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Development of the SAPHIR Precipitation Retrieval and Profiling Scheme (PRPS).

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The retrieval of precipitation from all available precipitation-capable satellite sensors is critical to achieve adequate temporal and spatial sampling. To date the development of precipitation retrievals have concentrated upon the main passive microwave imaging and sounding sensors. A Global Precipitation Measurement (GPM)-lead scheme was developed for the Sondeur Atmosphérique du Profil d'Humidité Intertropicale par Radiométrie (SAPHIR) instrument, but was discontinued due to poor performance. A new scheme has subsequently been developed utilizing some of the aspects of the Goddard PROFiling (GPROF) scheme, but much simpler in operation and removing the need for dynamic model-derived constraints. The Precipitation Retrieval and Profiling Scheme (PRPS) utilizes all 6 channels of the SAPHIR instrument, together with static information on altitude and land/sea surface types. A database of surface precipitation and profiles is generated using coincident GPM Dual-frequency Precipitation Radar and SAPHIR observations. The database comprises of nearly 13 million profiles and is capable of being held within computer memory during processing, ensuring the efficient access to the retrievals. To further improve retrieval speed, the database is stratified land and ocean and by the two most disparate channels, in the case of SAPHIR, channels 1 and 6: an index provides a start and end point in the database and thus avoids searching irrelevant profiles; all six-plus years of SAPHIR data can be processed in under 24 hours. Each retrieval consists of the geolocation, an estimate of surface precipitation, profile number (to able to access the full vertical precipitation profile), a measure of uncertainty, a measure of 'fit' between the observation and the database profiles and a quality flag.

Results of the scheme have shown significant promise from instantaneous to monthly scales, particularly so considering that essentially only a single frequency (183 GHz) is utilized. However, the current version of the scheme does underestimate precipitation by about 20% primarily due to the averaging of the best six profiles, thus leading to a low-intensity bias: this will be addressed in future versions. Alongside the further development of the SAPHIR PRPS technique, a version is being implemented for the Microwave Humidity Sounder (MHS) and the Advanced Technology Microwave Sounder (ATMS). The PRPS technique will also be extended to observations from the Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS) mission once they are available.