



Integrated non-CO₂ Greenhouse gas Observing System

The InGOS Project: Setup and First Results

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InGOS overview



Improving and extending
European observation capacity
for non-CO₂ greenhouse gases

- **Infrastructure project: Integrating Activities**
- **Budget 10 M€, EU 8 M€**
- **34 (35) partners, 14 (15) countries, 24 (28) observing stations**
- **1 October 2011 – 1 October 2015**
- **Will integrate the non-CO₂ observations in ICOS infrastructure**
- **Builds on: CHIOTTO, SOGE, CarboEurope, GHGEurope, IMECC etc.**
- **Coordination: ECN, NL**
- § <http://www.ingos-infrastructure.eu>

Activities

- n Networking activities:
 - n Improve historic datasets CH₄, N₂O, SF₆, H₂, CO
 - n Good practice development for all gas, isotope and flux observations
 - n Near real-time provision of tracer data and
 - n Provision of QA'ed new observational data
- n Trans National Access:
 - n 18 stations
 - n Provision of
 - n lab calibration standards
 - n Gases for comparisons
- n Service activities: databases (linked/shared with ICOS/AGAGE/WMO etc)
- n Research activities
 - n Testing and (co-)developing new sensors/instruments/methods
 - n Integration of measurements and (inverse) modelling, network optimisation.
 - n Link with remote sensing (TCCON)
 - n Development of new observations (halocarbons, isotopes)
 - n Integration of flux and concentration measurements at tall tower sites

Transnational access (TNA)

- n Facilities and services open for external parties,
(travel and subsistence costs covered)
- n Supersites: join our campaigns
- n Atmospheric and flux sites open e.g. for:
 - n Bring your instrument for comparison/tests
 - n Take bag/flask samples at interesting sites
 - n Visit site or laboratory for training
- n Two CH₄ flux surveyor aircraft
- n ¹³CH₄ and ²H isotope analysis
- n Working standards for non-CO₂/halocarbons

Apply for TNA through web site:

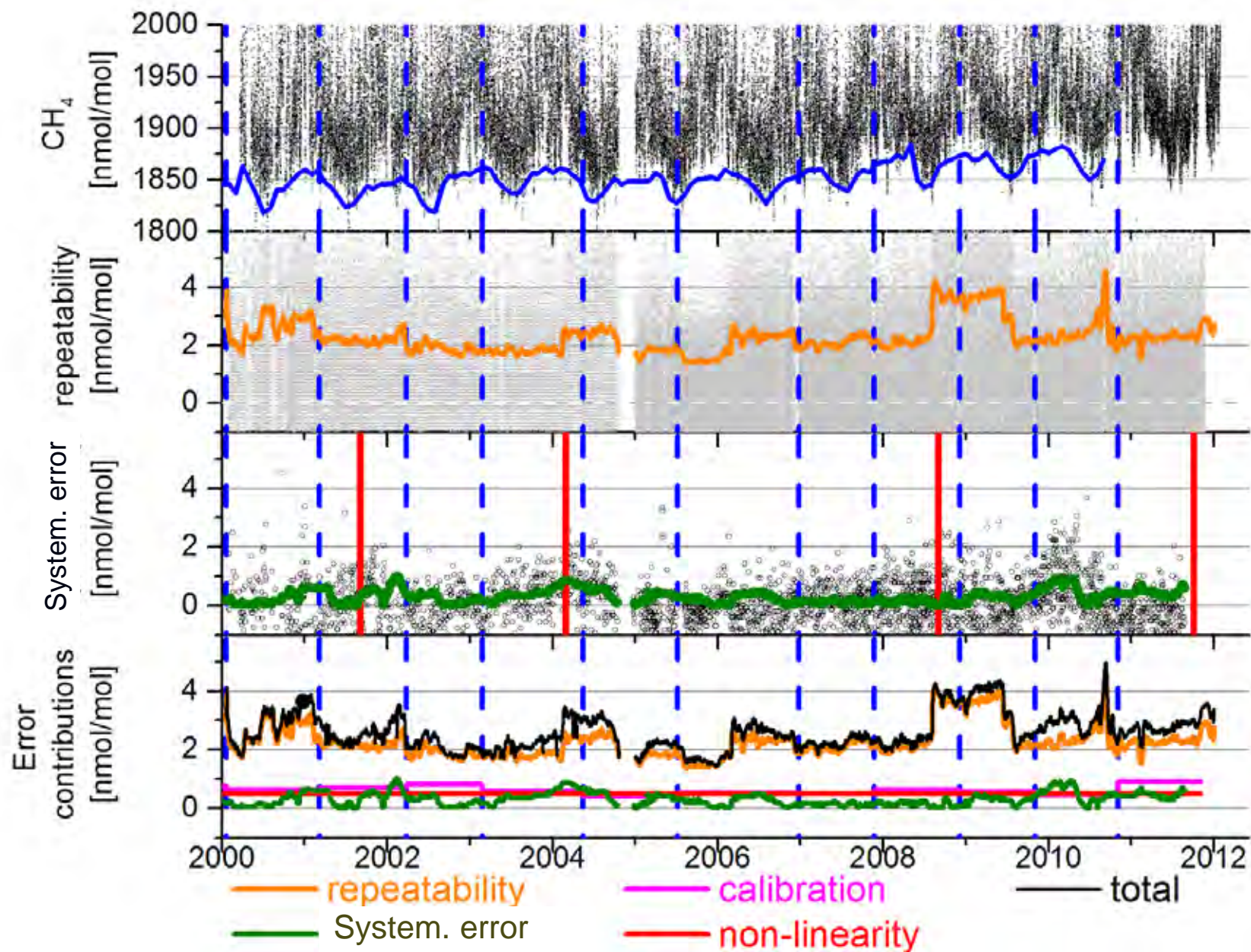
<http://www.ingos-infrastructure.eu/> -> Get Access

- n Databases: Get Access -> Data Center

Results: Historic data CH₄

Abbrev	station name	lat	lon	altitude	period	partner
ZEP	Zeppelin	78.90	11.88	475m+10m	since 2001	NILU
PAL	Pallas	67.97	24.12	565m+7m	2004-2011	FMI
VOI	Voeikovo	59.95	30.70	72m+6m	2001-2013/gaps	ECN
TT1	Angus	56.55	-2.98	313m+222m	2006-2012	UEDIN
LU1	Lutjewad	53.40	6.35	1m+60m	since 2001	CIO
BI5	Bialystok	52.25	22.75	183m+300m	since 2005	MPG
MHD	Mace Head	53.33	-9.90	25m+15m	since 2001	UNIVBRIS
WEY	Weybourne	52.58	0.37	21m+10m	since 2010	UEA
CB4	Cabauw	51.97	4.93	-1m+200m	since 2000	ECN
OX3	Ochsenkopf	50.05	11.82	1022m+163m	since 2006	MPG
HEI	Heidelberg	49.42	8.67	116m+30m	2000-2011	UHEI
KAS	Kasprowy W.	49.25	19.98	1984m+5m	since 2009	AGH-UST
GIF	Gif sur Yvette	48.71	2.15	165m+?m	2007-2012	CEA
SIL	Schauinsland	47.91	7.91	1205m+8m	2001-2011	UBA/UHEI
TRN	Trainou	47.96	2.11	250m+180m	2007-2012	CEA
HU1	Hegyhatsal	46.95	16.65	248m+96m	2006-2012	HMS
JFJ	Jungfrauoch	46.55	7.98	3580m+10m	2004-2012	EMPA
IPR	Ispra	45.80	8.62	223m+15m	2008-2011	JRC-IES
PUY	Puy de Dome	45.77	2.97	1465m+10m	2010-2012	CEA
LMP	Lampedusa	35.52	12.63	45m+10m	since 2006	UNITUS

Example CH₄ Heidelberg 2000-2012



GIF - NRT data view tool

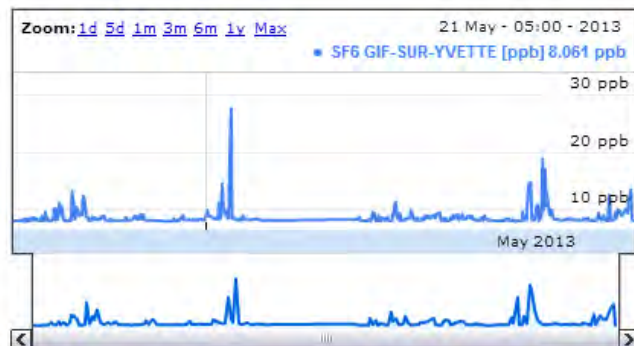
This is an interactive time series line chart with optional annotations from the last measurements of N₂O and CH₄ from Gif-sur-Yvette station. Measurement are hourly resolved. Use the zoom links ("1d 5d 1m" and so on) to navigate into the time series. Use your mouse to move into the time series. Below the time series is the zoom range selection area (the area at the bottom of the chart). The outline in the zoom selector is a log scale version of the time series in the chart, scaled to fit the height of the zoom selector. You can also use the selector to move into the time series. Note that the chart is rendered within the browser using Flash.

- ▶ PUY - NRT data view tool
- ▶ MHD.169.ch4
- ▶ Near real time data
- ▶ GIF - NRT data view tool
- ▶ TTA.158.ch4

CH₄



SF₆



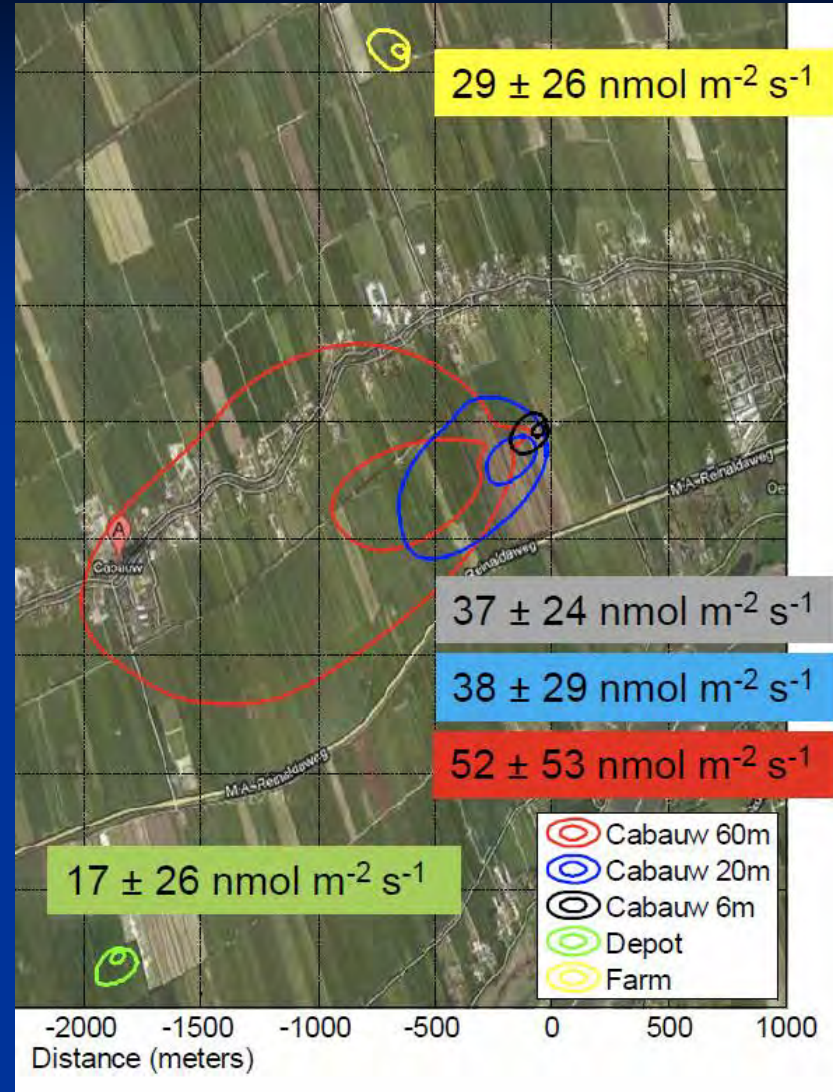
N₂O



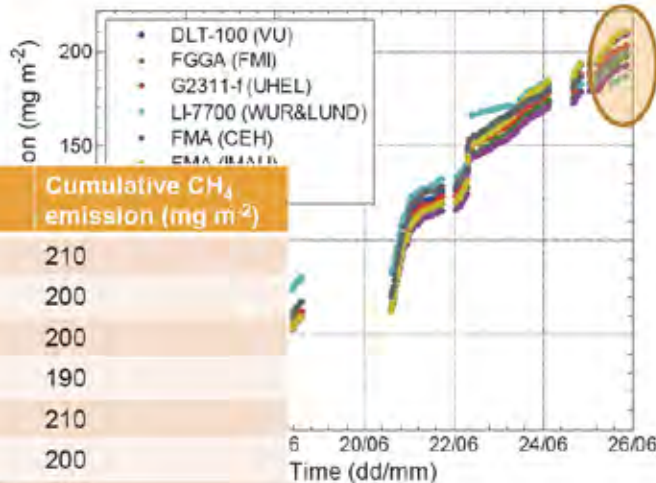
Near real-time example:
<http://ingos-atm.lscce.ipsl.fr/GIF-NRT>



Results: CH₄ flux campaign Cabauw



NA5: cumulative sum



	Cumulative CH ₄ emission (mg m ⁻²)
DLT-100 (VU)	210
FGGA (FMI)	200
G2311-f (UHEL)	200
FMA (CEH)	190
FMA (IMAU)	210
QCL (ECN)	200
LI-7700 (WUR&LUND)	190

May, 2013



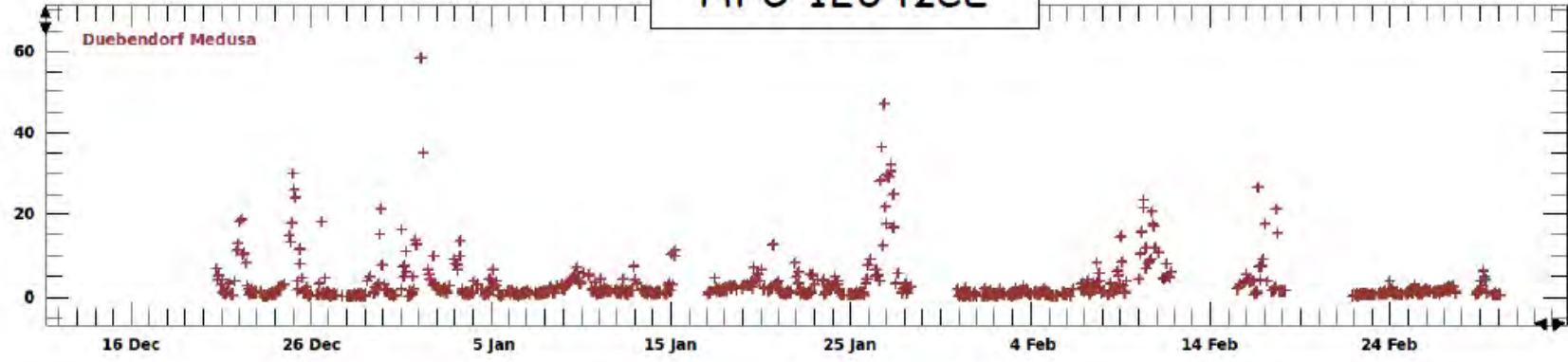
Results: new compounds

Gas: HFC-1234zeE Runtype: air Xaxis: time Yaxis: C (reported)

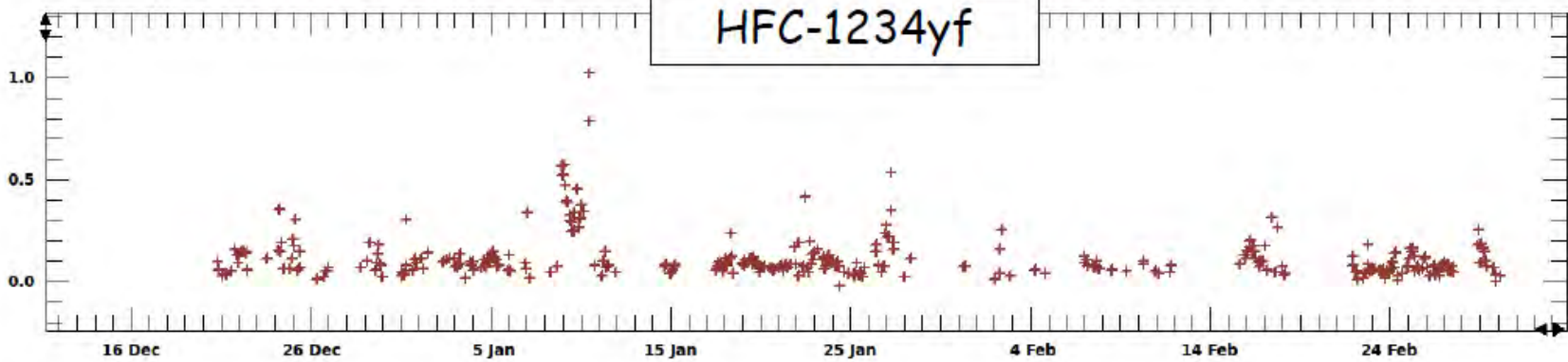
Gas: HFC-1234yf

- Cape Grim Medusa
 - Mace Head Medusa
 - Cape Matatula Medusa
 - Ragged Point Medusa
 - Trinidad Head Medusa
 - La Jolla Medusa
 - La Jolla Medusa7
 - Aspendale Medusa
 - Gosan Medusa
 - Jungfraujoch Medusa
 - Zeppelin Medusa
 - Shangdianzi Medusa
 - Duebendorf Medusa**
 - India MD
 - Shangdianzi sogeA-MD
 - Zeppelin ADS
 - Aspendale ADS
 - Jungfraujoch ADS
 - Cape Grim ADS
 - Mace Head ADS
 - Cape Grim SF6/ECD
- show multiple sites
 show single site
 show monthly means

HFC-1234zeE

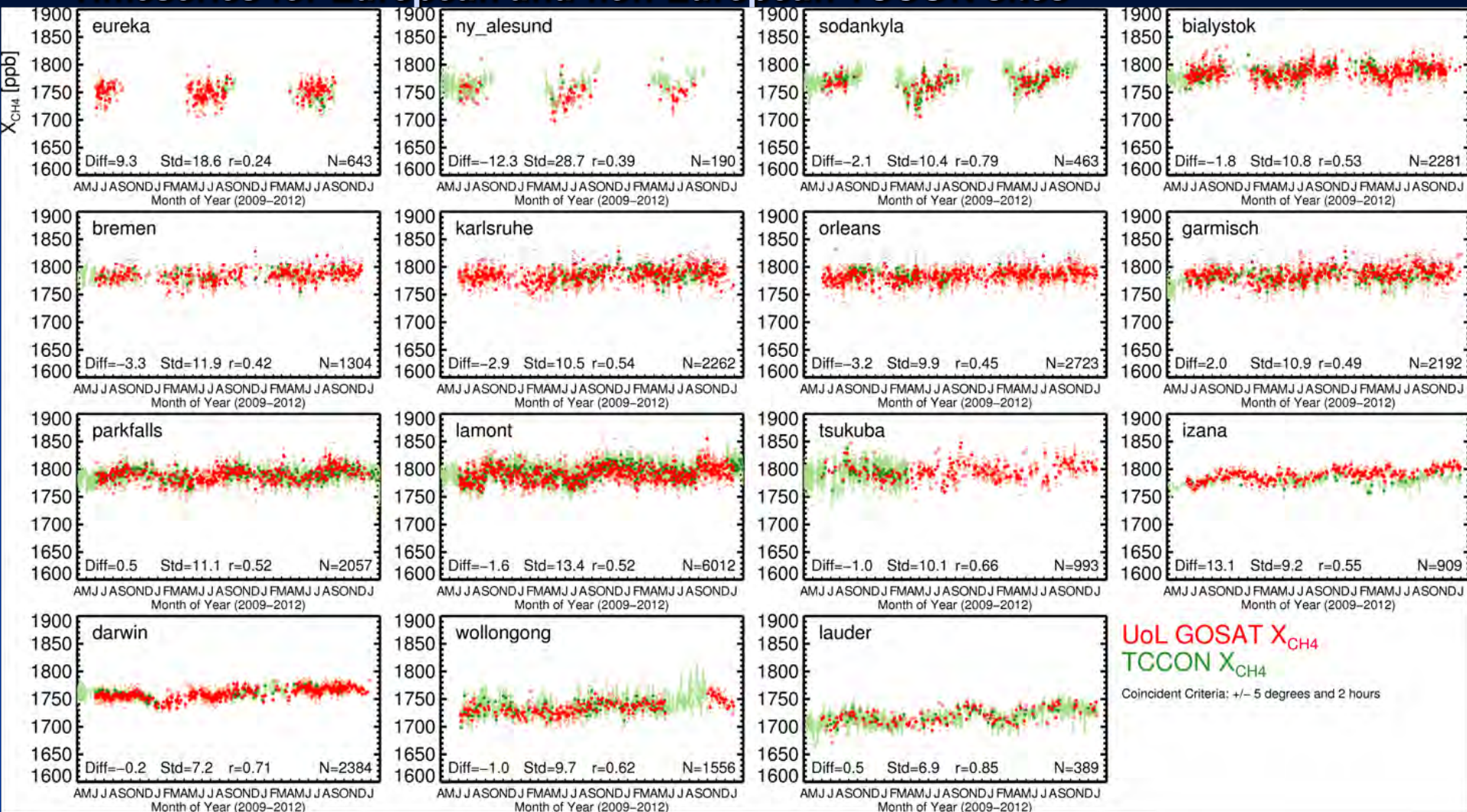


HFC-1234yf



Results: Remote Sensing

Timeseries for European and non-European TCCON sites

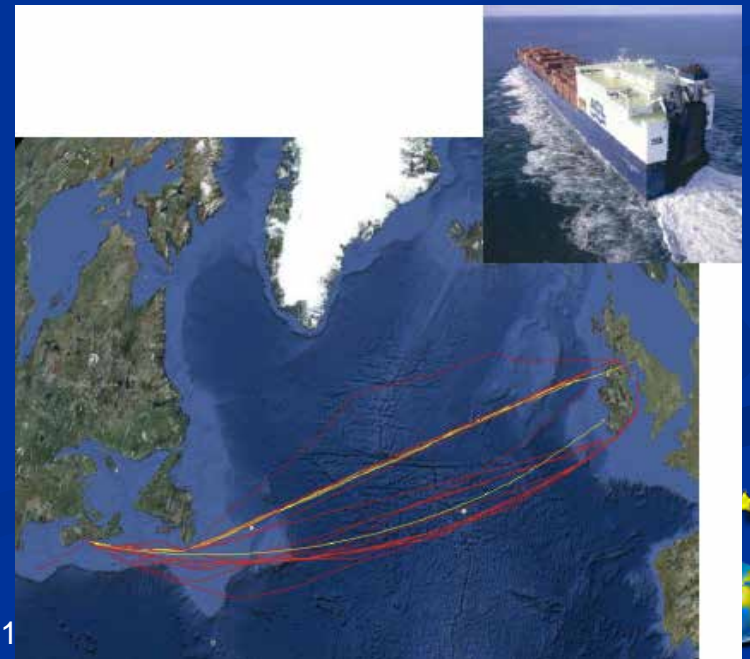
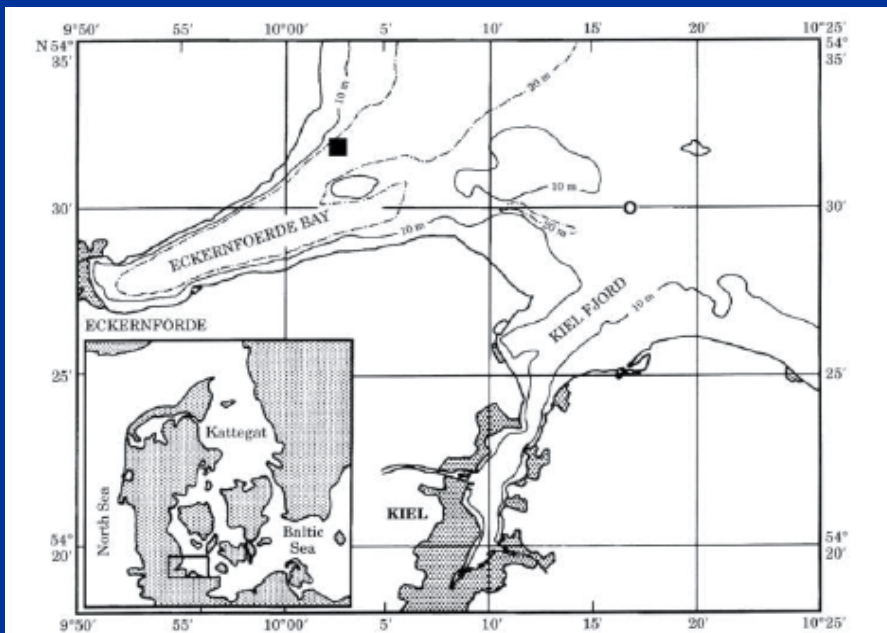
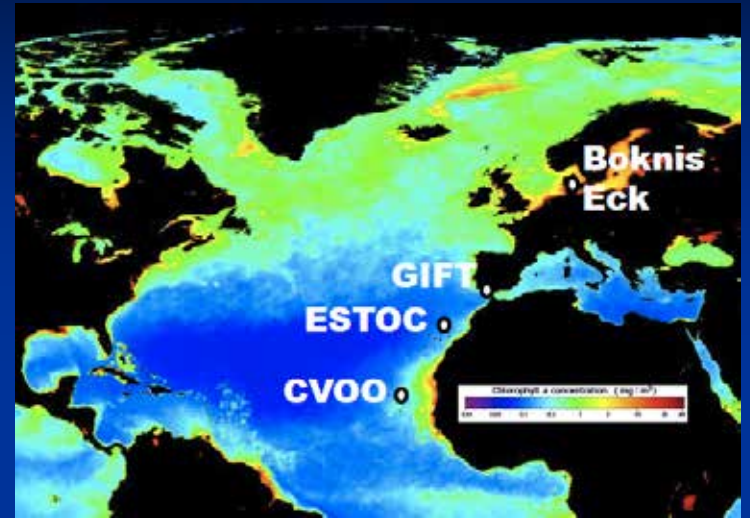
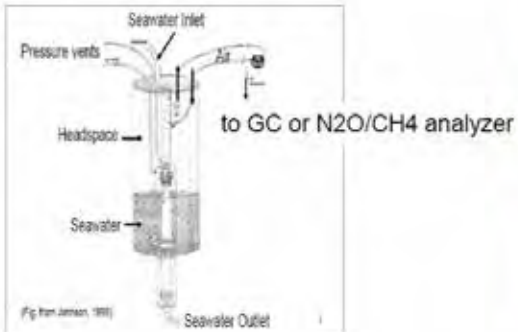


- Retrieval algorithm of tropospheric X_{CH_4} for TCCON
- A good agreement found between GOSAT and TCCON with mean difference < 3.5 ppb (0.2 %)
- Higher latitude sites: difference due to different a priori assumptions?

Byckling, UoL

Results: Ocean

'Showerhead' Equilibrator
Design : R. Weiss (SIO)

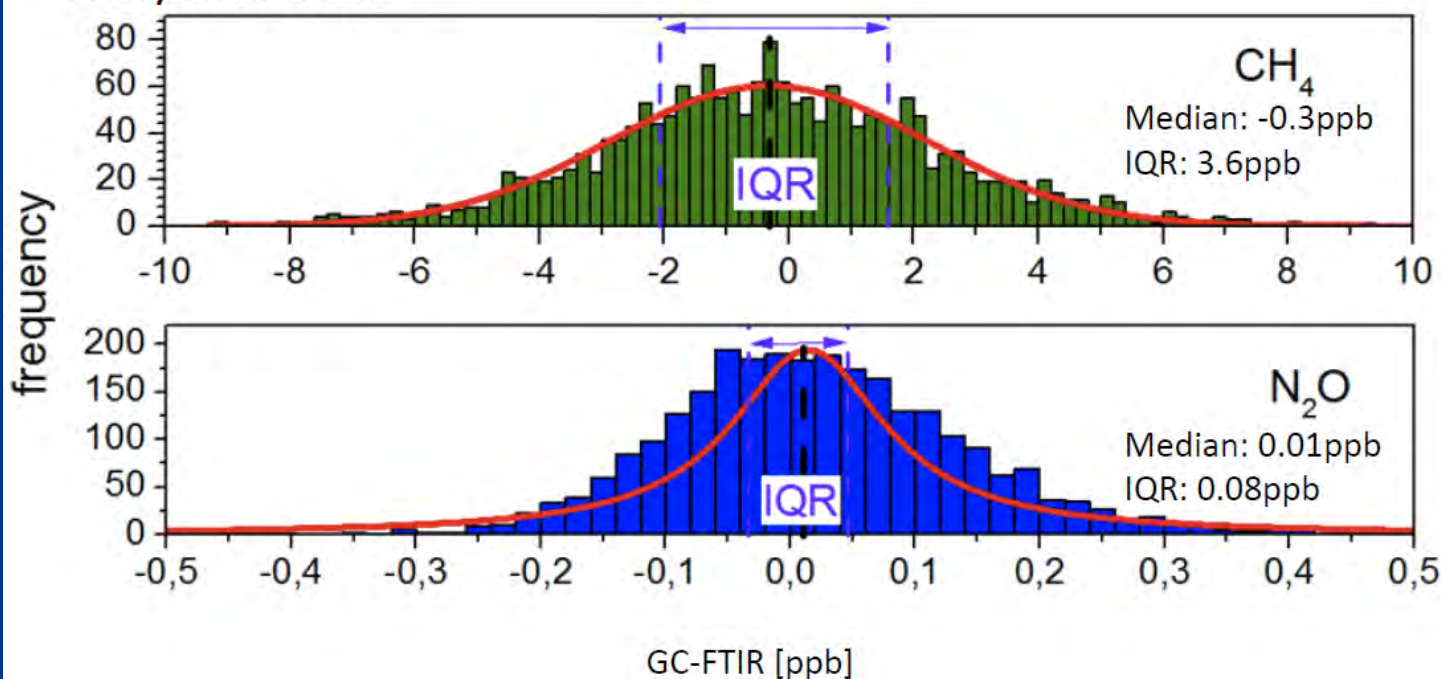


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Significant but small scale offsets detected with new high precision instrumentation

Comparison GC-FTIR in Heidelberg Same intake line

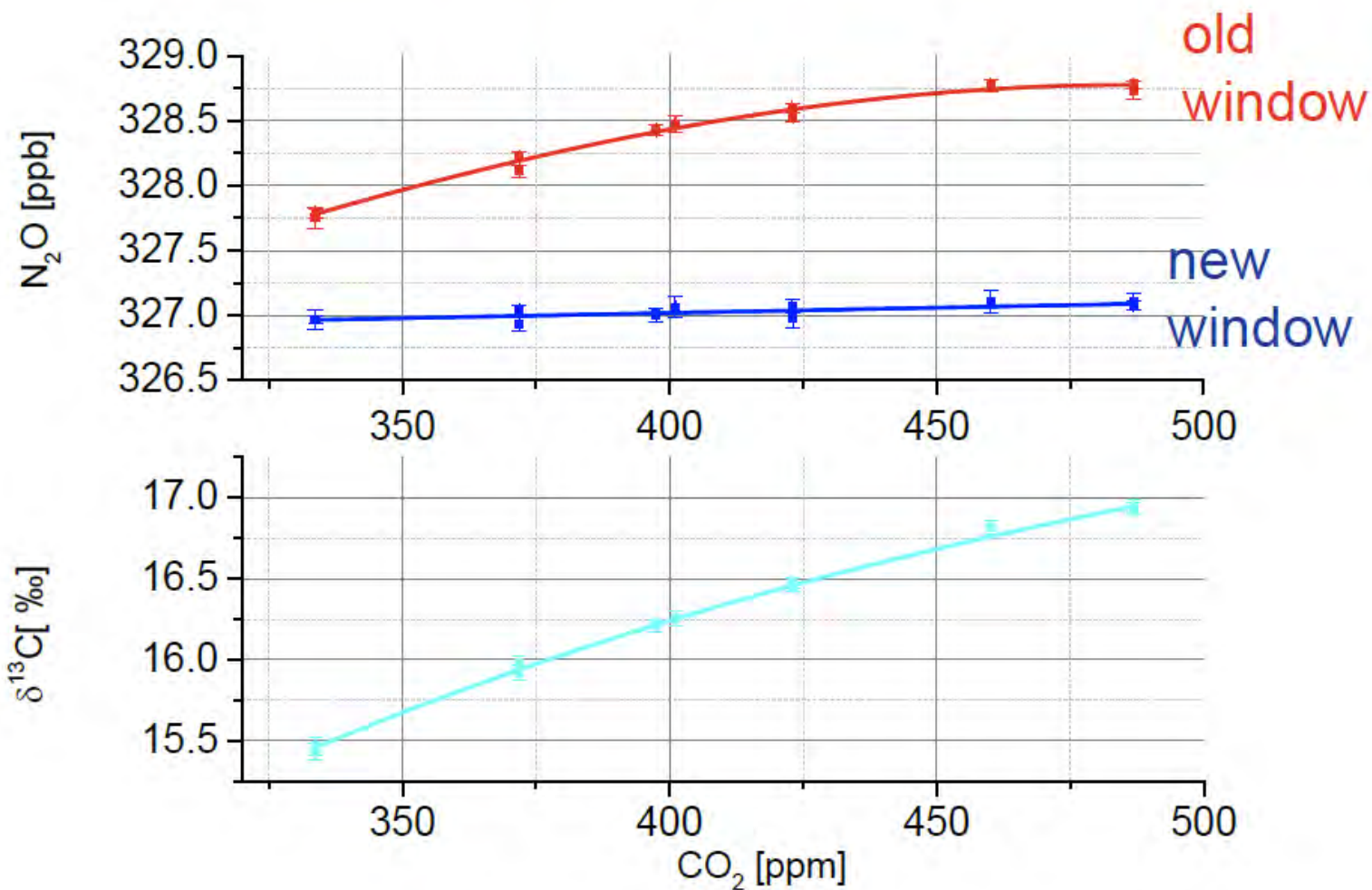
Nov/Dec 2012



Sanam Vardag
UHEI

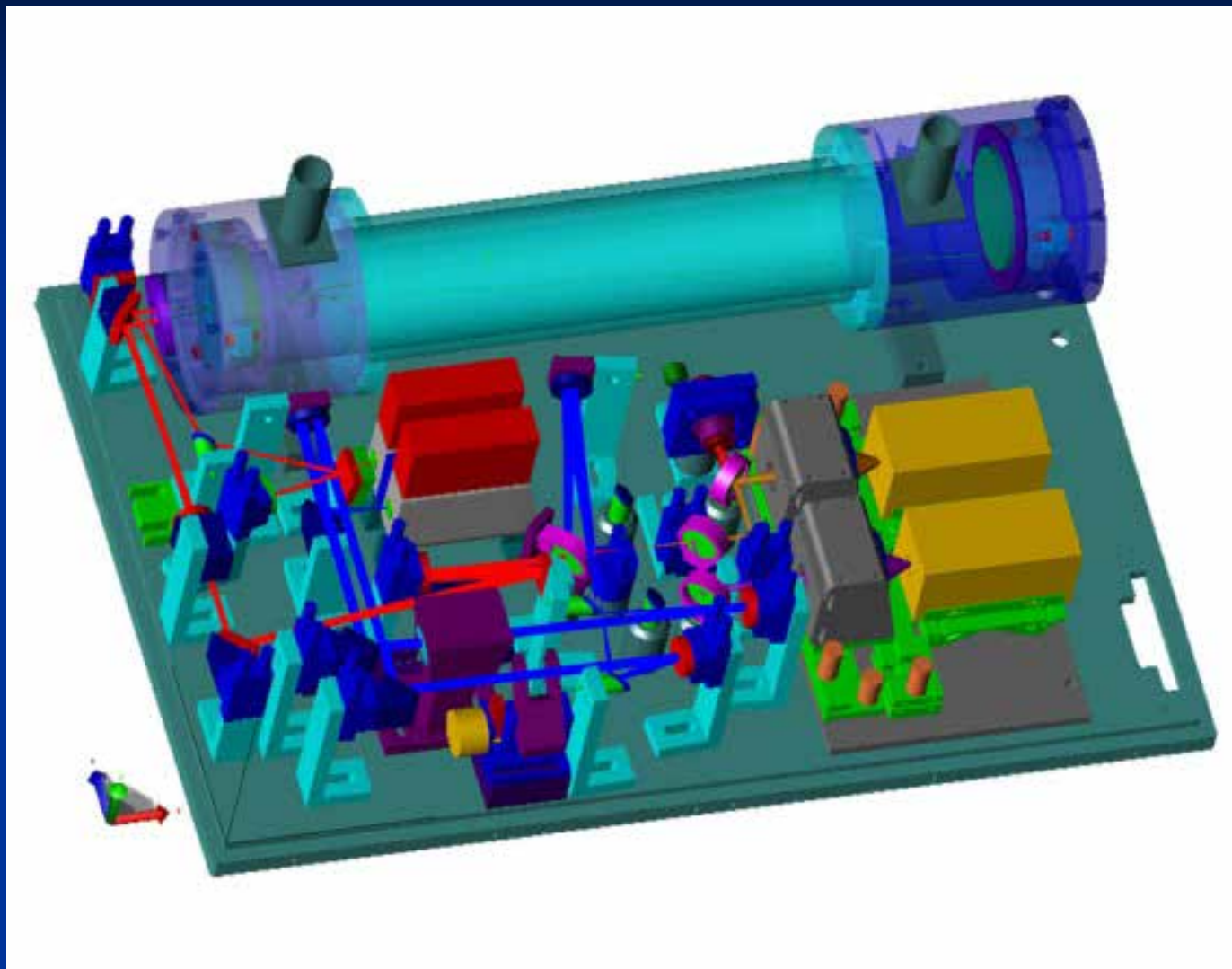
Instrument improvements

New spectral window



Sam Hammer
UHEI

QC laser spectrometer for real-time CH₄ isotopic measurements ¹³C + ²H, WP16 (JRA5), EMPA

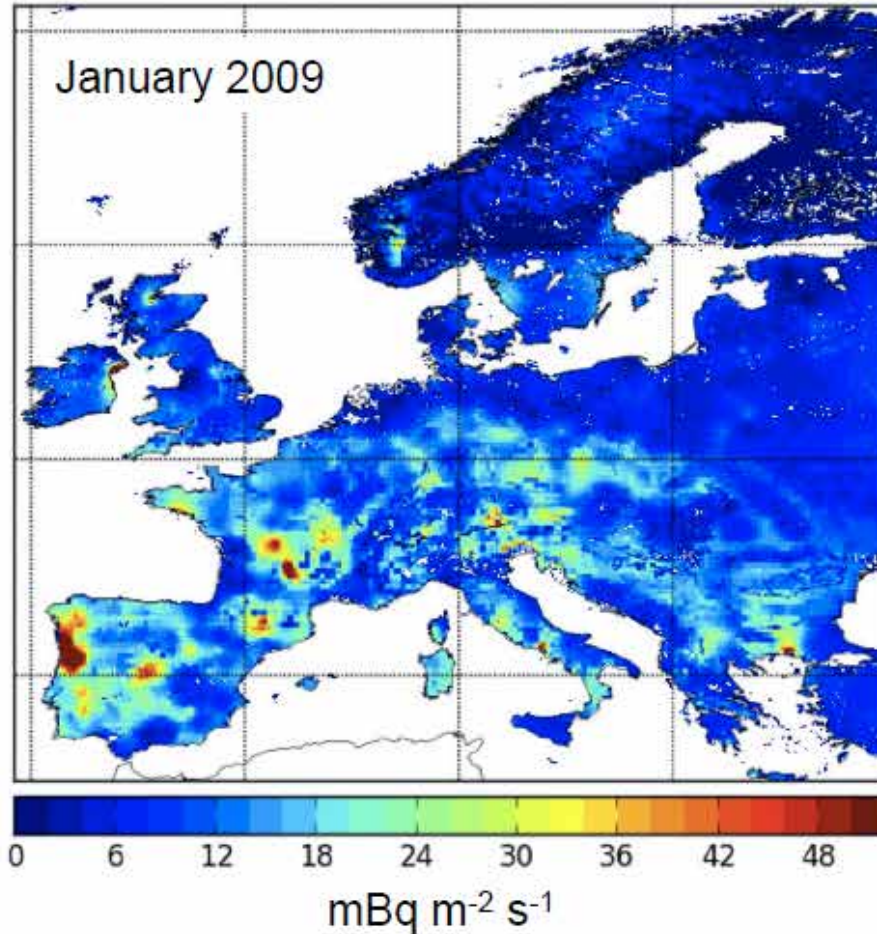


Integration of models and obs.

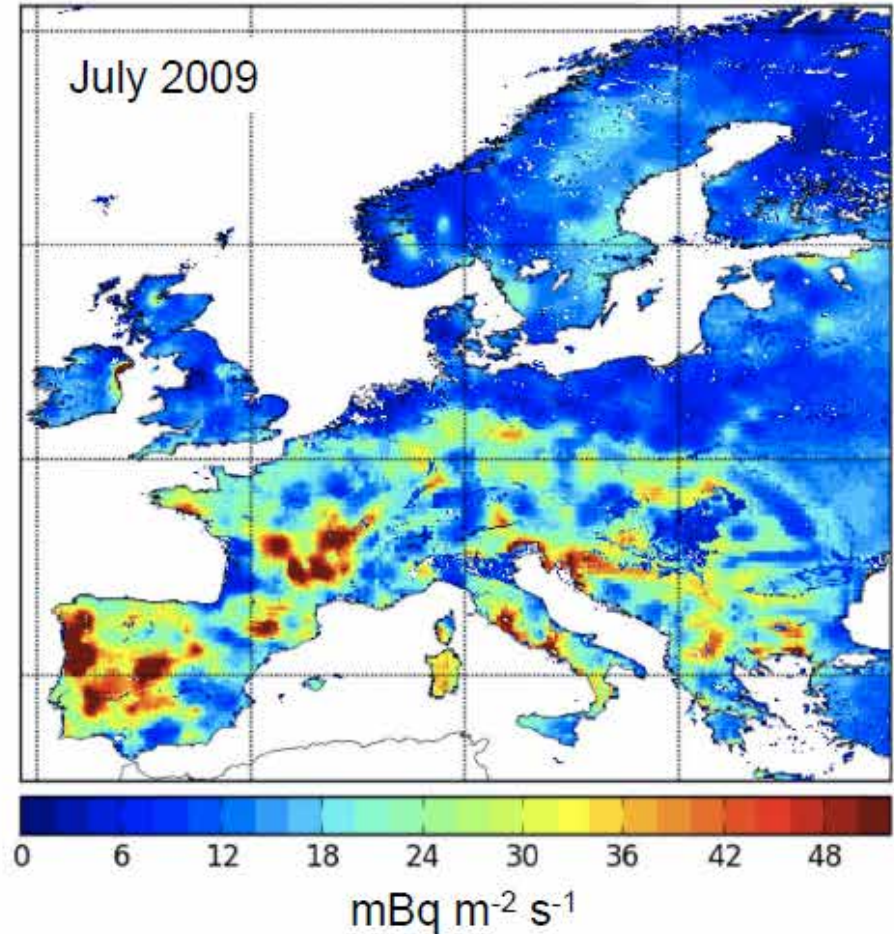
- n $\text{CH}_4 + \text{N}_2\text{O}$:
 - n Network sensitivity for current network (22), ICOS (34), ICOS to be (50) stations
 - n Special EDGAR 4.2FT for prior emission estimates
- n High resolution ^{222}Rn emission maps for model validation (connects with Transcom-BLH)
- n Forward and inverse modelling by 7 independent global and/or regional models
- n $^{13}\text{CH}_4$ tracer modelling
- n Halocarbon inversions

InGOS ^{222}Rn Flux Map version 1.0

^{222}Rn Radon Exhalation 2009-01

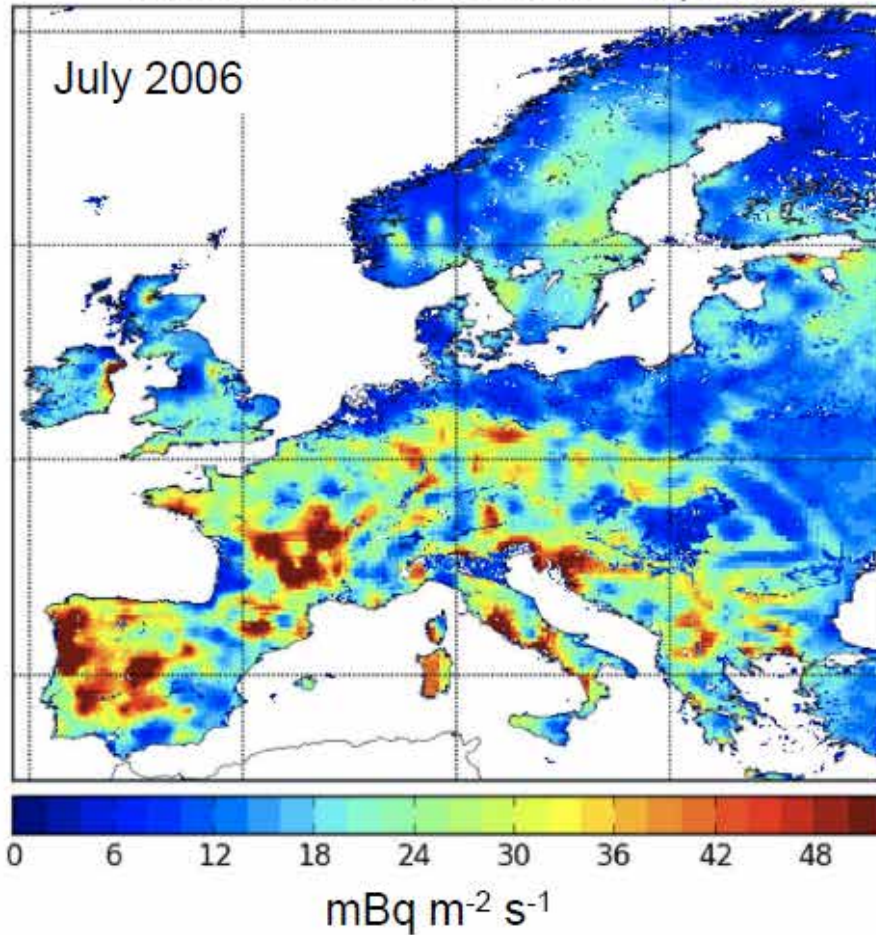


^{222}Rn Radon Exhalation 2009-07

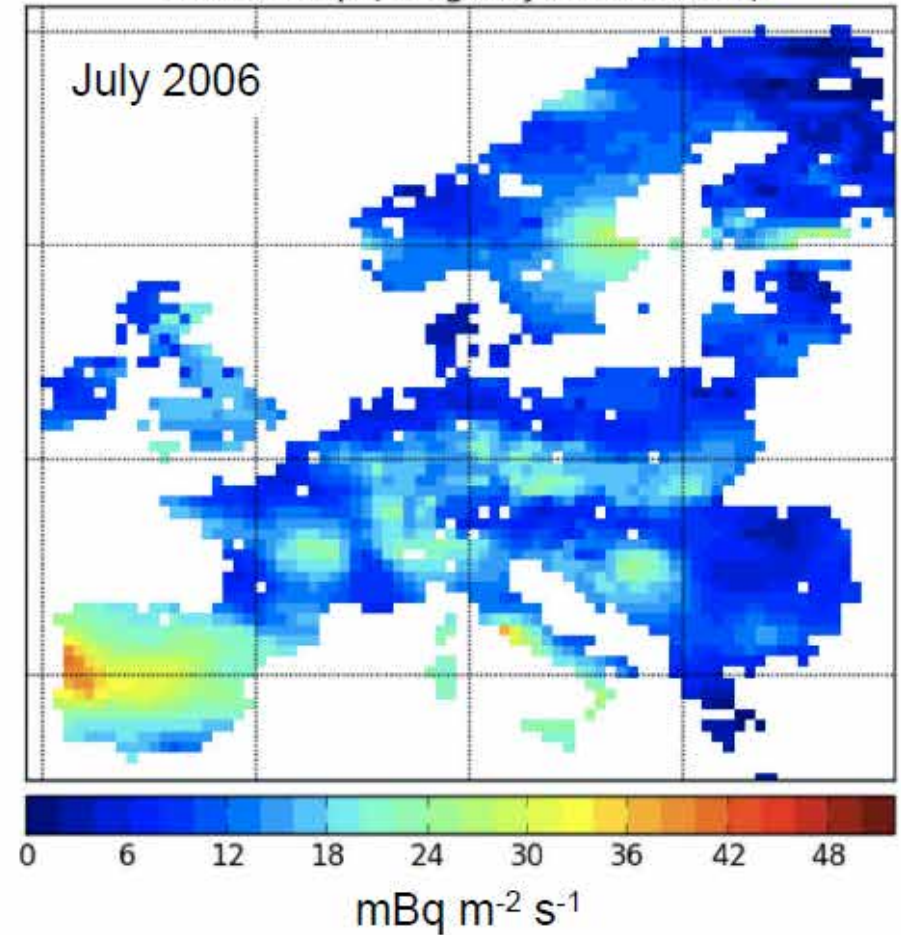


Comparison with existing ^{222}Rn Radon Flux Map

^{222}Rn Radon Exhalation 2006-07 mq60 n w



Radon map (Szegvary et al., 2008)



Radon flux based on correlation with γ -dose rate measurements (Szegvary et al., 2008)

Summary

- n InGOS now well underway (18 months) showing good progress
- n InGOS integrates different communities (surface measurements, remote sensing and modelling)
- n InGOS will provide
 - n Harmonized historic datasets for continuous European obs. of CH₄, N₂O, SF₆, H₂, inclusive error analysis
 - n Near realtime continuous data for CH₄, N₂O, SF₆, H₂, ²²²Rn...
 - n Improved regional emission estimates (bottom up+top down)
 - n Network design for non-CO₂ monitoring
 - n Improved measurement techniques and methods

THANK YOU!