Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 6, 831-846, 2006
www.atmos-chem-phys.net/6/831/2006/

Technical note: analytical estimation of the optimal parameters for the EOF retrievals of the IASI Level 2 Product Processing Facility and its application using AIRS and ECMWF data

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Abstract. The Empirical Orthogonal Function (EOF) retrieval technique consists of calculating the eigenvectors of the spectra to later perform a linear regression between these and the atmospheric states, this first step is known as training. At a later stage, known as performing the retrievals, atmospheric profiles are derived from measured atmospheric radiances. When EOF retrievals are trained with a statistically different data set than the one used for retrievals two basic problems arise: significant biases appear in the retrievals and differences between the covariances of the training data set and the measured data set degrade them.

The retrieved profiles will show a bias with respect to the real profiles which comes from the combined effect of the mean difference between the training and the real spectra projected into the atmospheric state space and the mean difference between the training and the atmospheric profiles.

The standard deviations of the difference between the retrieved profiles and the real ones show different behavior depending on whether the covariance of the training spectra is bigger, equal or smaller than the covariance of the measured spectra with which the retrievals are performed.

The procedure to correct for these effects is shown both analytically and with a measured example. It consists of first calculating the average and standard deviation of the difference between real observed spectra and the calculated spectra obtained from the real atmospheric state and the radiative transfer model used to create the training spectra. In a later step, measured spectra must be bias corrected with this average before performing the retrievals and the linear regression of the training must be performed adding noise to the spectra corresponding to the aforementioned calculated standard deviation. This procedure is optimal in the sense that to improve the retrievals one must resort to using a different training data set or a different algorithm.

Final Revised Paper (PDF, 1269 KB) Discussion Paper (ACPD)

Citation: Calbet, X. and Schlüssel, P.: Technical note: analytical estimation of the optimal parameters for the EOF retrievals of the IASI Level 2 Product Processing Facility and its application using AIRS and ECMWF data, Atmos.

Chem. Phys., 6, 831-846, 2006. Bibtex EndNote Reference Manager