Geophysical Research Abstracts
Vol. 15, EGU2013-6178, 2013
EGU General Assembly 2013


# Mesoscale modelling of cold-air outbreaks over the marginal sea ice zone in the Arctic.

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A non-hydrostatic model NH3D is used for idealized simulations of Arctic cold-air outbreaks using horizontal grid spacings between 1.25 and 60 km. Despite the idealized setup, the model results agree well with observations over Fram Strait. It is shown that an important characteristic of the flow regime during CAOs is an ice-breeze jet with a maximum wind speed exceeding often the large-scale geostrophic wind speed. It is shown that the main physical mechanism responsible for the jet formation is the baroclinicity related with heating of the cold air mass over the open water. According to the present simulations, which agree very well with those of another non-hydrostatic mesoscale model (METRAS), the occurrence, strength, and horizontal extent $L$ of this jet depend strongly on the external forcing and especially on the direction of the large-scale geostrophic wind relative to the orientation of the ice edge. It is found that coarse-resolution runs underestimate the strength of the jet. This underestimation has important consequences to the surface fluxes of heat and momentum, which are also underestimated by about 10-15% on average over the region between the ice edge and 120-180 km downstream. Our results suggest that a grid spacing of about $L/7$ is required (about 10-30 km) to simulate the ice-breeze jet strength with an accuracy of at least 10%. Thus large-scale atmospheric models or reanalyses using coarse resolution might underestimate the ice-breeze jet as well which is influencing the energy budget in a large region along the marginal sea ice zones.