Algorithm

KOPRA (The Karlsruhe Optimized and Precise Radiative transfer Algorithm) is a layer by layer line by line radiative transfer code for calculation of atmospheric transmission and radiances spectra along with the partial derivatives of the spectra with respect to atmospheric state parameters. The KOPRA forward model has been developed in particular for analysis of data from SAPHIR instrument on Envisat and has been used for different feasibility and sensitivity studies in this context.

The forward model was compared to other models and validated by IASI Sounder Science working group.

The retrieval tool KOPRAFT based on this model applied the \( T_0 \) method in contrast with probabilistic approach (optimal estimation methods) use analytically defined constraints in the ill-posed problems solution. The optimized value here is not only a posteriori error of the retrieval, but also the Degree Of Freedom for the solution.

The main reason for which we use the \( T_0 \) method is less dependent on the ozone statistics. Available statistics may have following problems:

- Available statistical covariances are not always invertible
- Available statistical covariances can have unwanted correlations
- Available statistical covariances are uncertain, especially in the troposphere

Regularization methods in contrast with probabilistic approach (optimal estimation methods) use analytically defined constraints in the ill-posed problems solution. The \( T_0 \) method here is not only a posteriori error of the retrieval, but also the Degree Of Freedom for the solution.

The standard case of regularization is the Tikhonov-Phillips method with the diagonal constraint matrix and one adjustable parameter called the strength of regularization. We use a more sophisticated form which consists in applying an altitude dependent constraint to constrain the different parts of the atmosphere with different strengths. Regularization method may retain an enlarged freedom for the solution in spite of known low variability and therefore may be more adapted for unexpected climatological conditions.

Method

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