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ABSTRACT

The purpose of this study is to explain methods developed in order to improve a rain retrieval algorithm called BRAIN (Bayesian Rain Algorithm Including Neural networks) (Viltard et al., 2006). The presented work will focus on two aspects of the retrieval which are the algorithm database over ocean and the rainy/non-rainy pixels classification over land. Such as other well-known algorithms like the GPROF (Goddard Profiling algorithm), BRAIN uses a bayesian approach which implies that the results strongly depends on the representativeness of the database used for the retrieval. Given the natural distribution of profiles in the database and the large computing time required, increasing the number of profiles in the database raises the difficulty of finding a good balance between the quality of samples and the time required for retrieval. First of all, in order to optimize the database, we need to reduce the part of it that contains weak and repetitive profiles and afterwards add heavy but less represented rainfall rates. Thus, we followed the suggestion of Barthes et al. (2003) using a Self-Organizing Map (SOM) developed by Kohonen (2001). Indeed, given the complexity of the relationship between the brightness temperatures and the rainfall rate, finding an objective criterion of resemblance for the profiles is not obvious. By using SOMs, we are given a possibility to cluster identical profiles in terms of topology, owing to the fact that it is a non-supervised method which classify the data upon a criterion that is unknown beforehand. This method is only applied to ocean surfaces for the moment. More precisely, we focused on the rain rates under 5 mm/h that account for nearly 90 % of the whole dataset. To demonstrate the method's efficiency we proceed in two steps: first the compared use of the two databases on the retrieval for the case of an intense hurricane called DEAN that formed in the Caribbean on 17 August 2007; Second the statistical comparison of the retrieval performed on a hundred orbits randomly selected above ocean for the database reduction. Over a hundred orbits it appeared that the mean of the relative bias between the rain rate obtained with the former database and the reduced one is about -0.08 mm/h whereas the bias for the variance obtained reaches a maximal value of 2 $(mm/h)^2$. Finally we demonstrate the interest of the method for the retrieval by "reducing" the entire co-located database and using for retrieval the obtained database which contains many more high rainfall profiles. The second aspect of the algorithm optimization is about the discrimination of rainy situations from non-rainy ones before the retrieval itself that allows a preliminary filtering of the data and reduces the number of pixels retained for retrieval and consequently the computation time. The classification method was initially a classification tree used regardless of the satellite and the surface type. We developed and tested a classifier based on a Multi-layer Perceptron for the TRMM data over both land and ocean surfaces.

Keywords : tropical rainfall, radiometer measurements, inversion algorithm, neural networks, vector quantization

Bibliography:

[1] Rain Retrieval from TMI Brightness Temperature Measurements Using a TRMM PR–Based Database. Viltard Nicolas, Burlaud Corinne and Christian D. Kummerow, 2006. J. Appl. Meteor. Climatol., 45, 455–466.

[2] Self-Organizing Map. Kohonen Teuvo, 2001. Springer, Berlin.

[3] Neural network model for atmospheric attenuation retrieval between 20 and 50 GHz by means of dual-frequency microwave radiometers. Barthès Laurent, Mallet Cécile and Gole Peter, 2003. RADIO SCIENCE, VOL. 38, 1082, 17 PP.