A retrieval algorithm of hydrometer profile for submillimeter-wave radiometer

Yuli Liu (1,2), Stefan Buehler (2), and Heguang Liu (1)

(1) National Space Science Center, Chinese Academy of Sciences, Beijing, China , (2) Meteorological Institute, University of Hamburg, Hamburg, German

Vertical profiles of particle microphysics perform vital functions for the estimation of climatic feedback. This paper proposes a new algorithm to retrieve the profile of the parameters of the hydrometeor(i.e. ice, snow, rain, liquid cloud, graupel) based on passive submillimeter-wave measurements. These parameters include water content and particle size. The first part of the algorithm builds the database and retrieves the integrated quantities. Database is built up by Atmospheric Radiative Transfer Simulator(ARTS), which uses atmosphere data to simulate the corresponding brightness temperature. Neural network, trained by the precalculated database, is developed to retrieve the water path for each type of particles. The second part of the algorithm analyses the statistical relationship between water path and vertical parameters profiles. Based on the strong dependence existing between vertical layers in the profiles, Principal Component Analysis(PCA) technique is applied. The third part of the algorithm uses the forward model explicitly to retrieve the hydrometeor profiles. Cost function is calculated in each iteration, and Differential Evolution(DE) algorithm is used to adjust the parameter values during the evolutionary process. The performance of this algorithm is planning to be verified for both simulation database and measurement data, by retrieving profiles in comparison with the initial one. Results show that this algorithm has the ability to retrieve the hydrometeor profiles efficiently. The combination of ARTS and optimization algorithm can get much better results than the commonly used database approach. Meanwhile, the concept that ARTS can be used explicitly in the retrieval process shows great potential in providing solution to other retrieval problems.