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Collocating satellite-based radar and radiometer measurements – methodology and usage examples.

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Collocations between two satellite sensors are occasions where both sensors observe the same place at roughly the same time. We study collocations between the Microwave Humidity Sounder (MHS) onboard NOAA-18 and the Cloud Profiling Radar (CPR) onboard the CloudSat. First, a simple method is presented to obtain those collocations. We present the statistical properties of the collocations, with particular attention to the effects of the differences in footprint size. For 2007, we find approximately two and a half million MHS measurements with CPR pixels close to its centrepoint. Most of those collocations contain at least ten CloudSat pixels and image relatively homogeneous scenes. In the second part, we present three possible applications for the collocations. Firstly, we use the collocations to validate an operational Ice Water Path (IWP) product from MHS measurements, produced by the National Environment Satellite, Data and Information System (NESDIS) in the Microwave Surface and Precipitation Products System (MSPPS). IWP values from the CloudSat CPR are found to be significantly larger than those from the MSPPS. Secondly, we compare the relationship between IWP and MHS channel 5 (190.311 GHz) brightness temperature for two datasets: the collocated dataset, and an artificial dataset. We find a larger variability in the collocated dataset. Finally, we use the collocations to train an Artificial Neural Network and describe how we can use it to develop a new MHS-based IWP product. We also study the effect of adding measurements from the High Resolution Infrared Radiation Sounder (HIRS), channels 8 (11.11 μm) and 11 (8.33 μm). This shows a small improvement in the retrieval quality. The collocations are available for public use.