EGU22-3789 | Session AS3.7 | Tue, 24 May 2022

Relative Humidity distribution in the extratropical UT and LMS

Long-term evolution derived from in-situ observations of IAGOS and MOZAIC

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Federal Ministry of Education and Research

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IAGOS IN-SERVICE AIRCRAFT FOR A GLOBAL OBSERVING SYSTEM

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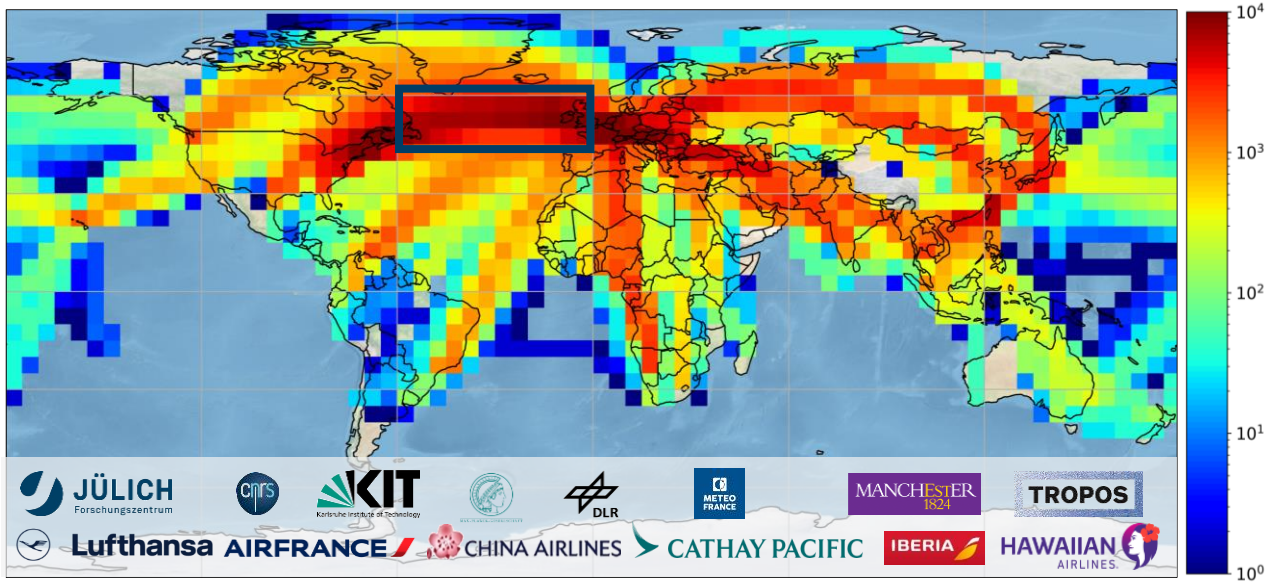
Atmospheric Composition Dataset from Instrumented Passenger Aircraft



- European Research Infrastructure since 2014 (MOZAIC: 1994-2014 / CARIBIC 2004-2014)
- Regular in-situ monitoring of essential climate variables H_2O, RH_{ice}, O_3, CO, NO_x, CO_2, CH_4, aerosols, clouds
- 8 long-haul aircraft + 1 Flying Laboratory
- Open data policy; visit www.iagos.org

H_2O /RH_{ice} data record spans 25 years.

Data analysis focusing on the North Atlantic.

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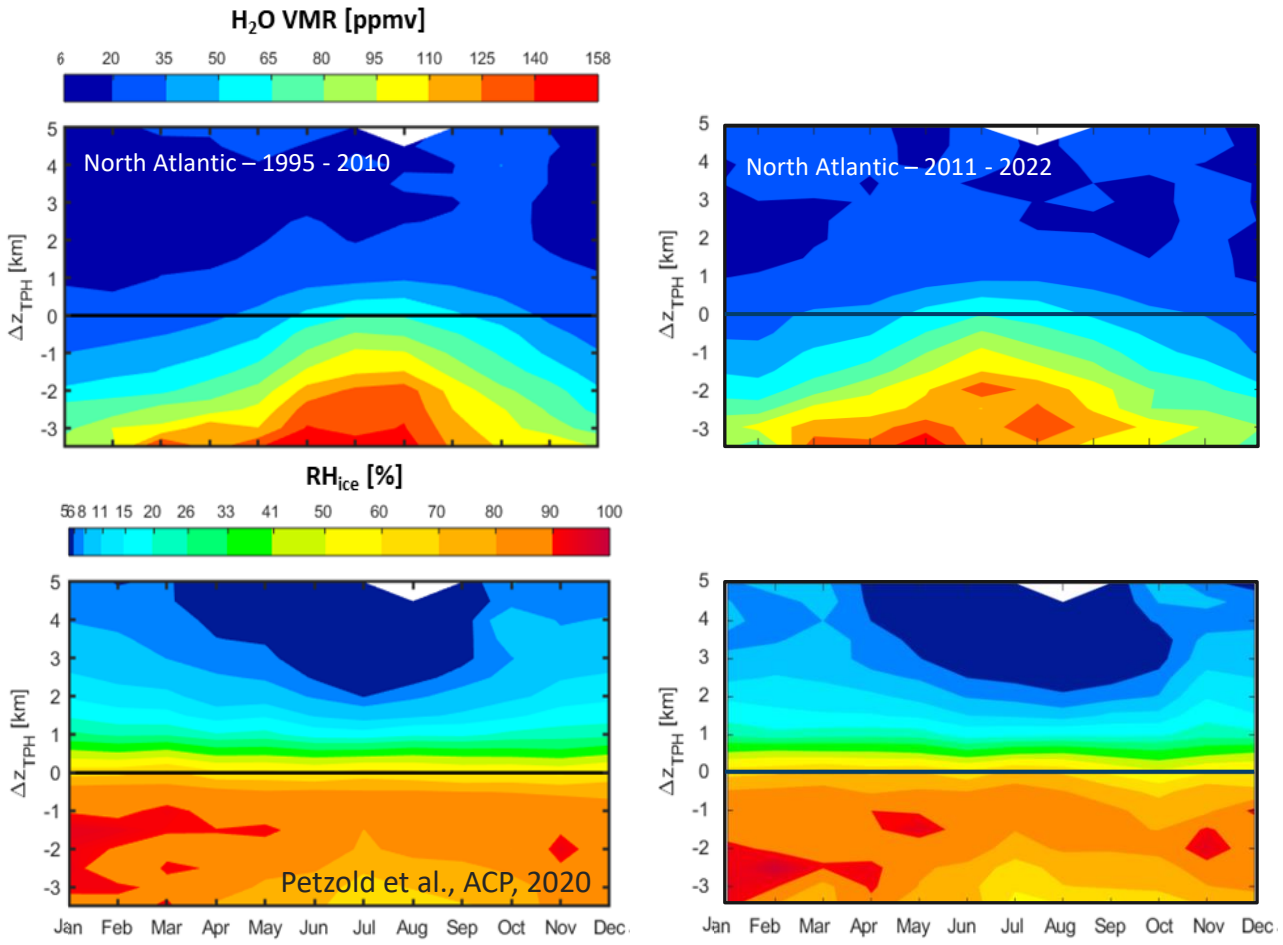
Seasonal Variation of RH_{ice} Across the North Atlantic Tropopause



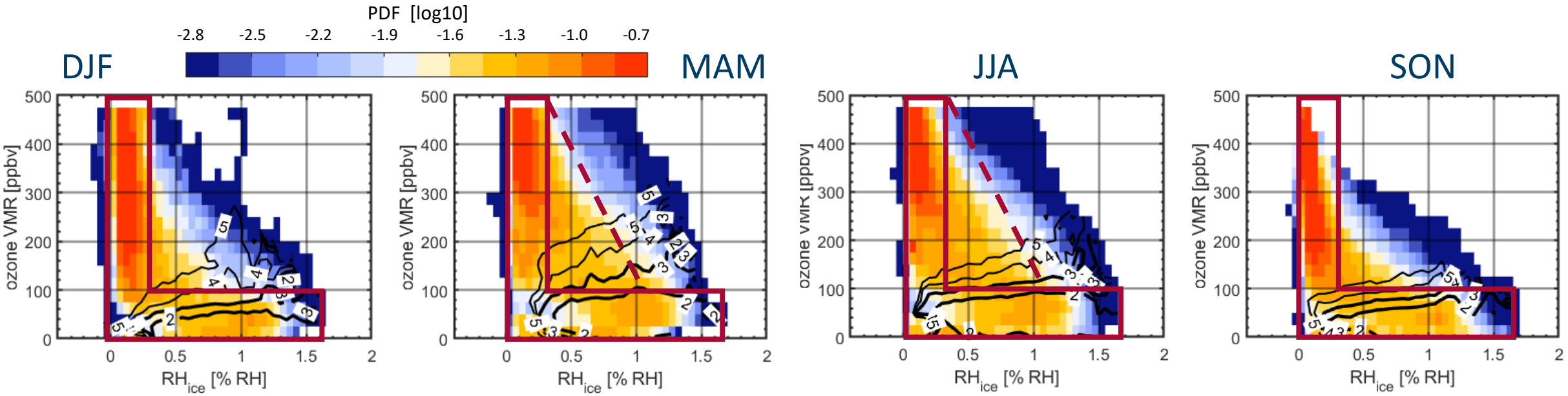
⇒ H_2O VMR:
Clearly visible moistening of the LMS in summer.

⇒ RH_{ice}:
Uppermost troposphere close to ice saturation.

see also EGU9841
Konjari et al., next talk

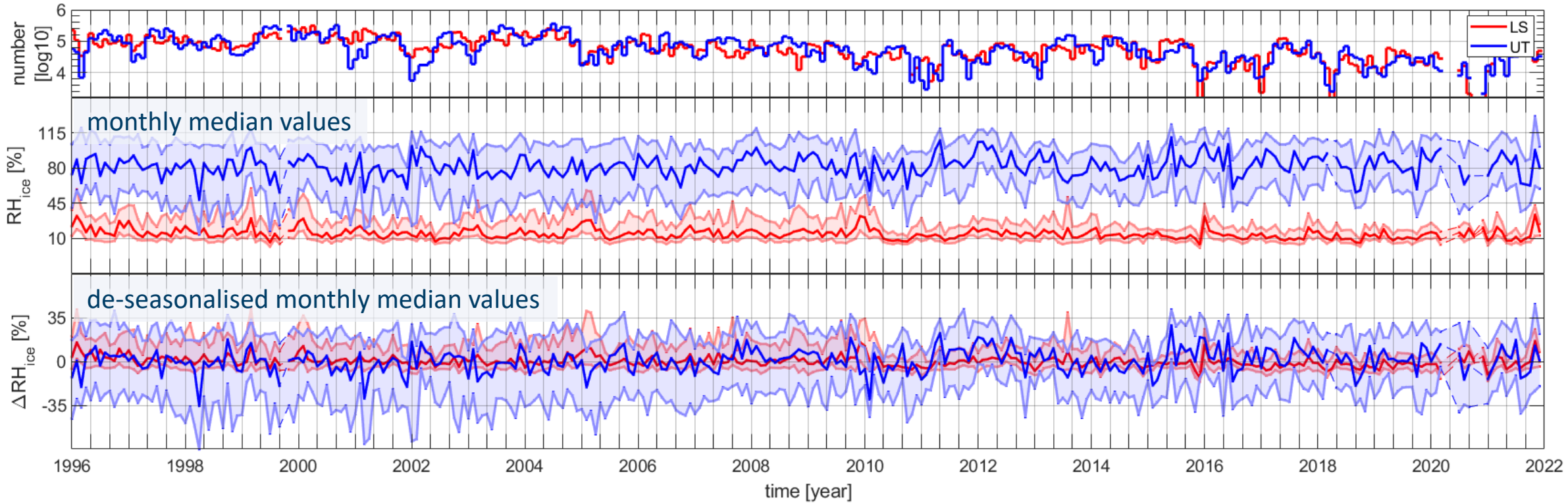
Averaged annual cycles of RH_{ice} for latitudes 40 °N to 60 °N
Distribution relative to the WMO thermal tropopause height z_{TPH}.

Seasonal Variation of RH_{ice} Across the North Atlantic Tropopause



- No cross-TP mixing of RH_{ice} in Fall and Winter.
- Humidification of lowermost stratosphere in Spring and Summer.

Long-Term Evolution of RI_{ice} Across the North Atlantic Tropopause



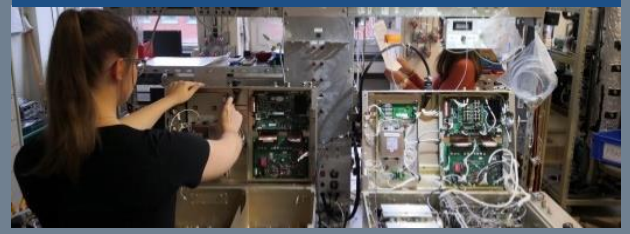
- Median RH_{ice} of UT ≥ 80%.
- No long-term change in ΔRH_{ice} observed for UT and LMS over 25 years.
- In-depth trend analyses are subject of ongoing work.

Supplementary Material

The IAGOS Workflow

IAGOS data products

Research Institutions



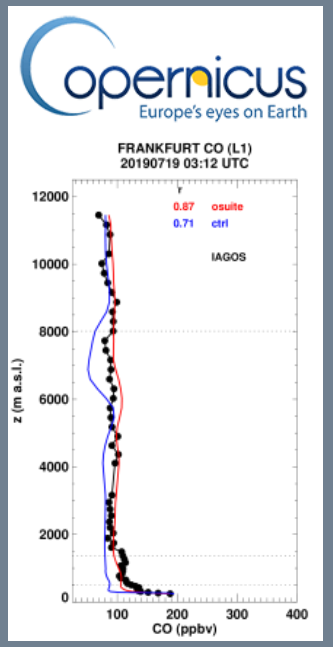
calibration data

metadata

IAGOS Data Centre
hosted by AERIS
in Toulouse, France

near real time

data transfer



deployment

maintenance

data

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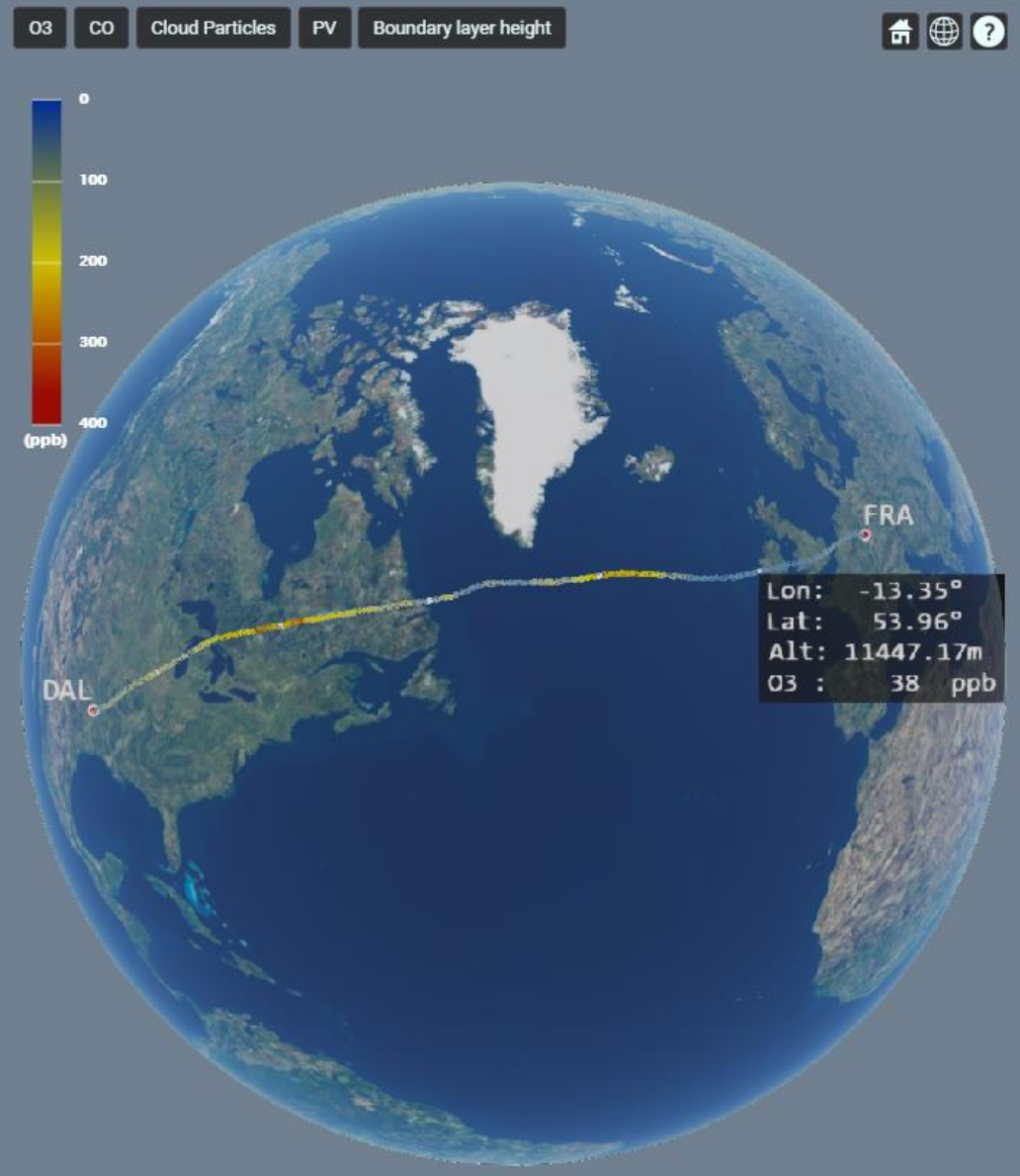

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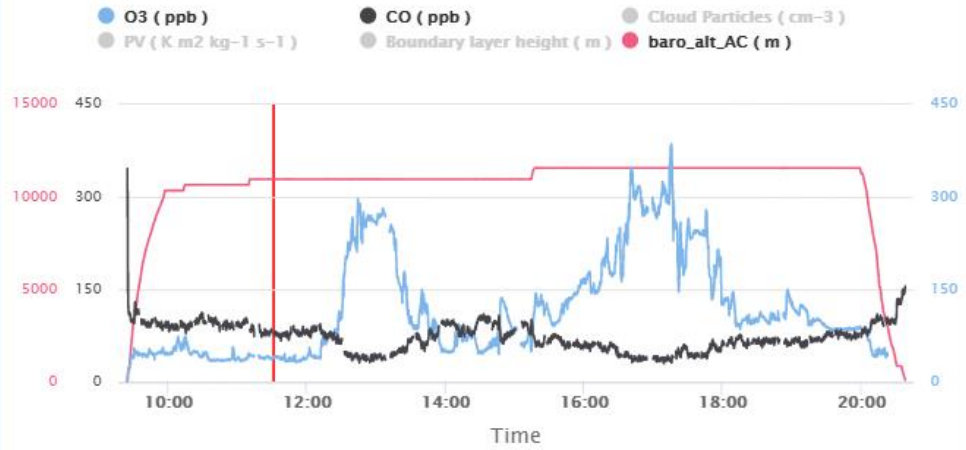
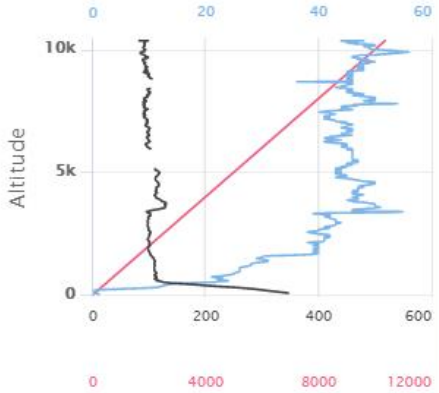
GRAPHS INFOS

Timeseries



Ascent profile



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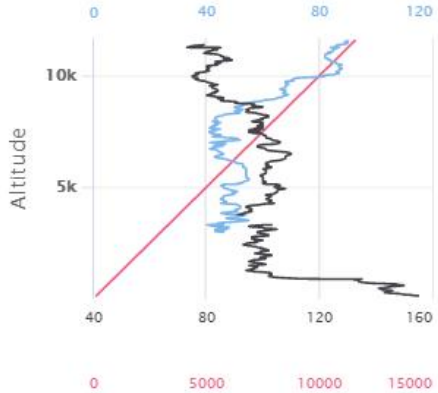
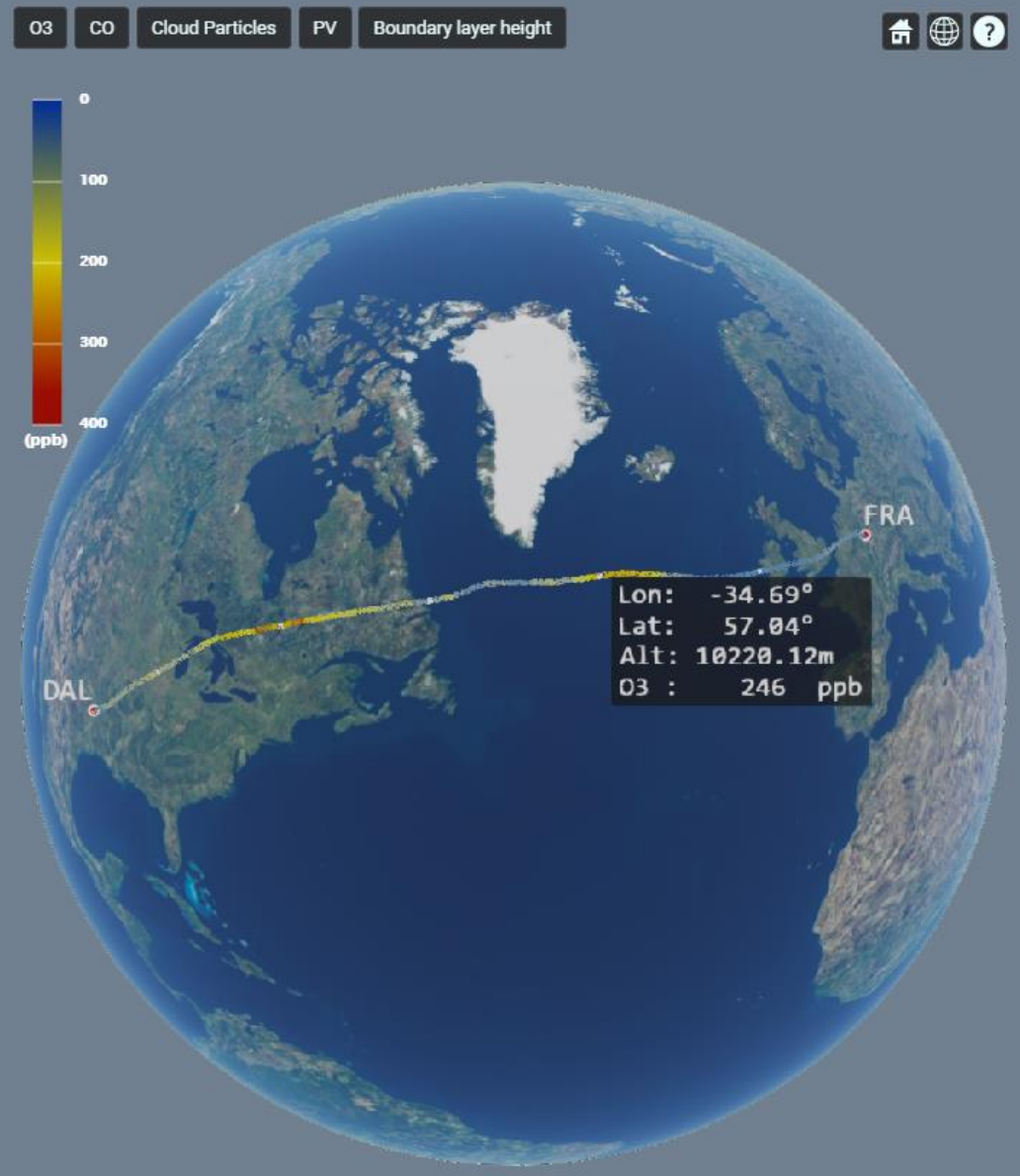


EXPORT ALL CHARTS TO PNG



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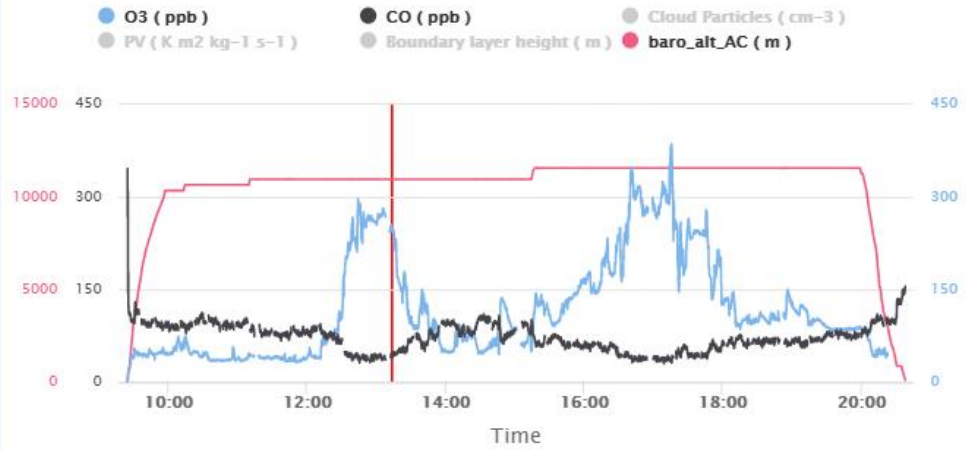

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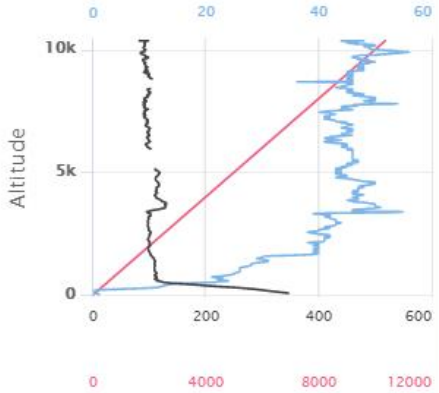

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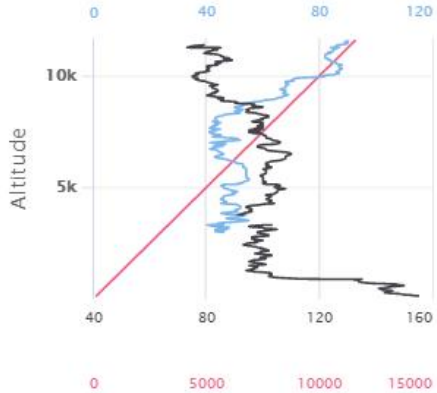

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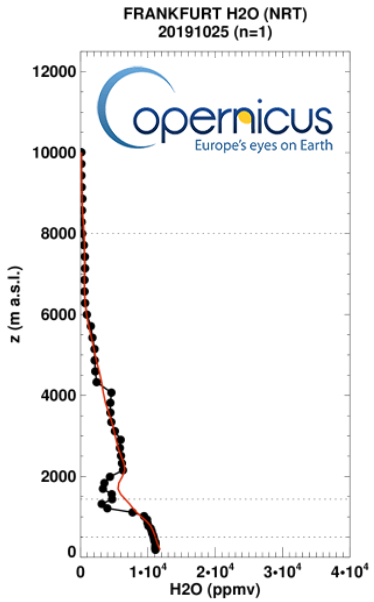
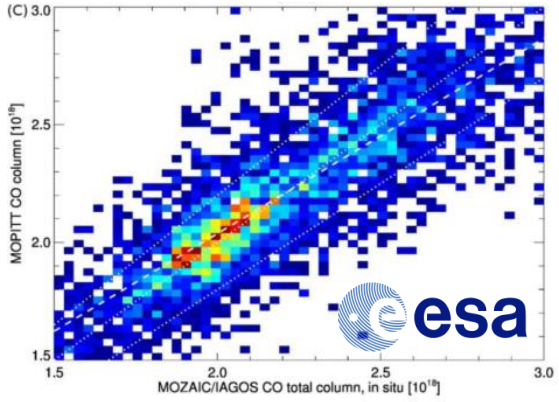
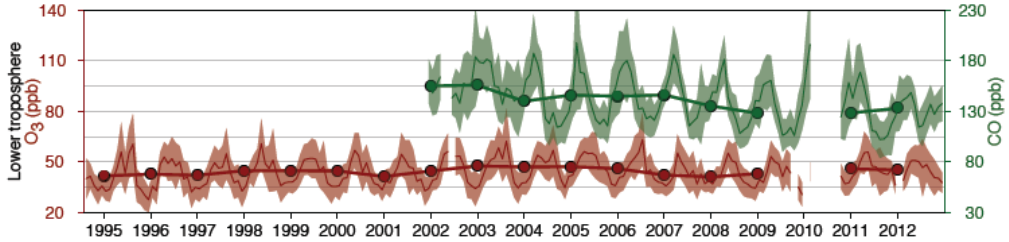


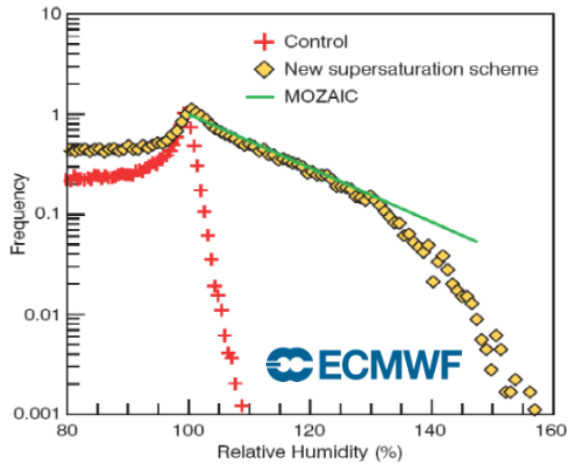
atmosphere monitoring



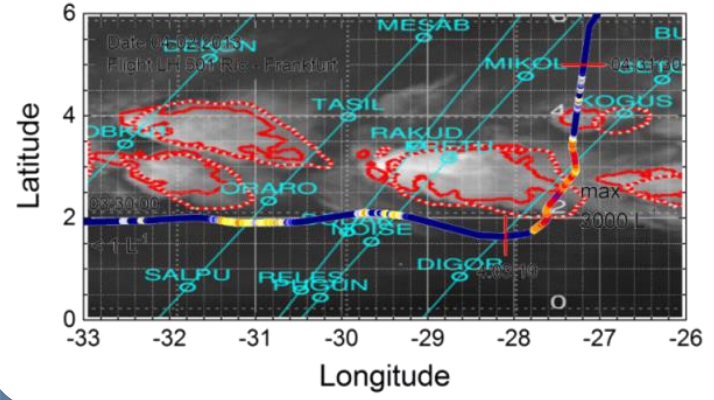
validation of satellite products



atmospheric long-term observation studies
trends in atmospheric composition change

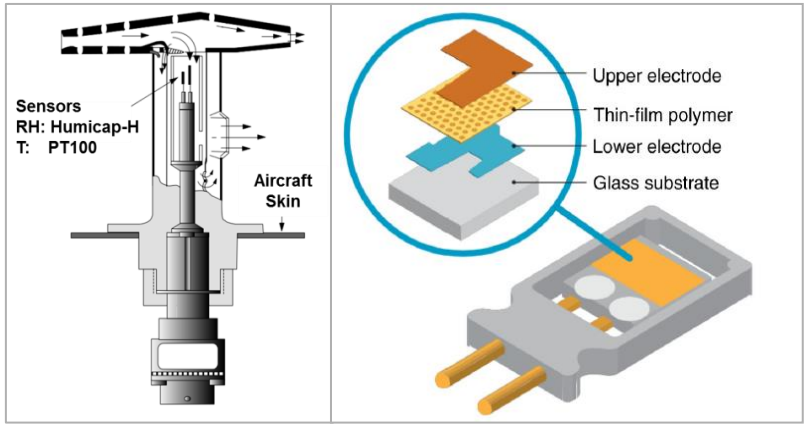


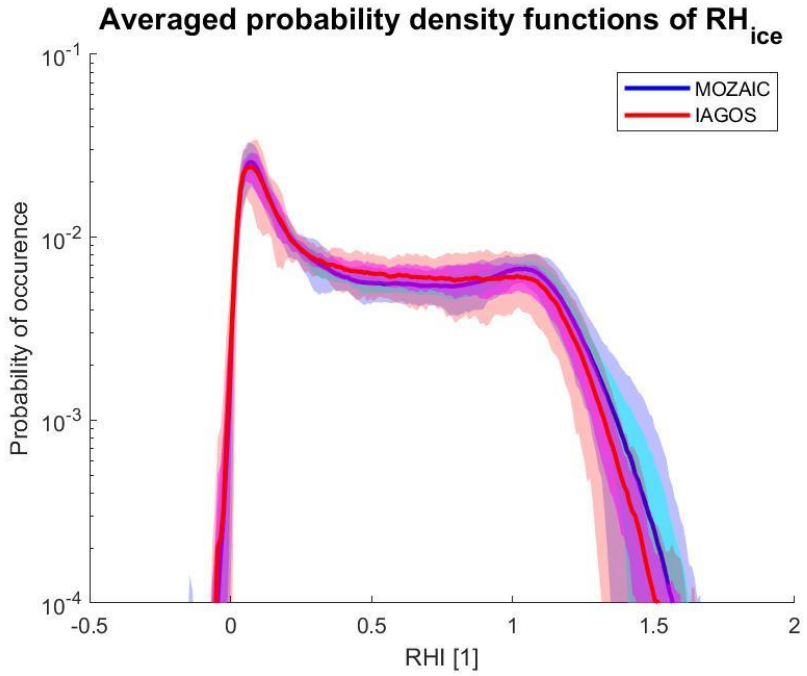
numerical weather prediction



safe
aircraft
routing

MOZAIC/IAGOS Capacitive Hygrometer (MCH/ICH)

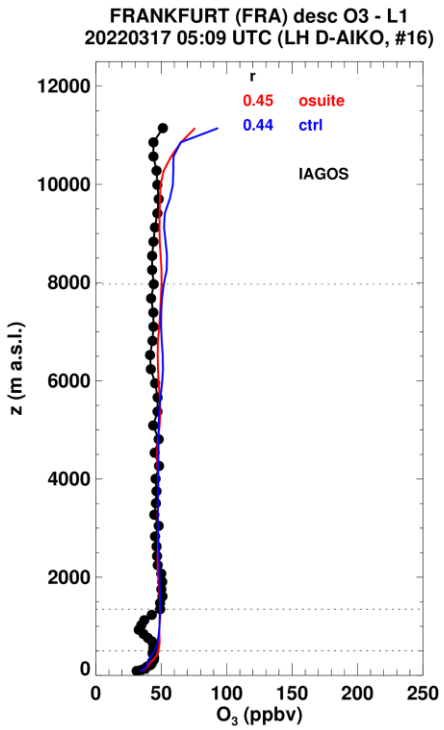


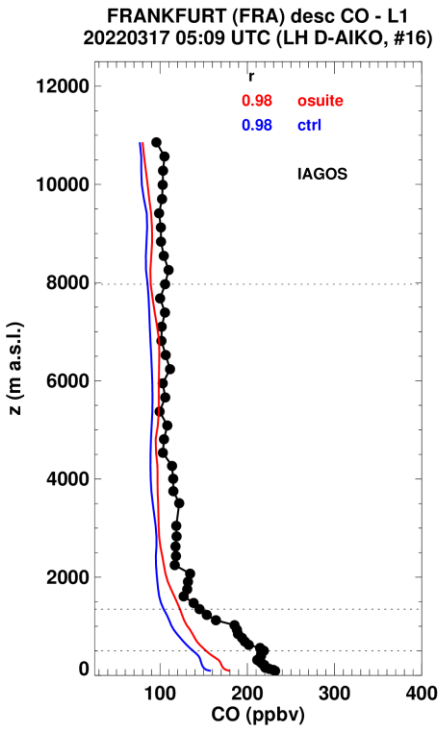


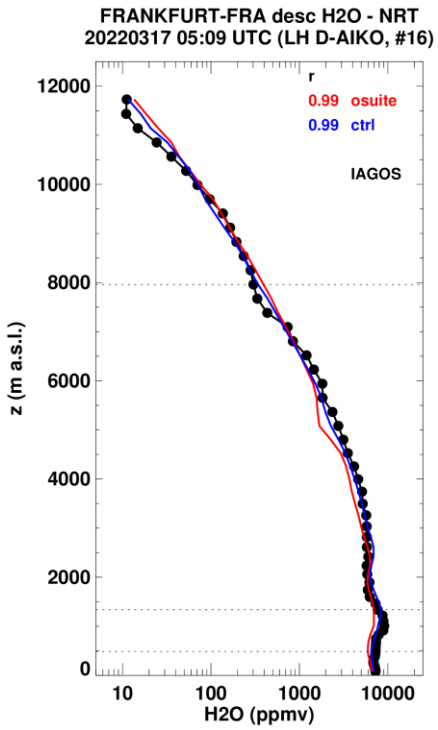
- Hydroactive Polymer Film which adsorbes H_2O
- Capacitance depends on relative humidity (RH);
- Calibrations traceable to frost point mirror
- Low maintenance requirements
- In-flight blind intercomparison:
  5% RH_{liquid} uncertainty, LOD approx. 10 ppmv
- 2σ - variability of observed Ice Supersaturation (ISS) at 10^{-4} occurrence probability is max. 155% RH_{ice}
- Values fit into the range of homogeneous freezing thresholds at typical extratropical tropopause conditions (Koop et al., 2000 : $RH_{ice,hom}$ = 158% at 205 K and 154% at 215 K
- Change of sensor design of MCH into ICH has no impact on measuring capabilities
- In Flight Calibration (IFC) accounts for offset drift

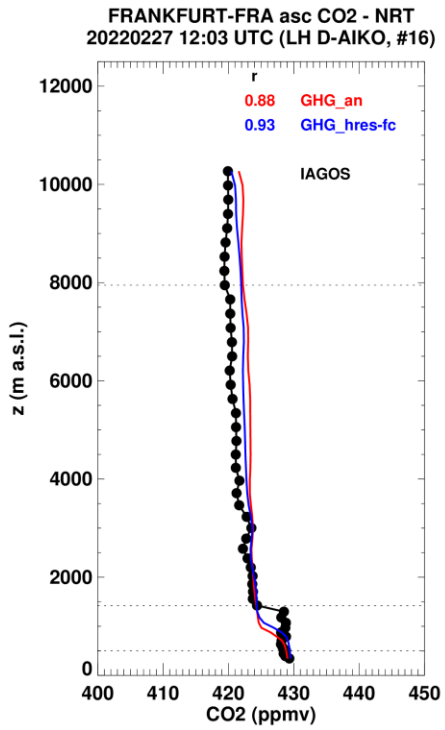
Neis et al., Atmos. Meas. Tech. 2015; Neis et al., TellusB, 2015; Smit et al., JAOT, 2008; Smit et al., ACP 2014 ; Petzold et al., ACP, 2020

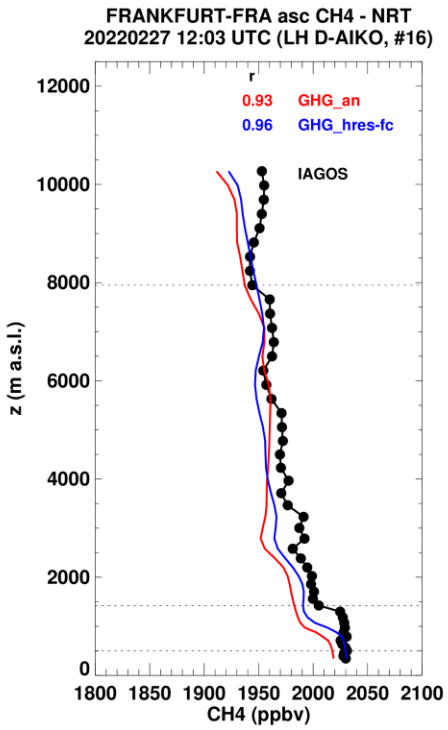
IAGOS Near Real-Time Data Stream to COPERNICUS Atmosphere Monitoring Service







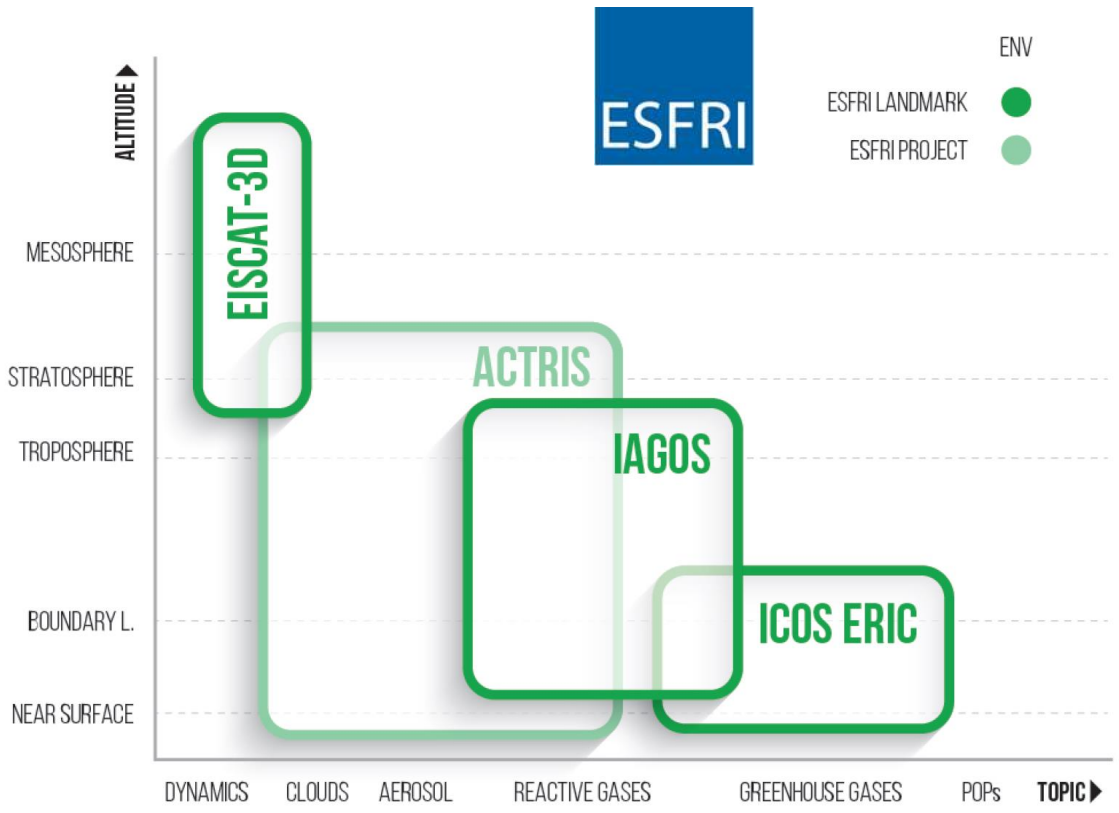


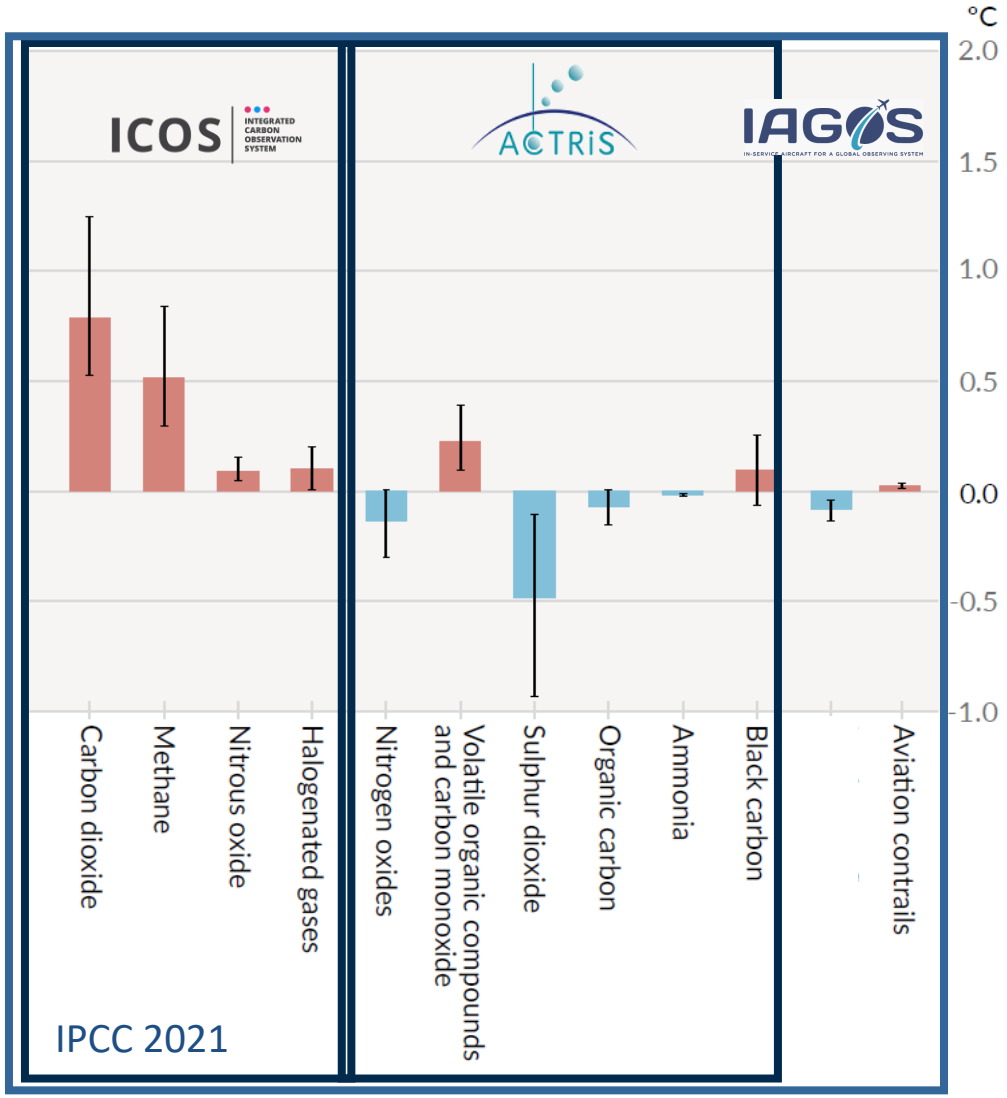


http://www.iagos-data.fr/cams/nrt_profiles.php

ESFRI Research Infrastructure for Atmospheric Observation

ESFRI Roadmap 2016 - Atmosphere





ESFRI Roadmap 2021: Landscape Analysis Environment Domain

IAGOS
In-service Aircraft for a Global Observing System

Open data resources and management for atmospheric composition observations
Near real time data on atmospheric chemical species to weather and research services.

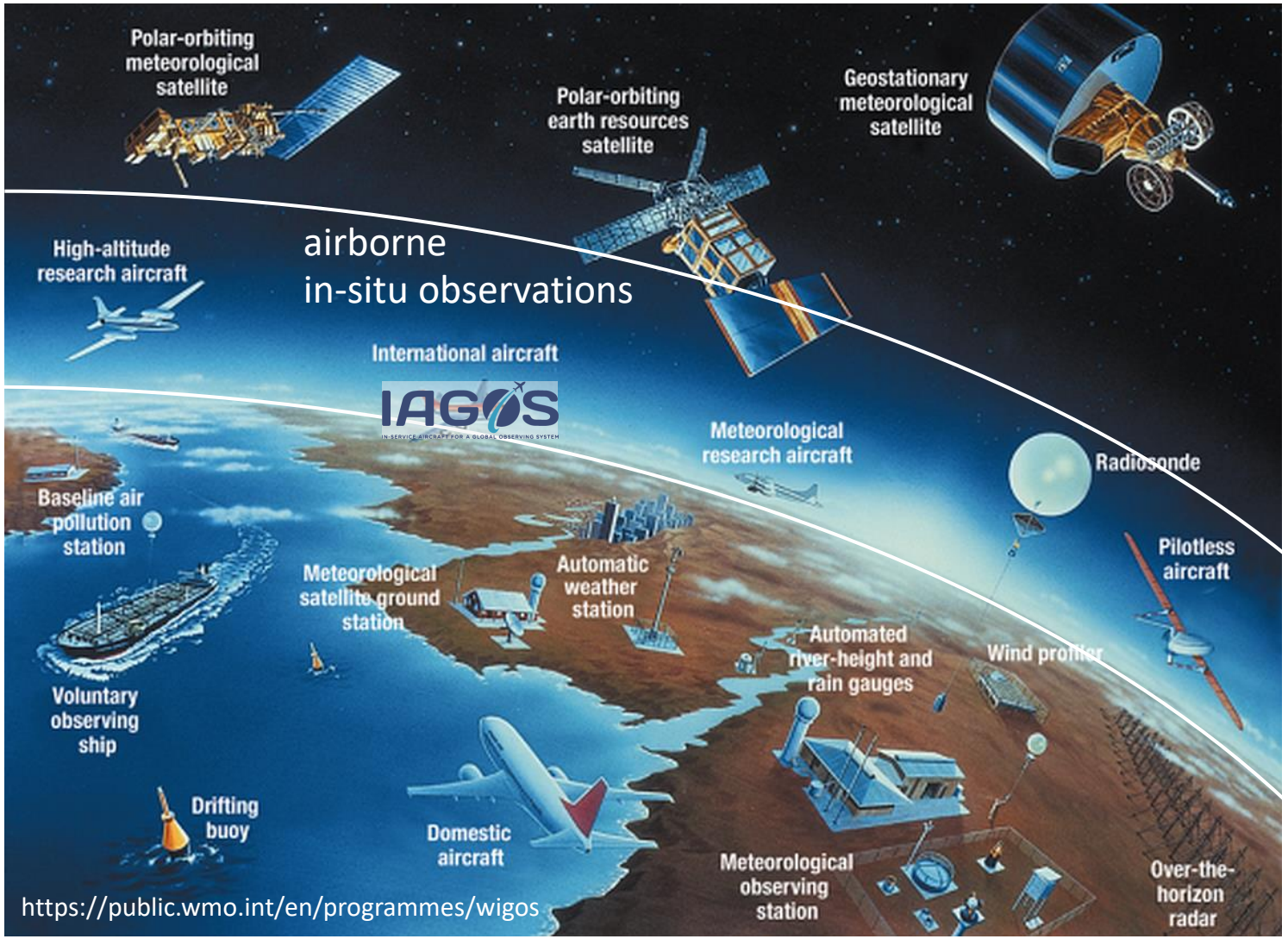
Global observations of atmospheric composition for energy supply and consumption
Key atmospheric parameters and environmental assessments related to different energy production forms.

Global observations of atmospheric composition for health and food
Measurements of air quality parameters and impact on health.

New technologies and approaches for atmospheric composition observations
Development of instrument and technologies.

Social and cultural aspects of atmospheric composition observations
Key atmospheric observations, climate change and impact on human well-being.

IAGOS @ WMO Integrated Global Observing System



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Please visit www.iagos.org

or contact s.rohs@fz-juelich.de