Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03689, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03689
EGU General Assembly 2008

Global source identification of Arctic air pollution using statistical analysis of particle dispersion model output and measurement data

D. Hirdman (1), J.F. Burkhart (1), S. Eckhardt (1), H. Sodemann (1), A. Stohl (1)
(1)Norwegian Institute for Air Research, Norway (dhi@nilu.no)

Arctic air pollution has received renewed interest recently because of its contribution to climate change in the Arctic. Nevertheless, its sources are still not known with sufficient accuracy. Most of our understanding of Arctic air pollution sources is based on model simulations, analysis of air pollution episodes or, at best, statistical analysis of air mass back-trajectories. We present a new approach, namely combining the output of a Lagrangian particle dispersion model, FLEXPART, with measurement data from Arctic air pollution monitoring sites (Alert, Barrow, Zeppelin). This approach is similar to existing statistical methods for analyzing back-trajectories in conjunction with air pollution monitoring data. However, it has the advantage that the underlying model calculations also take into account turbulence and convection in the atmosphere, which are ignored by ordinary trajectory calculations. FLEXPART is run 20 days backward in time from each of the stations and every three hours, for several years. With every calculation, a so-called potential emission sensitivity (PES) field is obtained, which identifies where the measured air mass has come into contact with the Earth's surface. It quantitatively measures the sensitivity of the signal obtained at the station, to emissions occurring at or near the surface. By combining these PES fields with measured concentrations of several trace species and performing a statistical analysis, we identify where the measured species originate. Statistical analyses are performed both for average concentrations as well as the 10th and 90th percentiles of the measured frequency distribution. We show results for black carbon (BC), carbon monoxide (CO) and ozone (O_3) for every station individually as well as by combining data from all stations, both yearly and for different seasons of the year. We find strong differences

in source regions between the 10th and 90th percentiles, in particular for CO.