Benefits of Assimilating SAPHIR Observations on Analysis and Forecasts of Tropical Fields in the Met Office Global Model

A. Doherty, S. India Rani, S. Newman, and W. Bell,
Quarterly Journal of the Royal Meteorological Society, (accepted)

Abstract: The SAPHIR instrument provides improved sampling of tropical atmospheric moisture vertically, horizontally and temporally. The impact of these unique characteristics is investigated through: an idealised study of retrieved humidity profiles; single observation experiments; assimilation experiments in a global NWP system; and an investigation into the spin-down of precipitation in the early phase of the forecast. SAPHIR offers improved performance over similar satellite instruments and beneficial impacts were found in all investigations. When assimilated in conjunction with observations from the microwave imager AMSR-2 the impact is further improved. Retrieval studies showed the errors in retrievals from SAPHIR were lower than those obtained from MHS or ATMS at all levels above 600 hPa. Single observation experiments showed that, when assimilated together with AMSR-2, AMSR-2 driven humidity increments were modified to give more realistic vertical structure. In assimilation experiments employing a near-operational configuration of the Met Office global model, the assimilation of clear-sky SAPHIR data improved the root-mean-square errors of a number of forecast metrics, most notably temperature at 250 hPa (improved by 2%), relative humidity at 500 hPa (2%) and wind at 500 hPa (1%) at forecast lead times of 12 and 24 hours. The results of this work form a clear recommendation for future remote sensing missions including both SAPHIR and AMSR-2 channel configurations.