



## Assimilation of cloudy AIRS radiances

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The initial use of AIRS radiances at NWP centres required rigorous cloud detection to be applied. The details varied between centres, but for all the amount of cloud-free AIRS data assimilated for lower troposphere sensing channels was very small (less than 10%). At some centres (e.g. ECMWF) an attempt was made to only reject channels at wavelengths where atmospheric opacity above the cloud top was significantly less than unity. The "significance" here can be taken as a requirement that the radiometric effect of the cloud was less than or equal to the cloud-free observation error. However even for these schemes mid to upper tropospheric sensing channels have data voids in the AIRS data assimilation due to cloud detection. In the study presented here a different approach was taken to assimilation of radiances in the presence of cloud. Simulated cloudy AIRS observations were generated from a dataset derived from ECMWF model profiles of temperature, humidity and cloud by Chevalier (2001). Realistic observation errors were added to the simulated data, and temperature, water vapour and cloud fraction profiles were analysed in 1D-var. The data were then passed through a second 1D-var with cloud screening based on the analysed cloud field but also passing the analysed cloud as a fixed estimate to be used in the second 1D-var. The second 1D-var is intended to simulate a 4D-var assimilation system. The results show that useful information is analysed at all levels to cloud top and even below cloud top (arising from cases where cloud fraction is low). The analysis in the cloudy areas is of a comparable quality to that in cloud-free areas.