Active assimilation of MHS channel 5 (the lowest-peaking in the water vapour band) over land

Here we discuss the impact in NWP of enhancing the use of MHS observations over land. A set of 3 month experiments were run with/without the assimilation of MHS channel 5 (channel 5 experiment/control experiment):

- for low orography, skin temperature >278 K,
- and with dynamically retrieved emissivities [1] (i.e. retrieved from observations at 89GHz, surface emission and reflection). Experiments were run in two periods (following the work in [2]):
  - summer (July, August, September 2006),
  - summer (June, July, August/1) 2011 with a richer observational system than in the 2006 experiments.

Mean difference between the TCWV analysis in the channel 5 experiment and the control experiment averaged over August 2006. The red dots indicate the location of GPS stations.

The impact on the forecast skill of assimilating MHS channel 5 is neutral to positive for different variables: temperature, wind, soil moisture, and sea ice. The systematic drying over Central Africa during the whole diurnal cycle is consistent with the measurements at the IGS (4) station in Gabon in the 2006 period (see Figure 6). Both the channel 5 experiment and the control experiment show variations of TCWV during the day which follow well what is measured by the GPS stations.

Validation against GPS TCWV

The assimilation of just one extra MHS channel over land has a relevant impact on the mean humidity analysis in both the 2006 and 2011 period (see Figure 7 and Figure 8).

The assimilation of channel 5 improves the fit to MERIS TCWV in part of Central Africa (see Figure 6 and Figure 7), and greater number of MERIS observations are assimilated in the same area.

The assimilation of channel 5 improves the fit to MSEI-MSF over land from May 2012 onwards. The impact on the forecast skill of assimilating MHS channel 5 is neutral to positive for different variables and forecast ranges, which is consistent with a relatively small impact of these observations on the analysis.

Conclusions

MHS channel 5 will be operationally assimilated at ECMWF also over land from May 2012 onwards. The impact on the forecast skill of assimilating MHS channel 5 is neutral to positive for different variables and forecast ranges, which is consistent with a relatively small impact of these observations on the analysis.

Active assimilation of MHS water vapour channels over sea ice

A set of data assimilation experiments were run with/without the active assimilation of MHS channel 3 and 4 (the high peaking channels in the water vapour band) over sea ice (sea ice experiment/control experiment):

- dynamic emissivities [4] retrieved at 157GHz (channel 2) are used for the other MHS channels over sea ice,
- the use of MHS water vapour channels is extended also over cold sea (i.e. skin temperature < 278 K).

The assimilation of channel 4 in the sea ice experiment before bias correction.

Conclusions

MHS channels 3 and 4 are good candidates to be assimilated at ECMWF also over sea ice, while the active assimilation of MHS channel 5 requires a better estimation of surface emissivity and cloud screening.

References


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