# JRA 5: Innovation in halocarbon and COS measurement techniques

- Basis: available instrumentation/knowledge
- Potential issues
- Potential outcome

# JRA 5 Basis: Measurement platforms in Europe

#### **On-line**







#### 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.

#### JRA 5: Objectives

- New halogenated substances have been detected and will be implemented in continuous measurements University of East Anglia (UK), University of Bristol (UK) and Empa (CH)
- Progress achieved for using time-of-light mass spectrometry (GC-TOF) in continuous atmospheric trace gas measurements; work ongoing for proof of concept University of Frankfurt (D), University of East Anglia (UK),
- Trapping systems on GCMSs can be adapted to analyse also the very volatile NF<sub>3</sub>: also named "the missing greenhouse gas" and will be implemented in European measurements

University of Bristol (UK), Empa (CH), NILU (NO)



Laube et al., Nature Geoscience, 2014



	Identified at Bristol	Identified at Tacolneston	Identified at Mace Head	Identified at Jungfraujoch
desflurane	Y	Y	Y	Y
sevoflurane	?	Ν	Y	Y
isoflurane	Y	Y	Y	Y
cyclopentane	Y	Y	Y	Y
furan	Y	N	Y	N
Halon-1202	Y	Y	Y	Y
HFO-1234yf	N	Y	Y	Y
HFO-1233zd (E )	Ν	Ν	Ν	Y
HFO-1234ze (E )	Y	Y	Y	Y
HCFC-21	Y	Y	Y	Y
HCFC-31	Y	Y	Y	Y
HCFC-133a	Y	Y	Y	Y
HFC-329p	Y	N	Ν	Ν
HFC-41	Y	Ν	Ν	Ν
PFC-216	Ν	Ν	Ν	Y
C4F80	Y	Ν	Y	Y









## Implementation of new ToF-MS instrumentation JRA 5: Task 17.2



#### 3. Digital archive: Proof of concept

## Further development of the existing state-of-the art in GCMS technology JRA 5: Task 17.3



#### JRA 5: deliverables

**D17.1** Report on the identification of new HFCs with potential for large-scale industrial usage (month 18)

**D17.2** Report evaluating the potential developments and highest impact for upgrading GCMS-based technology (month 24)

**D17.3** Guideance using ToF-MS for measurement of halocarbons at European atmospheric measurement stations (month 45)

**D17.4** Implementation of continuous measurements of relevant HFCs (month 45)

**D17.5** Report on developments for upgrading GCMS technology for long-term measurements of halocarbons (month 45)

#### **JRA 5:** milestones

**MS73** Identification of new halocarbons not yet measured by continuous ground-based networks world-wide (month 24)

**MS74** GC-TOF technology implemented for laboratory and field measurements (month 24)

**MS75** Identification of new halocarbons not yet measured by continuous ground-based networks world-wide (month 36)

**MS76** GCMS instrumentation optimized for long-term, low maintenance continuous measurement of halocarbonsImplementation of continuous measurements of relevant HFCs (month 36)

**MS77** Measurements of selected new halocarbons implemented on the European scale (month 45)

**MS78**: Report on observations of halocarbons using GC-TOF (month 45)

#### Deliverables & Milestones (M36)

- D4.4 Round-robin intercomparison with an ensemble of 4 standards with different concentrations (month 12, <u>failed</u>)
- **D4.7** Round-robin intercomparison with an ensemble of 4 standards with different concentrations (month 27, in-progress)
- D4.8 Internally consistent data set of halocarbon measurements (month 27, completed)
- D4.9 Stainless steel canister as tertiary calibration standards for halocarbons (month 41)
- D4.10 same as 4.7 (month 42)
- D4.11same as D4.8 (month 44)
- D4.12 same as D4.8 (month 48)

- **MS16** Analysis of calibration standards (month 12)
- MS17 & 20 Completion of round-robin comparisons (month 12, failed & 27 in-progress)
- MS19 & 21: Calibration results posted to central database (month 12 & 27, completed)
- MS22 Analysis of calibration standards (month 41)
- MS23 Completion of round-robin comparison (month 42)
- **MS24:** Calibration results posted to central database (month 44)