferring data. Additionally, SWAN is written in Fortran and COMPAS in C, and linking the models is achieved using C interoperability protocols. This works to our advantage, as the dynamic core of SWAN is extracted as a library function for COMPAS, where wave variables are managed by COMPAS and accessed by SWAN via pointers, circumventing the requirement to swap memory associated with variables between the two models. Lastly, momentum advection in COMPAS is cast in the vector invariant form, of which the vorticity component is analogous to the Stokes drift and vortex terms used in the wave coupling, significantly simplifying the inclusion of these terms. We elaborate on these concepts in this presentation, and provide some examples of the performance of the coupled system.