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Eddy modulation of air-sea interaction and convection

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Eddy modulation of air-sea interaction and convection that occurs in the process of mode water formation is analyzed in a baroclinically unstable wind- and buoyancy-driven flow in a pie-shaped sector of the sphere. The water mass transformation analysis of Walin is used to estimate the formation rate of mode water and to characterize the role of eddies in that process.

We find that diabatic eddy heat flux divergences in the mixed layer are comparable in magnitude, but of opposite sign, to the surface air-sea heat flux, and largely cancel one another. This suggests that mode water mass formation estimates based on non-synoptic air-sea heat flux data and outcrops are likely to be in error.

The key processes are described in terms of a transformed Eulerian-mean formalism in which eddy-induced mean flow tends to cancel the Eulerian-mean flow, resulting in weaker residual mean flow, subduction and mode water formation rates.

Finally a passive tracer is injected into the surface diabatic layer of the model to elucidate the origin of the water in the low PV pool and the role of eddies in its formation.