

# Importance of IAGOS to the Global Observing System for the atmospheric composition

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**WMO OMM**

World Meteorological Organization

Organisation météorologique mondiale

# Global Atmosphere Watch Programme



Provides international leadership in research and capacity development in atmospheric composition observations and analysis through:

- *maintaining and applying long-term systematic **observations** of the chemical composition and related physical characteristics of the atmosphere,*
- *emphasizing **quality assurance and quality** control,*
- *delivering integrated **products and services** related to atmospheric composition of relevance to users.*

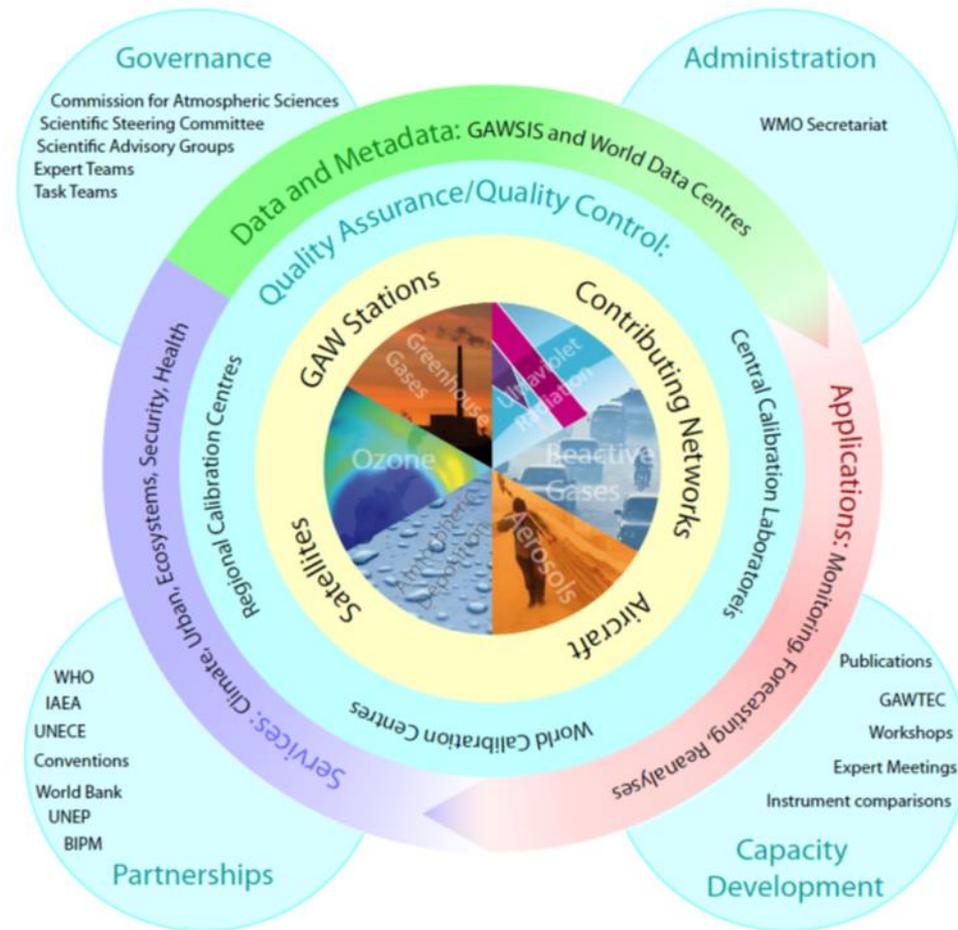
GAW builds on partnerships involving contributors from **100** countries (*including many contributions from research community*)

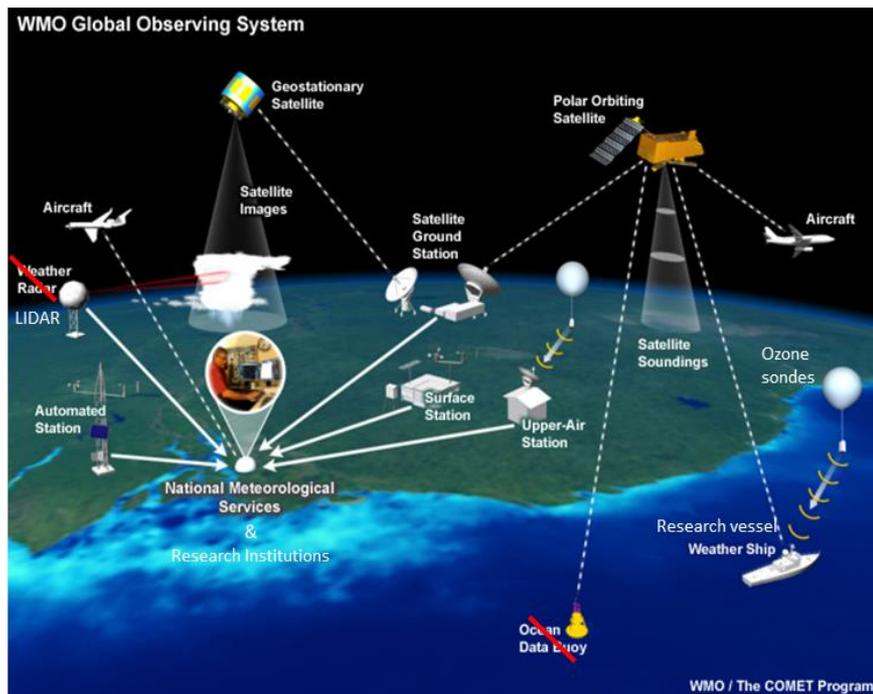


# Elements covered in the GAW Implementation Plan



- Observations
- Quality assurance
- Data management
- Modeling
- Joint research
- Capacity building
- Outreach and communications





Continue to improve observational systems and data using **RRR and WIGOS/WIS (WMO Integrated Global Observing System and WMO Information System)** to evolve the observing system for atmospheric composition to support the growing services to:

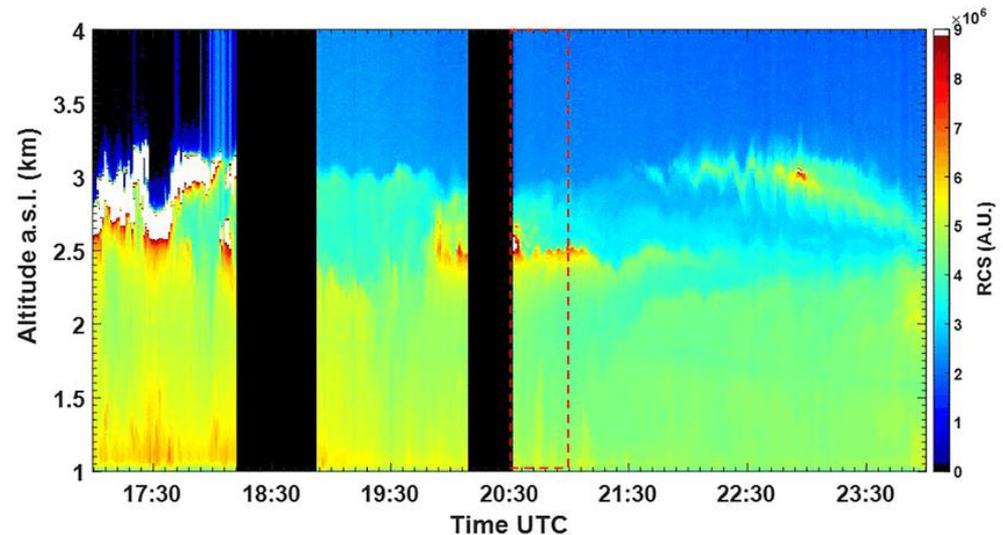
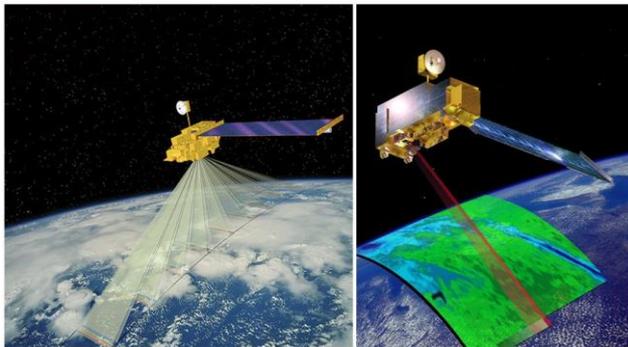
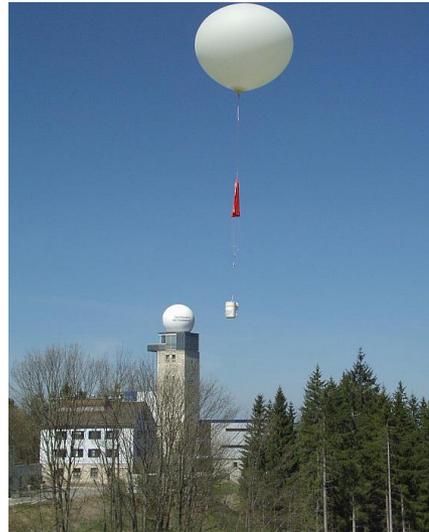
- allow near real-time provision of GAW data,
- ***support integration of surface, vertical profile and column datasets from different platforms to provide a unified understanding of aerosol and gas distributions,***
- minimize gaps in the measurement networks in data-poor regions.

**GAW observational network comprises:**

- Global stations (31)
- Regional stations
- Local stations
- Mobile platform
- Contributing networks (10)

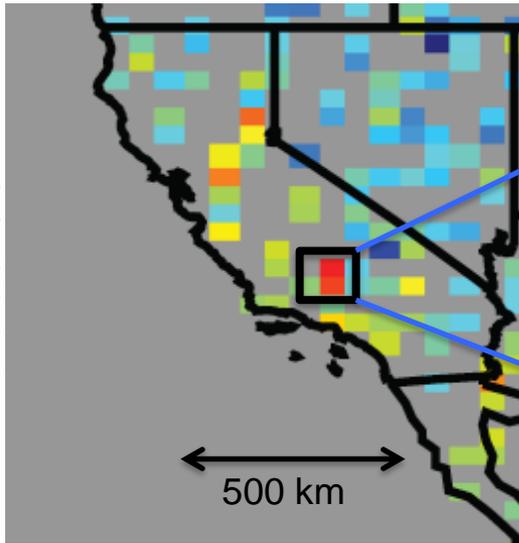
# How to get vertical component?

- Sondes
- Aircraft
- Remote sensing from the ground
- Satellite remote sensing



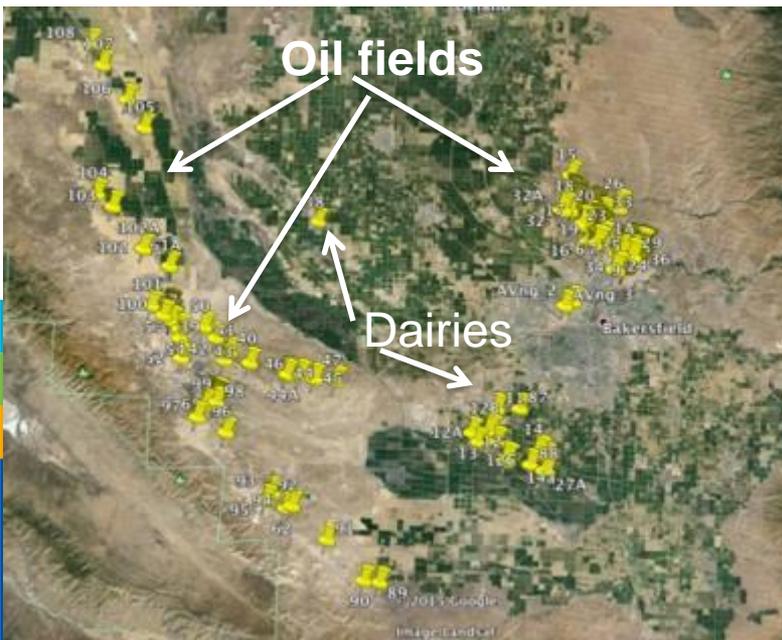
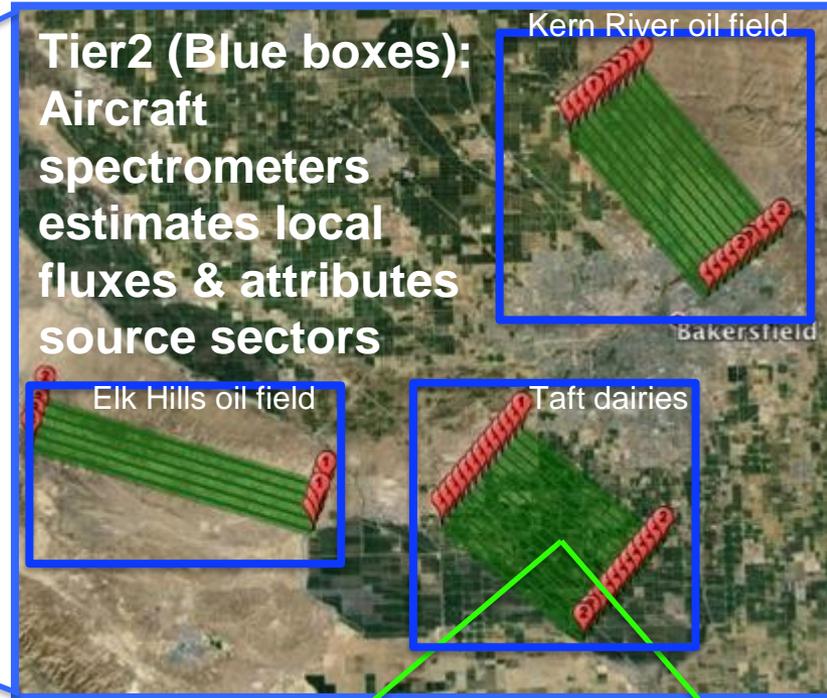
# A tiered strategy for monitoring methane leaks in the US

**Tier 1: Satellite detects hotspot region**



Turner et al 2015

**Tier2 (Blue boxes):**  
Aircraft spectrometers estimates local fluxes & attributes source sectors

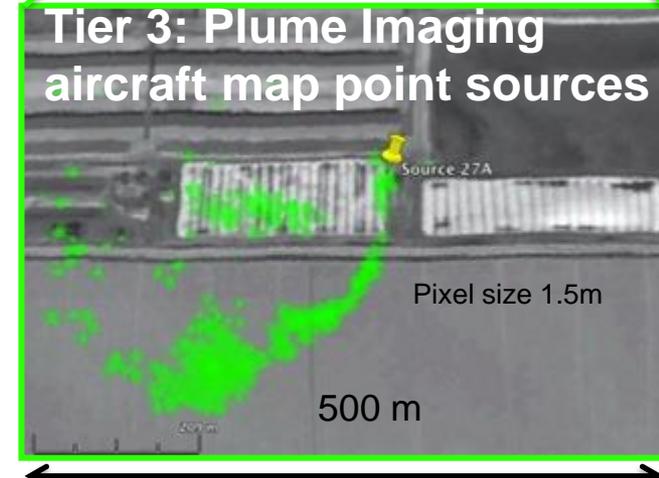


**Enhanced Activity Data**

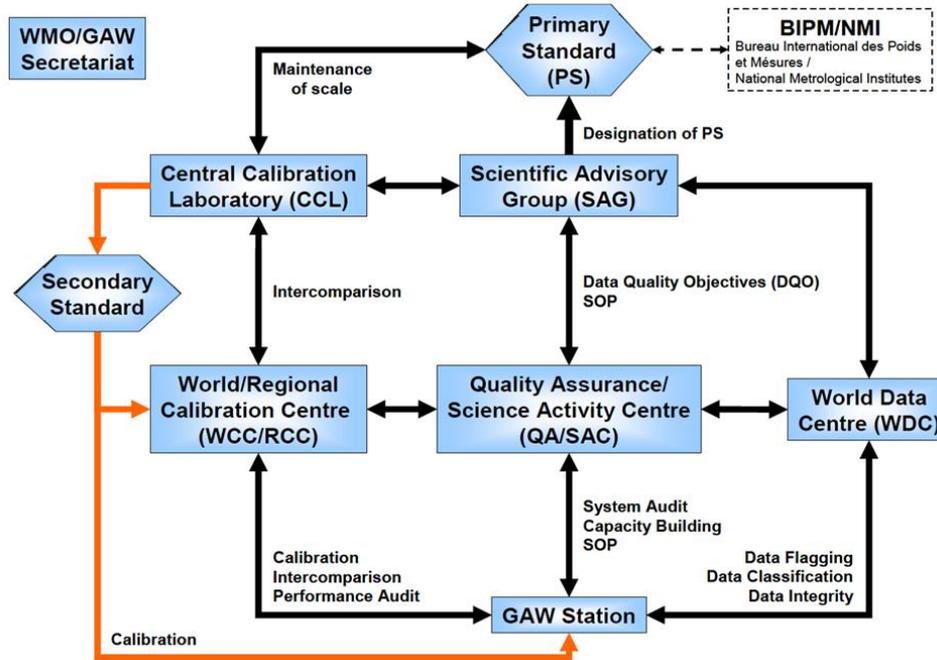
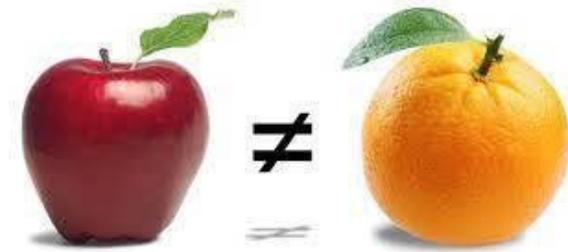


**Tier 4 (not shown):**  
Surface observations

**Tier 3: Plume Imaging aircraft map point sources**



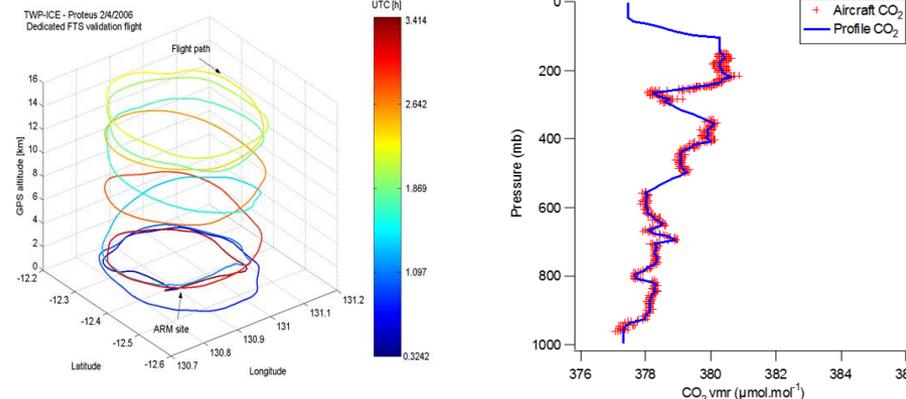
# How to put all components together (QA/AC)



- Network-wide one reference standard
- Full traceability to the primary standard
- The definition of data quality objectives (DQOs)
- Established guidelines on how to meet the quality targets

## GAW Quality Assurance Framework

### TCCON traceability approach



# Examples of the applications in GAW

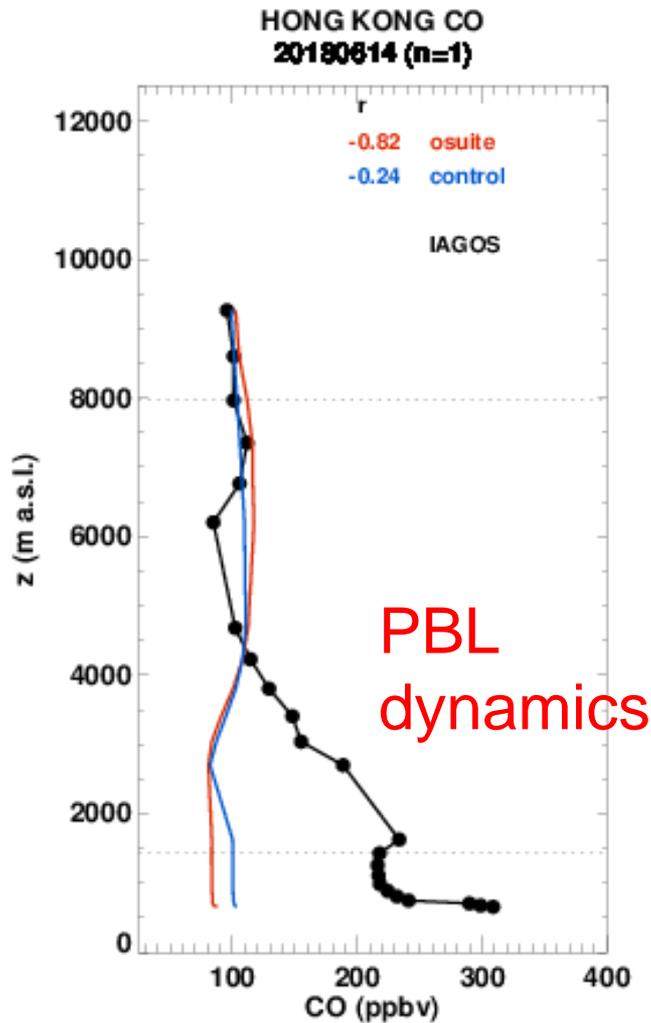


- *Support of international conventions:* stratospheric ozone, IG<sup>3</sup>IS
- *Ecosystem services:* analysis of total deposition, nitrogen cycle, deposition to the oceans/marine geoengineering
- *Health:* air quality including sand and dust storms and biomass burning contributions, urban air quality (GURME)
- *Food security:* atmospheric composition and agriculture
- *Transport security:* volcanic ash forecasting



# IAGOS for air quality forecasting

NRT data are needed for forecast verification or for the direct assimilation in the models



Verification with IA x Verification of Global Ser x R Example from the ceilom x

Secure | <https://atmosphere.copernicus.eu/user-support/validation/verification-global-services>

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- Greenhouse gases
- Data Monitoring

**Near-real-time Ozone and Carbon Monoxide forecasts**

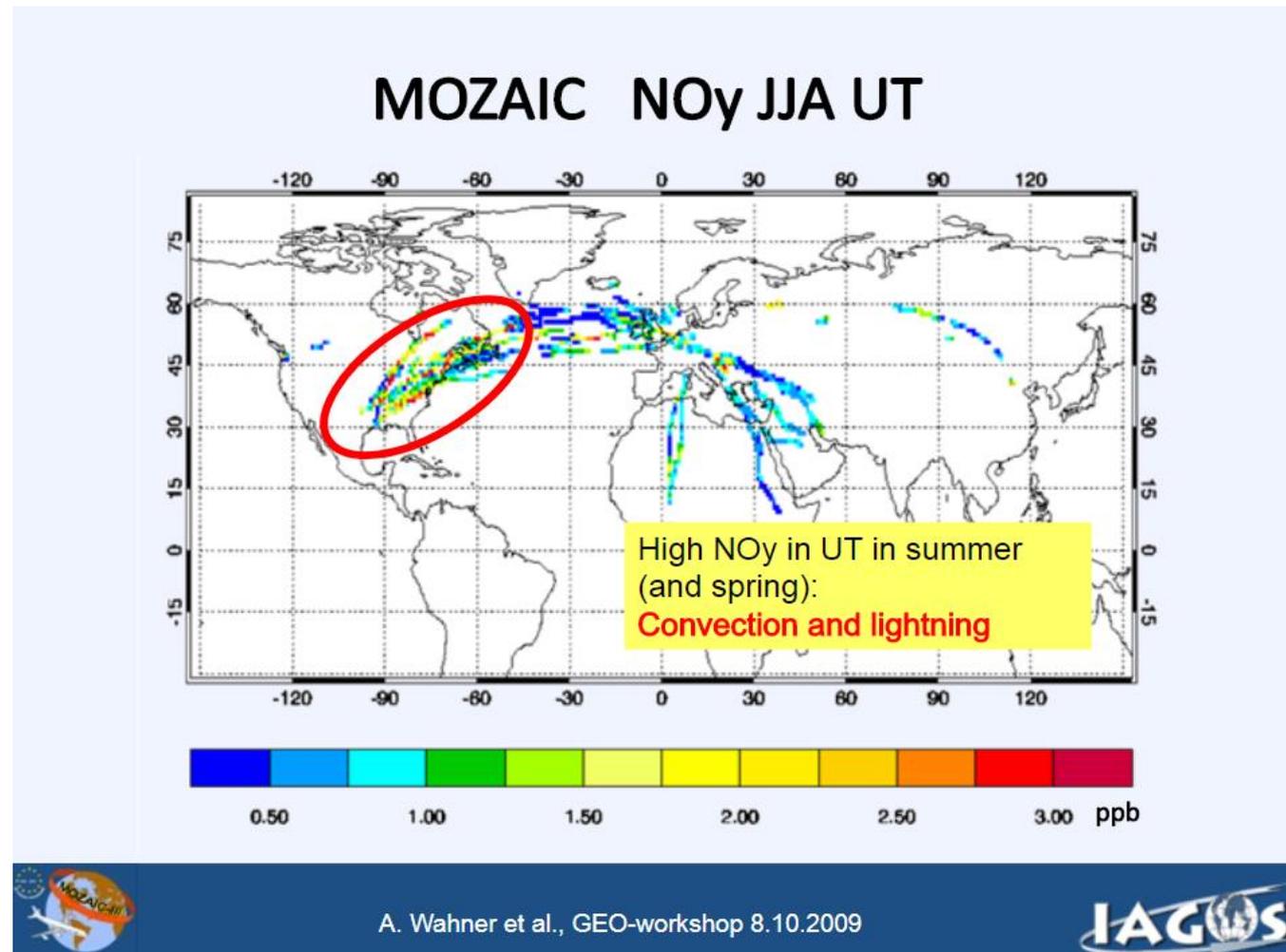
Surface ozone and carbon monoxide from the near-real-time analysis/forecast system are routinely verified against data from some of the WMO GAW stations.

**Near-real-time evaluation using IAGOS data**

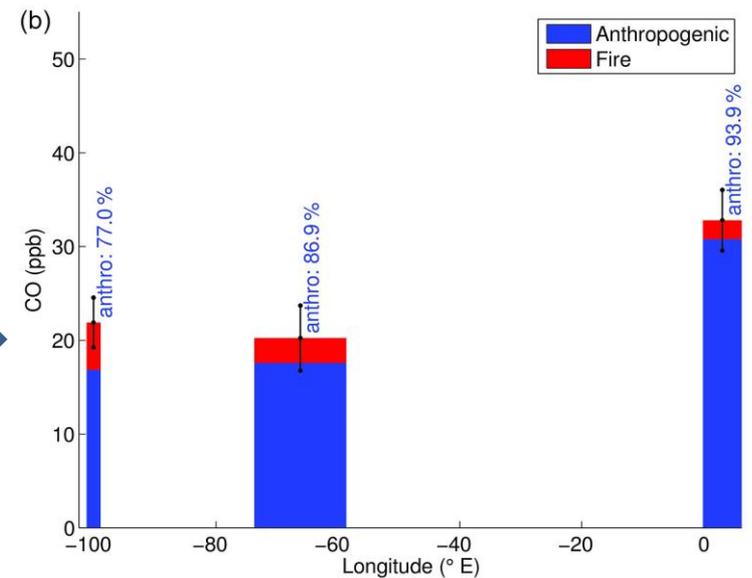
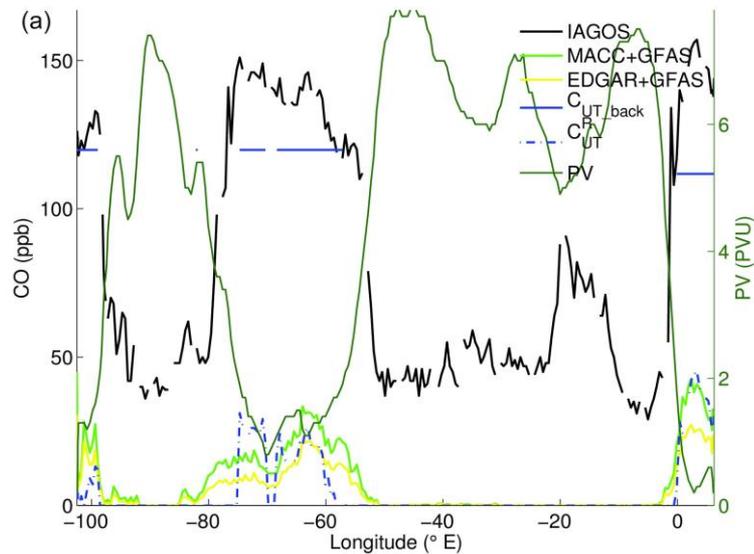
O<sub>3</sub> and CO from the CAMS NRT models as well as the MACC reanalysis are validated with profiles from IAGOS/MOZAIC aircrafts. Time-series of the difference between model and observations are presented for each available year, along with profiles at individual airports, and the observed climatologies.

# IAGOS for atmospheric processes studies

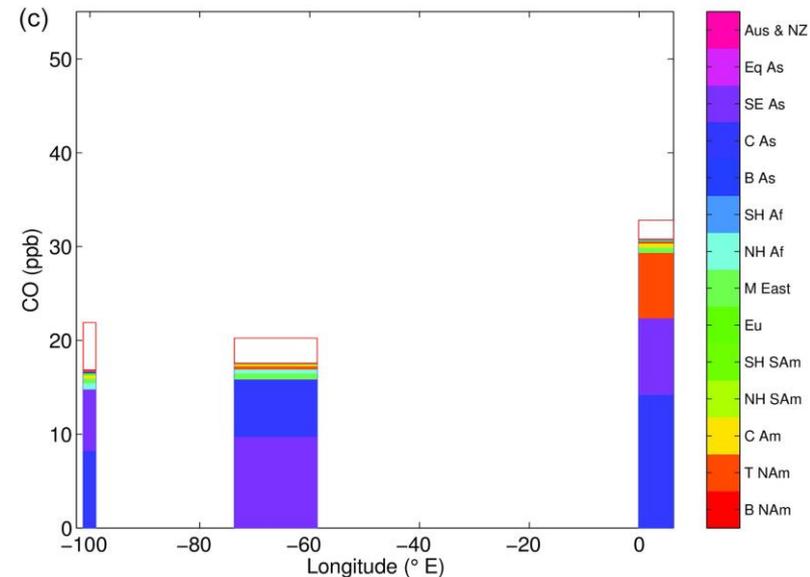
Improvement of the parametrization of transport processes (convection, mixing, stratosphere-troposphere exchange) in global CTMs



# IAGOS for pollution source attribution



From B. Sauvage et al. (ACP, 2017):  
 Figure 6. (a) Carbon monoxide zonal profile during the 10 March 2002 MOZAIC-IAGOS flight from Frankfurt to Denver.



# Conclusions

- IAGOS provides the unique observational data for an important part of the atmosphere where measurements are impossible or impractical by the other means
- IAGOS observations follow international standards concerning quality of observations which allows for their easy integration with the other observations (in GAW) and ensures high quality of the measurements
- IAGOS data are used in multiple applications from direct studies of the atmospheric processes to source attribution and validations of predictive models and satellite observations

# Thank you Merci



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