

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

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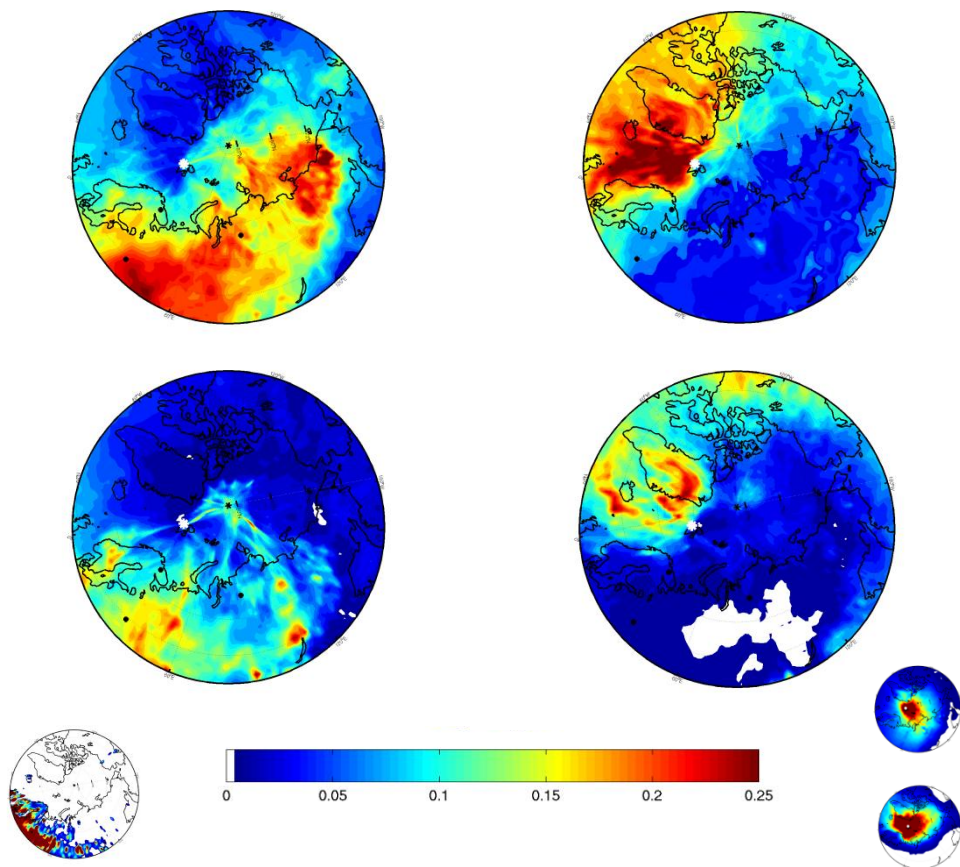
## Conclusion:

By combining potential sensitivity fields from FLEXPART with measurement data, an emission inventory and statistical analysis, we find strong differences in source regions between clean (10<sup>th</sup> percentile) and polluted (90<sup>th</sup> percentile) air masses arriving at Zeppelin, Spitsbergen. The preferred transport routes of air masses into the lower Arctic troposphere over a 5-15 year period, agree quite well with earlier studies (1,2,3).

It confirms Europe as the main source region for this part of the Arctic atmosphere during autumn, winter and spring.

## References:

- (1) Barrie L.A., Atmos. Environ., 20, 643 (1986)
- (2) Klonecki A. et.al., J. Geophys. Res., 108 (2003)
- (3) Stohl A., J. Geophys. Res., 111 (2006)



Source sensitivity maps in fraction of the total flow for CO (below) and sulphate (above) for the arctic station Zeppelin, with source regions for “polluted” air to the left and “clean” air to the right.

## Method:

FLEXPART (LPDM) is run 20 days backward in time from the Zeppelin station every three hours, for more than 15 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 near the surface. By combining these PES fields with measured concentrations of several trace species (shown here CO and Sulphate) we identify where the measured species most likely originates from.

Statistical analyses are performed both for average measured concentrations as well as for the 10<sup>th</sup> and the 90<sup>th</sup> percentiles of the measured frequency distributions. Selected PES fields are normalized with the total PES field.

## Results:

With the use of these maps in combination with an emission inventory map we are able to weight each source region’s long-term contribution to the pollution events in the Arctic. We are able to identify the main source regions to stretch from central Europe to north-western Asia. For sulphate we also see indications of contribution from eastern Asia.