Development of modular ice microphysics retrieval for AWARE and other ARM sites

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The retrieval of ice microphysics is still a challenge because it relies on the characterization of critical parameters such as particle size distribution (PSD), particle mass-size and fall speed–size relationships, particle habit, and orientation. Those parameters are particularly altered by aggregation and riming. In this framework, triple-frequency radar measurements are an essential tool because they revealed potential to constrain key parameters of the PSD and particle density as demonstrated both from theoretical scattering studies and from observations.

During the Atmospheric Radiation Measurements West Antarctic Radiation Experiment (AWARE) field campaign, the deployment of an unprecedented number of multi-wavelength active and passive remote sensing systems (including triple-frequency radar measurements) at the McMurdo site presents a unique opportunity to evaluate the importance of these microphysical processes in Antarctica. A preliminary analysis of the January and February days of precipitating ice suggests that the signature of aggregation and riming are evident for significant periods of time.

This poster presents the status in the development of a modular Optimal Estimation retrieval capable of integrating multiple observations from the instruments deployed at the McMurdo AWARE site (e.g., reflectivity and Doppler velocity from triple-frequency radars, lidar and microwave radiometer). This retrieval is also designed to be applied to other ARM polar facilities and is first trained on few case studies from the BAECC field campaign where extensive in-situ measurements of the snow at the ground are available for validation. The success of this retrieval relies on the development and use of accurate scattering databases. To this aim an aggregation and riming model is used to link scattering properties with the physical parameters of ice particles such as e.g., the rime mass fraction.

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