The impact of liquid cloud vertical profile and cloud top entrainment on droplet size retrieval from 3MI

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As a next generation POLDER-type sensor, the 3MI (Multi-viewing, Multi-channel and Multi-polarization Imaging) instrument will provide measurements at a spatial resolution of 4 km at nadir and the swath of the instrument will provide complete daily coverage of the Earth. The passive retrievals of cloud effective radius often assume that the cloud droplet size is vertically homogeneous. Even in the case of an ideal adiabatic cloud profile, such retrievals have to be interpreted carefully considering the weighting function of spectral radiances used by the algorithm. Retrievals of cloud properties for fields having non-adiabatic profiles or significant entrainment at cloud top are even more complex to interpret since the spectral weighting functions cannot be determined without a priori knowledge of the actual cloud vertical profile.

This talk aims to investigate the sensitivity of the 3MI observations to the vertical distribution of particles size and concentration. For this purpose, we produced synthetic cloud fields using large-eddy simulations, the retrieval results are analyzed as a function of effective radii profiles generated from the Regional Atmospheric Model System (RAMS). The talk includes two parts: (1) we first evaluate in which conditions 3MI observations could be used to constrain arbitrary or simplified effective radius profiles retrievals; (2) secondly it is investigated whether strength of entrainment at cloud top and turbulent mixing can create detectable signatures in 3MI observations and retrievals.

Preferred mode of presentation: Oral/Poster