Influence of surface fluxes on mesoscale cyclone development: idealised simulations

*Annick Terpstra[1], Thomas Spengler[1]

1. Geophysical Institute, University of Bergen, Norway and Bjerknes Centre for Climate Research, Bergen, Norway

Excursions of cold air masses into oceanic regions are
frequently accompanied by the development of intense mesoscale cyclones. This particular ocean-atmosphere configuration exhibits favorable conditions for relative large surface turbulence exchange of momentum, moisture, and heat. In this study, we examine the impact of this air-sea-exchange on the development of such mesoscale cyclones.

We utilise an idealised numerical channel model to gain insight into the role of surface heat and moisture fluxes on the dynamical evolution of mesoscale cyclones. The initial setup consists of a baroclinic jet in thermal wind balance. To mimic cold air outbreaks, we prescribe sea surface temperatures that are higher than the low-level air temperature. This setup enables a systematic investigation of the relative contributions from surface sensible and latent heat fluxes on cyclone development by varying the intensity of the initial baroclinicity, moisture, and air-sea temperature difference. In addition, we investigate the relative role of sensible and latent heat fluxes by gradually changing the intensity of surface exchange in a set of sensitivity experiments. Identification of moisture sources and sinks further illustrates the role of surface heat and moisture exchange on the intensification of mesoscale cyclones.

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