JRA 5/WP17 Basis:
Measurement platforms in Europe

On-line

Off-line

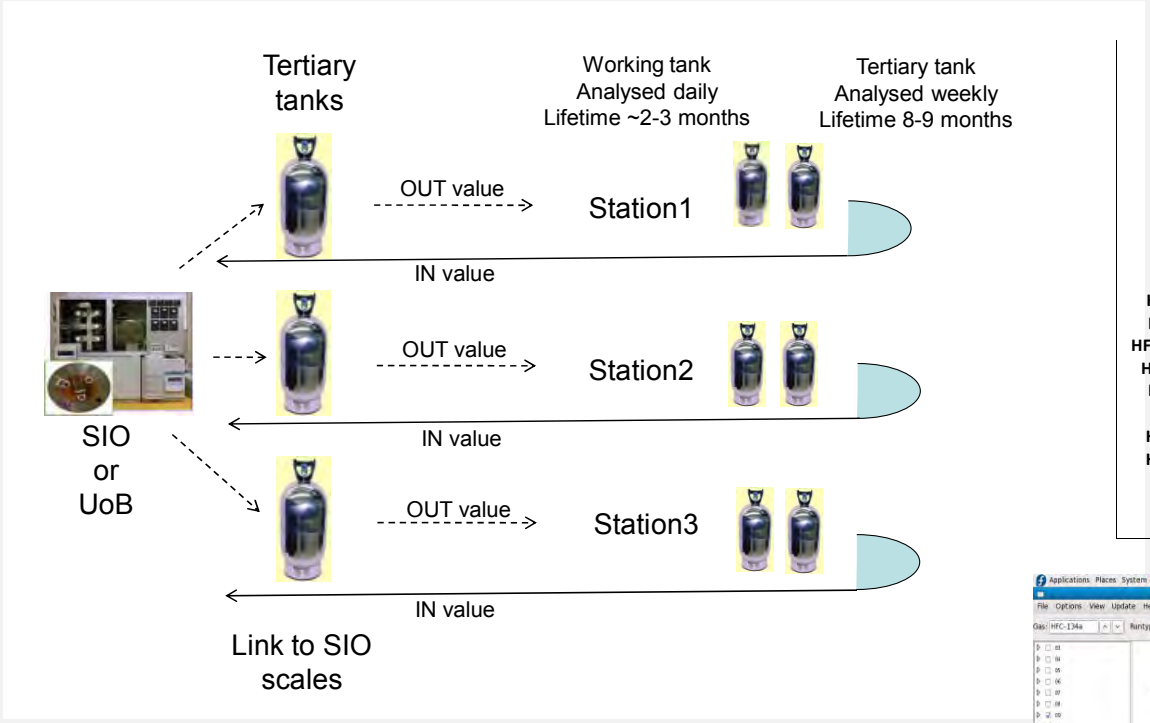
Overview WP4/NA4

- To Establish a calibration matrix that relates the calibration scales of each laboratory to one another. This will enable the creation of an integrated, European halocarbon database

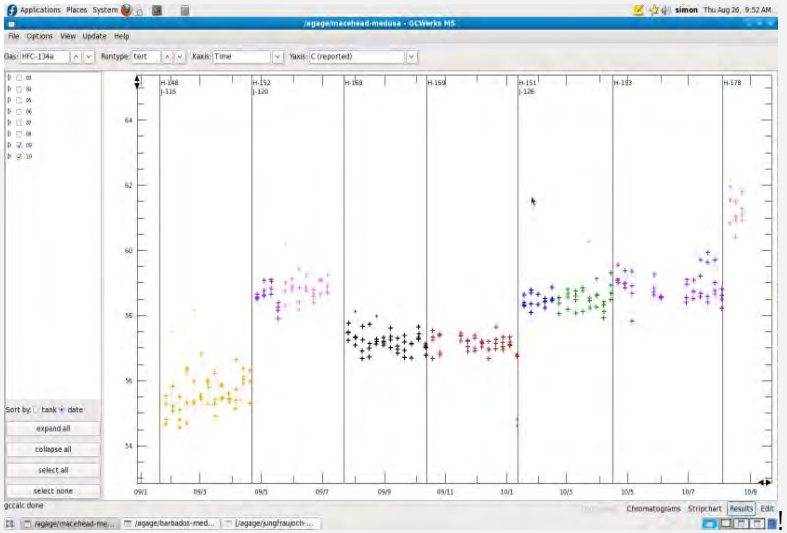
- To Establish a quality assurance system for European halocarbons measurements with a calibration standard center and a system of routinely comparing secondary(tertiary) and working(quaternary) standards with the primary AGAGE calibration scales maintained by Scripps Institution of Oceanography (SIO).

- To integrate and harmonise trace gas measurements in Europe, with the result of having a sustainable and reliable observation network for highly time-resolved data across Europe.

Halocarbon Calibration



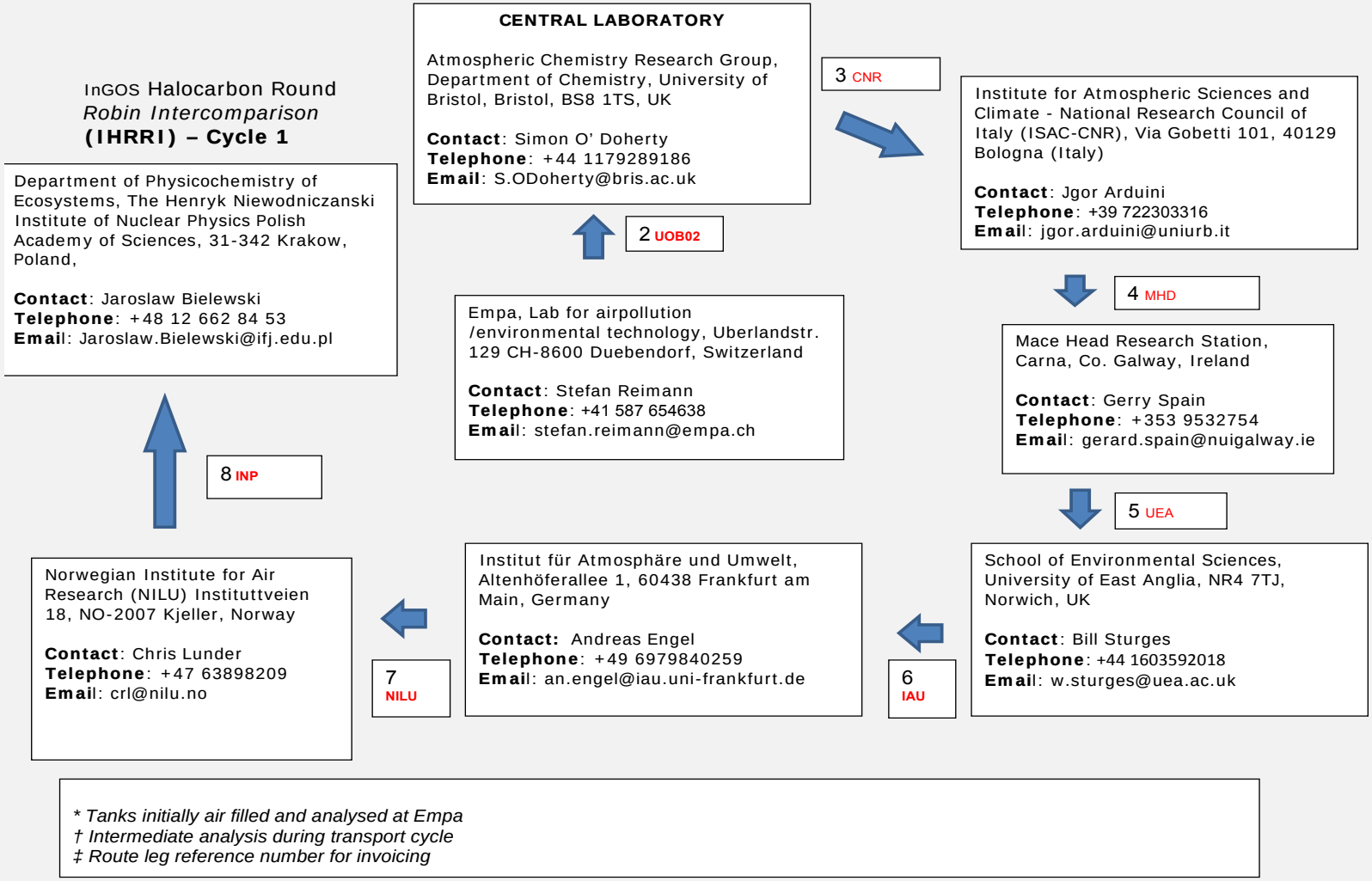
SF_6	SIO-05	**CFC-11**	SIO-05
CF_4	SIO-05	**CFC-12**	SIO-05
C_2F_6	SIO-07	**CFC-13**	SIO-UB-p
C_3F_8	SIO-07	**CFC-113**	SIO-05
c-C_4F_8	SIO-10-p	**CFC-114**	SIO-05
HFC-23	SIO-07	**CFC-115**	SIO-05
HFC-32	SIO-07	**H-1211**	SIO-05
HFC-134a	SIO-05	**H-1301**	SIO-05
HFC-152a	SIO-05	**H-2402**	NOAA-1992-p
HFC-125	UB-98	**CH_3Cl**	SIO-05
HFC-143a	SIO-07	**CH_3Br**	SIO-05
HFC-227ea	Empa-2005	**CH_3I**	NOAA-Dec09
HFC-236fa	Empa-2009-p	**CH_2Cl_2**	UB-98
HFC-43-10mee	SIO-10-p	**CH_2Br_2**	NOAA-Jul10-p
HFC-365mfc	Empa-2003	**$CHCl_3$**	SIO-98
HFC-245fa	Empa-2005	**$CHBr_3$**	NOAA-Dec09-p
HCFC-22	SIO-05	**CCl_4**	SIO-05
HCFC-141b	SIO-05	**CH_3CCl_3**	SIO-05
HCFC-142b	SIO-05	**$CHCl=CCl_2$**	UB-98
HCFC-124	NOAA-2003B	**$CCl_2=CCl_2$**	NOAA-2003B
HCFC-123	-		



University of Bristol (UK), Mace Head (Ireland), Empa (Switzerland), NILU (Norway), University of Urbino (Italy).

University of Frankfurt (Germany), University of Krakow (Poland), NUIG (Ireland), Zugspitze (Germany).

Round Robin route



JRA 5: Objectives

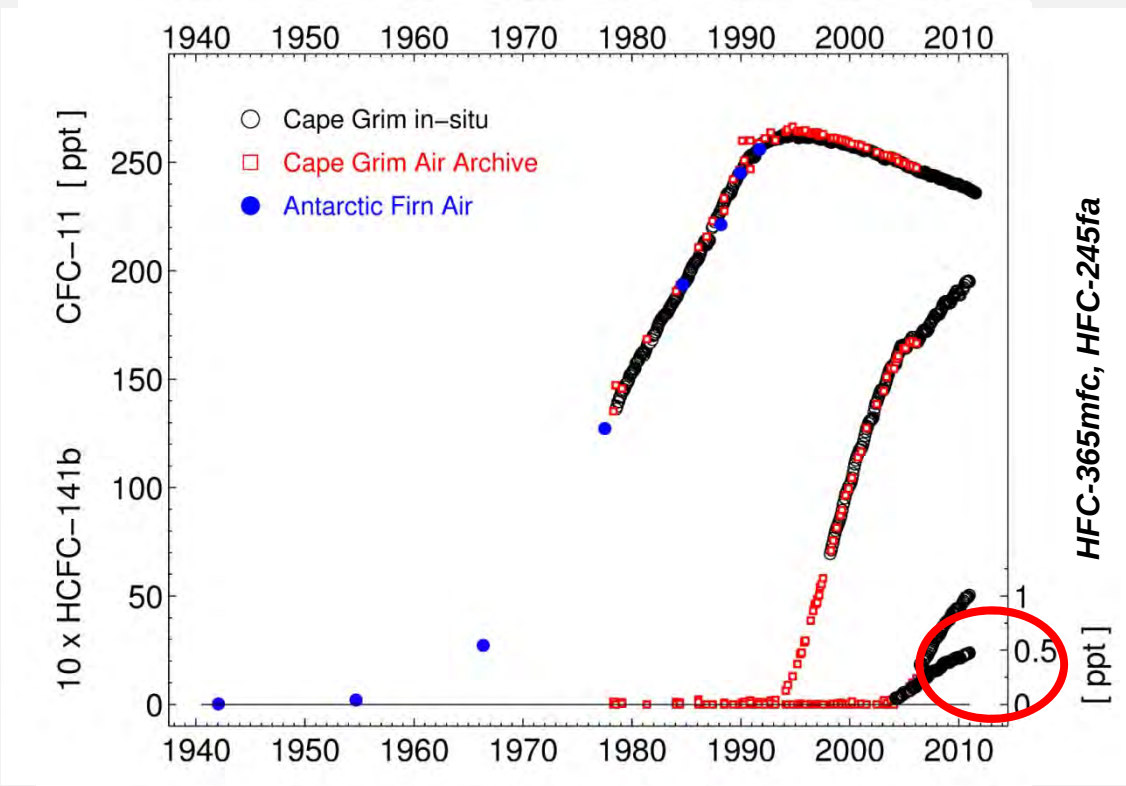
• To detect and quantify “new” halogenated greenhouse gases (GHGs) in the atmosphere, with the aim of creating an early-warning tool for potential threats to the climate and the environment, and to comprehensively determine the occurrence and abundance of all such strong GHGs in the atmosphere, many of which are not presently monitored nor even quantified.

• To implement new Time-of-Flight – Mass Spectrometer (ToF-MS) to evaluate its potential as a new tool for long-term monitoring of halocarbons at ground stations and to use the resulting full scan mass spectra for use as a “virtual air archive”.

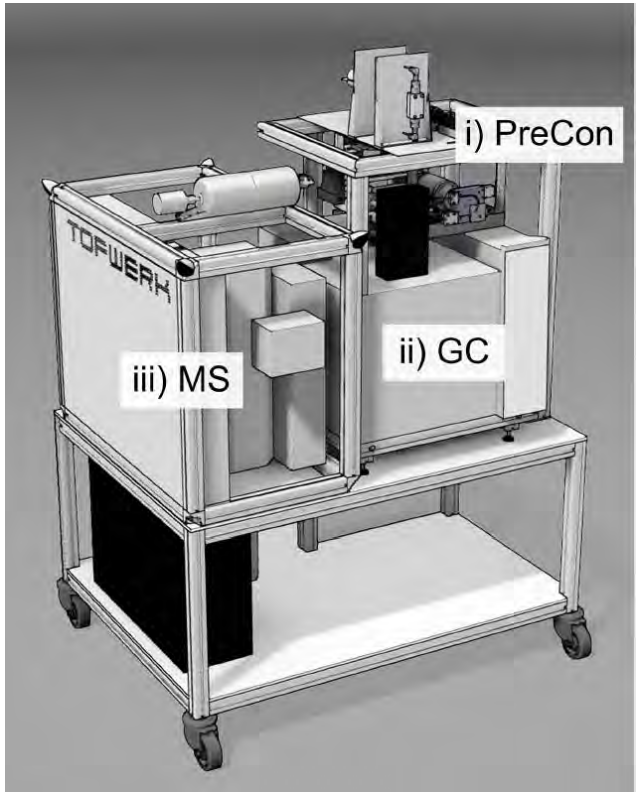
• To further develop the existing state-of-the art in Gas Chromatography – Mass Spectrometry (GCMS) technology, developing a more efficient and more precise and accurate European network for halogenated greenhouse gases.

History of synthetic halogenated compounds

- 1950s: 1st generation: chlorofluorocarbons (CFCs), halons: Cl, F, Br, -
- 1990s: 2nd generation: hydrochlorofluorocarbons (HCFCs): H, Cl, F, -
- 1990s: 3rd generation: hydrofluorocarbons (HFCs), perfluorocarbons (PFC): H, F, -
- 2010s: 4th generation hydrohaloalkenes (hydrohaloolefines, hydro-fluoroolefines, HFOs) H, Cl, F, =

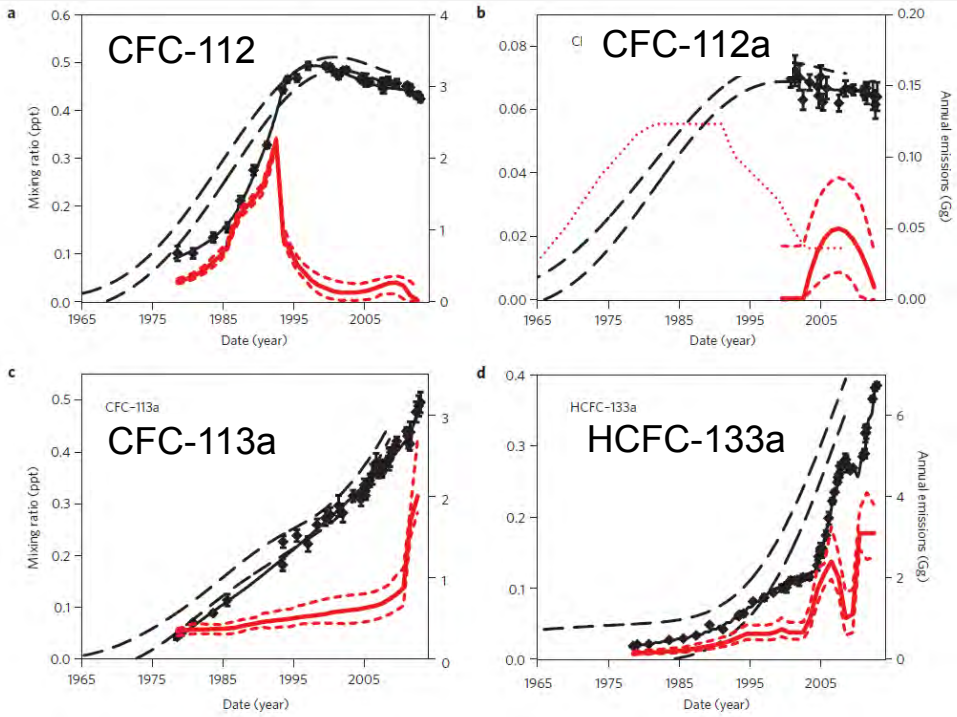


New GC-TOFMS installation tested for continuous measurements

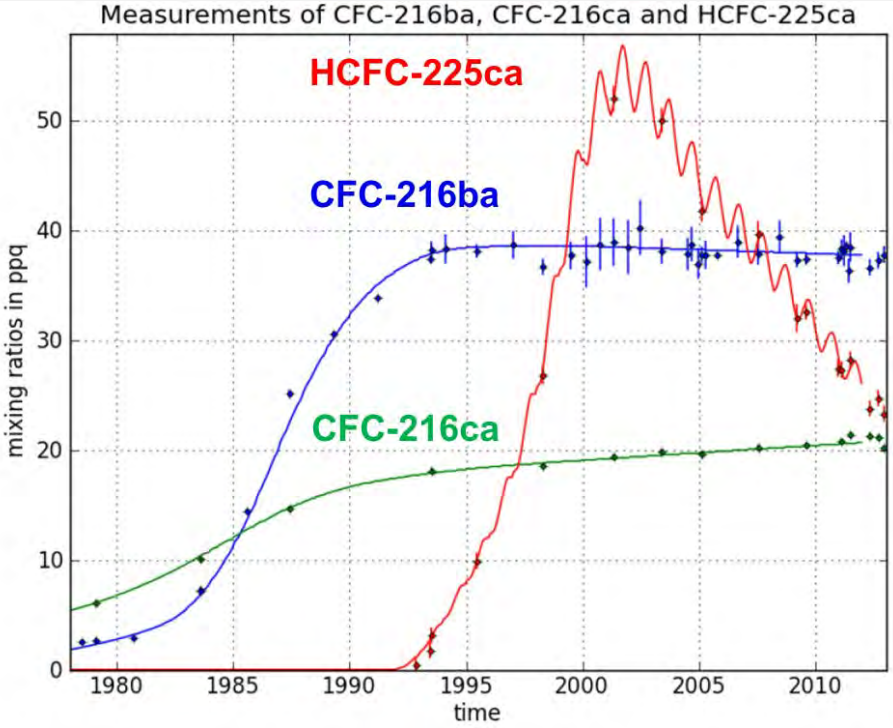


New CFCs and HCFCs

ppt



Laube et al. (Nature Geoscience ,2014)



Kloss et al., Atmosphere, 2014

Anaesthetics

Geophysical Research Letters

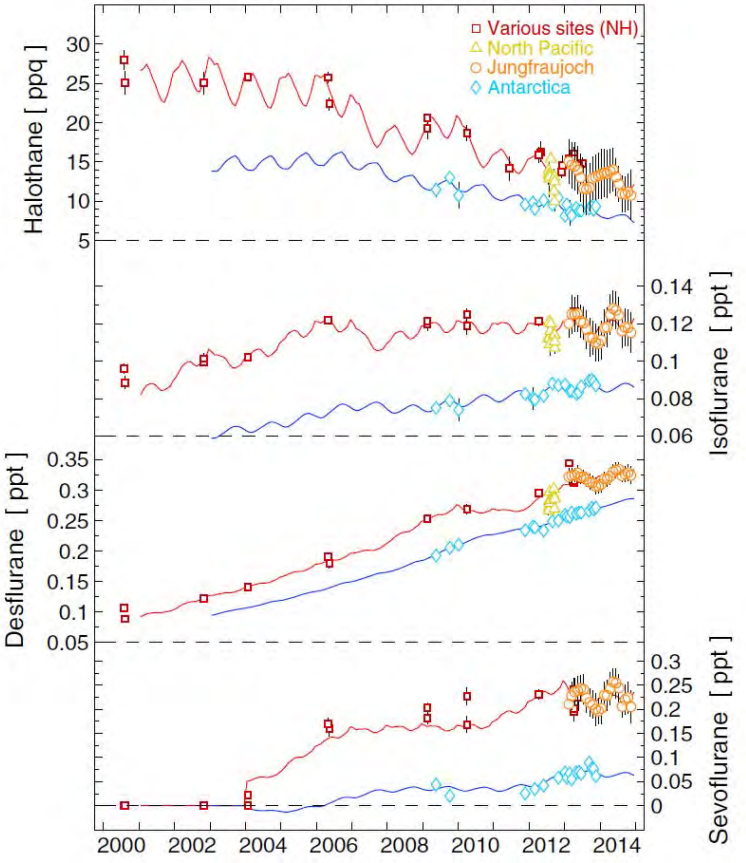
RESEARCH LETTER
10.1002/2014GL062785

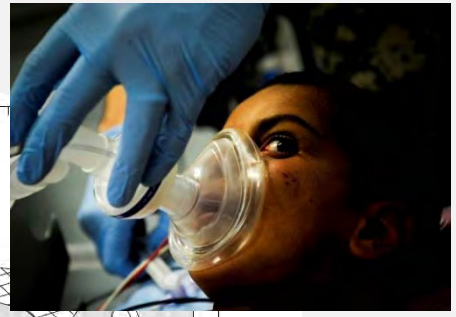
Modern inhalation anesthetics: Potent greenhouse gases in the global atmosphere

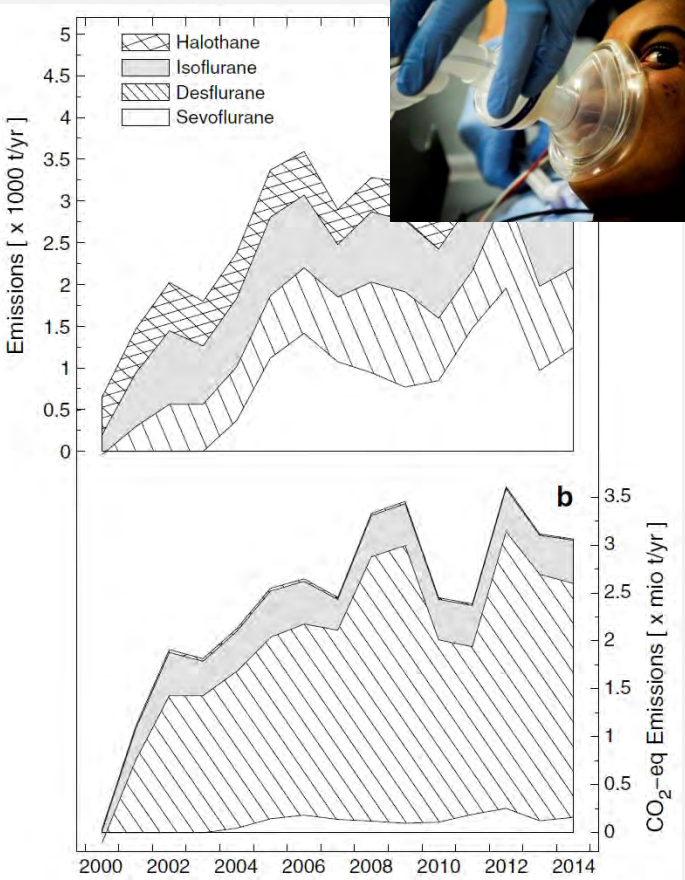
Martin K. Vollmer[1], Tae Siek Rhee[2], Matt Rigby[3], Doris Hofstetter[4], Matthias Hill[1], Fabian Schoenenberger[1], and Stefan Reimann[1]

[1]Laboratory for Air Pollution and Environmental Technology, Empa, Swiss Federal Laboratories for Materials Science and Technology, Dubendorf, Switzerland, [2]Korea Polar Research Institute, KIOST, Incheon, South Korea, [3]School of Chemistry, University of Bristol, Bristol, United Kingdom, [4]Alphacare, Zurich, Switzerland

Key Points:
- Measurements of potent greenhouse gases
- Emissions for the fluranes are increasing
- Halothane declines







Environmental Science & Technology

Article

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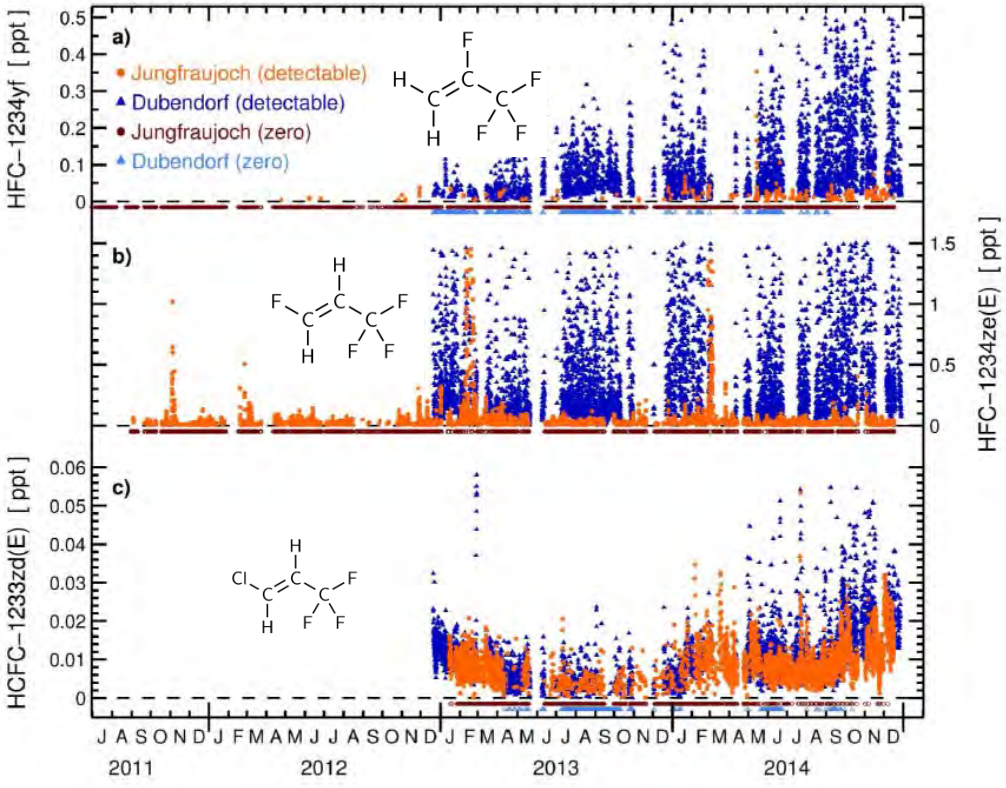
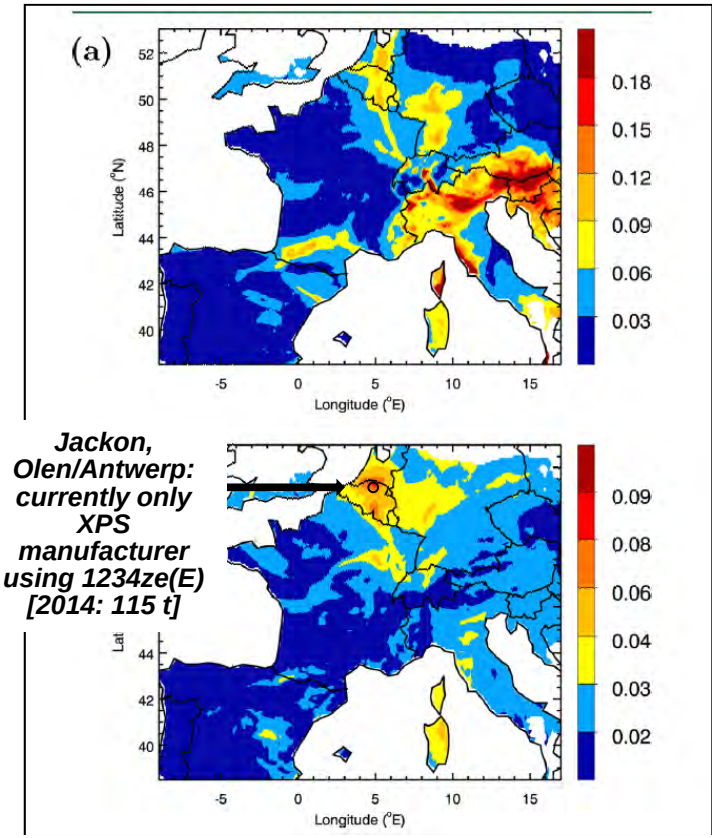
DOI: 10.1021/es505123x
Environ. Sci. Technol. 2015, 49, 2703−2708

First Observations of the Fourth Generation Synthetic Halocarbons HFC-1234yf, HFC-1234ze(E), and HCFC-1233zd(E) in the Atmosphere

Martin K. Vollmer,* Stefan Reimann, Matthias Hill, and Dominik Brunner

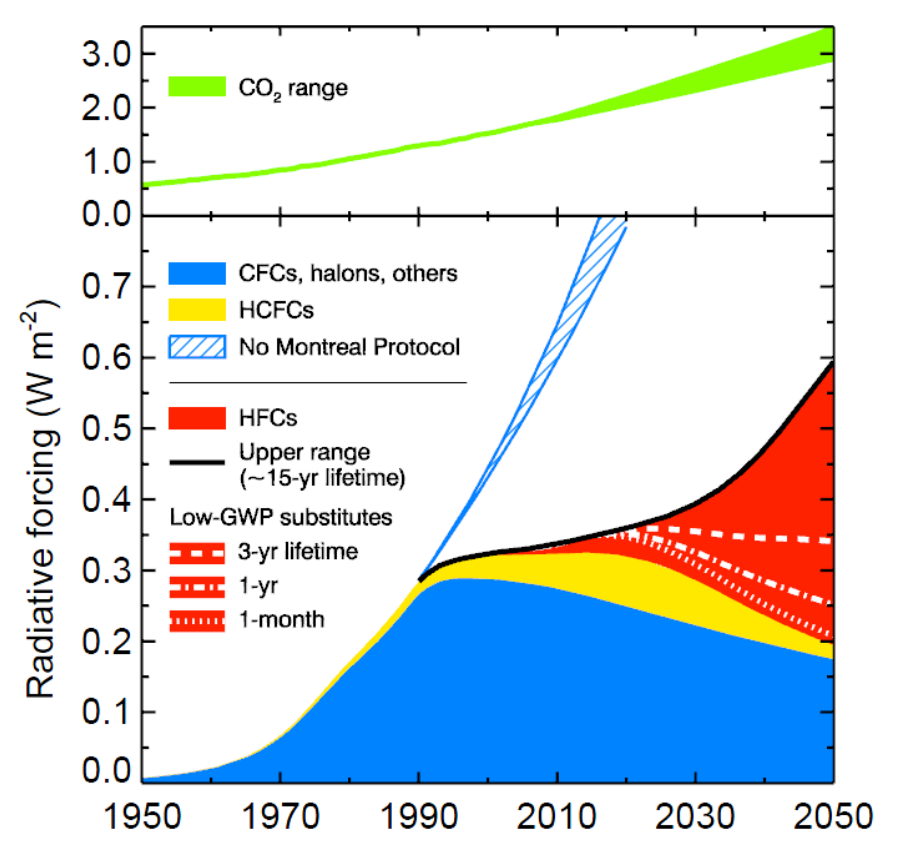
Laboratory for Air Pollution/Environmental Technology, Empa, Swiss Federal Laboratories for Materials Science and Technology, Dubendorf, 8600, Switzerland



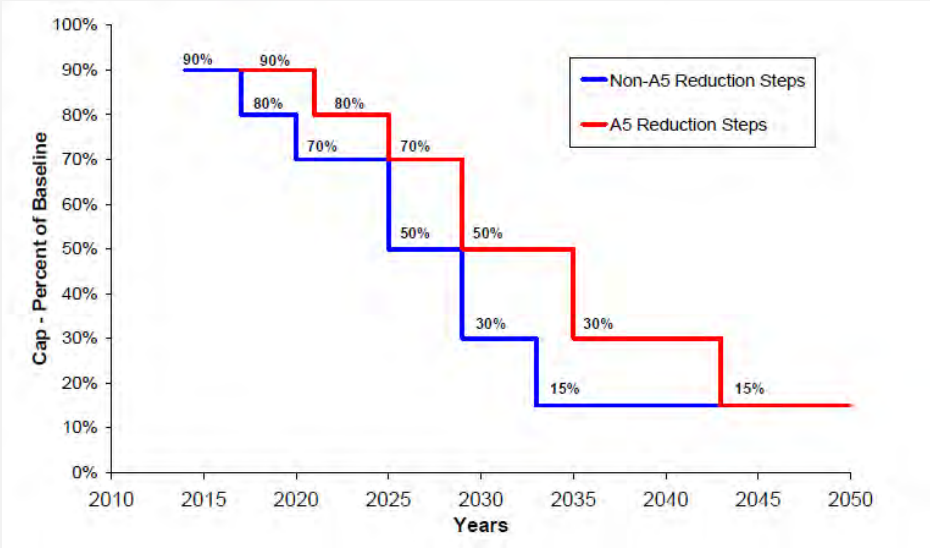


Jackon, Olen/Antwerp: currently only XPS manufacturer using 1234ze(E) [2014: 115 t]

Instead of a conclusion…
CFCs/HCFCs/HFCs in the future



2012
Velders et al., Science



2015
US proposal of phase-down plan
under the Montreal Protocol