Comparing cloud radar Doppler observations with 1D cloud microphysical model simulations using different autoconversion schemes

Stratocumulus clouds are a key contributor to Earth's radiation budget, however their representation in global climate models (GCMs) remains an open challenge due to the uncertainty in the description of cloud-scale microphysical processes including drizzle production. Drizzle formation is one of the main liquid water removal mechanisms and strongly affects cloud dynamics and lifetime of stratocumulus clouds all over the globe. In recent years new observables called "higher moments" of cloud radar Doppler spectra (opposed to the standard moments reflectivity, mean Doppler velocity and Doppler spectral width), showed a potential for early drizzle formation detection within the cloud. Among the higher moments, the skewness is sensitive to early drizzle production and drizzle growth through the thin cloud layers: normally, cloud droplets without any significant fall velocity but under the influence of turbulence will lead to a Gaussian Doppler spectrum (i.e. skewness is zero), whereas the onset of drizzle will lead to a deviation from the ideal Gaussian form (i.e. positive skewness at first and negative when drizzle starts to dominate the spectrum). The information derived by these new observations can be used to evaluate and select appropriate modeling schemes by using a radar forward simulator. Here, we compared observations from maritime and continental sites (Graciosa Island, Azores and Juelich, Germany) with simulated measurements obtained by coupling a steady-state 1D model using spectral microphysics with a radar forward simulator. De-noising filtering techniques are applied to the data in order to identify coherent skewness structures and to indicate microphysical signatures of drizzle onset. Understanding how the radar type (ARM vs MIRA) and the cloud type (maritime vs continental) affect our ability to detect early drizzle production is key in order to properly compare with models. Subsequently, the observed skewness and reflectivity values are linked to quantities like LWC and cloud to drizzle water content ratio by using the 1D model. Finally, preliminary results on the performance of different autoconversion schemes are shown.