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Influence of ECMWF background error covariances on the retrieval of temperature and humidity by the HAMP radiometer.

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Profiles of temperature (T) and humidity (Q) are fundamental for weather forecasting, climate monitoring as well as the interpretation of remote sensing instrument measurements. Radars, for example, rely on the accurate knowledge of T and Q profiles to calculate the attenuation of the emitted pulses and for the discrimination between liquid and solid targets. Since direct measurements of these variables by radiosondes and dropsondes are rather limited in space and time, passive microwave observations are routinely used to retrieve such profiles with improved temporal resolution and spatial coverage.
Bayesian retrieval algorithms typically blend instrumental measurements and a-priori information into the most probable solution for the retrieved variable. For such algorithms the knowledge of a-priori and measurement errors plays a fundamental role. They govern the weight given to the measurements and to the a-priori information on the retrieved variable and thus they need to be properly assessed.
In this work we present an 1-D variational assimilation algorithm to retrieve profiles of temperature and humidity for an AMSUA-MHS-like radiometer. ECMWF 3-hour forecast profiles of temperature and humidity are used as a-priori information. Vertical error correlation matrices and standard deviations of the a-priori profiles are derived from ECMWF ensemble data assimilation system using the method described by Holm and Kral (2012).
The retrieval is applied to brightness temperatures collected during an aircraft campaign and validated against measurements from dropsonde launched during the flights. The information content added by the radiometer measurements to the a-priori profiles is assessed. In addition, a sensitivity study is performed on the dependency of the added information content with varying a-priori standard deviations.
The radiometer used for the algorithm validation is the passive component of the HAMP instrument (Microwave Package for HALO, the High Altitude Long Range aircraft), which consists of a 36 GHz Doppler cloud radar and a 26-channel radiometer. The HAMP radiometers have frequencies along absorption lines (22, 60, 118 and 183 GHz) and in window regions, overlapping with those of AMSUA and MHS.
HAMP flew during a test campaign over Germany in June and July 2013 and will participate in December 2013 and January 2014 in the dedicated remote sensing HALO mission NARVAL (Next-generation Aircraft Remote-sensing for VALidation studies). During the NARVAL campaign HALO will be flown over Northern and Tropical Atlantic, giving the opportunity to test the newly developed retrieval algorithm in different environmental conditions.