

# Susan Rennie (Bureau of Meteorology)

## Assimilating radar data in ACCESS Numerical Weather Prediction

### Abstract:

Weather radar observations are the primary source of information about rainfall at the storm scale. These observations are used to adjust the precipitation in the Bureau's convection-allowing numerical weather prediction systems. In the current operational convection-allowing numerical weather prediction system (APS3 ACCESS-C), this takes the form of 15-minute rainfall accumulations which are ingested using Latent Heat Nudging (LHN). This relatively old nudging method is able to influence the generation and suppression of rainfall in the model, to adjust the simulated precipitation closer to what is observed. This method will be retired with the Met Office's Unified Model (UM), and precipitation information must be assimilated in other ways.

Recently, the direct assimilation of radar reflectivity for the UM has been developed (Hawkness-Smith & Simonin, 2021). In contrast to LHN, this involves including reflectivity observations along with all other observations in a 4D-Var assimilation step, to adjust the model initial conditions in a more physically consistent way. Reflectivity assimilation presents various challenges. It is a non-linear and discontinuous observation type, which means that the observed and modelled reflectivity can disagree substantially due to mislocated precipitation or differences in intensity. These large discrepancies make it difficult for the assimilation to find an optimal solution to the minimisation problem. Additionally, the radar coverage and radar skill are constrained by radar data quality and the disposition of the weather radar network.

Results from several radar data assimilation trials will be presented, with a focus on how the model precipitation in runs with reflectivity assimilation is adjusted compared to LHN. Considerations for implementation in future operational NWP systems will be discussed.

### Reference:

Hawkness-Smith, L. D. and Simonin, D. (2021) Radar reflectivity assimilation using hourly cycling 4D-Var in the Met Office Unified Model. QJRMS, 147, 1516-1538. <https://doi.org/10.1002/qj.3977>.