EGU21-4029
https://doi.org/10.5194/egusphere-egu21-4029
EGU General Assembly 2021

Inverse modeling of halocarbons: sensitivity to the baseline definition

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The identification of the baseline is an important task in inverse modeling of greenhouse gases, as it represents the influence of atmospheric chemistry and transport and surface fluxes from outside the inversion domain, or flux contributions prior to the length of the backward calculation for Lagrangian models. When modeling halocarbons, observation-based approaches are often used to calculate the baseline, although model-based approaches are an alternative. Model-based methods need global unbiased fields of mixing ratios of the observed species, which are not always easy to get and which need to be interfaced with the model used for the inversion. To find the best way to identify the baseline and to investigate whether the usage of observation-based approaches is suitable for inverse modeling of halocarbons, we use and analyze a model-based and two frequently used observation-based methods to determine the baseline and investigate their influence on inversion results. The model-based method couples global fields of mixing ratios with backwards-trajectories at their point of termination. We simulate those global fields with a Lagrangian particle dispersion model, FLEXPART_CTM, that uses a nudging routine to relax model data to observed values. The second method under investigation is the robust estimation of baseline signal (REBS) method, that is purely based on statistical analysis of observations. The third analyzed method is also primarily observation-based, but uses model information to subtract prior simulated mixing ratios from selected observations. We apply those three methods to sulfur hexafluoride (SF_6) and use the Bayesian inversion framework FLEXINVERT for the inverse modeling and the Lagrangian particle dispersion model FLEXPART to calculate the source-receptor-relationship used in the inversion.