# T3.3-P12. Hierarchical prior for source term determination and its Variational Bayes estimation

Tools for fusion of atmospheric transport models with data are of a great importance in many fields where characteristics of a source term are sought. Theoretically, as the most promising seem to be tools based on Bayesian analysis. Their most appealing feature is the inherent capability to treat the full probability distributions of involved uncertainties. Since the output is a posterior probability distribution, probabilistic interpretation of results can be drawn. However, practical application of Bayesian methods can be difficult because a proper specification of a prior distribution is needed. Particularly in the case of continuously operating non-supervised analysis tools must be ensured that the prior selection procedure is robust enough to work under various circumstances. A solution to this problem can be use of simple parameterized priors. We present a method based on prior hyper-parametrization and estimation of these parameters using Variational Bayes method. The method can be applied in different setups with different complexities: from estimation of diagonal elements of a covariance matrix under the assumption of homoscedasticity (having the same variance) up to estimation of all elements of a covariance matrix (given a large number of data). The method will be demonstrated on an example.

**Primary author:**   HOFMAN, Radek (CTBTO)

**Presenter:**   HOFMAN, Radek (CTBTO)

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