

The ICOS Atmospheric Thematic Center (ATC)

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⁶ Institut für Umweltphysik (IUP), University of Heidelberg, Germany

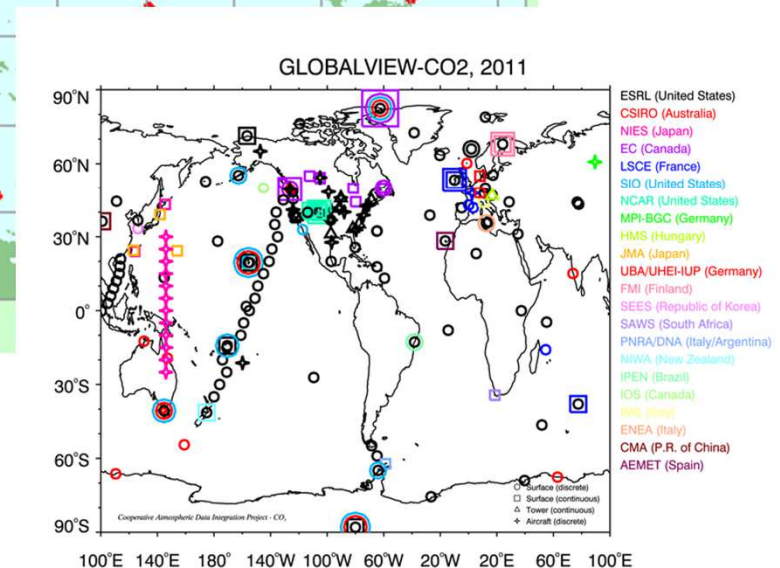
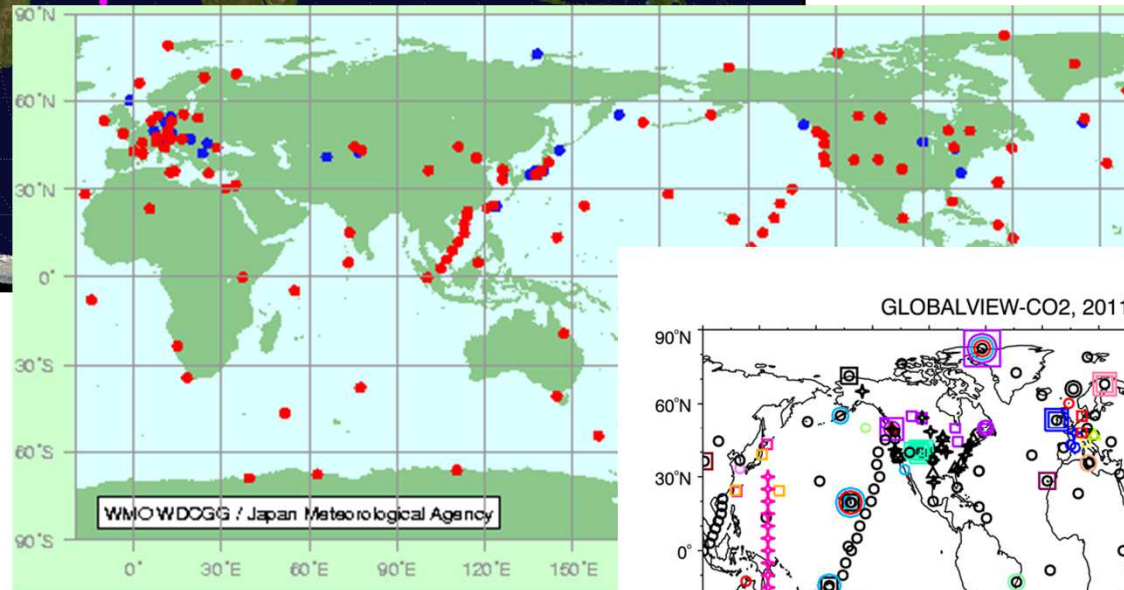
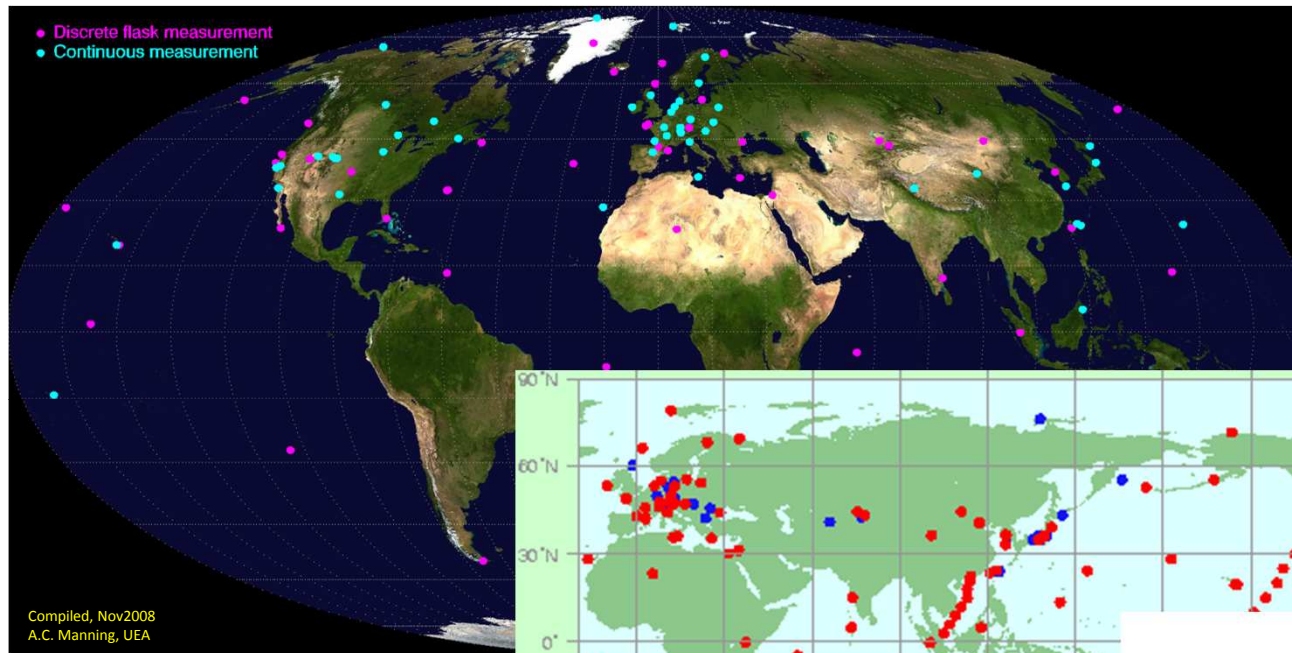


FINNISH METEOROLOGICAL INSTITUTE



Europe is well covered for CO₂ observations

Why do we need a new infrastructure ?

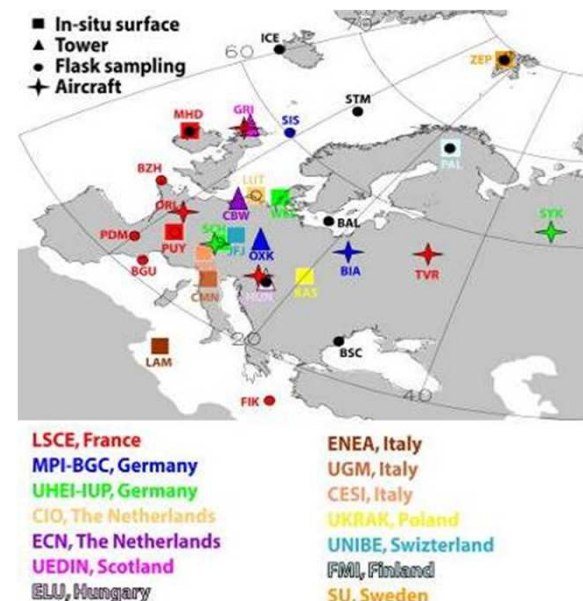
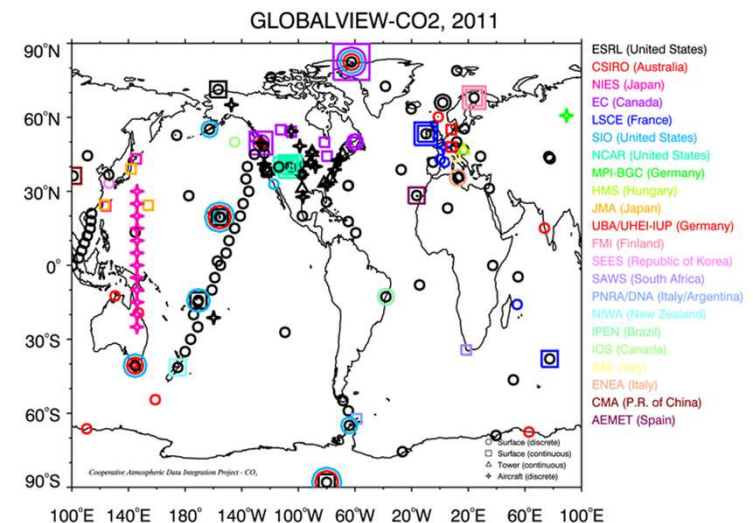


Globalview dataset

Contributions are coming from:

- ✓ 9 institutes from Europe
- ✓ 5 institutes from North America
- ✓ 4 institutes from Asia
- ✓ 2 institutes from Australia/New Zealand
- ✓ 1 institute from South America
- ✓ 1 institute from Africa

There are more European institutes involved in the emerging monitoring network. Not yet contributing to Globalview



Characteristics of the European network



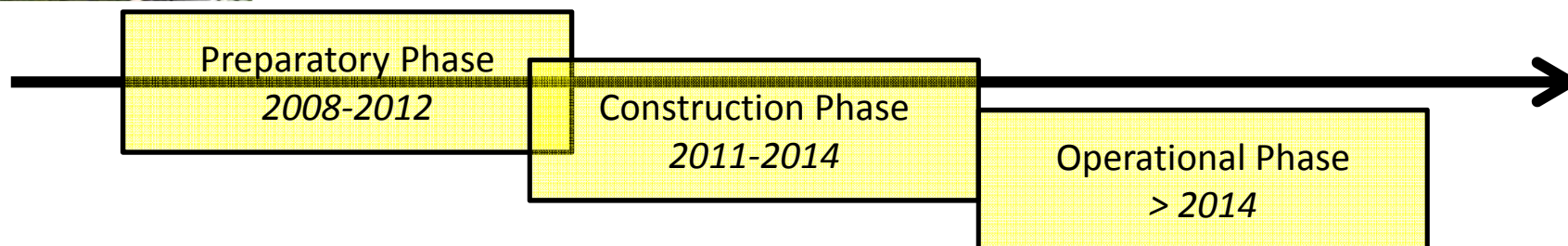
- ✓ Dense network of in-situ observatories
- ✓ Large heterogeneity in protocols
- ✓ Very active scientific community
- ✓ Implementation of ICPs programs



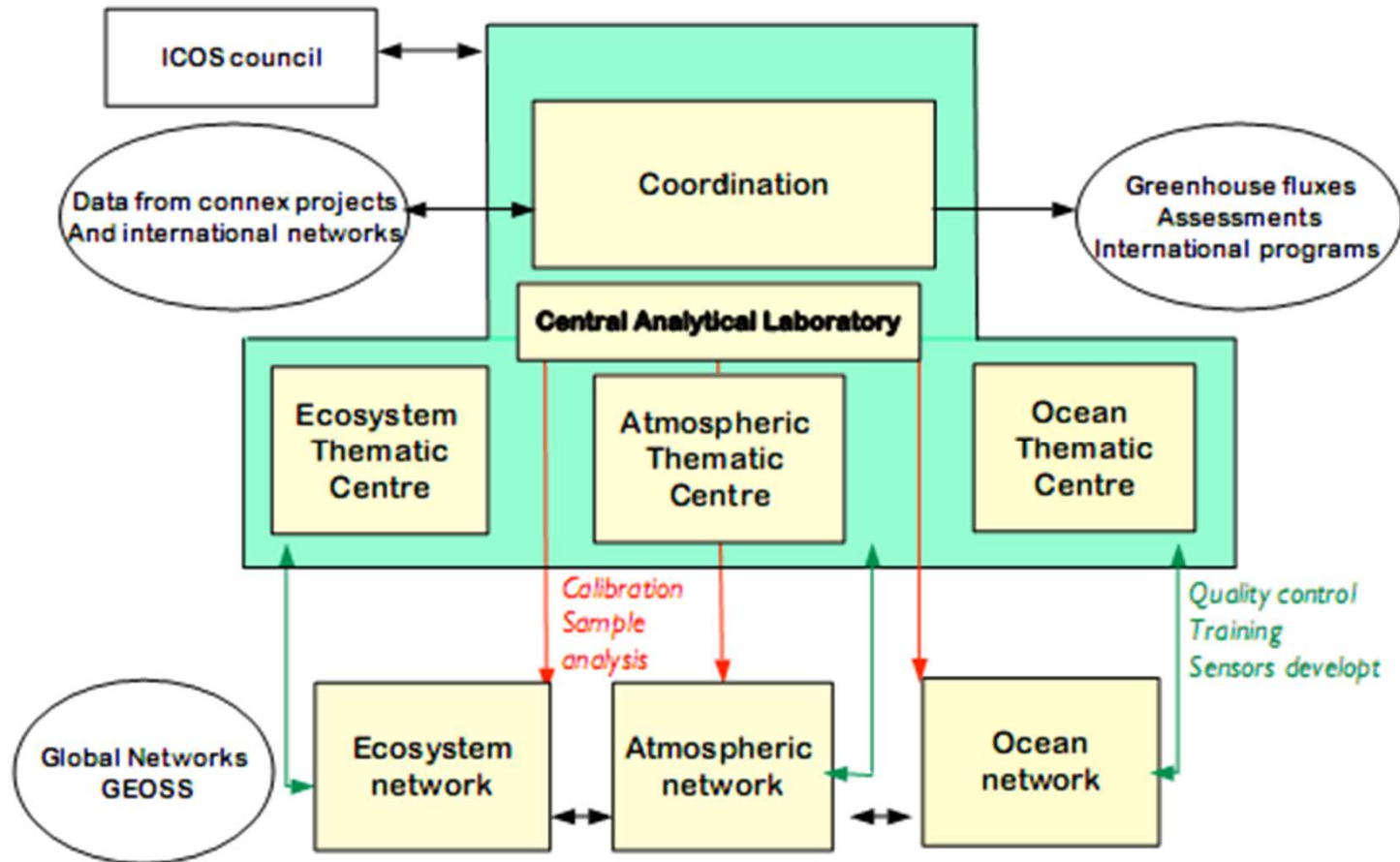
- ✓ Short term (3-4 years) collaborative projects
- ✓ Large heterogeneity in protocols
- ✓ Accessibility to the data (network)
- ✓ Lack of metadata



- ❑ European Research Infrastructure to estimate the greenhouse gases fluxes
- ❑ Long term monitoring of GhGs in Europe and key regions
- ❑ Distributed networks and centralized infrastructures



Networks & Centralized infrastructures

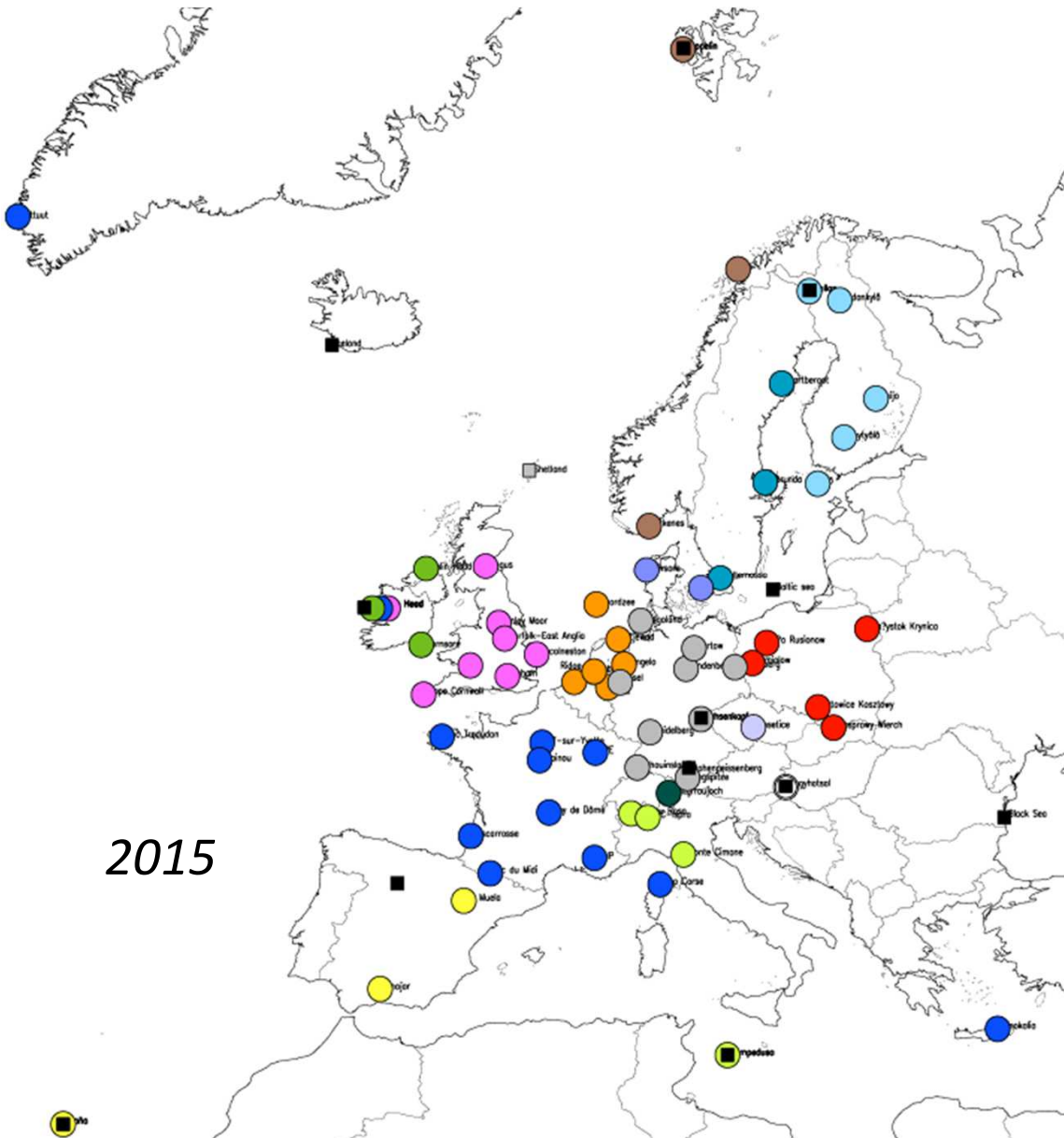


*Analytical Lab:
Working gases,
flask analysis*

*Thematic Centers:
Data processing,
technical support to
stations, technology
survey*

*Monitoring
Networks*

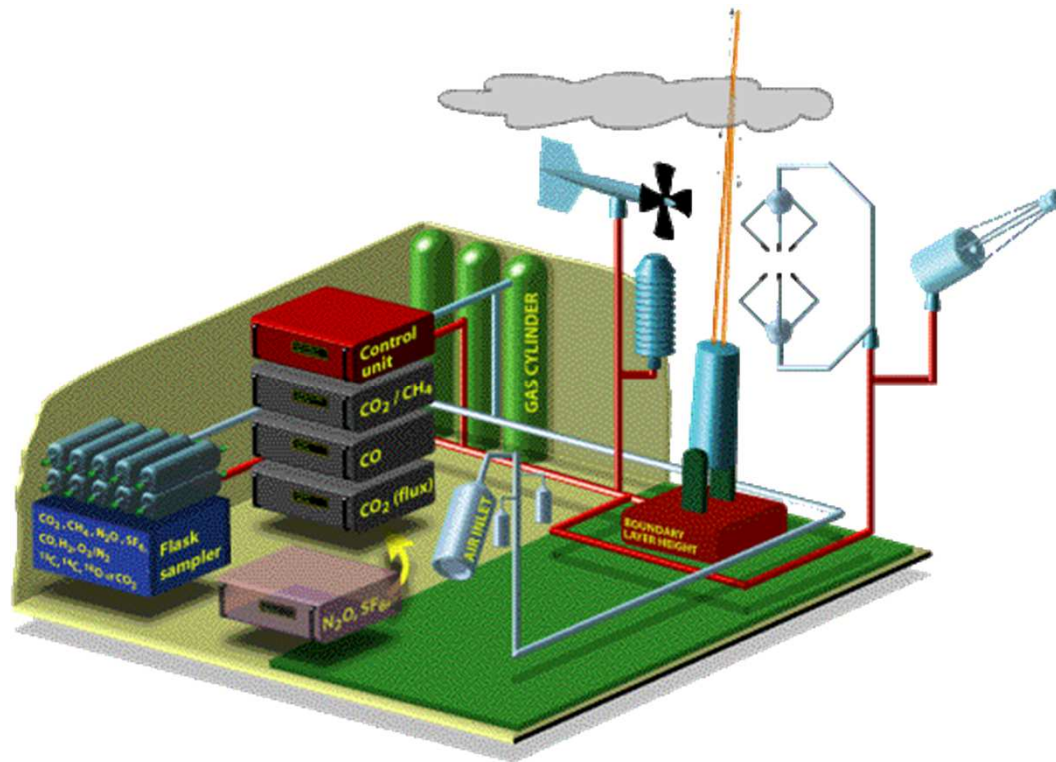
The European network



- ✓ Sum of national measurement networks
- ✓ Poor coverage of South-East Europe
- ✓ Overlap with ESRL/NOAA network at ≈ 7 sites
- ✓ Overlap with TCCON at $\approx 3-5$ sites
- ✓ Redundant continuous measurement at Mace Head (+ overlap AGAGE)
- ✓ Flask sampling required at Level-1 stations

See Poster BP07, and Talk B3

What parameters will be monitored ?



Measurements

- CO₂
- Meteo (Wind, P, T, H)

Level 2

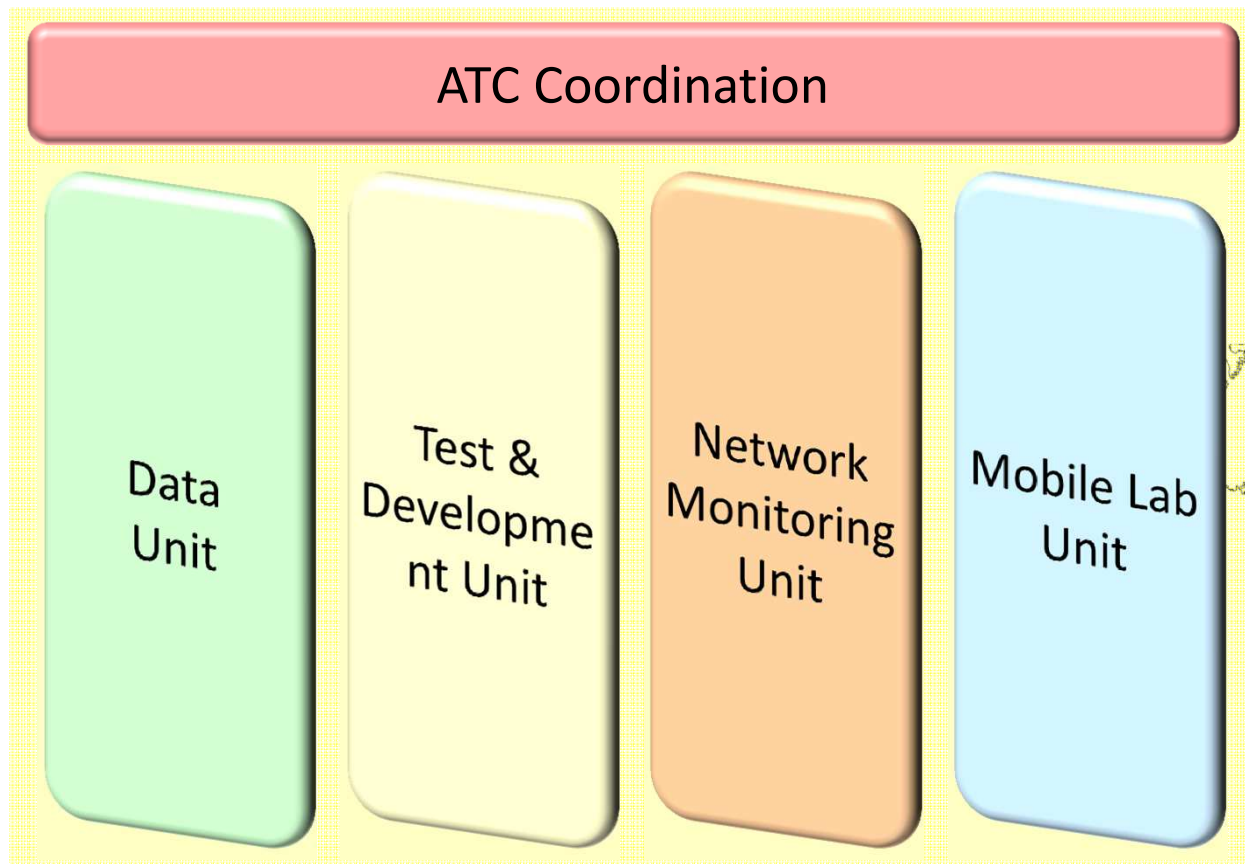
- CH₄
- CO
- PBL height
- Weekly air samples (CO₂, CH₄, N₂O, SF₆, CO, H₂, isotopes)

Level 1

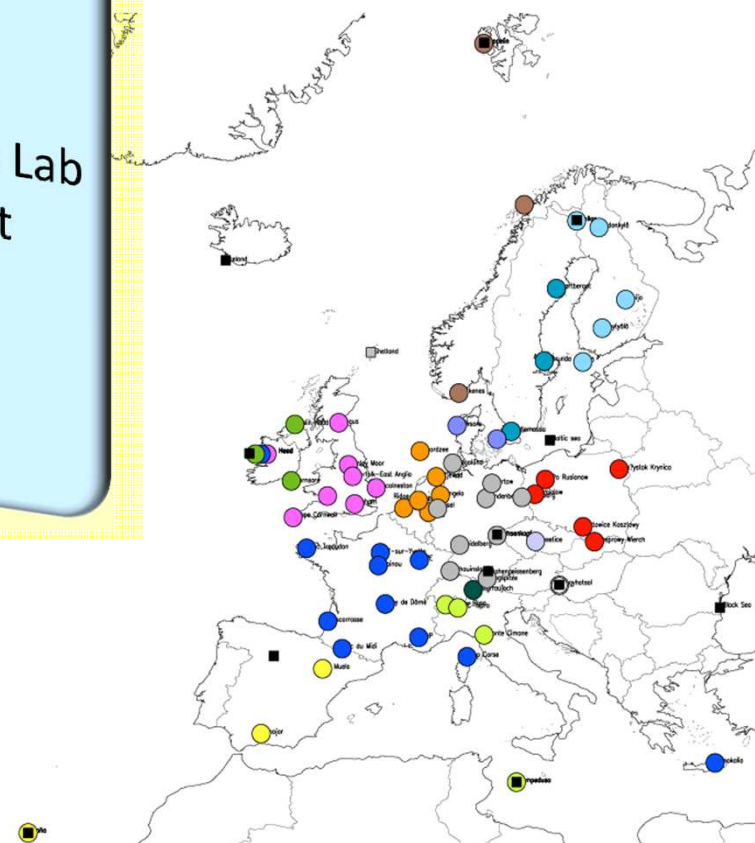
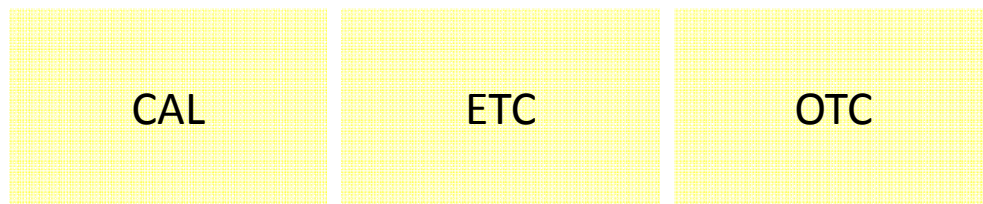
- Radon
- N₂O
- O₂/N₂

Options

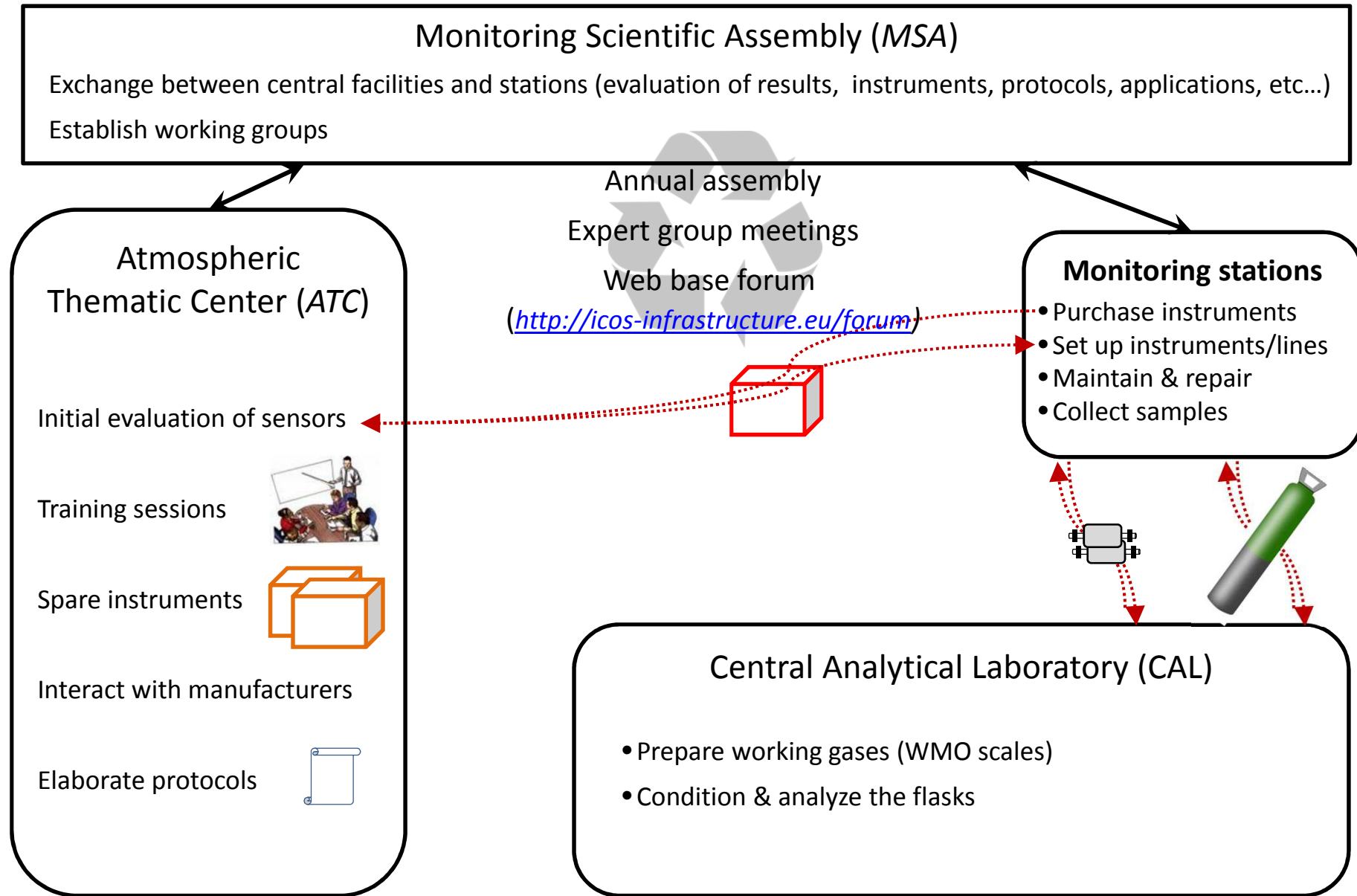
Organisation of the Atmospheric Thematic Center



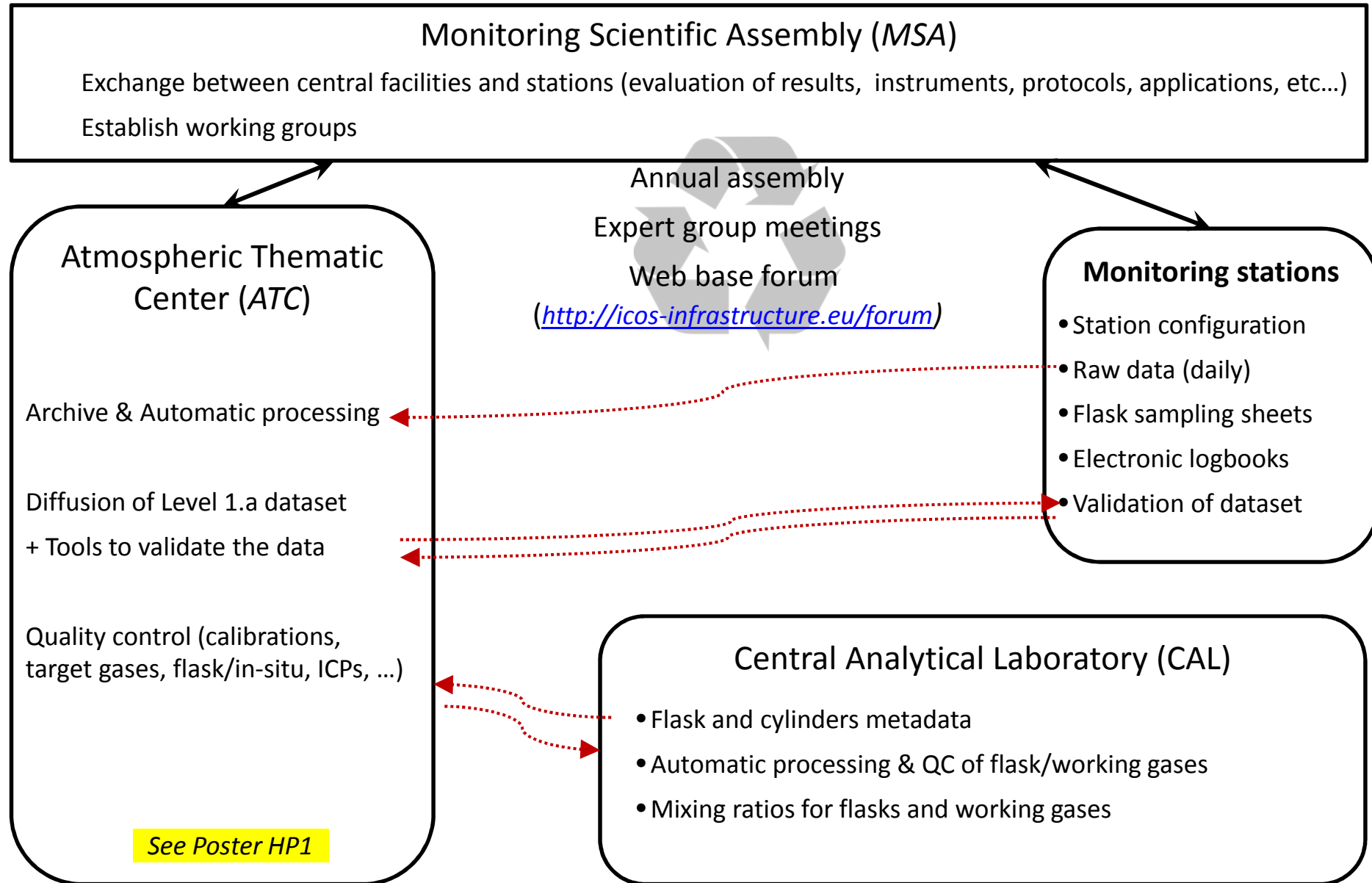
ICOS Coordination



ICOS interactions (metrology)



ICOS interactions (data)



The DEMO Experiment

<https://icos-atc-demo.lsce.ipsl.fr/demo-experiment-network>

Demo Experiment

- Presentation
- The Demo Network
- Atmospheric Thematic Center

ICOS stations

- Cabauw Observatory
- ▼ Mace Head Observatory
 - Interactive plot
 - Panel board
- OPE-ANDRA Observatory
- Puijo Observatory

Measurements

- CO2 - 24H

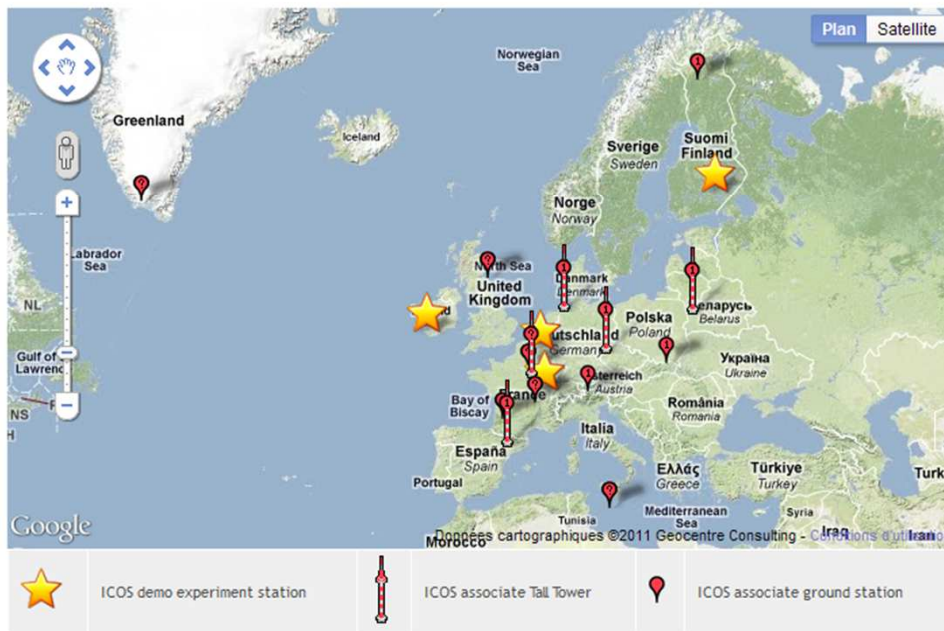
User login

Username *

Password *

- Create new account
- Request new password

The Demo Atmospheric Network



- Goals:**
- Evaluate instruments and protocols in real conditions
 - Evaluate the data processing
 - Communicate about the ICOS project

Station ICOS – OPE



High tower (120m) equipped with:

- Meteo sensors (120m, 50m, 10m)
- CO₂ flux with *Licor7200* & *Sonic Gill HS-50* (50m)
- 11 sampling lines at three levels (120m, 50m, 10m)
- Optic fiber

Shelter equipped with:

- Analyzer for CO₂/CH₄ with *Picarro G1301* (120m, 50m, 10m)
- Analyzer for CO/N₂O LGR(120m, 50m, 10m)
- Lidar Leosphere *ALS-300*
- Air sampling system for weekly flasks (120 m)
- Air sampling system for ¹⁴CO₂ (120 m)
- Analyzer for Radon (10m)



Running since March 2011

See Poster BP1



Virtual visit of the OPE station

Demo Experiment

- Presentation
- The Demo Network
- Atmospheric Thematic Center

ICOS stations

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Measurements

- CO2 - 24H

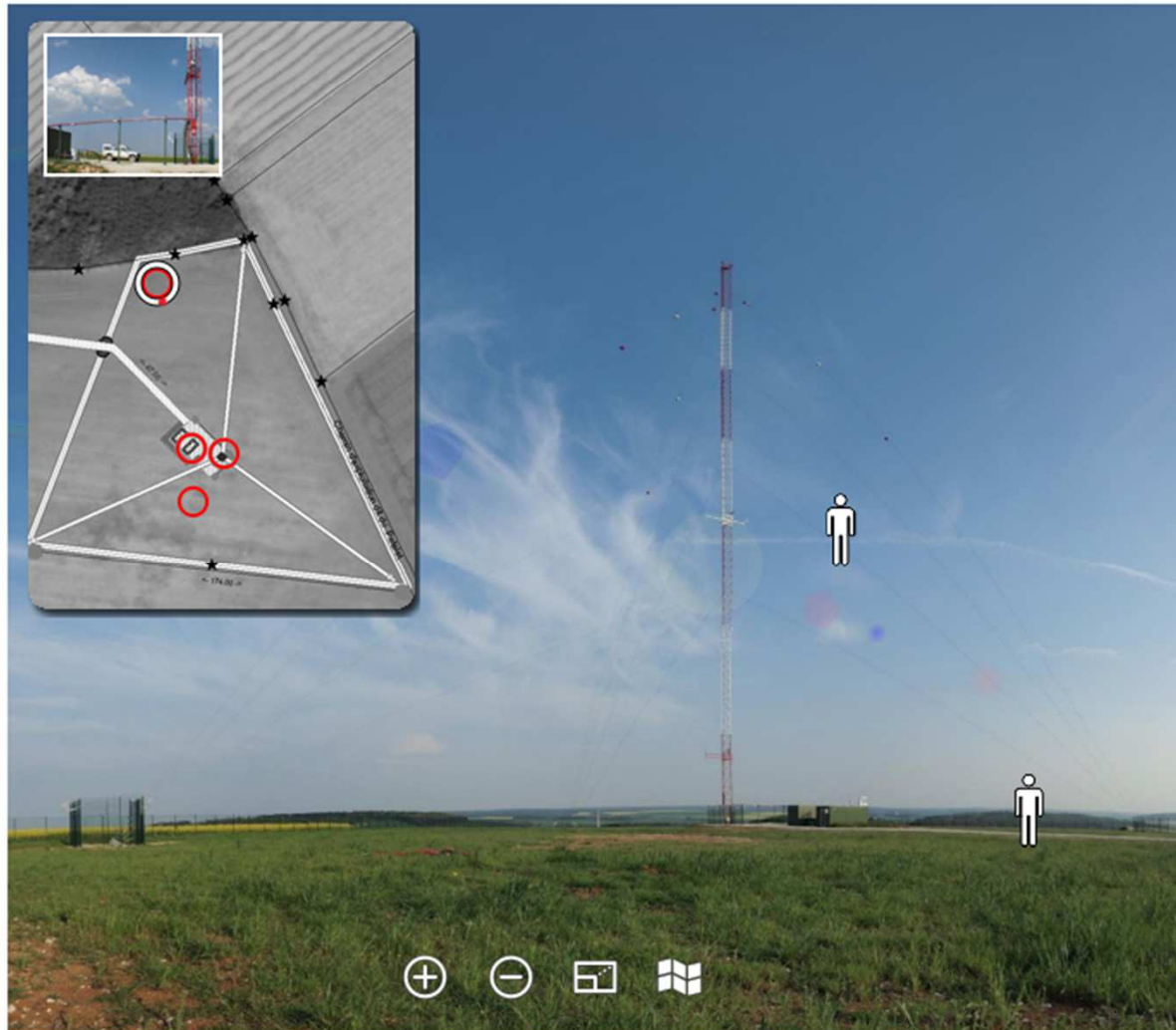
User login

Username *

Password *

- Create new account
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Virtual Visit



Short descriptions of the stations, instruments & protocols.

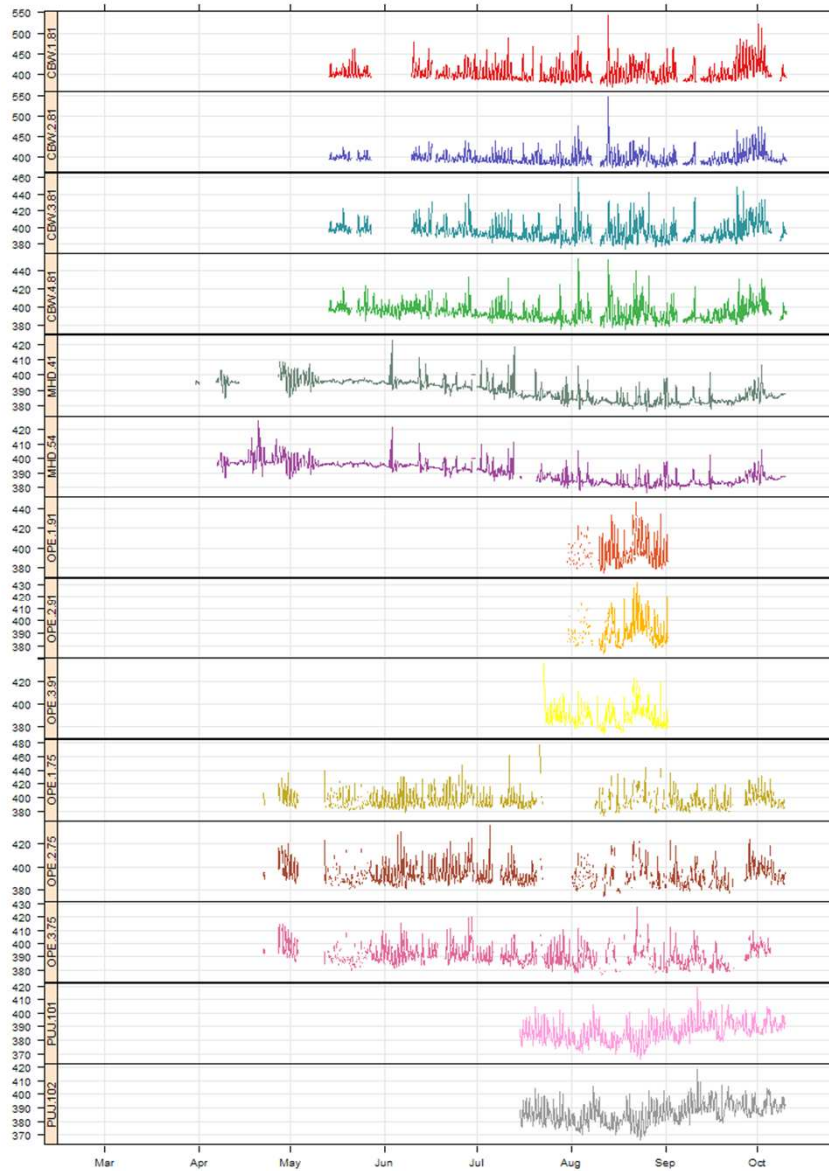
Access to the data in near real time (24hr)

Testing several configurations & protocols

		OPE (France)		Mace Head (Ireland)		Puijo (Finland)		Cabauw (Netherlands)
Analyzer	Type	Picarro G2301	Picarro G1301	Picarro G2301	Picarro G1301	Picarro G2301	Picarro G2301	Picarro G2301
	ATC ID	75	91	54	41	101	102	81
Ambient air	Sampling Levels (agl)	10, 50 & 120m	10, 50 & 120m	20 m	20 m	75 m	75 m	20, 60, 120 & 200 m
	Drying System	None	Cryo trap	Cryo trap	None	Nafion	None	None
	Inlet over Pressure	NO	YES (110 kPa abs.)	NO	NO	NO	NO	NO
	Duration	30 min/Level	30 min/Level	420 min	420 min	540 min	540 min	5 min/Level
Calibration Strategy	Nb of Calibration Gas	4	4	4	4	3	3	4
	Nb of sequencies	4	4	5	5	1	1	1
	Calibration Gas order	Crescendo	Crescendo	Crescendo	Crescendo	Crescendo	Crescendo	None
	Cal. Gas duration	30 min	30 min	30 min	30 min	15 min	15 min	5 min
	Calibration period	15 days	15 days	9 days	9 days	12 days	12 days	21 hours
	Cal. Gas through Dryer	N/A	NO	NO	N/A	YES	N/A	N/A
Control Strategy	Short Term Target Gas	30 min/4 ^h 30	30 min/4 ^h 30	20 min/7h	20 min/7h	12 min/9h	12 min/9h	5 min/15 min
	Long Term Target Gas	30 min/15 days (end of calibration)	30 min/15 days (end of calibration)	None	None	15 min/36h of ambient air sampling	15 min/36h of ambient air sampling	5 min/15 min of ambient air sampling

CO₂

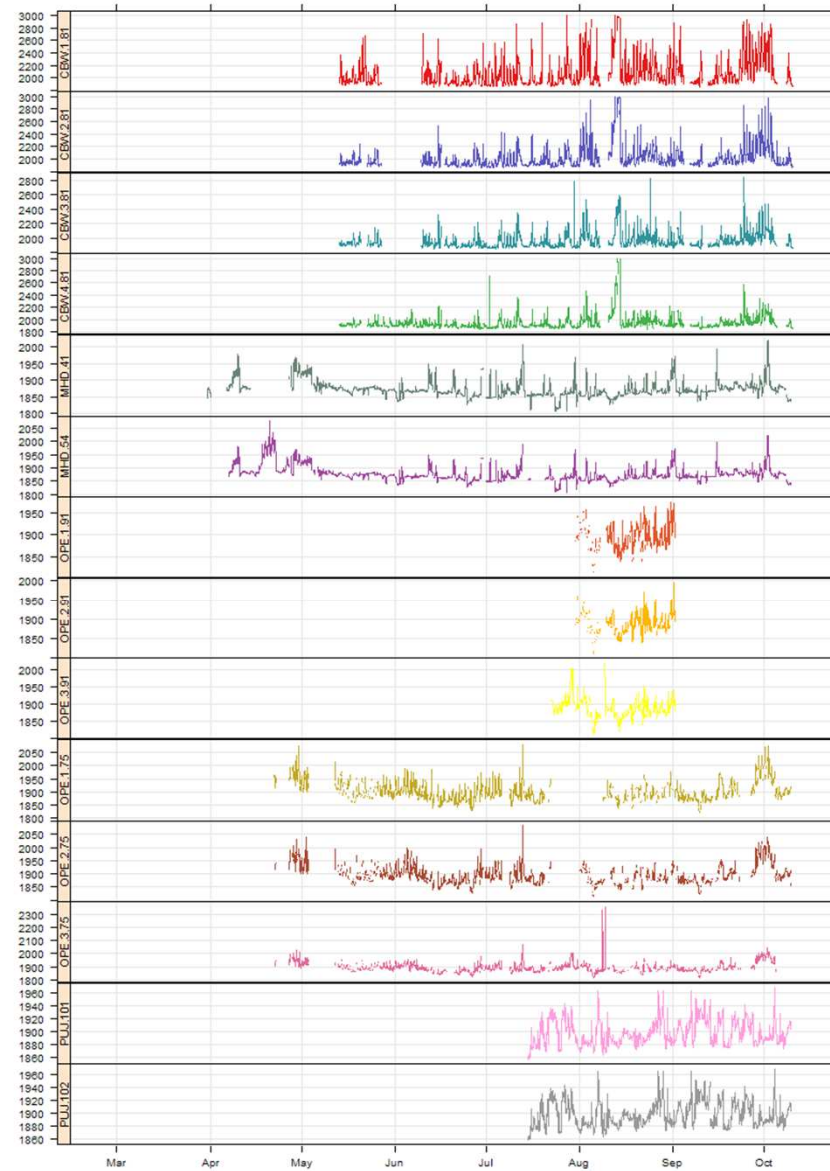
CO₂ - computed@LSCE, 2011-10-12 17:29:29



— CBW.1.81	— CBW.4.81	— date	— OPE.1.91	— OPE.1.75	— PUJ.101
— CBW.2.81	— MHD.41	— OPE.2.91	— OPE.2.75	— PUJ.102	
— CBW.3.81	— MHD.54	— OPE.3.91	— OPE.3.75		

CH₄

CH₄ - computed@LSCE, 2011-10-12 17:29:35



— CBW.1.81	— CBW.4.81	— date	— OPE.1.91	— OPE.1.75	— PUJ.101
— CBW.2.81	— MHD.41	— OPE.2.91	— OPE.2.75	— PUJ.102	
— CBW.3.81	— MHD.54	— OPE.3.91	— OPE.3.75		

CBW

MHD

OPE

PUJ



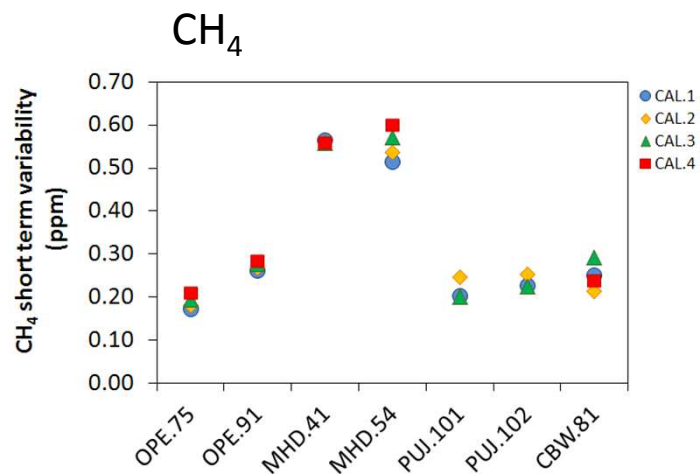
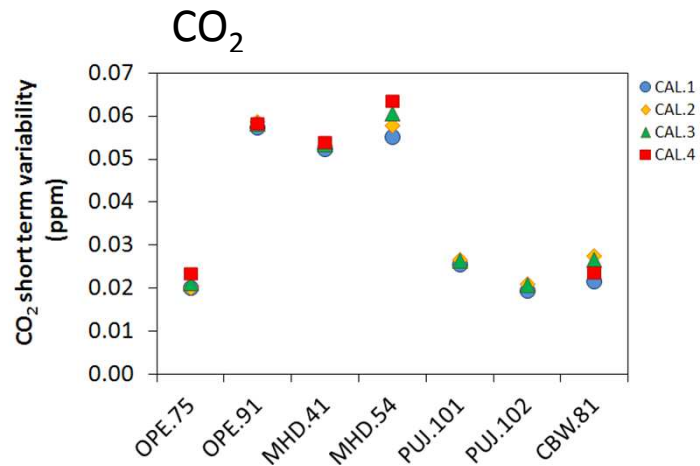
Quality control

- ❑ Calibration with 3-4 calibrated gases prepared by MPI (WMO scale)
- ❑ Two 'target' gases to monitor the instrument reproducibility
- ❑ Weekly flask sampling
- ❑ Roving instrument See Talk H9



Tracking the instrument precision

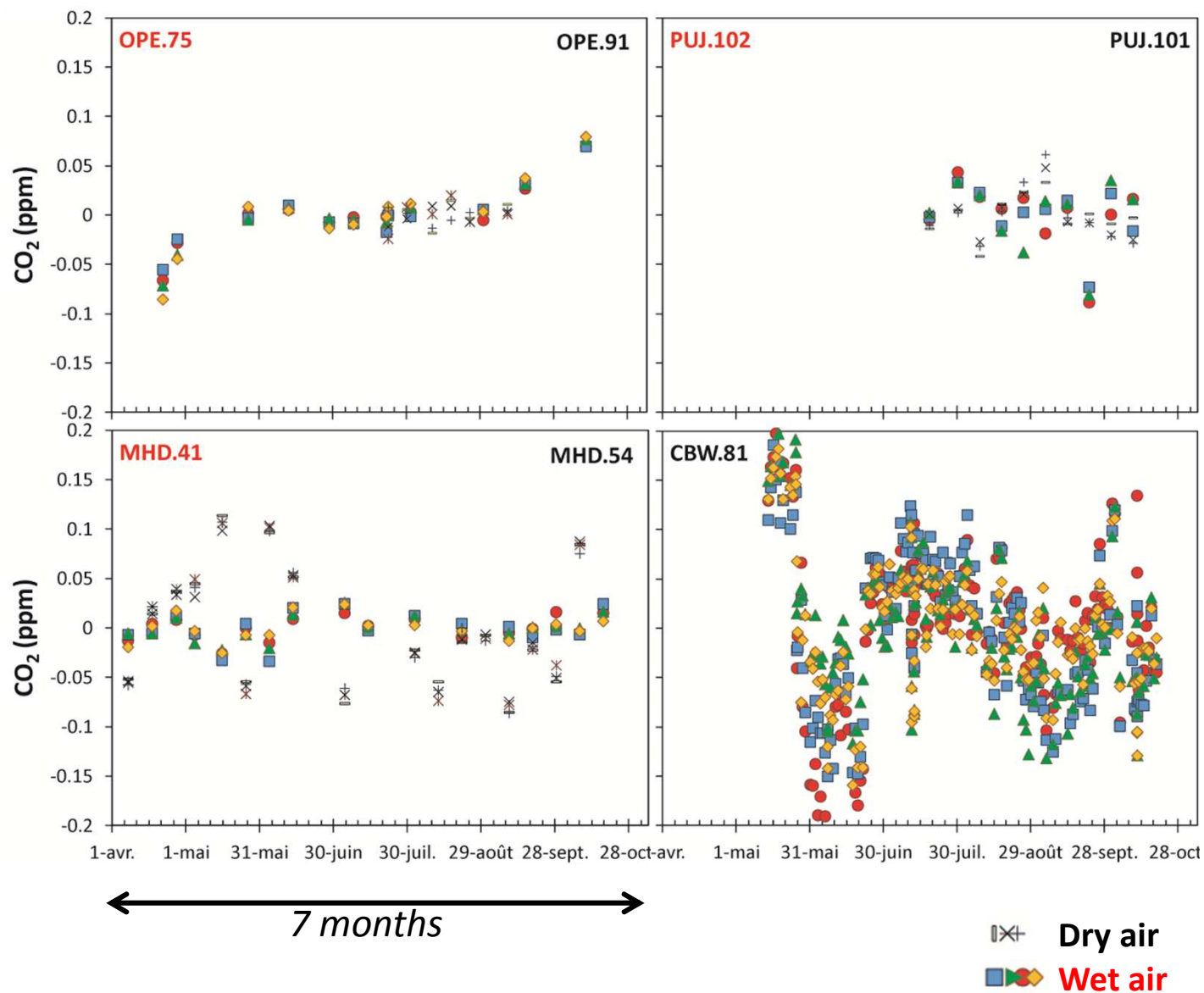
See Talk G3



Site ID	Instru ID	Model	Factory Precision	ATC Precision	Field Precision
OPE	75	G2301	0.019	0.014	0.021
OPE	91	G1301	0.067	-	0.058
MHD	41	G1301	0.052	-	0.053
MHD	54	G2301	0.067	0.025	0.059
PUJ	101	G2301	0.019	-	0.026
PUJ	102	G2301	0.027	-	0.020
CBW	81	G2301	0.024	-	0.025

Site ID	Instru ID	Model	Factory Precision	ATC Precision	Field Precision
OPE	75	G2301	0.18	0.18	0.19
OPE	91	G1301	0.27	-	0.27
MHD	41	G1301	0.68	-	0.56
MHD	54	G2301	0.58	0.26	0.55
PUJ	101	G2301	0.25	-	0.22
PUJ	102	G2301	0.24	-	0.24
CBW	81	G2301	0.20	-	0.25

Tracking the calibrations

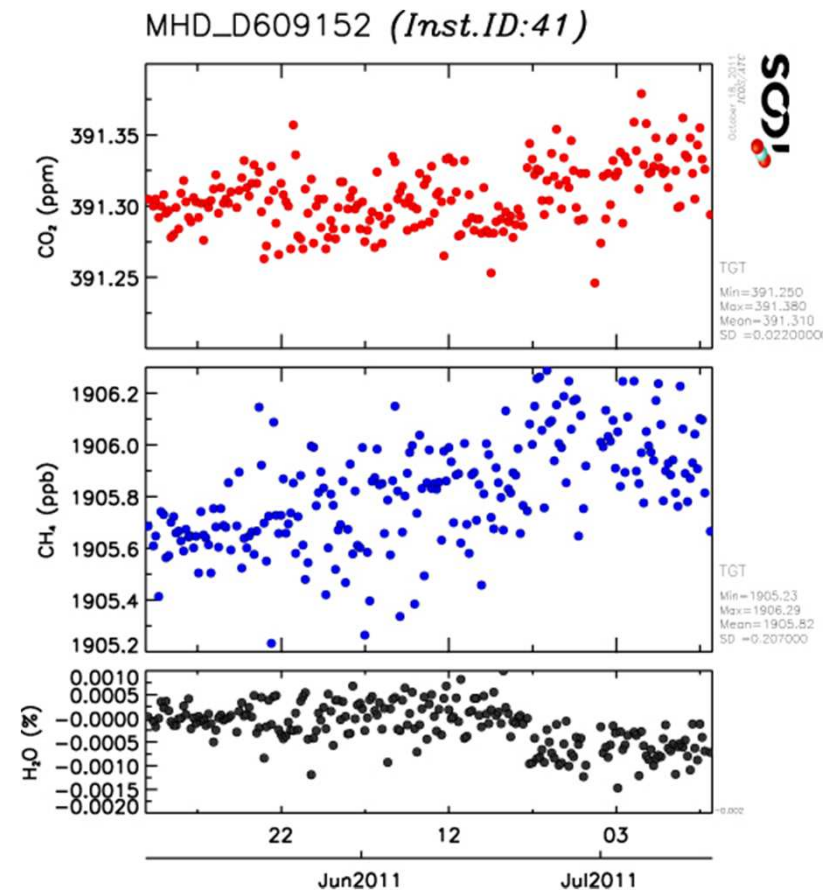


Instrument MHD.54 will be sent back to factory for replacement of the cavity

Tracking the target gases

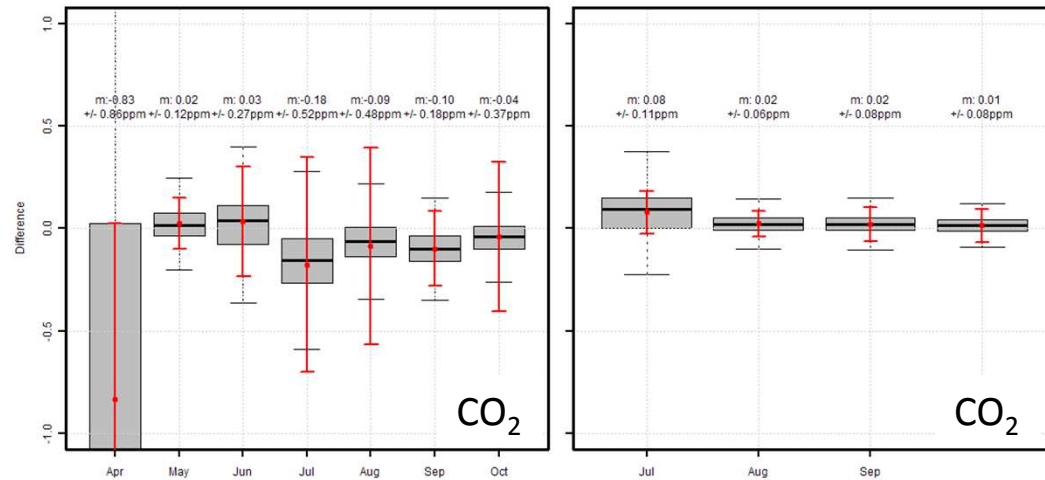
Site ID	Instru ID	Model	CO2 ppm	CH4 ppb
OPE	75	G2301	±0.024	±0.29
OPE	91	G1301	±0.037	±0.27
MHD	41	G1301	±0.022	±0.21
MHD	54	G2301	±0.067	±0.47
PUJ	101	G2301	±0.026	±0.33
PUJ	102	G2301	±0.036	±0.42
CBW	81	G2301	-	-

Dry air
Wet air

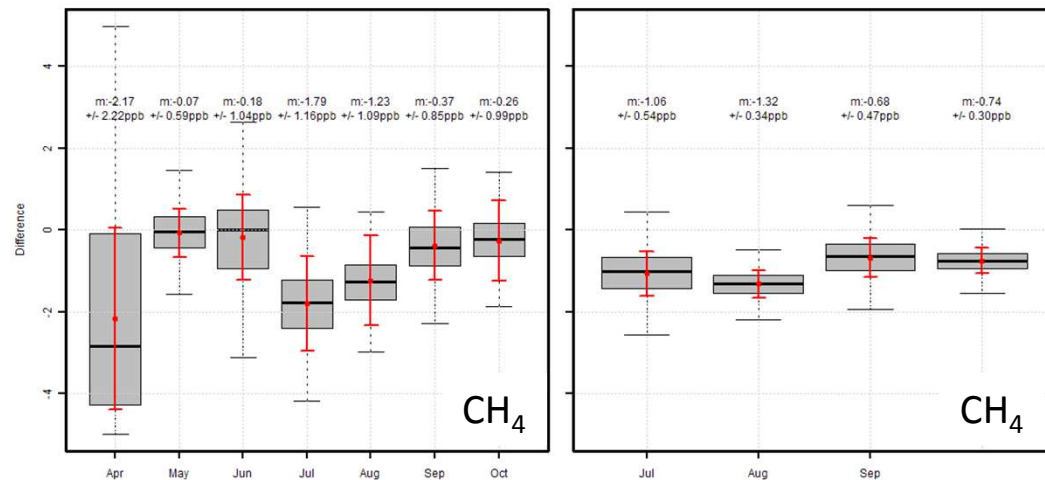


Comparison of redundant measurements

MHD.41.data2 - MHD.54.data2 - CO2 - computed@LSCE, 2011-10-14 17:46:23 PUIJ.101.data2 - PUIJ.102.data2 - CO2 - computed@LSCE, 2011-10-14 17:44:57



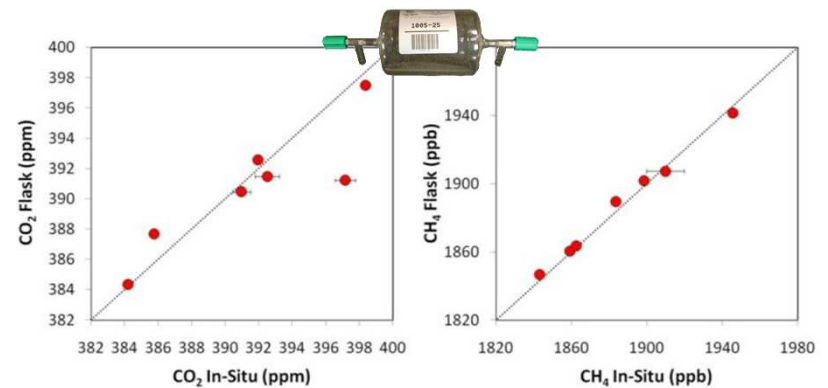
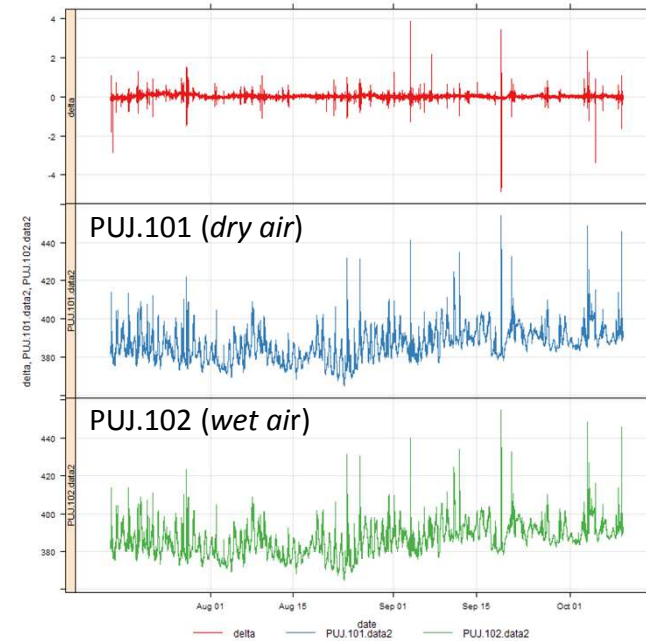
MHD.41.data2 - MHD.54.data2 - CH4 - computed@LSCE, 2011-10-14 17:46:55 PUIJ.101.data2 - PUIJ.102.data2 - CH4 - computed@LSCE, 2011-10-14 17:45:15



Mace Head, Ireland

Puijo, Finland

Puijo, Finland



OPE, France



- ✓ Building an European infrastructure is a tremendous challenge.
- ✓ Previous European projects (AEROCARB, CARBOEUROPE, TACOS, IMECC, ...) have established the community, and enabled the emergence of central data archive, near real time data collection, exchange of expertise, etc...
- ✓ ICOS is going beyond what's been done before in terms of standardization, central processing of data, working gases and air samples.
- ✓ Optimizing the relationships between the nation-based networks, and the central facilities will need a lot of iterations. It will be essential to continue to make profit of the expertise and research activities which are on-going in the networks.
- ✓ The on-going Demo Experiment is providing an opportunity to test protocols and interactions between the partners.
- ✓ Many developments are ongoing for the data processing and links with stations
- ✓ Workshop will be organized in early 2012 to discuss about the results of the Demo; Task force group on data management will be gathered in Nov. 2011

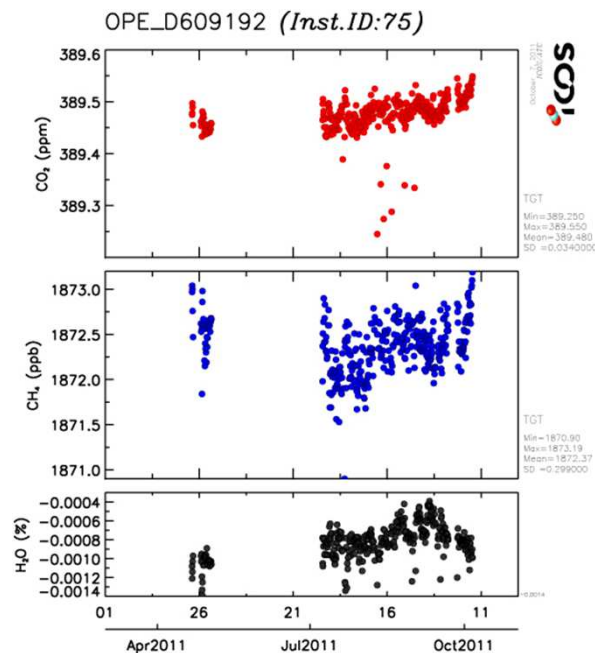
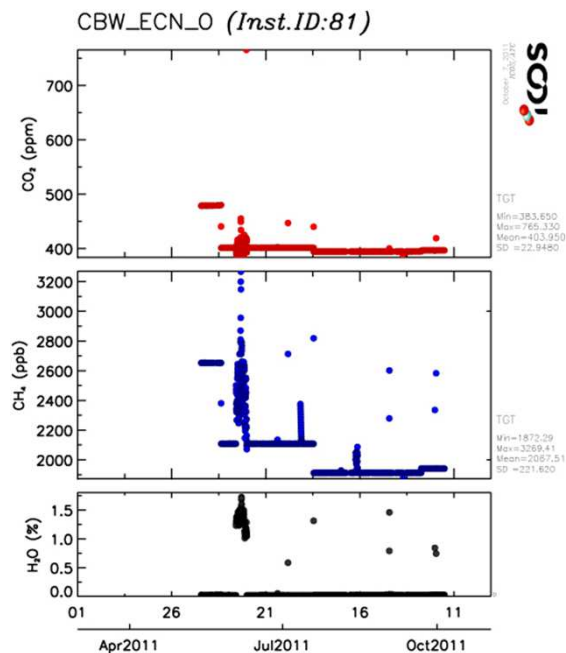
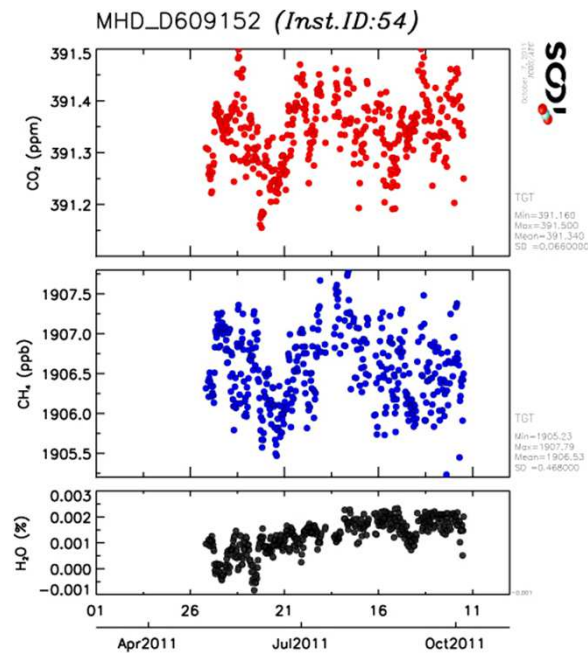
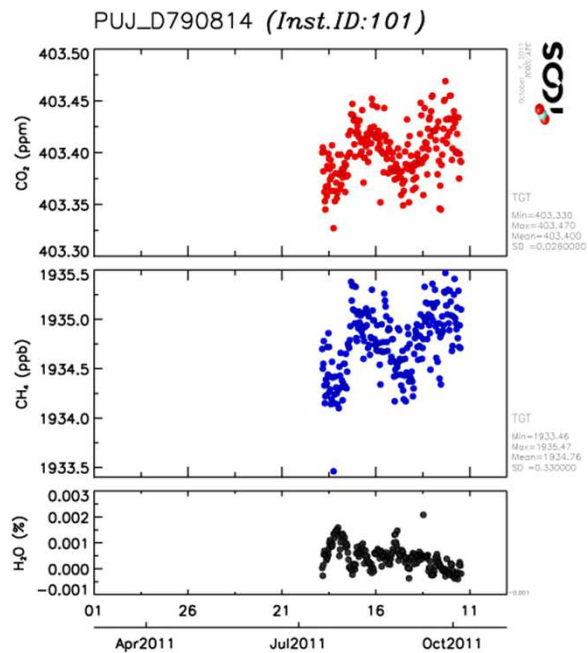


Atmospheric data products

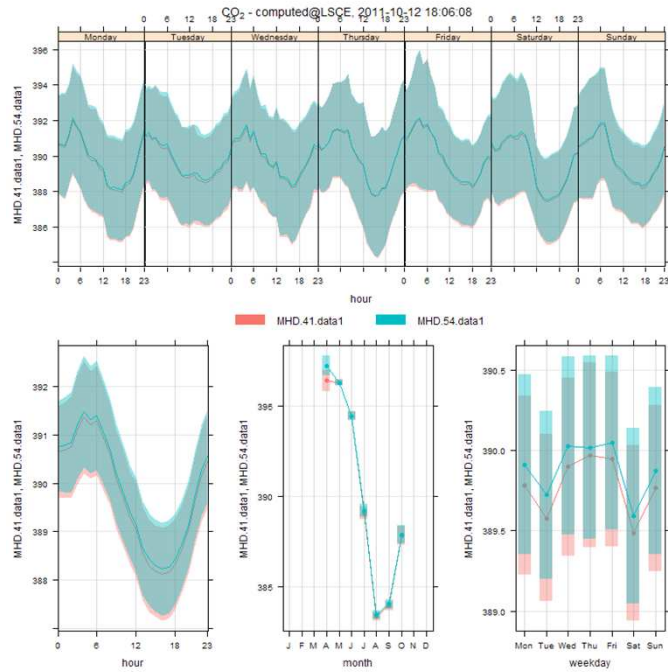
Following the experience of European projects like CarboeuropelP and IMECC, the data acquired by the Atmospheric Network will be available at different processing levels

- **Level 0**: Raw data (e.g. current, voltages) produced by each instrument
- **Level 1**: GHG concentrations in geophysical units (e.g. ppm-CO₂)
 - Level 1.a : Rapid delivery data (24hr)*
 - Level 1.b : Long term validated data*
- **Level 2**: Elaborated GHG concentrations (e.g. gap-filling, selection, etc...)
- **Level 3**: Added value products (to be defined with AS PIs)

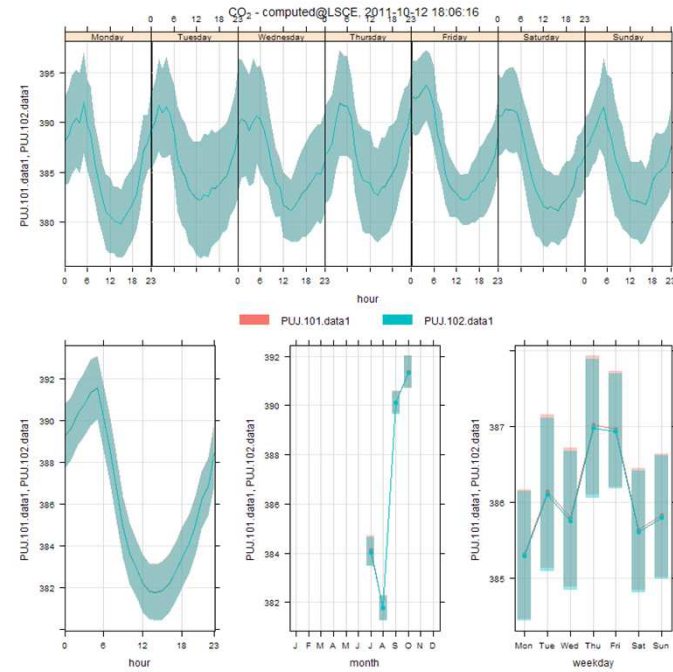
Metadata, ancillary information, other relevant information will be also standardized .



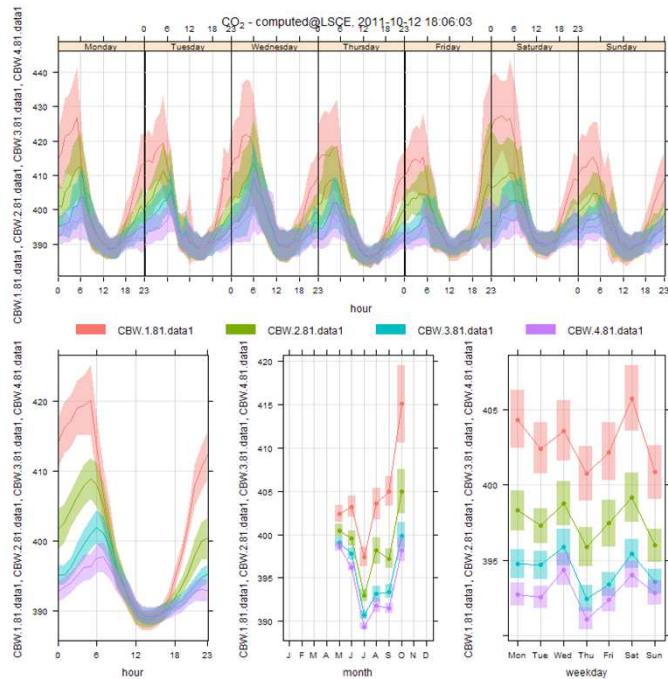
MHD



PUJ



CBW



OPE

