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# Possibilities to assimilate microwave radiance observations (AMSU-B) in NWP using Ensemble Kalman filter techniques

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It is well known that microwave radiance observations (AMSU-B) could provide NWP with valuable information about vertical profiles of humidity. However, the observation operator that relates the observations with the model state variables is highly non-linear. This makes the extraction of information about humidity profiles less straightforward. Any Kalman filter data assimilation procedure consists of two main steps. The first step is the filtering of observation errors, which is performed in the space of observations under Gaussian assumptions for distributions of both forecast errors and observation errors. The second step is the solution of an inverse problem, which means prediction of the model state variables from the result obtained by the first step in the space of observations, and this is done by a linear regression technique. Dealing with microwave radiance observations (AMSU-B), these both assumptions are violated. The main aim of the paper is to investigate performance of different regression methods, which can be used in solving the inverse problem: the generalized least square methods (principle component regression and partial least square regression) and the non-linear regression method (a spline smoothing and a kernel regression). The performance of the standard least square technique looks quite promising and has its main strength in the ability to treat multivariate information. The partial least square regression can be efficiently used to reduce the dimensionality of problem and the principle component regression helps interpreting results. The efficiency of a spline smoothing and a kernel regression performance depends on the optimality in the choice of parameters, and this is computationally expensive. The inverse problem is solved assuming that the Gaussian assumptions on distributions in observation space are feasible. Some methods to investigate the feasibility are discussed in the paper. The experiments are

performed under the framework of a square-root Kalman filter with the localized influence of observations applied to a limited area numerical weather prediction model. Simulated radiance observations are used in the study.