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Iinfluence of bottom topography on large-scale decadal basin modes

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The influence of bottom topography on the generic properties of the baroclinic basin modes is investigated through linear stability analysis of a two-layer shallow water ocean model.
Various idealized bottom profiles imitating a mid-ocean ridge and continental slopes are analyzed in an extratropical beta-plane closed basin.
Only large-scale features are examined, theeddy effects being parametrized as turbulent eddy viscosity that allows the selection of large-scale eigenmodes.
At coarse resolution, the largest-scale lowest-frequency baroclinic modes appear as the least damped modes.
For scales much larger than the internal deformation radius, the damping rate is relatively independent of dissipation, the mode energy, mostly potential, being depleted by lateral viscosity work.
The damping rate of the leading baroclinic mode is found to be weakly sensitive to bottom topography while the decadal period is shortened by bottom elevations.
The mechanism of modal decay is rationalized through energy and vorticity budgets for the barotropic and baroclinic components, to characterize the energy routes and conversions. For small amplitude topography, the barotropic flow results accurately from the interaction of the flat-bottomed baroclinic motion with the topographic height: it is found to be three times stronger within closed potential vorticity contours than with blocked contours.
However, the conversion of energy from the baroclinic to the barotropic mode
remains weaker than the frictional processes.