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Representing the ocean bottom topography with z, z-σ and σ vertical coordinates

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The vertical coordinate system is probably the clearest way to distinguish between different ocean models. Its varying ability to describe the ocean bottom topography has strong impacts on the model performance up to global scales.

FEOM can work with z, z-σ and σ vertical discretization, and z-coordinate version can be configured with full cell or partial cell grids. The z-σ discretization implies that there are only several topography-following layers while the rest uses the geopotential coordinate. Partial cell, z-σ and σ grids suffer from pressure gradient errors yet they are limited to the elements close to the bottom in the partial cell and z-σ cases. These errors are reduced by a density interpolation scheme.

A suite of test cases is run with different types of bottom representation. It includes the Gaussian mountain case, bottom trapped waves and overflow problems. The calculation results are compared to analytical solutions or to other available model results. Conclusions on performance of different vertical grids are drawn.