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Precipitation retrievals from cross-track sensors: initial results and validation of the TROPICS precipitation product.

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The estimation of precipitation from satellite sensors is crucial for measuring precipitation at the global scale. Due to the variability of precipitation, both temporally and spatially, it is necessary to exploit observations from both passive microwave imaging and sounding instruments, as well as visible/infrared observations. While visible/infrared techniques provide frequent sampling with reasonable resolution, the relationship between the cloud top properties and surface precipitation are often poor. Passive microwave observations are sensitive to the presence of the precipitation particles themselves and therefore the observations are more directly related to the precipitation at the surface. Exploiting both passive microwave imagers and sounders is necessary to ensure reasonable temporal sampling. The compact nature of passive microwave sounders has allowed these sensors to be developed for cubesats, such as the Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS) mission. This mission comprises of a total of 7 cubesats, an initial pathfinder launched in June 2021, followed by 6 more to be launched mid-2022. The pathfinder is currently in a polar orbit while the following 6 satellites will be in a low-inclination orbit, providing frequent observations across the Tropics. Each cubesat carries a passive microwave sounder gathering observations from 91.665 GHz to 204.8 GHz in a cross-track scanning mode with spatial resolutions similar to the current Microwave Humidity Sounder sensors. The Precipitation Retrieval and Profiling Scheme (PRPS), initially developed for the larger sounding instruments, has been adapted for use with the TROPICS observations. The PRPS uses an a priori database against which observed radiances are compared and the associated precipitation intensities retrieved. Initial results from the pathfinder will be presented, together with validation against surface reference data sets. These results are promising and show that the retrievals are comparable with other passive microwave sounding instruments.