Assimilating precipitation-sensitive observations in global weather forecasting

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Precipitation-sensitive observations are assimilated into global weather forecasting models to provide high-quality analyses of the current state of the atmosphere. At the European Centre for Medium-Range Weather Forecasts (ECMWF), passive microwave sensors are assimilated in all-sky conditions and provide around 30% of the impact on forecast quality, relative to the full global observing system. Forecasts are expected to benefit from the current renewal and expansion of the precipitation-sensitive observing system. This includes the transition to new microwave imagers such as AMSR3, WSFM-MWI and MWI (to be covered in another abstract), new sub-millimetre ice measurements from AWS and ICI, and more frequent coverage from small satellites. Precipitation assimilation is helped indirectly by developments targeting the low-frequency microwave, such as SMAP measurements at L-band. These developments will bring better use of precipitation-sensitive observations over difficult surfaces such as sea ice and snow, and improved techniques to identify Radio Frequency Interference (RFI). The operational assimilation of radar reflectivity from EarthCARE is expected shortly, with new information on the vertical placement of cloud and precipitation. The exploitation of Doppler fall speed information is also in development, along with many other observation sources. However, despite the wealth of new information on cloud and precipitation, current assimilation techniques do not address deficiencies in the forecast model itself. In particular, precipitation in the forecast remains strongly determined by the forecast model. So, for maximum impact on the quality of precipitation forecasts, the observations should also be used to improve the forecast model, especially the parameterisations of large-scale and convective cloud and precipitation. The rise of pure data-driven (machine learning) forecasting may be one way to address this issue. But a granular mix of data assimilation and machine learning is likely to provide a more physically-informed and detailed representation of observed and forecast precipitation.

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