NWPSAF 1D-Var User Manual

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This software and documentation was developed within the context of the EUMETSAT satellite Application Facility (NWP SAF). The partners in the NWP SAF are the Met Office, ECMWF, KNMI, and Météo-France.

Appendix D. Microwave Cloud Liquid Water Retrievals

If the parameter `Cloud_Liquid_Water` is requested to be retrieved in the Retrievals.NL namelist, the 1DVar code retrieves either Liquid Water Path or Qtotal depending on the value for Lqtotal given through the ControlData.NL. The retrieval code follows the one implemented in the deprecated SSMIS 1D-Var package but the minimisation routines which are used came from the Met Office 1D-Var. In this case the internal logical variable `MwClwRetreival` is set to `.TRUE.` If Lqtotal is set to 0, LWP is retrieved and if Lqtotal is set to 1, Qtotal will be retrieved.

The differences in processing when cloudy retrievals are used are:

- Background Profile should contain cloud liquid water profile in kg/kg.

- Bmatrix element is diagonal with no correlation to any other variables, and is hence set to a fixed value of 0.2, which is hardcoded.

- For LWP retrievals, the first guess is set to a fixed value 0.1 kgm^{-2}, which is also hardcoded.

   (Both these values are inherited from the SSMIS 1Dvar)

For LWP retrieval, during the minimization process, LWP is allowed to vary while a cloud structure S(i) remains fixed

$S(i)=clw(i)/LWP$, where *i* stands for pressure levels and *clw* for cloud liquid water profile.

Qtotal is defined as the sum of the water vapor content (q) and cloud liquid water content (clw). Instead of *ln(q), ln(qtotal)* is retrieved. The dependence of q and clw on qtotal is such that, below a threshold value of relative humidity of 95% q=qtotal. Between RH values of 95% and 105%, qtotal is split half way between q and clw. Above 105%, q is fixed and any excess water is clw.

It is recommended that Marquardt-Levenberg minimisation is used for cloudy retrievals.

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