Low level jet streams at the sea ice edge – Numerical experiments using WRF

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What is the problem?

- Marine activities at high latitudes demand precise predictions especially in terms of strong wind events
- One phenomenon causing strong winds is a low level jet stream connected to a boundary layer front at the ice edge
- State of the art theory fails, because it does not explain the deviation of the actual wind from geostrophic theory

Where are we?

- WRF is run with two nested domains (30km and 10km horizontal resolution, 28 eta-levels in the vertical)
  -> The outer domain extends from northern Norway to north of Svalbard and from about 7° longitude to Novaya Zemlya
  -> The inner domain is approximately centered around the ice edge

What I want to do!

1. Reproducing results by Grønås and Skeie [1999]

- Model results are in accordance with the simulation by Grønås and Skeie (1999) in terms of:
  -> Potential temperature
  -> x-wind component
- Which atmospheric parameters influence the genesis and intensity of the low level jet?
  -> Low level jet evolution along the ice edge (cross sections)
  -> Numerical experiments in order to investigate sensitivities to certain parameters, e.g., heat fluxes, static stability, fetch length

2. Extend the state of the art theory

- Sea ice and the open sea build a very distinct boundary in terms of surface heat fluxes
- Ageostrophic circulation in accordance with an increasing geostrophic wind at the surface
- BUT: The wind maximum occurs at ca. 925 hPa
  -> Semi-geostrophic theory has to be extended in order to include low level jets at the ice edge

3. Verification

- Outcome of the experiments will be compared to a climatology of ice edge jets
- If feasible a field campaign will be arranged
  -> The unmanned aerial vehicle (UAV) called SUMO [Mayer et al., 2012] is very appropriate for measuring in different heights

My thesis in 4 bullet points!

- Simulate the boundary layer front and its associated low level jet at the sea ice edge by using the model WRF
- Diagnose the characteristics and dynamics
- Extend the state of the art theory
- Verify the extended theory by comparing it to a climatology and in-situ measurements

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References