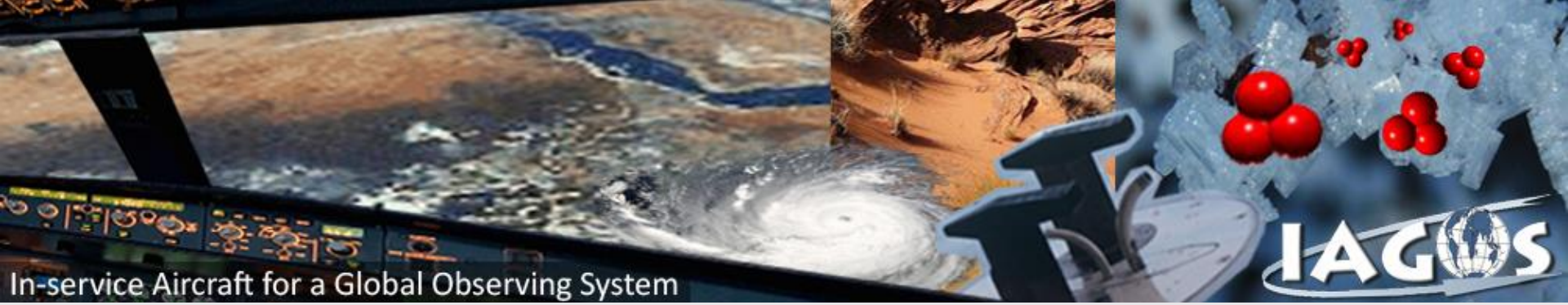


Implementation of an In-Flight Calibration method for the MOZAIC/IAGOS Capacitive Hygrometers

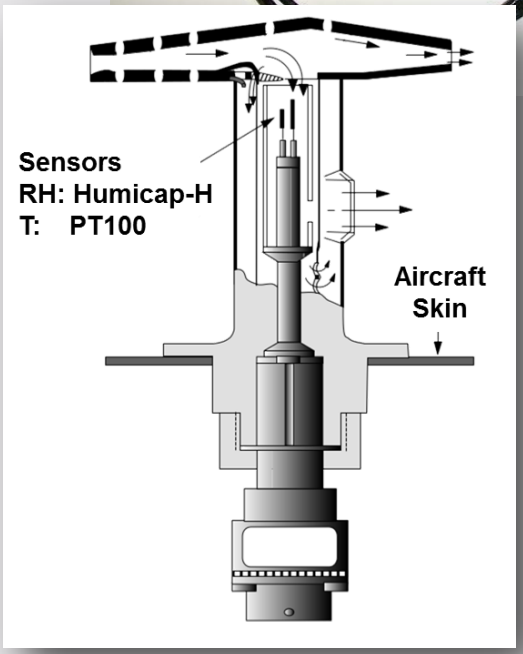
Susanne Rohs, Patrick Neis, Herman Smit, Andreas Petzold

Contact: s.rohs@fz-juelich.de

IAGOS – CORE CAPACITIVE HYGROMETER

www.iagos.org

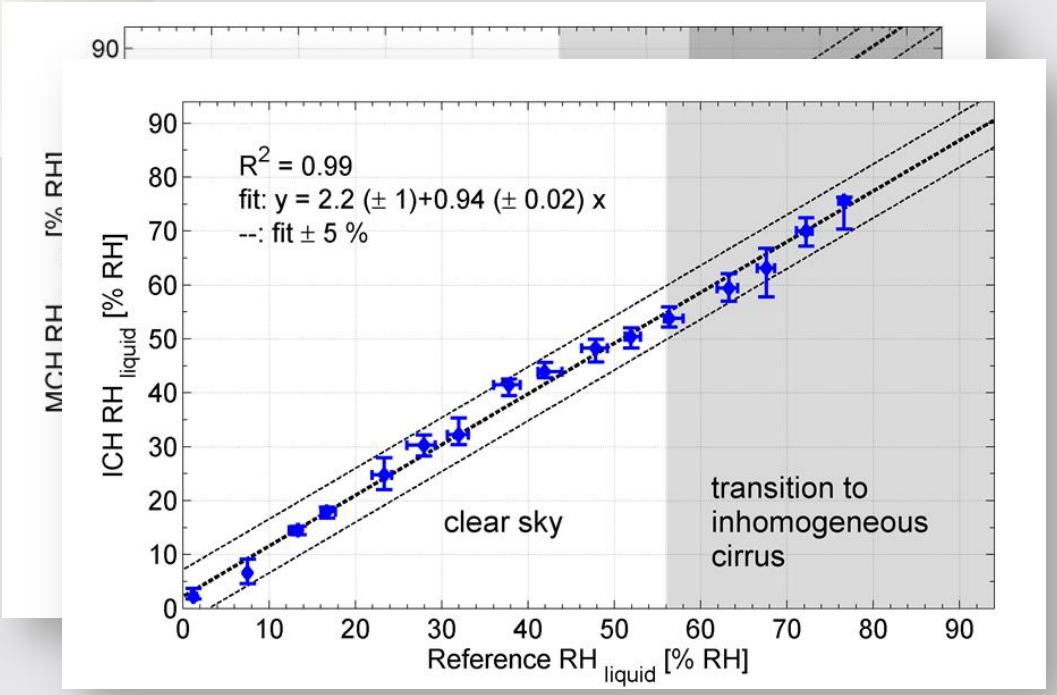
- Established technique (balloon soundings)
- Low maintenance requirements
- Regular pre- and post-flight calibrations
- Inflight blind intercomparison
  ⇒ 5% RH uncertainty



Reference instruments:

- **FISH**
- **OISTER**
- **SEALDH**

Neis et al., AMT 2015, Tellus B 2015



Environmental Simulation Facility to calibrate Airborne Ozone and Humidity Sensors.

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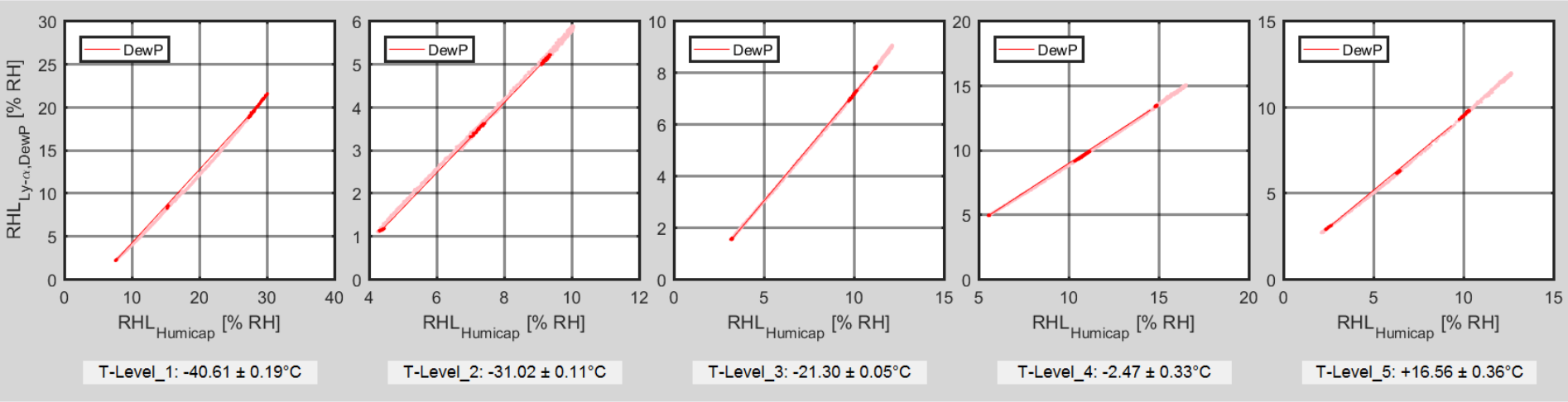

IAGOS –RH: Temperature dependence of Calibration Coefficients

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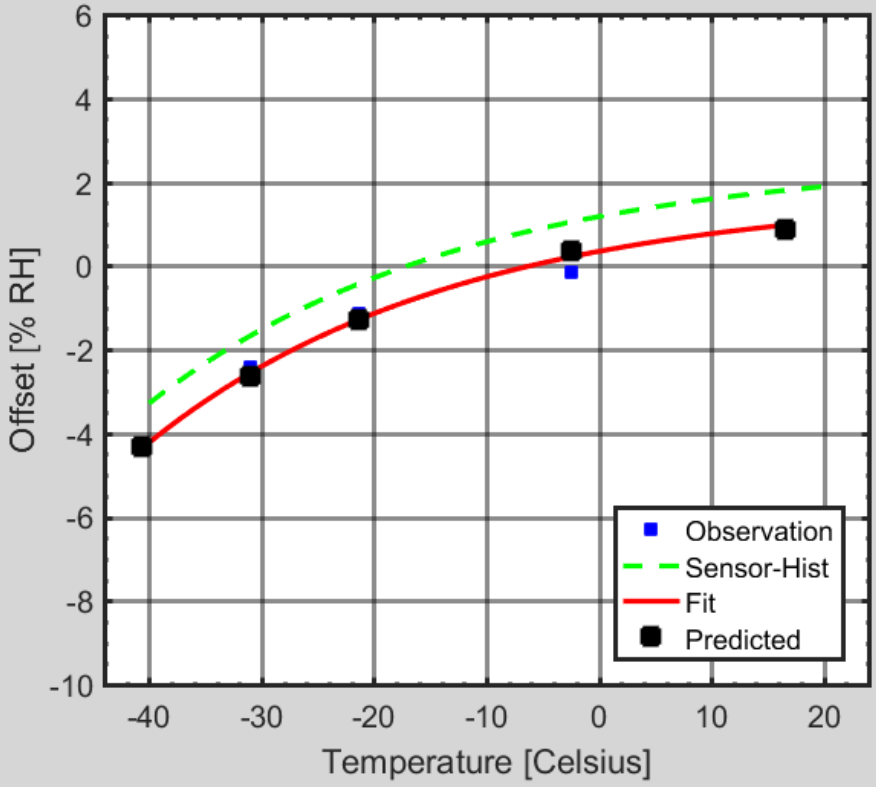

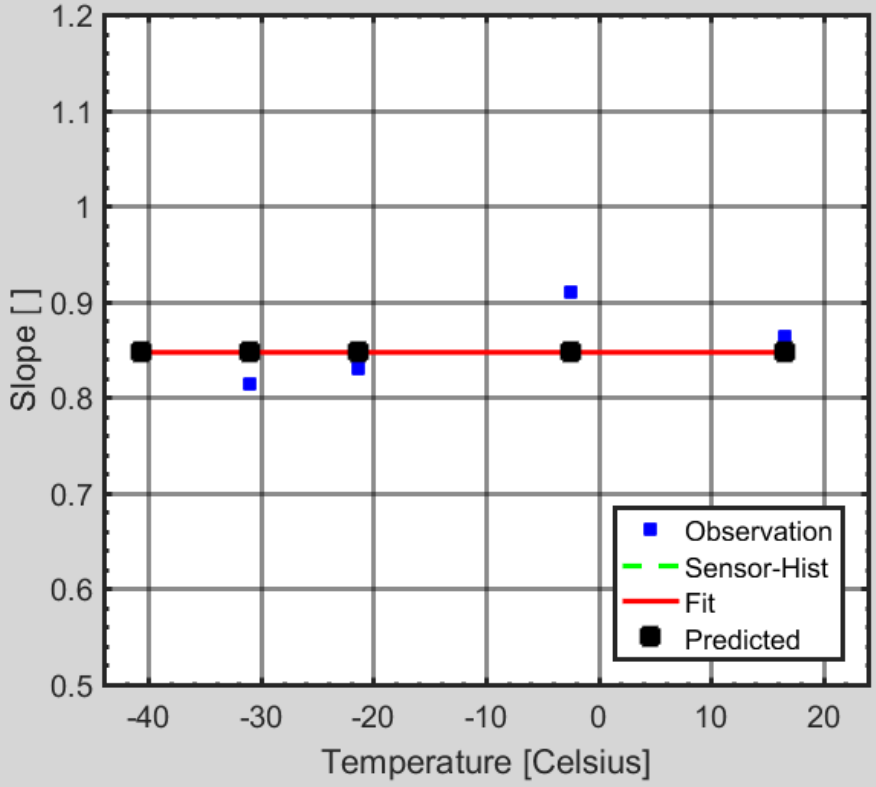

Offset [% RH]

Quality of fit R^2: 0.99767

a1 = 1.3808
a2 = 0.036498
a3 = 1.724

Offset = a3-a1*exp(-a2*Temperature)

Slope [ ]

Standard deviation of distribution:
NaN

Constant slope (Median) = 0.847

DRIFT IN SENSOR OFFSET

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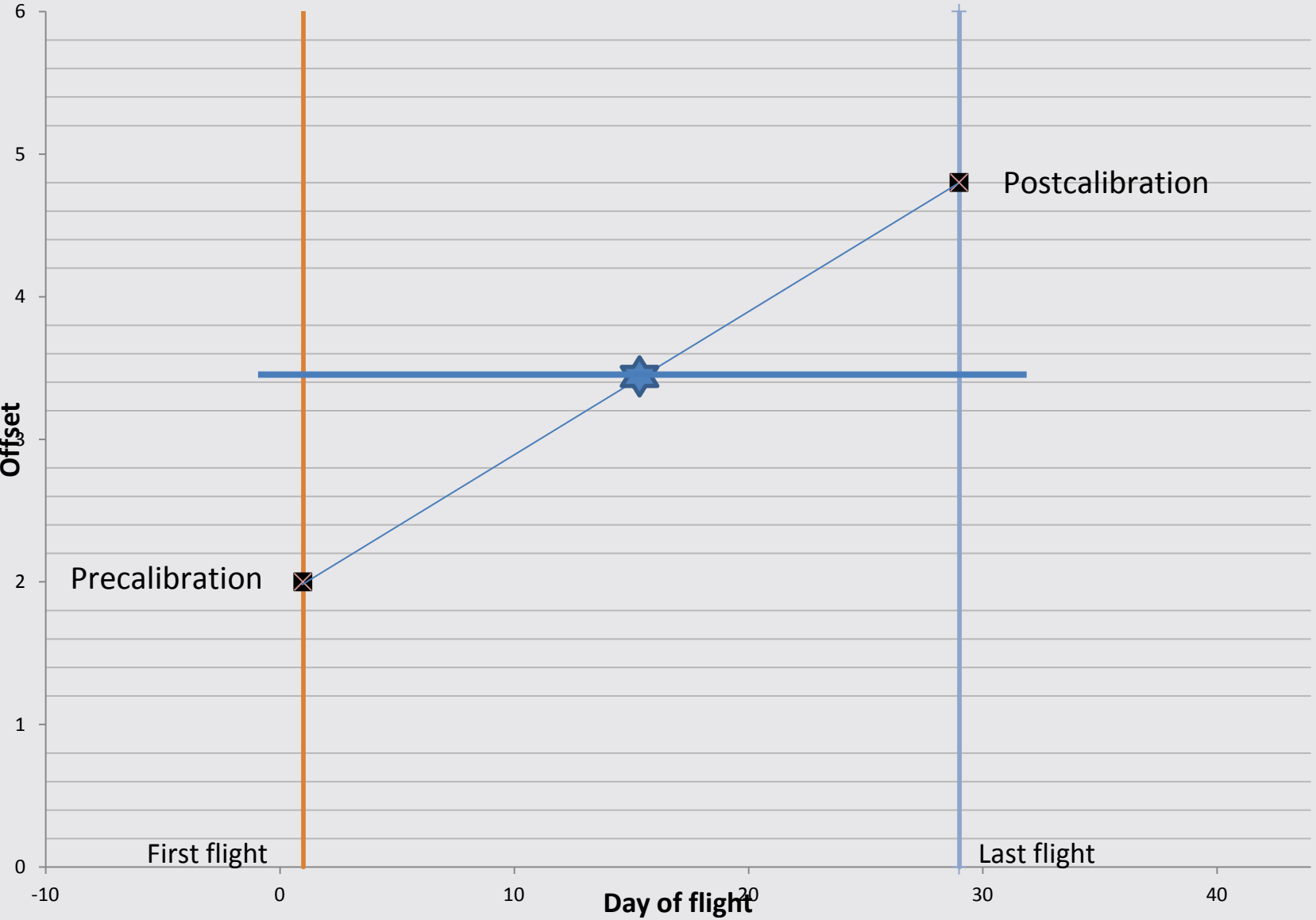

DRIFT IN SENSOR OFFSET

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An In-Flight Calibration Method for Near-Real-Time Humidity Measurements with the Airborne MOZAIC Sensor

HERMAN G. J. SMIT, ANDREAS VOLZ-THOMAS, MANFRED HELTEN, WERNER PAETZ, AND DIETER KLEY

Institute for Chemistry and Dynamics of the Geosphere: Troposphere (ICG-2), Research Centre Juelich, Juelich, Germany

(Manuscript received 12 January 2007, in final form 10 September 2007)

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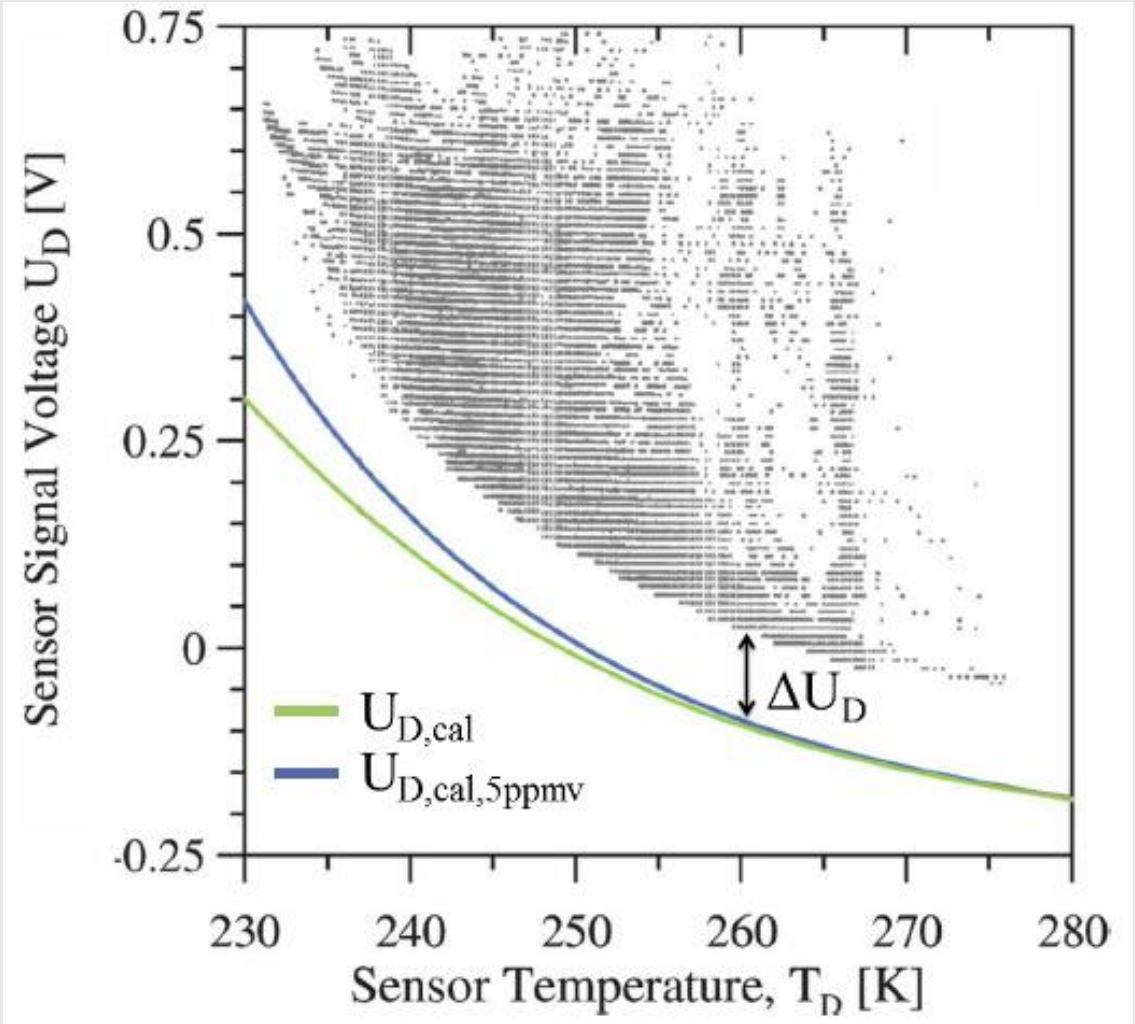

IFC-Method:

- Based on the technology and experience obtained during more than one decade of MOZAIC-RH/T operation.
- Slope shows nearly no drift.
- Long-term zero drift of MOZAIC-device is the critical and accuracy determining parameter.

EXAMPLE OF DRIFT IN OFFSET DURING FLIGHT PERIOD OF SENSOR

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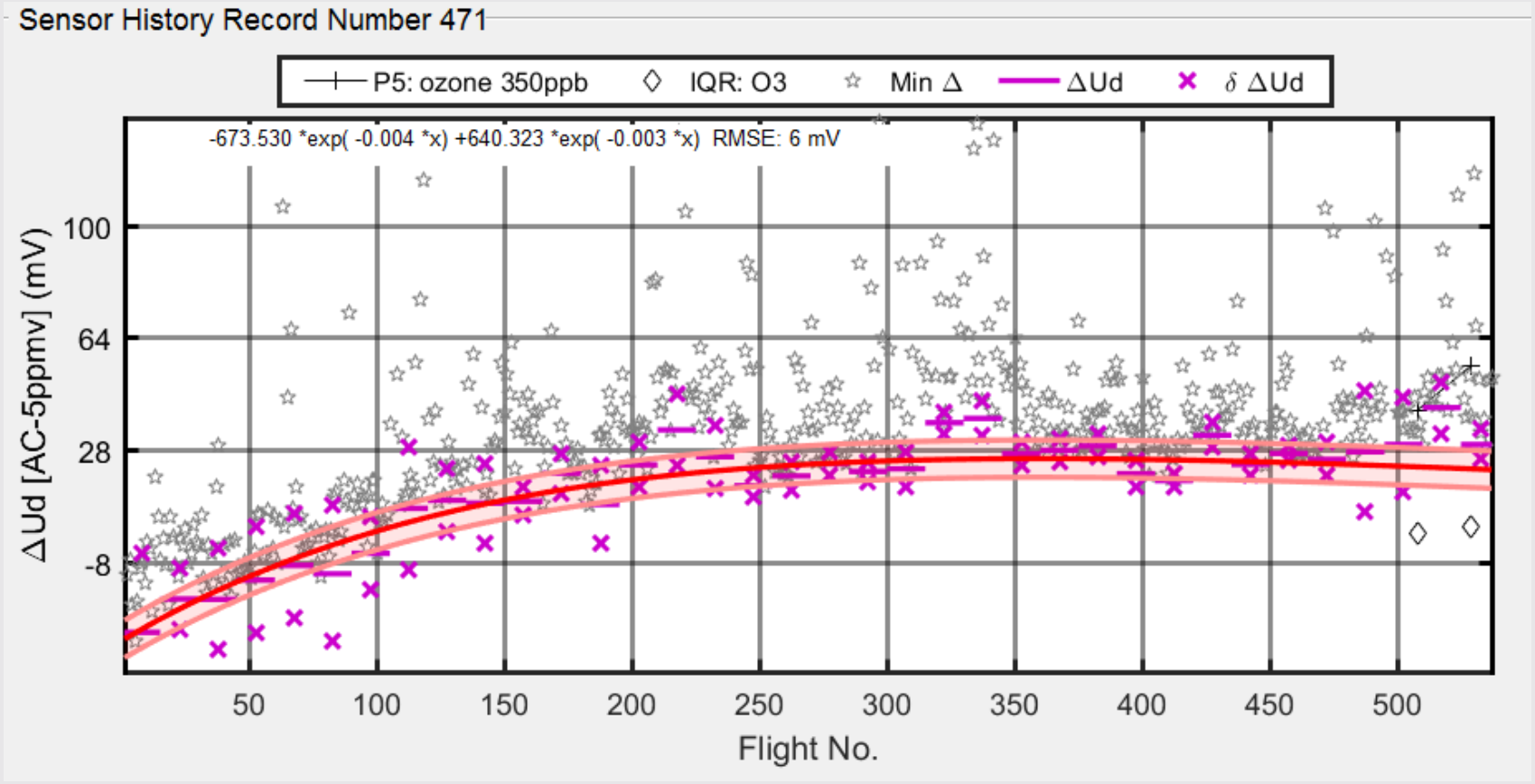

EXAMPLE FOR EFFECT OF IFC-METHOD

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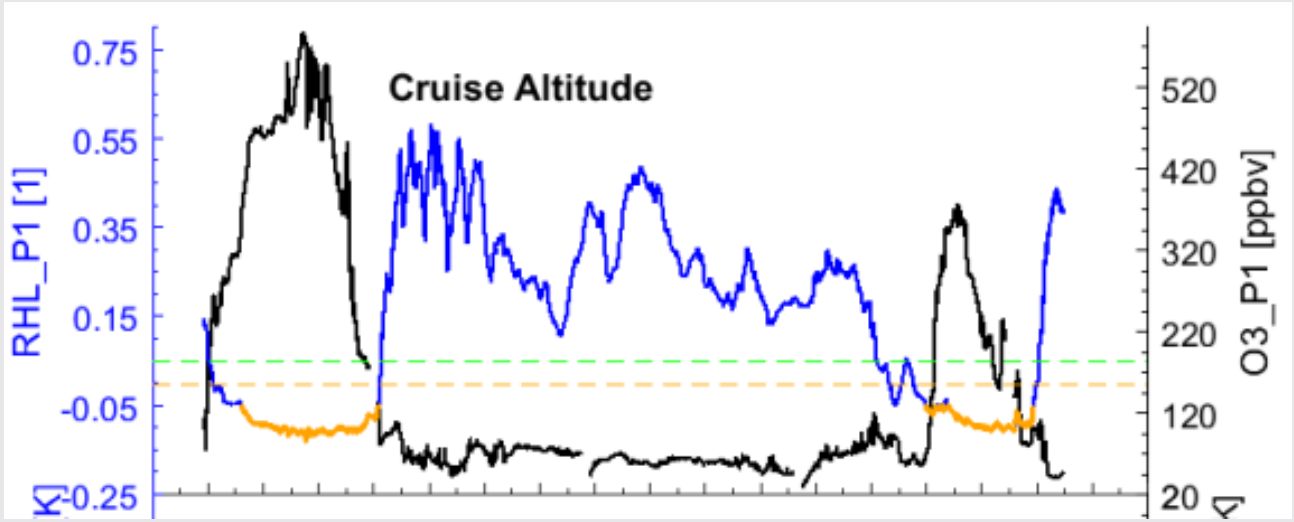
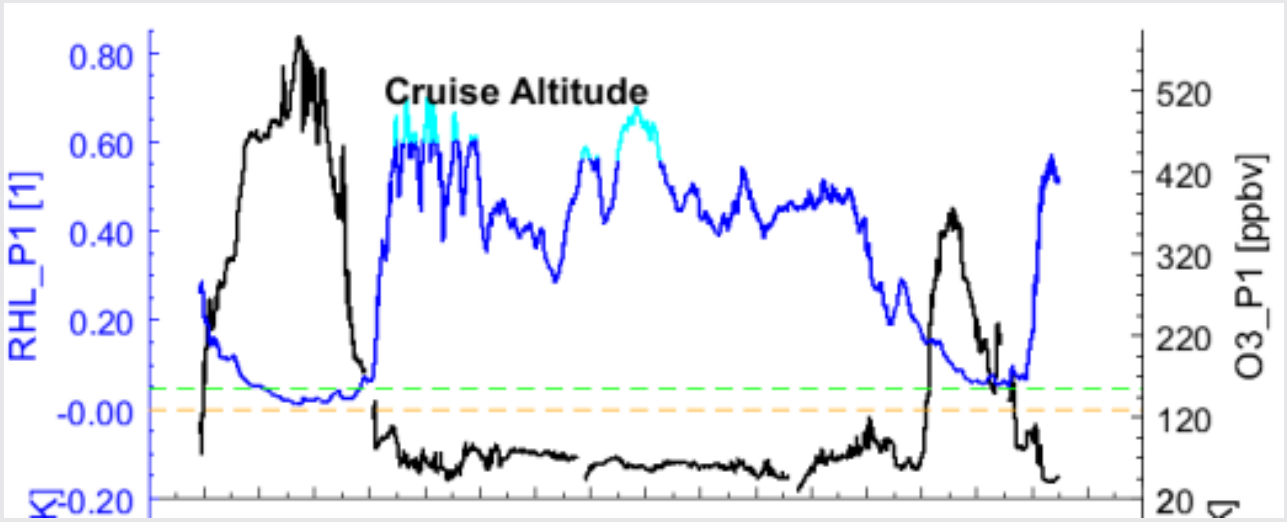


Without IFC
(Smit et al., 2014)



With IFC
(Neis-Rohs-Smit)

PROBABILITY DENSITY FUNCTION OF RH_{ICE}

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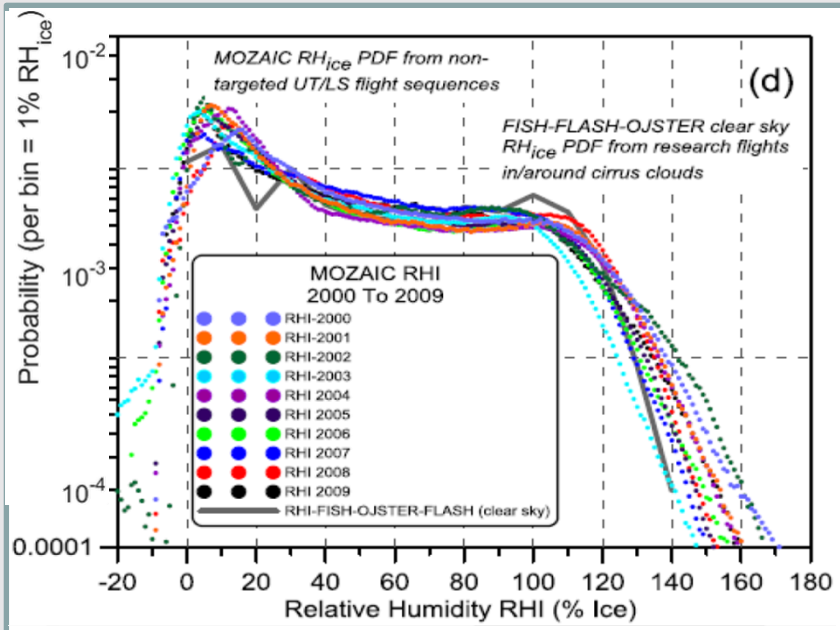

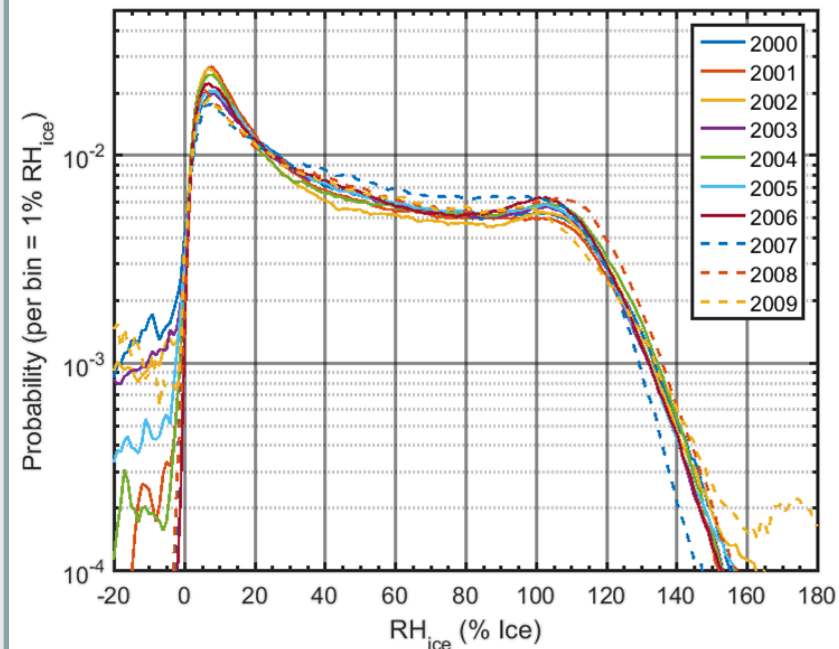

Without IFC
(Smit et al., 2014)

With IFC
(Neis-Rohs-Smit)

Outlook: Investigation of ISSR and Cirrus Clouds

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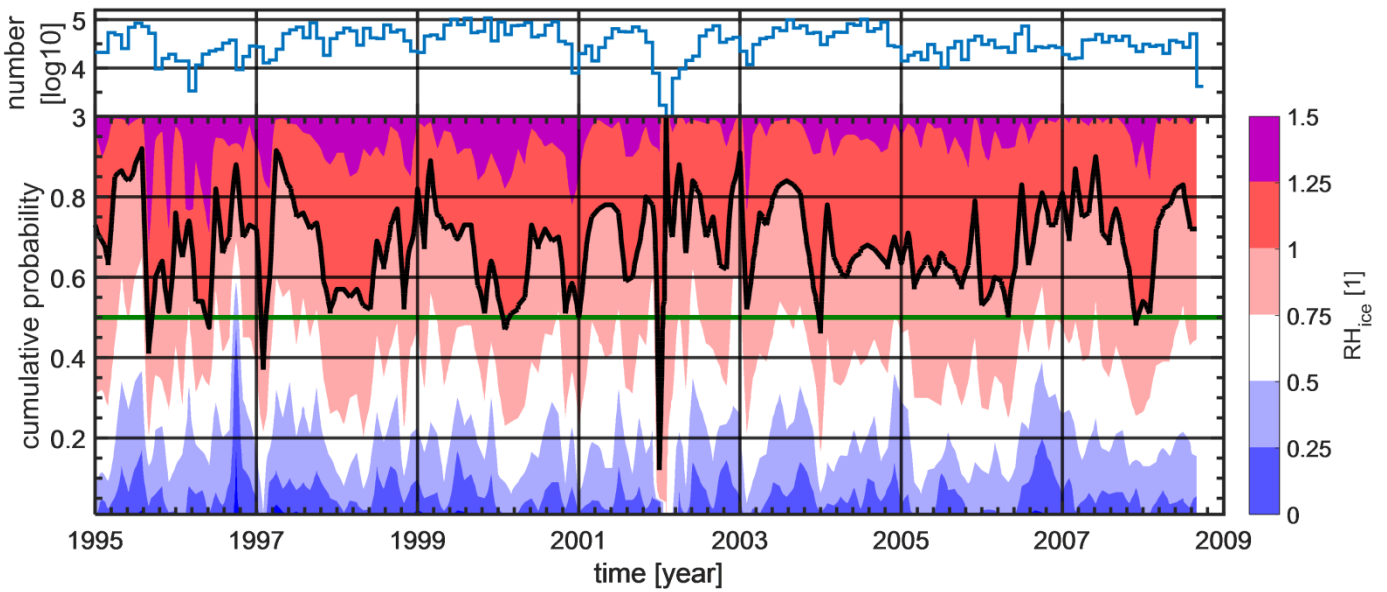
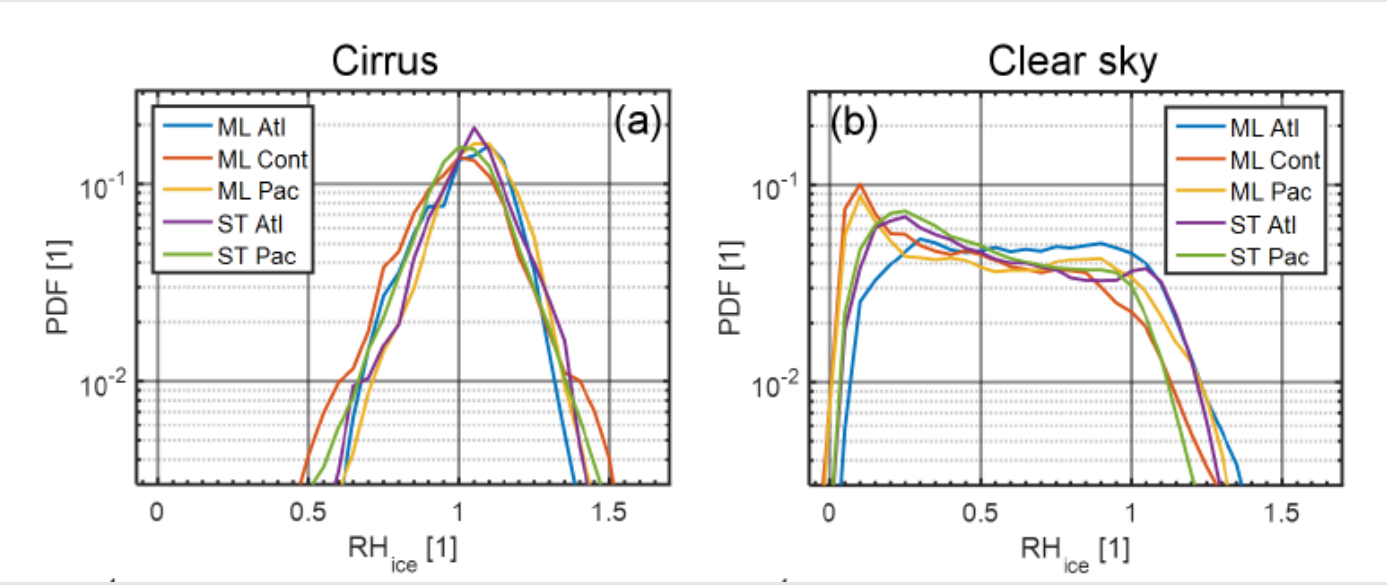


RH_{ice} cumulative probability for the highest upper tropospheric layer in the North Atlantic flight corridor.

P. Neis, PhD Thesis, 2017



Probability distribution functions of RH_{ice} in cirrus and in clear sky with IFC (July 2014 to Oct. 2015).

Petzold, Neis et al., 2017

MOZAIC-Humidity Device (MHD): Application of In-Flight Calibration (IFC)

www.iagos.org

[Smit et al., J.Atm.Ocean.Tech., 2008]

- Based on the technology and experience obtained during more than one decade of MOZAIC-RH/T operation.
- Long-term zero drift of MOZAIC-device is the critical and accuracy determining parameter
- In-Flight determination of long term zero drift during dry stratospheric episodes as a function of temperature.
- Correction of zero drift of RH-measurements.
- Re-analysis of RH-Data in 2017/2018: Application of IFC on 20 years of MOZAIC-RH measurements.

=> Better reliability of RH_{ice}.

=> Long term investigations of RH_{ice} in ISS regions.

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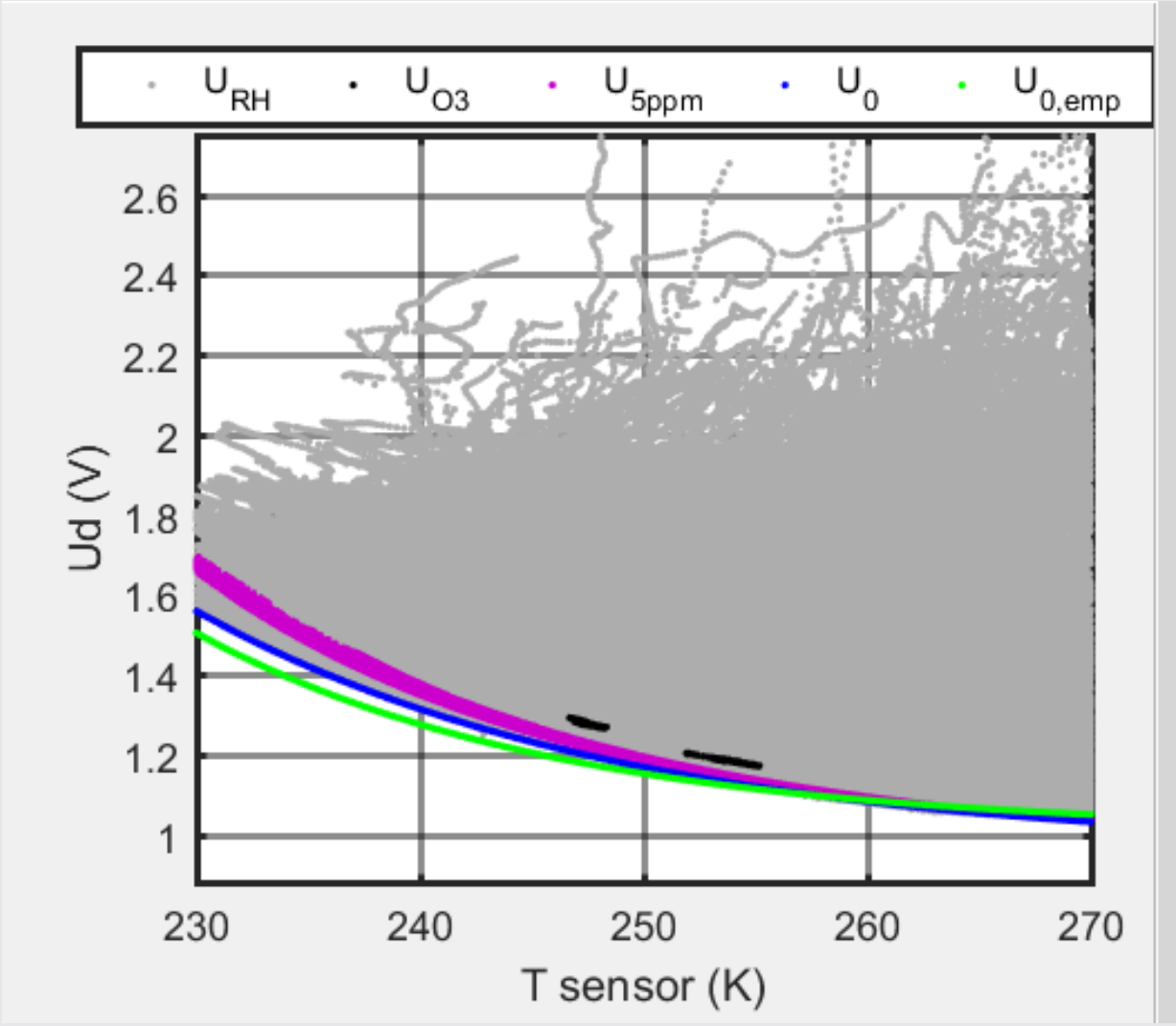
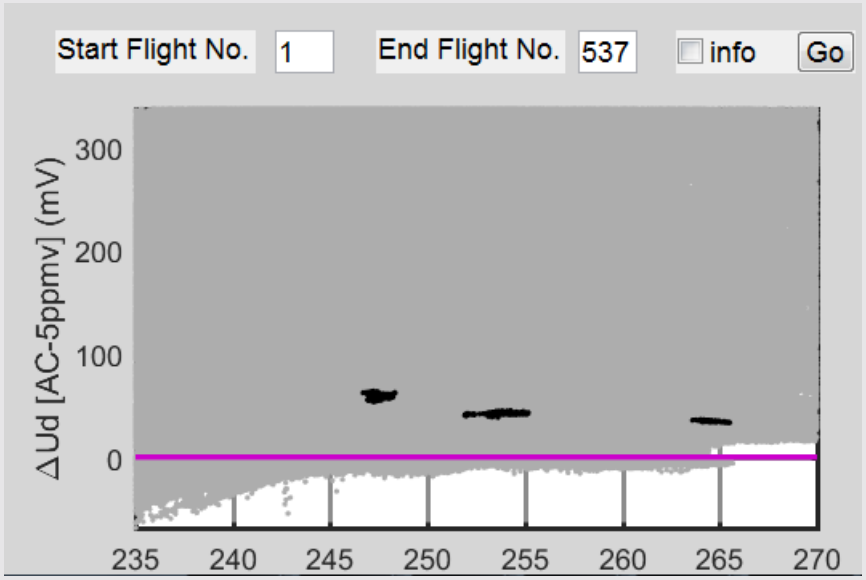
- national research programmes in Germany (BMBF), France (INSU-CNRS, MESR, CNES) and UK (NERC), and
- institutional resources in Germany (Helmholtz Association, Max-Planck-Society, Leibniz Association), France (Université de Toulouse, Météo-France) and UK (University of Manchester, University of Cambridge).

and the continuing support by participating airlines (Deutsche Lufthansa, Air-France, Iberia, China Airlines, Cathay Pacific and Hawaiian Airlines

Back Up Slides


U_RH
U_O3
U_5ppm
U_0
U_0,emp
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
Ud (V)
230
240
250
260
270
T sensor (K)


Start Flight No.
1
End Flight No.
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info
Go
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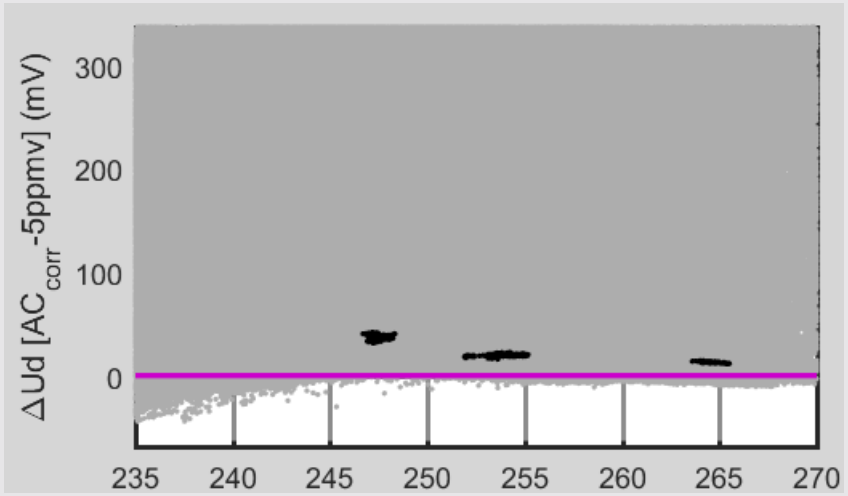
200
100
0
235
240
245
250
255
260
265
270


ΔUd [AC$_{corr}$-5ppmv] (mV)
300
200
100
0
235
240
245
250
255
260
265
270