Geophysical Research Abstracts
Vol. 18, EGU2016-13121-1, 2016
EGU General Assembly 2016

Lagrangian modeling of global atmospheric methane (1990-2012)

Florian Arfeuille, Stephan Henne, and Dominik Brunner
EMPA, Switzerland (florian.arfeuille@empa.ch)

In the MAIOLICA-II project, the lagrangian particle model FLEXPART is used to simulate the global atmospheric methane over the 1990-2012 period. In this lagrangian framework, 3 million particles are permanently transported based on winds from ERA-interim. The history of individual particles can be followed allowing for a comprehensive analysis of transport pathways and timescales. The link between sources (emissions) and receptors (measurement stations) is then established in a straightforward manner, a prerequisite for source inversion problems. FLEXPART was extended to incorporate the methane loss by reaction with OH, soil uptake and stratospheric loss reactions with prescribed Cl and O(1d) radicals.

Sources are separated into 245 different tracers, depending on source origin (anthropogenic, wetlands, rice, biomass burning, termites, wild animals, oceans, volcanoes), region of emission, and time since emission (5 age classes). The inversion method applied is a fixed-lag Kalman smoother similar to that described in Bruhwiler et al. [2005].

Results from the FLEXPART global methane simulation and from the subsequent inversion will be presented. Results notably suggest:
- A reduction in methane growth rates due to diminished wetland emissions and anthropogenic European emission in 1990-1993.
- A second decrease in 1995-1996 is also mainly attributed to these two emission categories.
- A reduced increase in Chinese anthropogenic emissions after 2003 compared to EDGAR inventories.
- Large South American wetlands emissions during the entire period.

Bruhwiler, L. M. P., Michalak, A. M., Peters, W., Baker, D. F. & Tans, P. 2005: An improved Kalman smoother fore atmospheric inversions, Atmos Chem Phys, 5, 2691-2702.