Ensemble-based data assimilation of satellite observations into a cloud resolving model

M. Grecu (1) and E. M. Anagnostou (2)

(1) University of Maryland, Baltimore County, (2) University of Connecticut

In this study, we investigate a strategy to directly assimilate brightness temperatures into a cloud-resolving-model. The assimilation is based on an Ensemble Kalman Filter methodology. The cloud resolving model used in the study is the Advanced Regional Prediction System (ARPS) developed at the University of Oklahoma. The model features several microphysical schemes, turbulent parameterizations, and surface submodels. In spite of its advanced physics packages, the model is deemed to over-predict the amount of solid phase hydrometeors. This has a negative impact on the assimilation of brightness temperatures because over-prediction of scattering may result in underestimation of surface rainrates. To mitigate this potential deficiency an “a priori” covariance term, based on independent radar-radiometer observations, is included in functional form associated with the assimilation process. This “a priori” covariance term constrains the model state variables to values consistent with independent observations. The methodology is evaluated using radar and radiometer observations. That is coincident real radar and radiometer data are assimilated into the model. Assimilations of radiometer only observations with and without the “a priori” covariance term are performed. The retrieved/forecasted state variables are compared to those derived in from the combined radar and radiometer observations, and the impact of the “a priori” covariance term on the assimilation is thus assessed. The radar observations are collected by an X-POL radar over Crete, while the associated radiometer observations are simulated from the radar retrievals in this semi-idealized study.