

Top-down assessment of European halocarbon emissions



Materials Science & Technology

Stefan Reimann, Martin K. Vollmer, Doris Folini, Martin Steinbacher
Empa,
Swiss Federal Laboratories for Materials Testing and Research, Switzerland

Abstract

European and Swiss emissions of halocarbons are estimated by long-term measurements at a remote Alpine site (Jungfraujoch) and in the polluted boundary layer (near Zurich). Emissions are still present for CFCs and other compounds banned within the Montreal Protocol - although to a declining extent. On the other hand, emissions of substitutes such as HFCs are growing due to their increased usage.

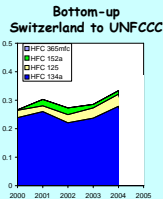
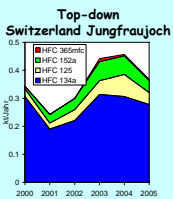
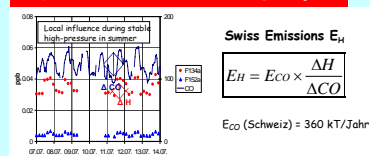
Conclusions

Continuous measurements within the polluted boundary layer and at background sites, which are at least sometimes influenced by regional emissions have the potential to be used as an independent tool for validation of regional emissions. Furthermore, these measurements can be used as an early detection system for newly produced compounds.

In the future a combination of different European sites with various influences of pollution could be used for the validation of greenhouse gas emissions to be supplied within the Kyoto-Protocol.

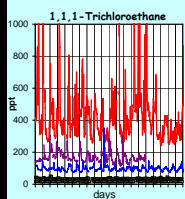
Swiss Emissions

Top-down Estimation from Jungfraujoch

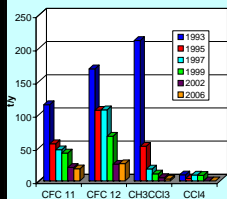


A comparison between the estimates from Jungfraujoch (top-down) and those from the Swiss Environmental Agency (FOEN) (bottom-up) show reasonable agreement for the HFCs, except for HFC 152a, which however has a small contribution to climate warming.

Top-down Estimation within Boundary Layer



During summer nights concentrations at a suburban site near Zurich increased during stable meteorological conditions. This represents fugitive emissions from in-use halocarbons and is shown for the formerly used solvent 1,1,1-trichloroethane (CH_2Cl_2).



By assuming a stable boundary layer height in different years the emissions could be compared. From 1993-2006 a substantial decline of emission for ozone-declining substances could be observed in Switzerland.

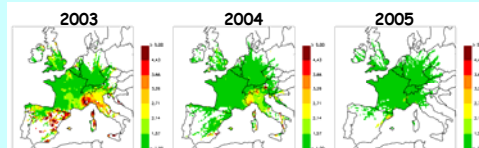
European emissions

Localization of Emissions:

1. Separation of pollution events from background
2. Connection of pollution events with concurrent trajectories
3. Averaging over time periods of years

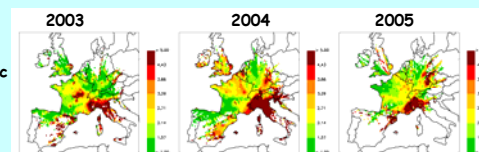


The foam blowing agents HCFC 141b and HFC 365mfc



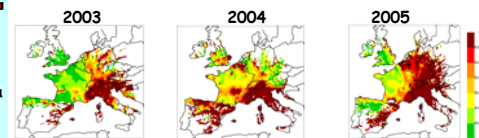
HCFC 141b was forbidden from usage in Europe in 2003. Emissions are still visible in 2003 from Northern Italy, where foam blowing industries are situated. Afterwards emissions decline fast, in compliance with the Montreal Protocol.

HCFC 141b
HFC 365mfc



HFC 365mfc (pentafluorobutane) is used as a substitute for the forbidden HCFC 141b. Emissions from Northern Italy are substantial after 2003. Interestingly the source in France points at the only factory worldwide, which produces HFC 365mfc.

The foam blowing agent HFC 152a



HFC 152a is used in insulation foams. European emissions are more or less equally distributed. A comparison with country-based emission estimates submitted to the UNFCCC shows obvious mistakes of the inventory (viz. Germany and Italy)

2003 National Communications to UNFCCC

Austria	520 t
Belgium	330 t
Netherlands	4 t
Germany	1880 t
France	460 t
Italy	0 t

Contact:

Stefan Reimann, e-mail: stefan.reimann@empa.ch, phone: +41 44 823 46 38