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Inverse constraints for emission fluxes of atmospheric tracers estimated from concentration measurements and Lagrangian transport

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Lagrangian transport models based on times series of Eulerian fields provide a computationally affordable way of achieving very high resolution for limited areas and time periods. This makes them especially suitable for the analysis of point-wise measurements of atmospheric tracers. We present an application illustrated with examples of greenhouse gases from anthropogenic emissions in urban areas and biogenic emissions in Japan and of pollutants in the Arctic. We asses the algorithmic complexity of the numerical implementation as well as the use of non-procedural techniques such as Object-Oriented programming. We discuss aspects related to the quantification of uncertainty from prior information in the presence of model error and limited number of observations. The case of non-linear constraints is explored using direct numerical optimisation methods.