JULIA H2O (COORDINATES & TRENDS)

Jülich Airborne In-situ Database

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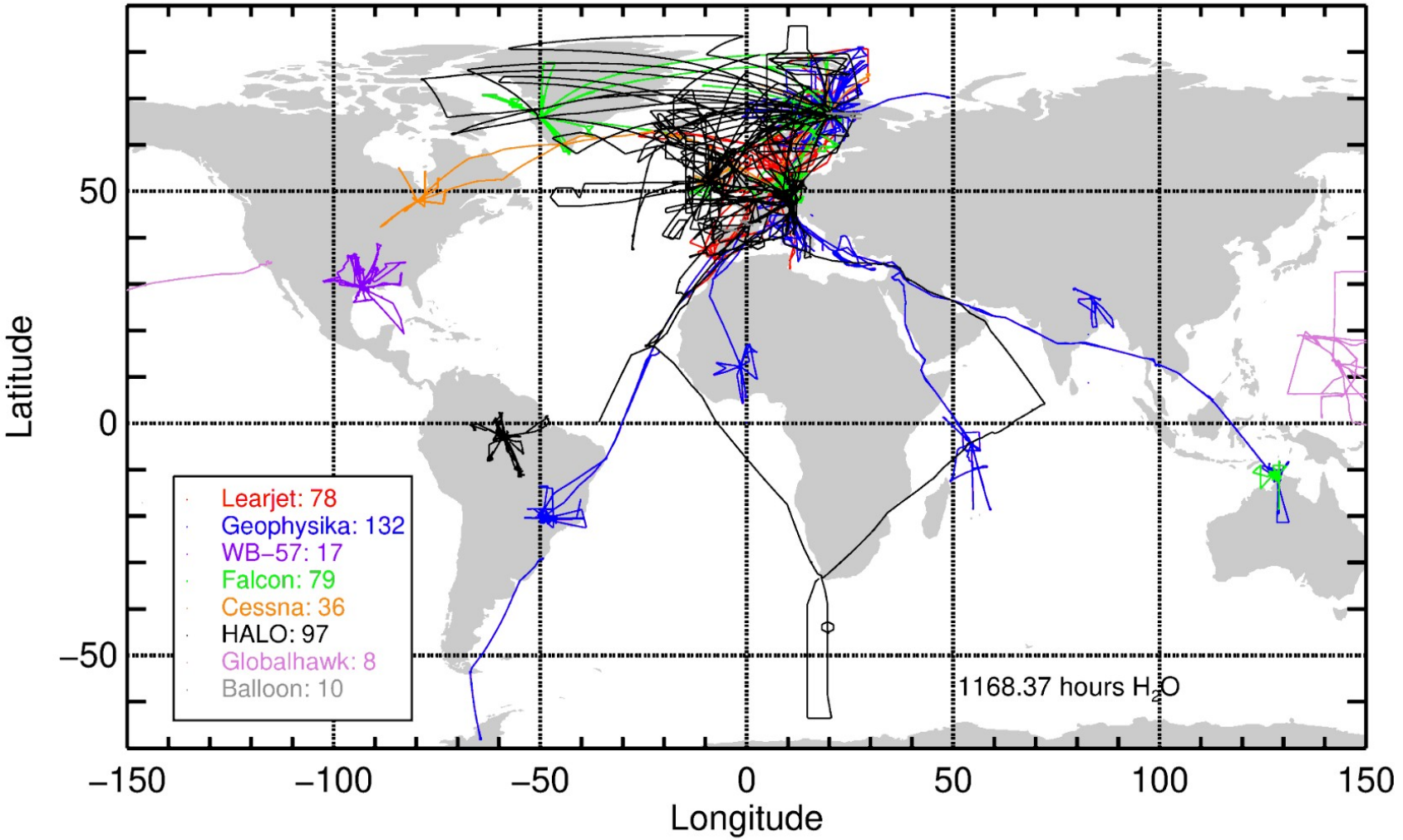
JULIA: JUELICH IN-SITU AIRBORNE DATA BASE

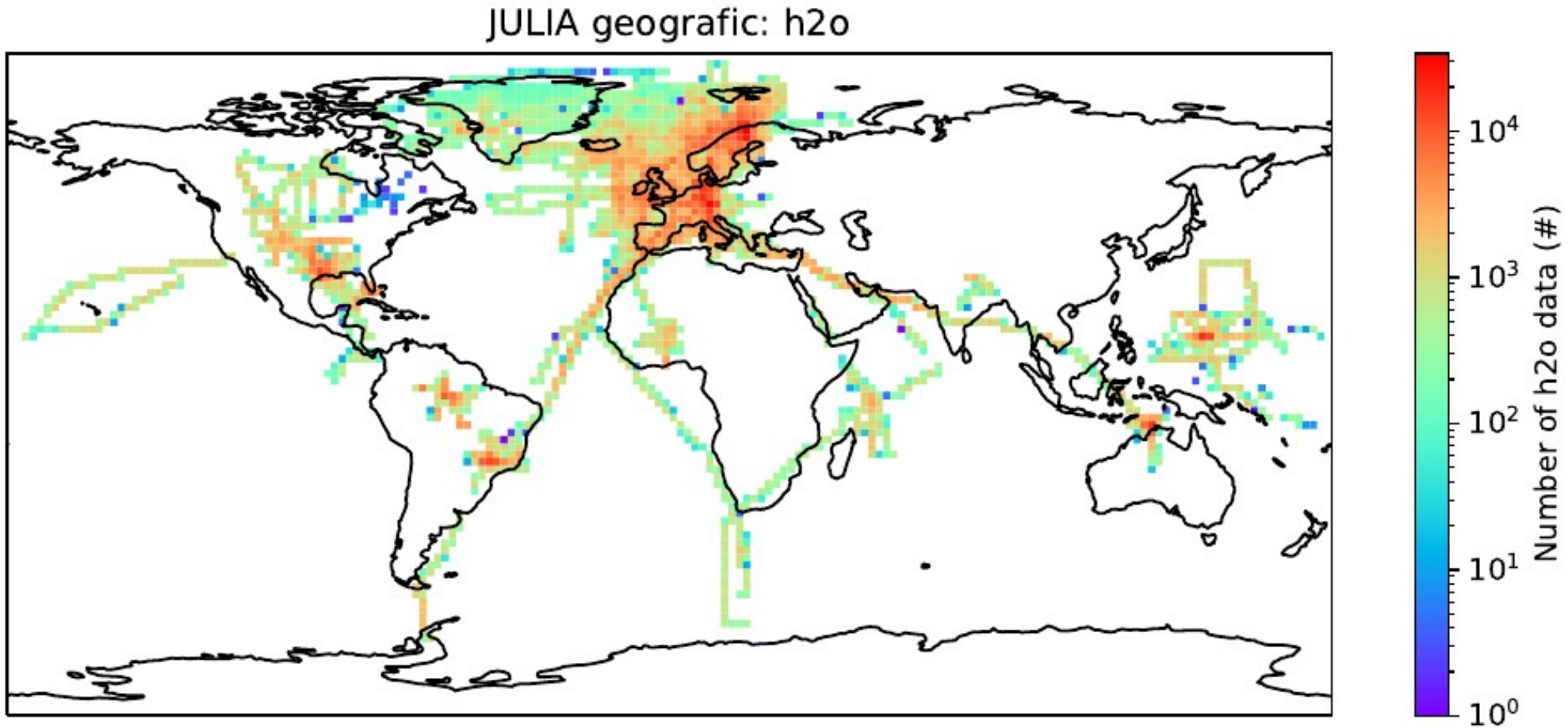
- JULIA-DB includes:
- high quality H2O, O3, clouds: IWC & N_{cloud}

- geogr. & met. Parameters (lat, lon, tempature, pressure, Rhi, theta)

- Altitude range: 6-21 km



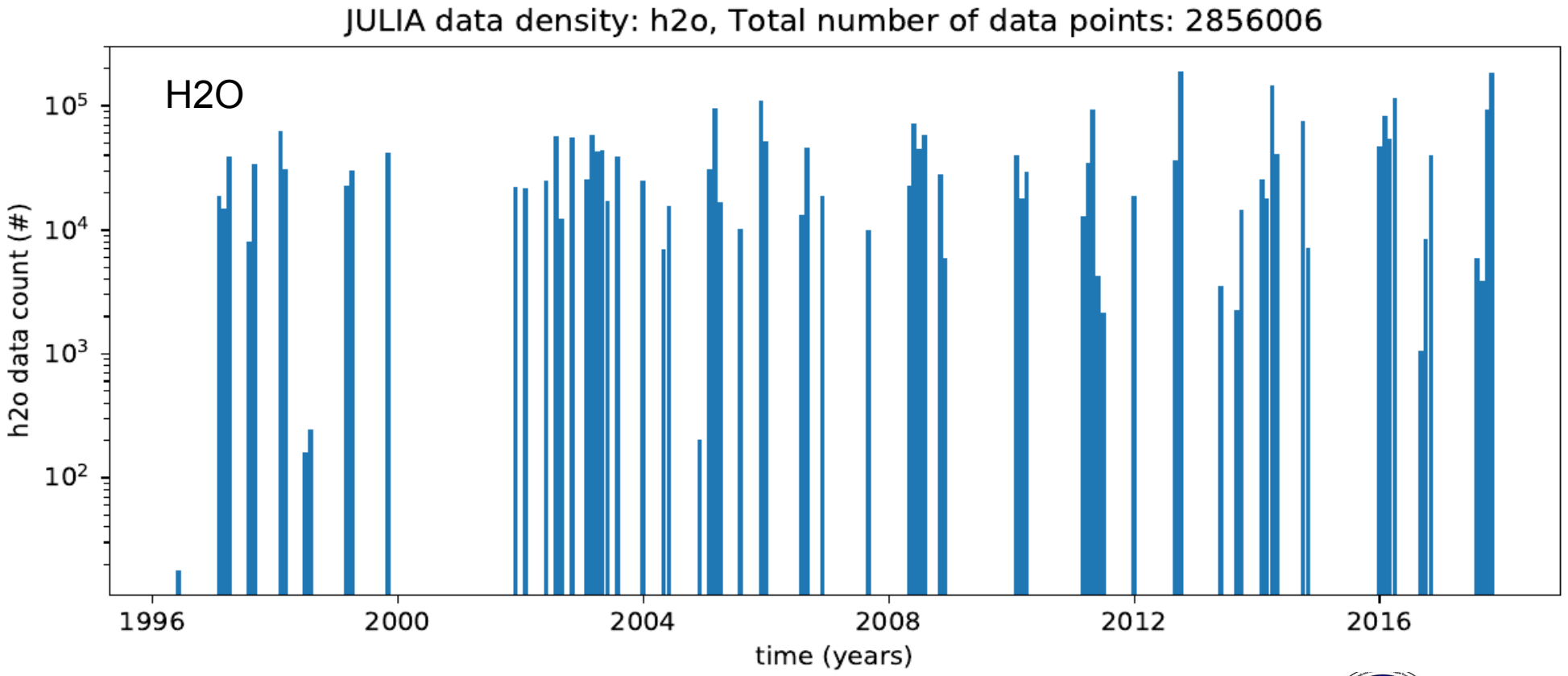
JULIA: JUELICH IN-SITU AIRBORNE DATA BASE



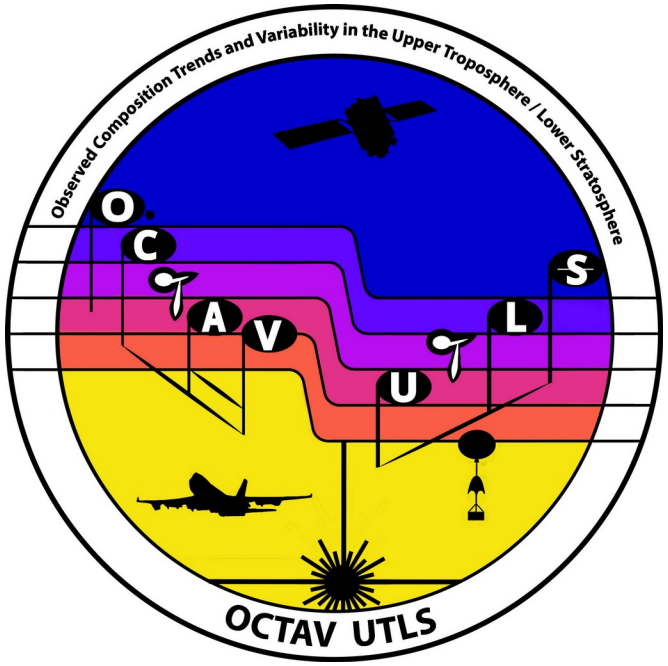
Clouds are excluded by using H_2O > 0.6 * sat_ice mixing ratio (60% RHi)

JULIA – TEMPORAL DATA COVERAGE

- Temporal coverage important for trend analysis
- Data coverage for about 20 years



JULIA UTLS WATER VAPOR ↔ METEOROLOGICAL DATA



- JETPAC (JEt and Tropopause Products for Analysis and Characterization) package

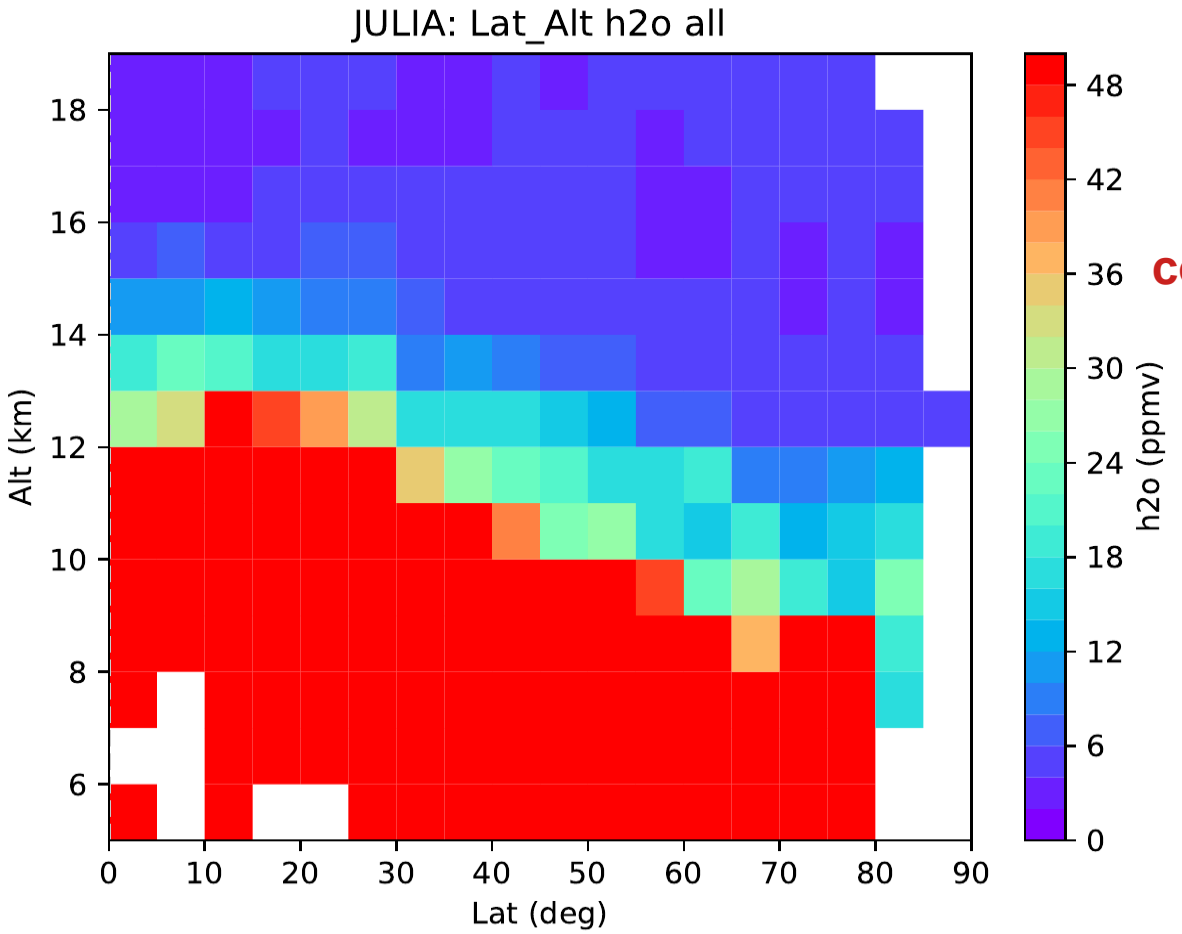
  provided by Gloria Manney & Luis Millan
  (Manney et al. 2011 & 2014)

- geogr. & met. parameters interpolated from MERRA-2:

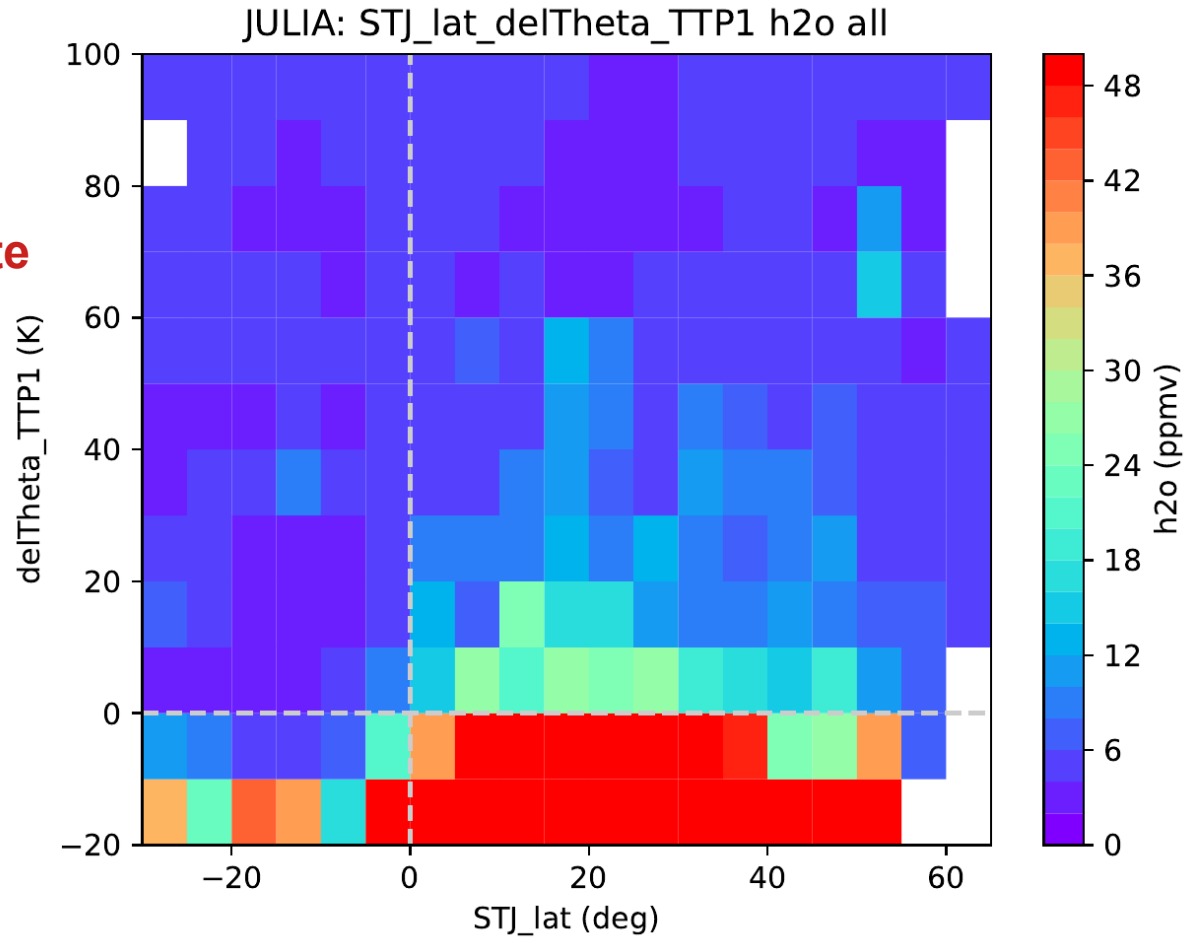
  Input: latitude, longitude, temperature, pressure, potential temperature

  Output: equivalent latitude, potential vorticity (PV), tropopause locations (dynamical & thermal), subtropical jet (STJ) location

JULIA – H2O (DIFF. COORDINATES)



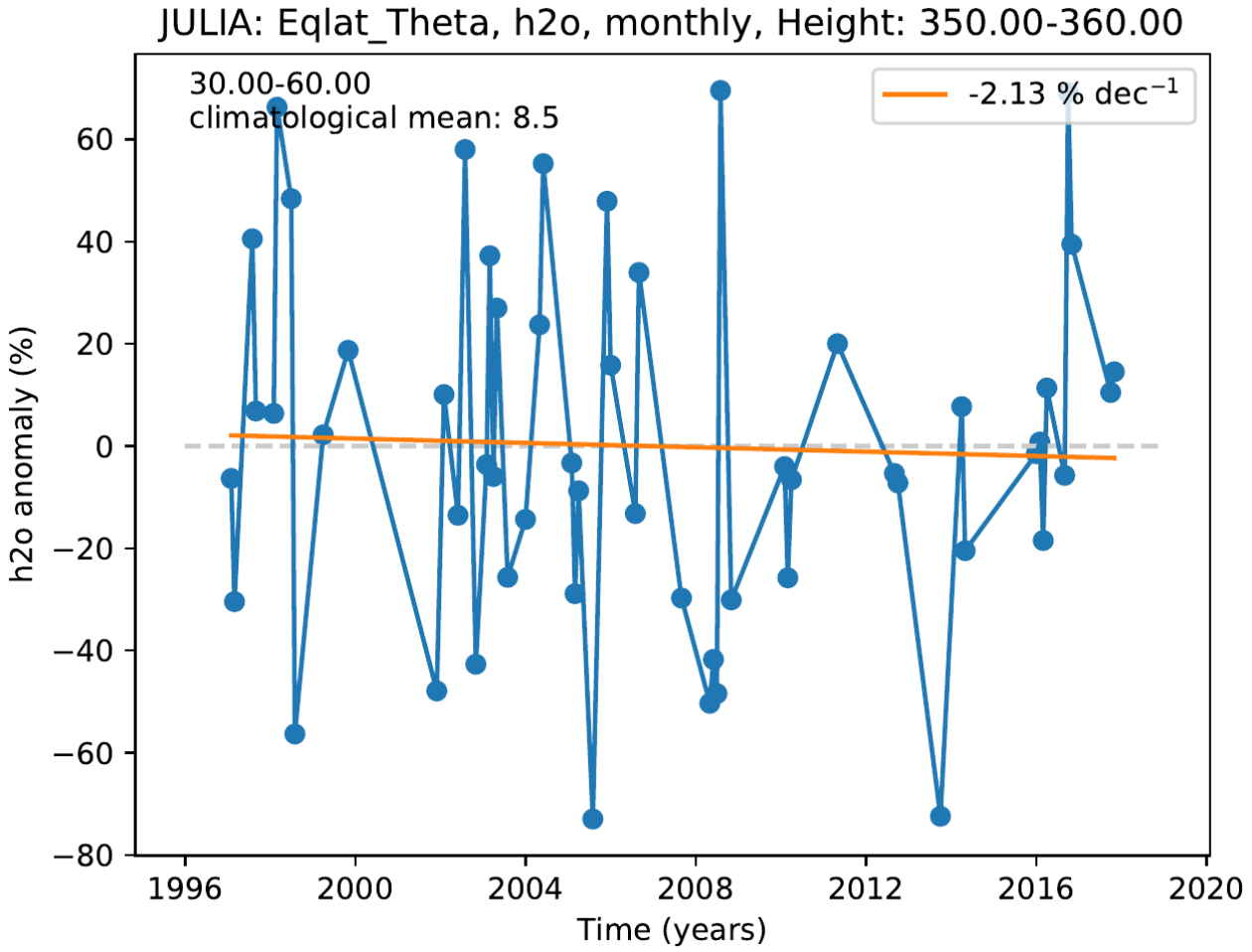
coordinate transf.



Other coordinates helps to reduce the effects of vertical and horizontal dynamics/variability

JULIA – TRENDS IN DIFF. COORDINATES

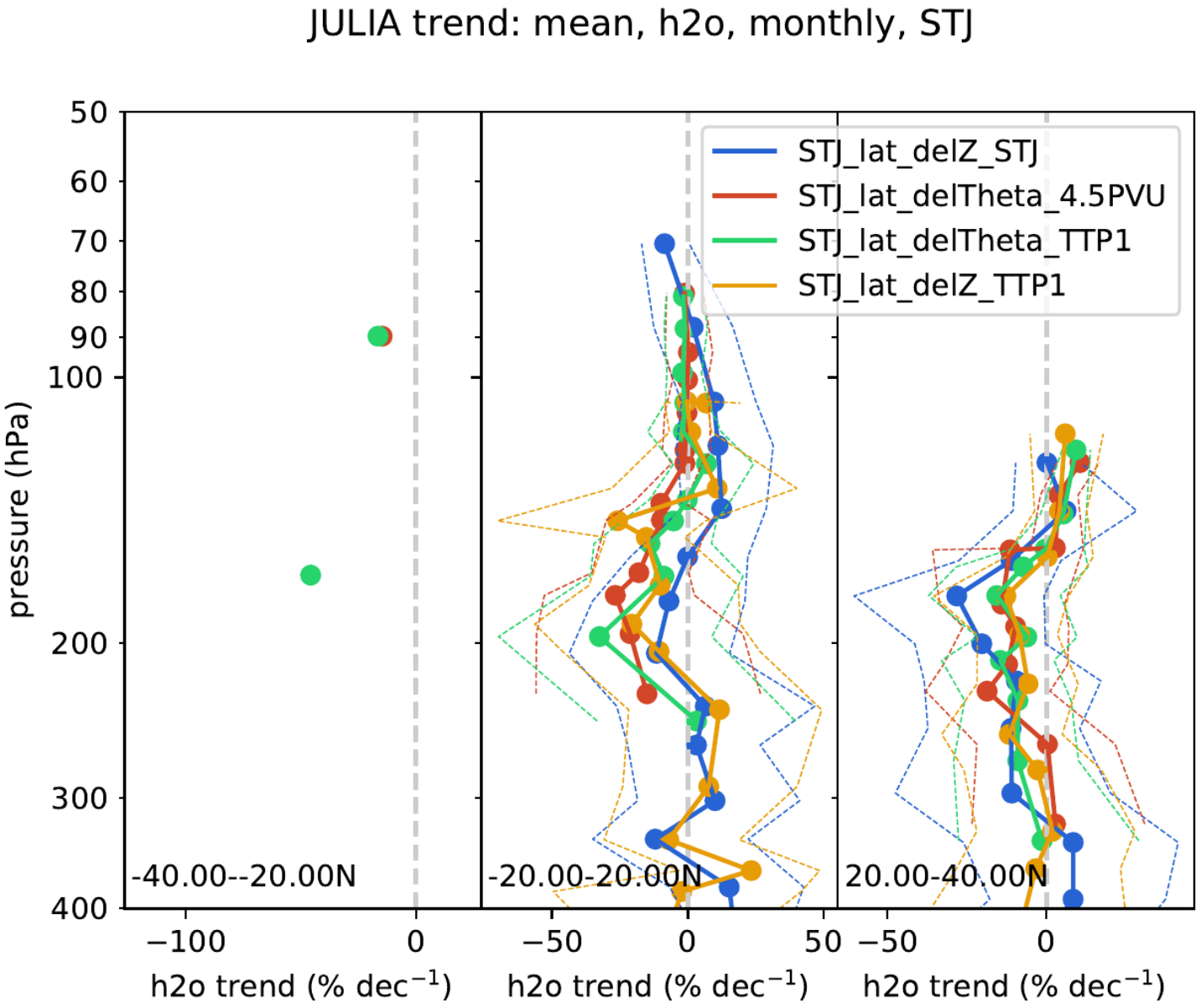
Anomalie [%] = (monthly_mean - monthly_climatology) / all_climatology * 100.
all_climatology = all data used



For each monthly/seasonal mean > 10 data points

For Trend estimates Samples > 15

JULIA – H2O TRENDS IN DIFF. COORDINATES



- Smaller variability in the lower stratosphere (smaller bootstrap error)
- Higher variability at the tropopause and below (larger bootstrap error)
- Indications for positive trend in the upper troposphere (but larger variability)
- Consistent negative trend around the tropopause region

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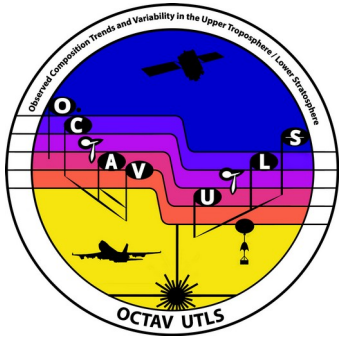
CONCLUSIONS



- **In-situ research aircraft data** include high temporal and spatial **water vapor variability**

- **Coordinate transformation reduce natural variability**
  - Horizontal Jet-based and vertical relative to tropopause based coordinates

  - Still variability above the tropopause → Need for high resolved water vapor data

- Trend analysis difficult with JULIA data (temporal and spatial coverage, highly uncertain)
  Non of the computed trends are statistical significant (2-sigma bootstrap error)

- **H2O trends**
  - Indications for positive trend in the upper troposphere (but larger variability)
  - Consistent negative trend around the tropopause region
  - Indications for slight positive trend in the lower stratosphere