Latitudinal variability of water vapour, aerosols and optically thin clouds

B06

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Research questions:

Q1: How large is the latitudinal variability of aerosols, water vapour and thin clouds between the North Atlantic ice edge and the inner Arctic?

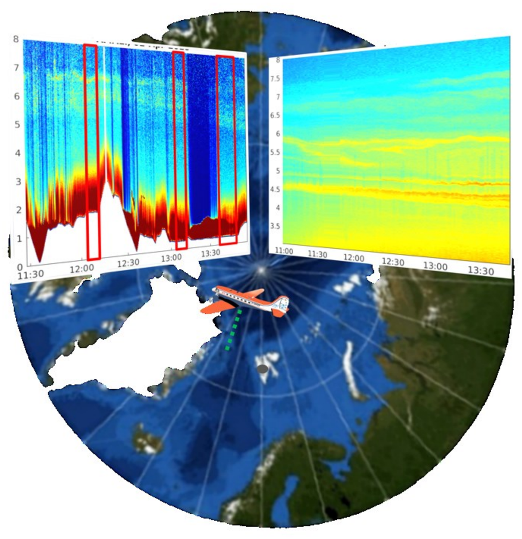
Q2: How do the aerosol optical properties vary within the European Arctic and what is the corresponding impact on the local radiative budget?

Achievements:

Aerosol optical and radiative effects

- Investigation of **aerosol optical properties by two** different **Lidar systems**
- **Aerosol Forcing (AF)** from ground-based **observations** (E02 collab.) and **Radiative Transfer Simulations** (C03-B02 collab.)
- **back-trajectories** (D01 collab.)

P 2018



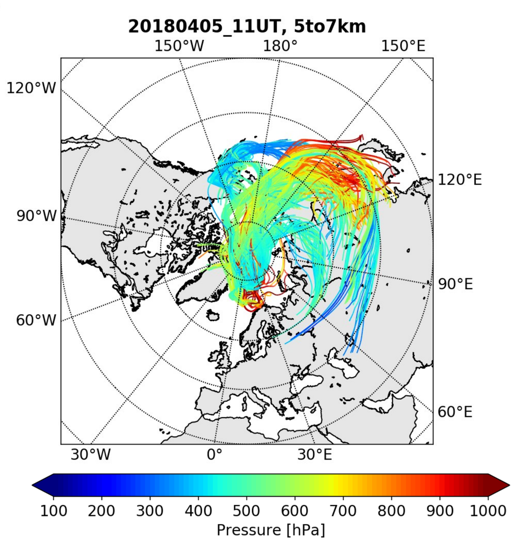


Fig. 2: LAGRANTO 10 day back-trajectories ending at Ny-Ålesund.

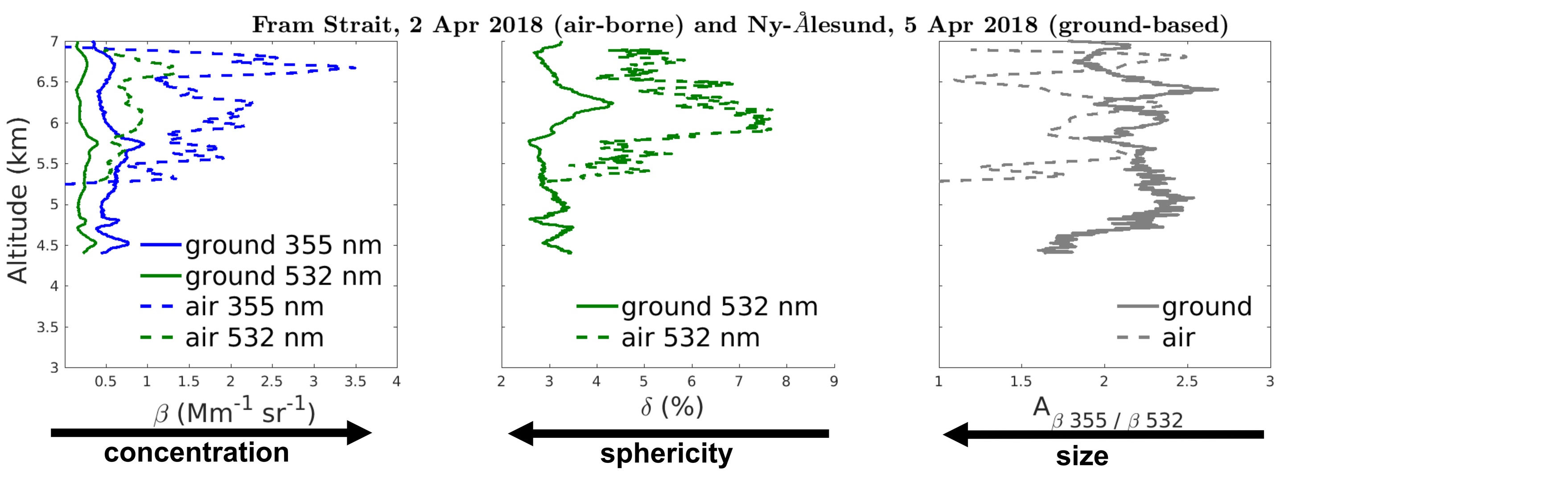


Fig. 3: Aerosol optical properties from ground-based and air-borne Lidar systems. ***Nakoudi et al., in prep***

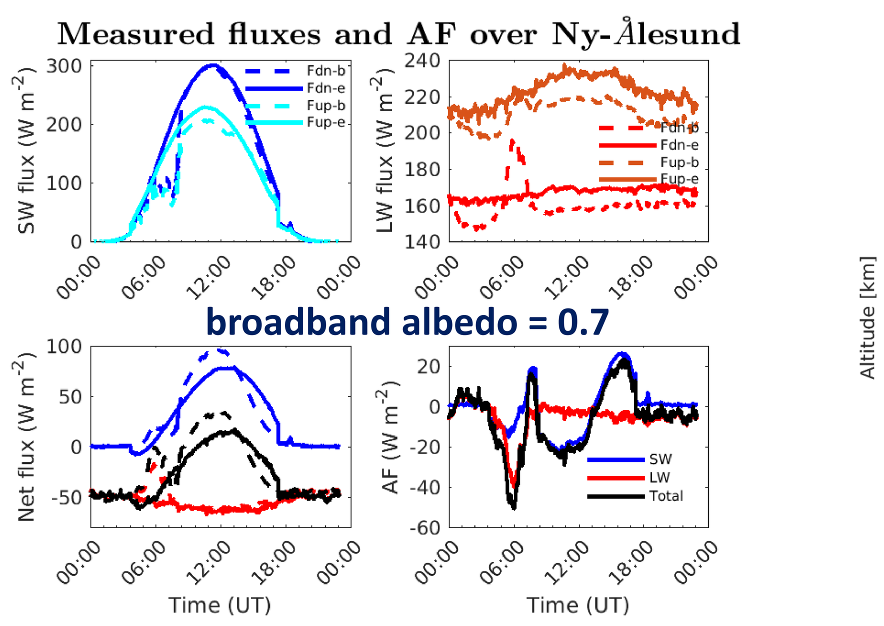


Fig. 4: Measured fluxes at the surface of Ny-Ålesund compared to a clear day (5 April 2003).

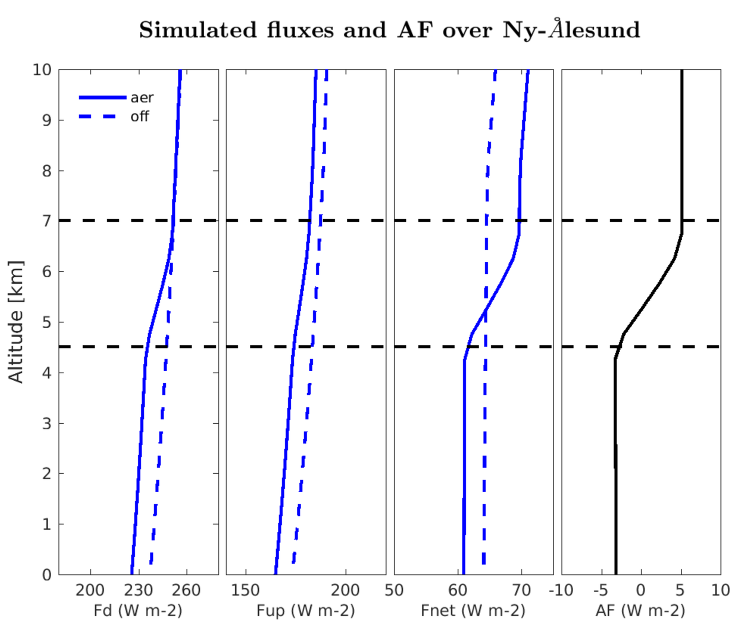


Fig. 5: Spectrally integrated SW fluxes and AF simulated with SCIATRAN.

New water vapour lidar calibration

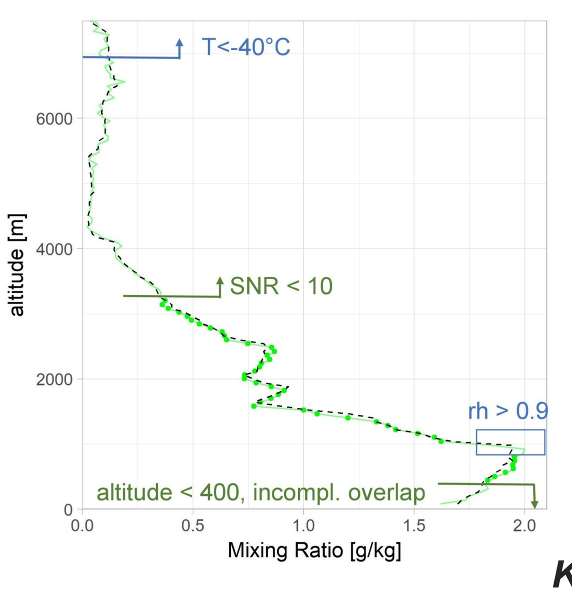
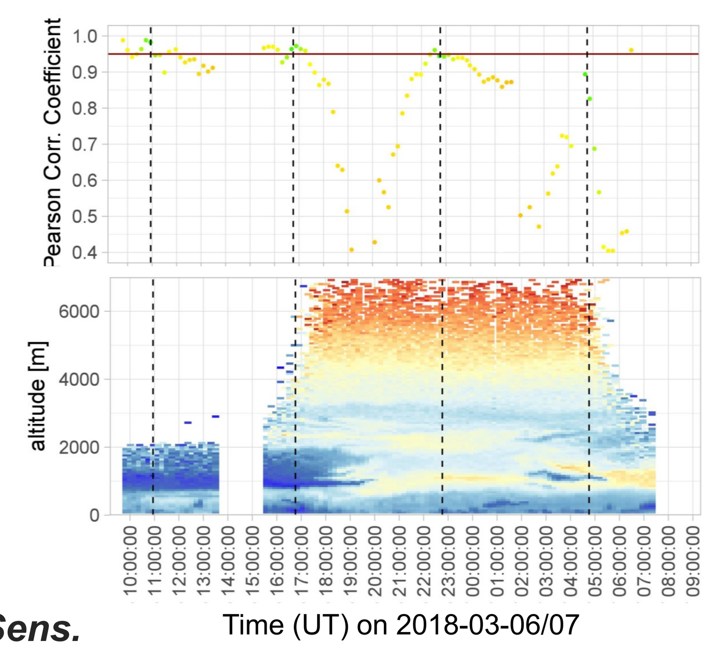


Fig. 6a (left): *Restrictions on lidar and radiosonde profiles used for water vapour calibration.*

Fig. 6b (right): *Correlation coeff. (upper) and calibrated water vapour mixing profiles (bottom) on 6th and 7th March 2018.*



Kulla and Ritter 2019, Remote Sens.

Hypothesis (Phase I)

The latitudinal variability of water vapour, aerosols, and thin clouds from mid–latitudes to the high Arctic impacts on Arctic climate changes.

Microphysical cloud parameters from ship-based measurements

- **Set up a retrieval** of microphysical cloud parameters in the thermal-infrared and far-infrared region
- **Measurements on RV Polarstern** during PS106/PS107 in the Arctic using an Emission-FTIR spectrometer (A01 collab.) and a solar absorption FTIR spectrometer (E02 collab.)

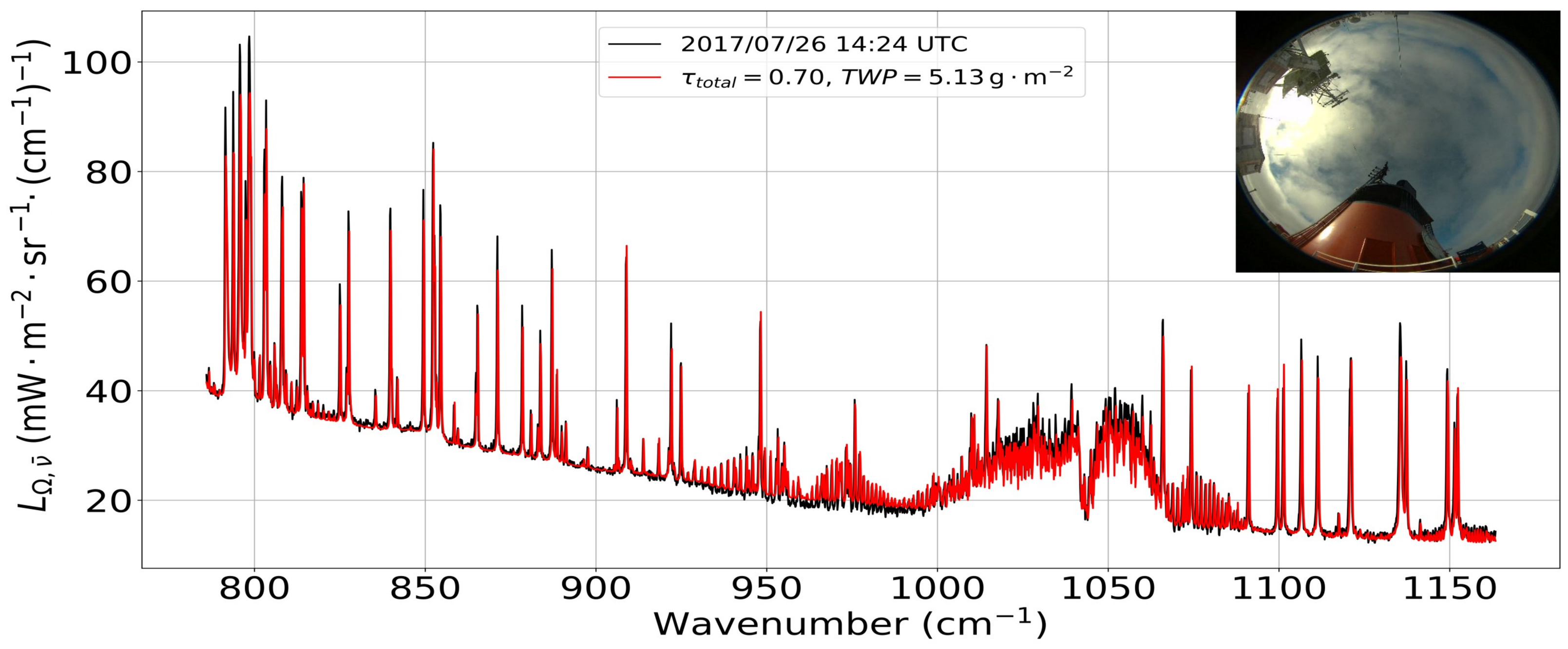


Fig. 7*: IR spectrum of atmospheric radiation at cloudy conditions and the corresponding fit.*

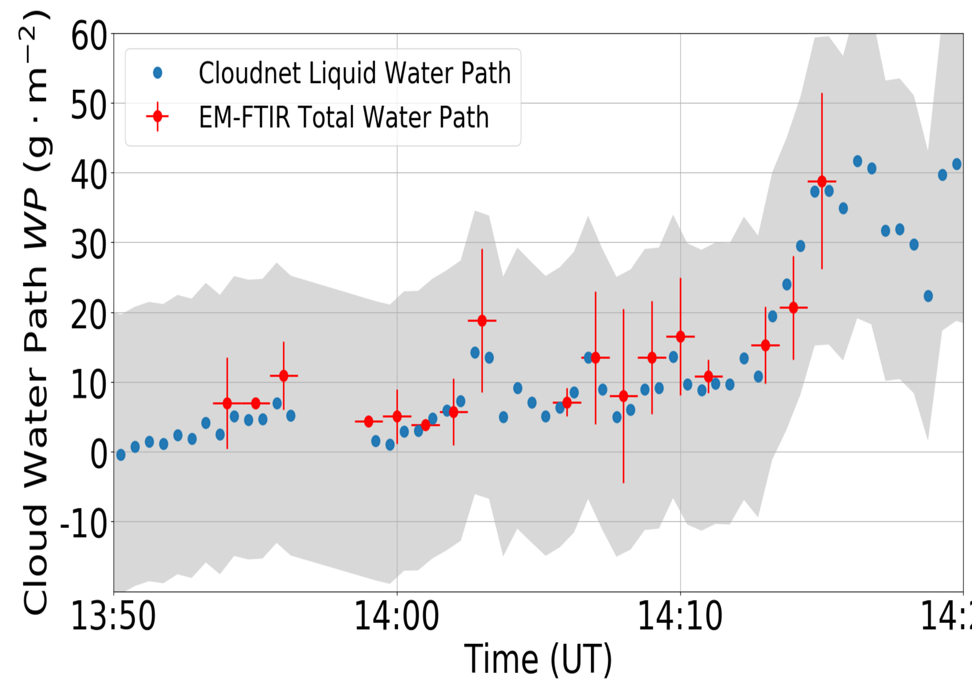


Fig. 8*: Time series of the cloud water path on 06/11/2017 around 81.3° N and 11.8° E (Cloudnet data by Griesche et al. 2019, A01).*

Richter et al., in prep.

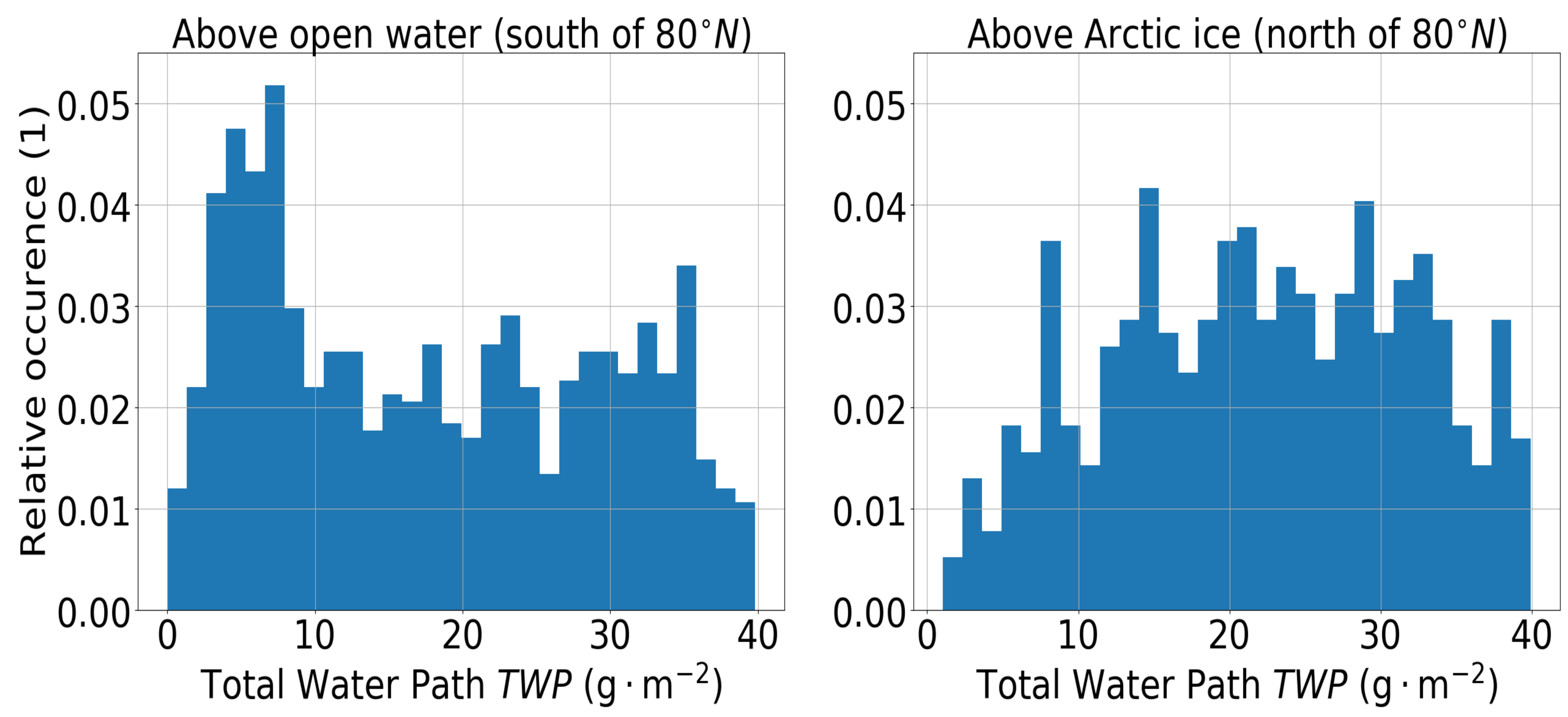


Fig. 9*: Distribution of the total water path TWP between the North Atlantic ice edge (left) and the Inner Arctic (right). Ongoing work.*

- **Biomass burning aerosol of similar sphericity and size observed over different parts of the European Arctic.**
- **Warming aerosol effect in the upper atmosphere, while cooling effect in lower troposphere and near surface.**
- **Small scale variations of humidity observed over Ny-Ålesund**

- **IR retrieval of microphysical cloud parameters allow to resolve small variations in the cloud water path.**
- **Cloud water path at the North Atlantic ice edge is lower than in the Inner Arctic.**

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