Effort towards combining passive sub-mm microwave (Arctic Weather Satellite) and IR for cloud ice mass

Utilization of L2 synergy product ACM-CAP

Forward Model

Radiative Transfer

Particle Size Distribution (ACM-CAP profiles)

Particle Habits (Yang, ARTS scattering DB)

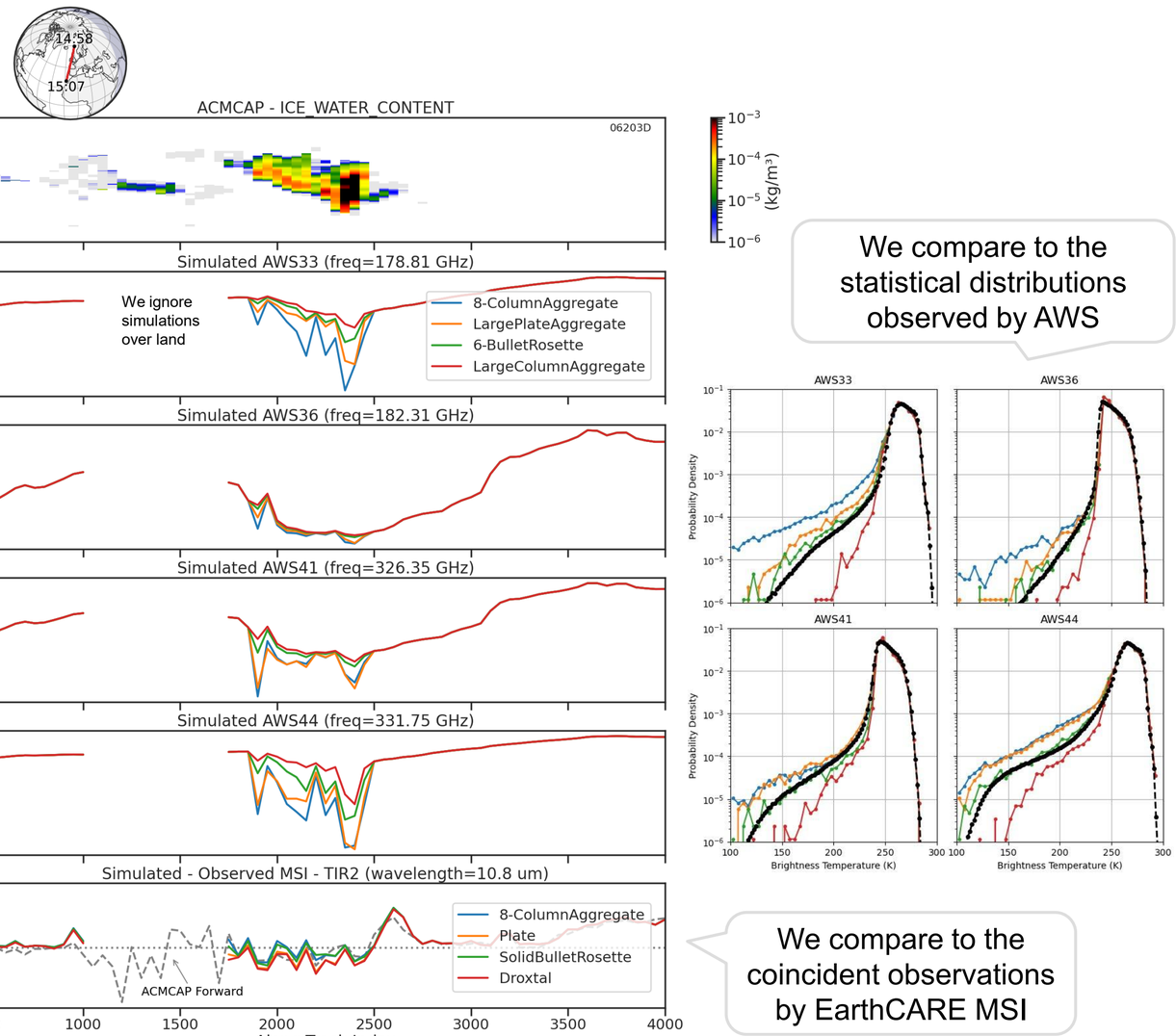
ARTS

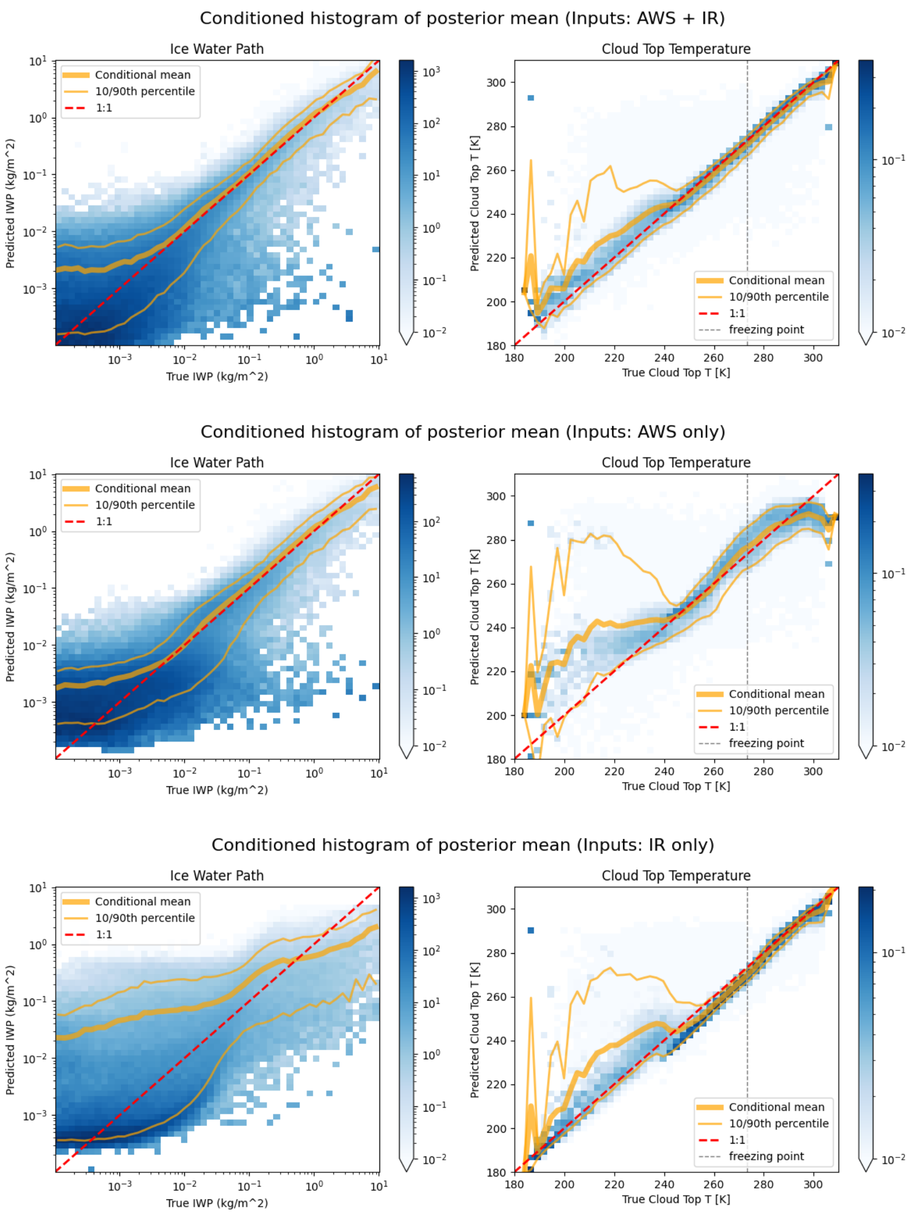
T_b @ 183 GHz

T_b @ 325 GHz

T_b @ 10.8 μm

Arctic Weather Satellite (AWS): passive sub-mm instrument that aims to measure ice mass. Among 19 channels in total, 6 of them are around 183 GHz and 4 around 325 GHz (new!), which are sensitive to scattering processes by the cloud ice.





Inverse Model

Quantile Regression Neural Network

T_b @ 183 GHz

T_b @ 325 GHz

T_b @ 10.8 μm

QRNN

Ice Water Path

Cloud Top Temperature

A large amount of simulated cases (N=1.2 million) facilitate to build a retrieval database. The ice water path is taken from ACM-CAP retrieval with their ice particle model, and the cloud top is defined as the highest altitude where the vertically integrated liquid and ice water content above is 10 g/m2.

We evaluate the 3 trained QRNN models, which differe on the inputs include either sub-mm or IR, or both. The result shows the benefit of combining both because they offer complimentary information.

Key Points

- The EarthCARE synergy product ACM-CAP provides particle size distribution (PSD) profile, which are retrieved from IR, radar and lidar measurements. Radiative transfer simulations are ran based on these profiles.
- For the assumed PSD, particle habits influence greatly on the simulated T_b at sub-mm MW, but not so much at IR.
- Combining IR and sub-mm measurements improves the joint retrieval of IWP and CTT .

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