

# Spatial satellite observation-error statistics for AMSU-A data

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## 1 Motivation

In the past, meteorological observations were scarce and inaccurate (as compared to the background). All we needed to know to optimally interpolate the observational information to grid points was observation-error *variances* and background-error *covariances*. Now, the situation is different. Satellite observations are comparable with the background both in accuracy and numbers. In addition, satellite observations, like the background, have spatially correlated errors due to state-dependent imperfections in their observation operators. As a result, poorly known and largely disregarded spatial statistics for satellite data seems to be now of comparable importance for data assimilation as the widely used background-error statistics.

The aim of this study is to objectively estimate the satellite observation-error spatial statistics for microwave AMSU-A observations known to be one of the most influential sources of observational information for numerical weather prediction.

## 2 Methodology

We compare bias-corrected satellite observations  $X_{sat}^{obs}$  with collocated radiosonde data  $X_{sond}^{obs}$  computing the differences  $d = X_{sat}^{obs} - \mathcal{H}(X_{sond}^{obs})$ , where  $\mathcal{H}$  is the satellite observation operator. Our satellite bias-correction scheme ensures that  $d$  is unbiased. Averaging  $d_i \cdot d_j$ , where  $i \neq j$  are indices of collocated pairs, we compute estimates of horizontal and inter-channel covariances for  $d$ . Our basic assumption is that errors of different radiosonde profiles are uncorrelated, which implies that covariances of  $d$  coincide with satellite-error covariances we seek to estimate.

Raw estimates of spatial covariances are smoothed with a moving-average filter and approximated by a truncated Fourier-Legendre series with non-negative coefficients (which yields positive definiteness).

To estimate the ‘white’ (spatially uncorrelated) satellite error component, we estimate horizontal covariances of satellite-minus-background differences,  $d_b = X_{sat}^{obs} - \mathcal{H}(X^b)$ , extrapolate the resulting covariance to zero distance, and compare the result with the variance of  $d_b$ . Here, our hypothesis is that background errors have no spatially uncorrelated component.

## 3 Data

AMSU-A (onboard NOAA-18) channels 6-9 are examined. The following radiosonde types are used: Vaisala, Sippican, VIZ, MODEM, Meisei, and Graw. We also use the 6-h. NCEP GFS forecast as the background.

## 4 Results

We present some selected preliminary results for 6 months of data (January-June, 2008). From the figures below, we see that both inter-channel and horizontal satellite-error correlations appear to be quite broad and more or less comparable with background-error temperature correlations. This suggests that allowing for these observation-error correlations in an analysis scheme will be beneficial.

In more detail, the results will be reported in a paper in preparation.

