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The Finite Volume Sea Ice-Ocean Model (FESOM2.0) with the arbitrary Lagrangian Eulerian (ALE) vertical coordinates

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In this study we will present first results regarding the latest version of Finite-Element Sea Ice-Ocean circulation model (FESOM) for the linear free surface case, were all vertical layers are fixed in time, as well as the full free surface case, with the zlevel and zstar vertical coordinates, where the first or all vertical levels area allowed the vary with the change in sea surface height, respectively. Furthermore, we will show the effect of floating sea-ice on the sea ice conditions and general ocean circulation of the model.
The latest version of the unstructured-mesh FESOM is largely based on its previous version FESOM1.4. The main difference is its dynamical core which uses now finite volumes instead of finite elements, thus using now prismatic instead of tetrahedral elements. The finite-volume approach has the advantage of a higher computational efficiency, due to a more efficient structuring of the data, and allows for clearly defined fluxes. To ensure in FEOSM2.0 the same functionality as in the previous version, like a full free surface and the use of a terrain following vertical discretization, we introduced arbitrary Lagrangian Eulerian (ALE) vertical coordinates. ALE provides the opportunity to incorporate a variety of different types of vertical coordinates (linfs, zlevel, zstar, sigma, hybrid) and effects (fullfree surface, partial cells, floating sea ice), with an only minor expansion of the code.