A macrophysical life cycle description for precipitating systems

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The lack of understanding of cloud and precipitation processes is still the overarching problem of climate simulation, and prediction. The work presented is part of the HD(CP)2 project (High Definition Clouds and Precipitation for Advancing Climate Predictions) which aims at building a very high resolution model in order to evaluate and exploit regional hindcasts for the purpose of parameterization development. To this end, an observational object-based climatology for precipitation systems will be built, and shall later be compared with a twin model-based climatological data base for pseudo precipitation events within an event-based model validation approach. This is done by identifying internal structures, described by means of macrophysical descriptors used to characterize the temporal development of tracked rain events. 2 pre-requisites are required for this purpose: 1) a tracking algorithm, and 2) 3D radar/satellite composite. Both prerequisites are ready to be used, and have already been applied to a few case studies.

We will show one case study from August 5th 2012, when convective precipitation was observed simultaneously by the BOXPOL and JUXPOL X-band polarimetric radars, located in Western Germany. We follow the main paths identified by the tracking algorithm during this event and identify in the 3D composite the descriptors that characterize precipitation development, their temporal evolution, and the different macrophysical processes that are ultimately related to the precipitation observed. These include the size of the cluster, the maximum reflectivity, the presence of differential reflectivity columns and their extent, the vertical extent of updrafts and their intensity, radar derived rain rates, number of lightning strikes and cloud top height. These observations are then compared to the results of radar based hydrometeor classification algorithm, in order to link the macrophysical and microphysical aspects of the storm evolution.