Name of research institute or organization:

EMPA Dübendorf, Swiss Federal Laboratories for Materials

Title of project:

Monitoring of halogenated greenhouse gases

Project leader and team:

Stefan Reimann, project leader; Konrad Stemmler, scientist; Daniel Schaub, scientist; Andrea Weiss, scientist.

Project description:

Since January 2000 halogenated greenhouse gases are continuously measured by gaschromatography-mass spectrometry (GCMS) at the high Alpine station of Jungfraujoch. These measurements are a part of a Swiss National project to estimate the Swiss source strengths of these gases as well as a part of the EU-project **SOGE** (System for Observation of Halogenated Greenhouse Gases in Europe).

Both projects have the aim of estimating emissions of these gases down to a regional scale. At Jungfraujoch as the receptor, the emission source strengths of these gases from different parts of Europe are represented by distinct fluctuations of the concentrations. Figure 1 shows the time series of the mixing ratios of HFC 125, CFC 115, and halone 1211 from July 2000 to October 2001 as illustrative examples for our measurements. It is apparent that the time series of the specific compounds differ with respect to the magnitude and frequency of pollution events monitored at the Jungfraujoch station. For example CFC's or halones show no major excursions from the tropospheric background concentrations anymore, reflecting their strongly reduced emissions since the regulations of the Montreal protocol.
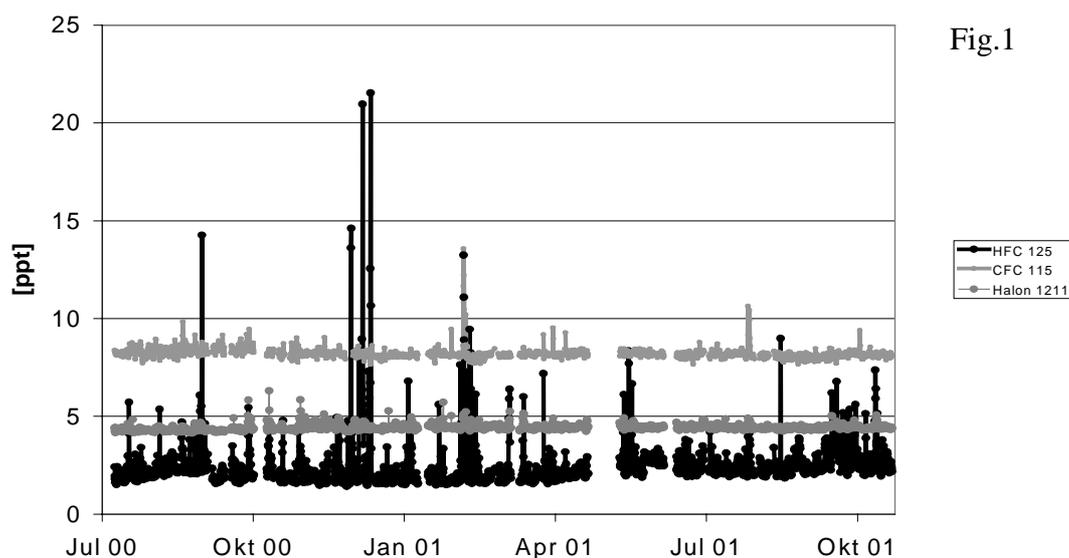

Fig.1

In combination with trajectory models the polluted cases are used to estimate the emissions of these gases down to the regional European scale. First results of the relative contribution of different European source regions to the concentrations

observed at the Jungfraujoch station for these gases are shown in Figure 2 as an example for the hydrofluorocarbon 134a.

HFC 134a is the most frequently used hydrofluorocarbon in Europe. It is mainly used as a refrigerant. Figure 2a shows that the mixing ratios of this compound can occasionally reach several hundred ppt at the Jungfraujoch station. During the measurement period from January 2000 to December 2001 its tropospheric background concentration has risen from 14 ppt in the beginning of 2000 to 23 ppt at the end of 2001 (i.e. an increase of ca. 30 % per year), which reflects its wide use. Figure 2B shows preliminary results from a simple trajectory statistic model applied to the whole data set for HFC 134a. The results of the model indicate that the main source regions of the HFC 134a pollution at the Jungfraujoch lie in southern direction (e.g. Po valley) or in south-western direction. A weaker source region may lie in northern direction (e. g. Germany, Benelux or Great Britain). HFC 134a is a purely anthropogenic pollutant. Therefore the regions indicated as off-shore sources of HFC 134a (e.g. Adriatic and Tyrenic Sea) are thought to result from the restricted distance resolution of this model in combination with a single observation site. Therefore an improvement of the results in the future is expected from a refinement of the model and from the incorporation of the data of the other SOGE-observation sites located at Mace Head, Ireland; at Spitsbergen, Norway; and at Monte Cimone (2000 m asl.), Italy. Furthermore, it is planned to use these data together with a particle model, which also would lead to a better spatial resolution of the estimated emissions.

Fig. 2A

Fig. 2B

Arbitrary units
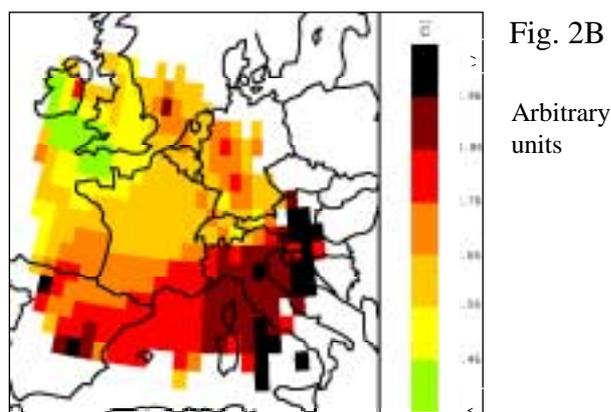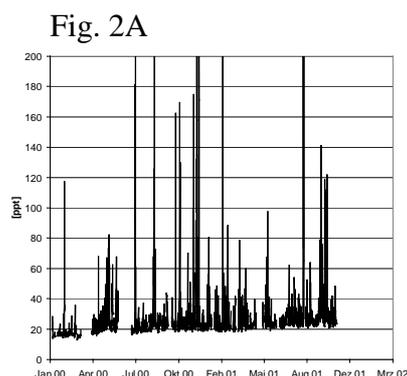
Key words

Greenhouse gases, halogenated hydrocarbons, CFC, HCFC, HFC, trajectory model, Kyoto Protocol

Collaborating partners/networks:

EU-project: SOGE (System for observation of greenhouse gases in Europe)

Scientific publications and public outreach 2001:

Preliminary results presented at the 8th European Symposium on the Physico-Chemical Behaviour of Atmospheric Pollutants; 17-20 September 2001, Torino (It).

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