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Constraining sources, transport pathways and process parameters on various scales by atmospheric Lagrangian inversions

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Inverse methods have become widely used tools to infer sources and sinks of atmospheric constituents based on observations. Inversion techniques can also help to better constrain input and process parameters and thus improve the underlying models. While the majority of today's inverse model frameworks use the Eulerian concept of transport, the capability of Lagrangian inversion to infer emissions of even ill constrained sources has been demonstrated (e.g. Stohl et al., 2011).
We will discuss Lagrangian inverse modelling as a powerful tool to solve problems on a wide range of scales in terms of spatial and temporal extent as well as complexity. First, two distinct applications on different scales will be presented: i) the retrieval of reaction rates that govern the chlorine catalyzed ozone destruction in the polar winter along individual trajectories connecting airborne observations in the Arctic in 2010, and ii) the derivation of emission altitudes and transport pathways of sulfate aerosol from the 2011 eruption of the Nabro volcano using CALIPSO satellite observations. Second, the potential and requirements for applications at even higher complexity, e.g. simultaneously retrieval of source, sink and process parameters on a global scale, will be explored.

Stohl, A., et al. 2011. Atmospheric Chemistry and Physics 11, 4333-4351.