Confronting and combining high-resolution simulations (ICON-LEM) with remote sensing observations

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Main points

- The ICON-LEM at resolutions between 600 m and 75 m is used to perform simulations of arctic mixed-phase clouds.
- By using the Passive and Active Microwave TRAnsfer simulator (PAMTRA), the model output is transformed to radar reflectivity, which can be compared to remote sensing observations.
- The comparison of sub-kilometer simulations and remote sensing observation can provide us with insights into the representation of cloud properties and the influence of specific microphysical assumptions and paramterizations.

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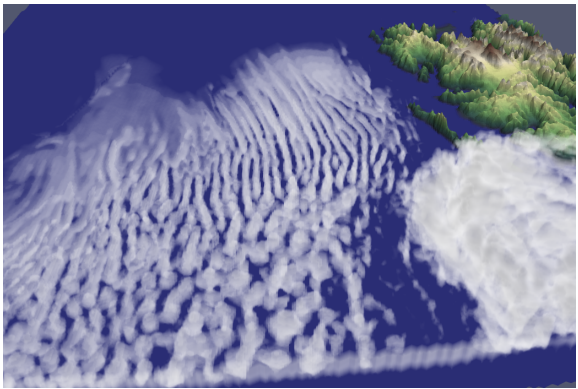
Case study - Cold-air Outbreak



- Simulation with the ICON-LEM forced by ECMWF IFS
- A visualisation of the simulation with 600 m is shown; for analysis simulations up to approx. 100 m have been performed

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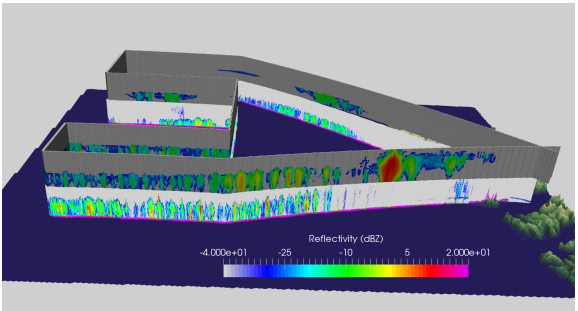
Comparison with the Passive and Active Microwave TRAnsfer simulator (PAMTRA)

- For comparison the output is sampled along the measured flighttrack
- The Passive and Active Microwave TRAnsfer simulator (PAMTRA) is used to transform the model output to radar reflectivity



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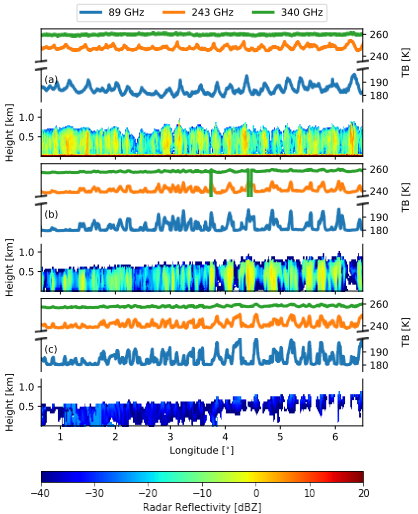
Sensitivity study



- A section across the cloud streets is analyzed for 2 different CCN/IN activation schemes
- The comparison of observed (top) and simulated (middle, bottom) radar reflectivities and brightness temperatures provides us with more insight into the simulated clouds and its properties

Mech, M., Maahn, M., Kneifel, S., Ori, D., Orlandi, E., Kollias, P., Schemann, V., and Crewell, S.: PAMTRA 1.0: A Passive and Active Microwave radiative TRAnsfer tool for simulating radiometer and radar measurements of the cloudy atmosphere, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-356, in review, 2020.

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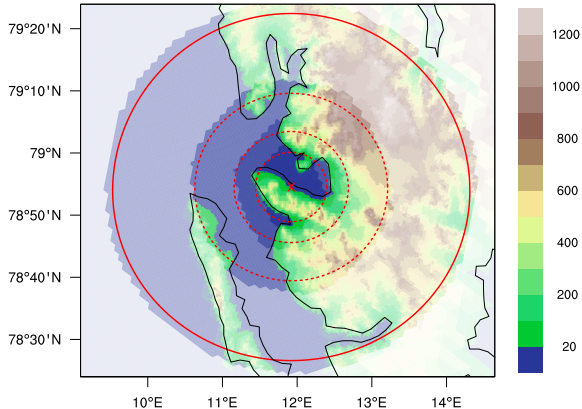
Local simulations at Svalbard

- Local ICON-LEM simulations around Ny-Ålesund (Svalbard) with a resolution of up to 75 m
- Analysis of 11 days (14.-24. June 2017)

Schemann, V. and Ebell, K.: Simulation of mixed-phase clouds with the ICON large-eddy model in the complex Arctic environment around Ny-Ålesund, Atmos. Chem. Phys., 20, 475?485, https://doi.org/10.5194/acp-20-475-2020, 2020.



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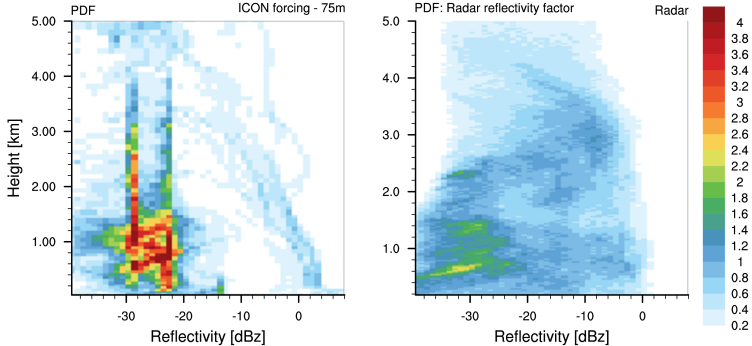
Statistical assessment of cloud properties



- Comparison of observed (right) and simulated (left) radar reflectivities for all 11 days
- The simulated reflectivities tend to be too low compared to the observed ones, but in principal the same range is covered, which shows the potential.

Schemann and Ebell, ACP, 2020

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