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Institut für Meteorologie  
und Geophysik



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Faculty of Earth Sciences,  
Geography and Astronomy

# Long-term Arctic homogenized radiosondes



Climate  
Change



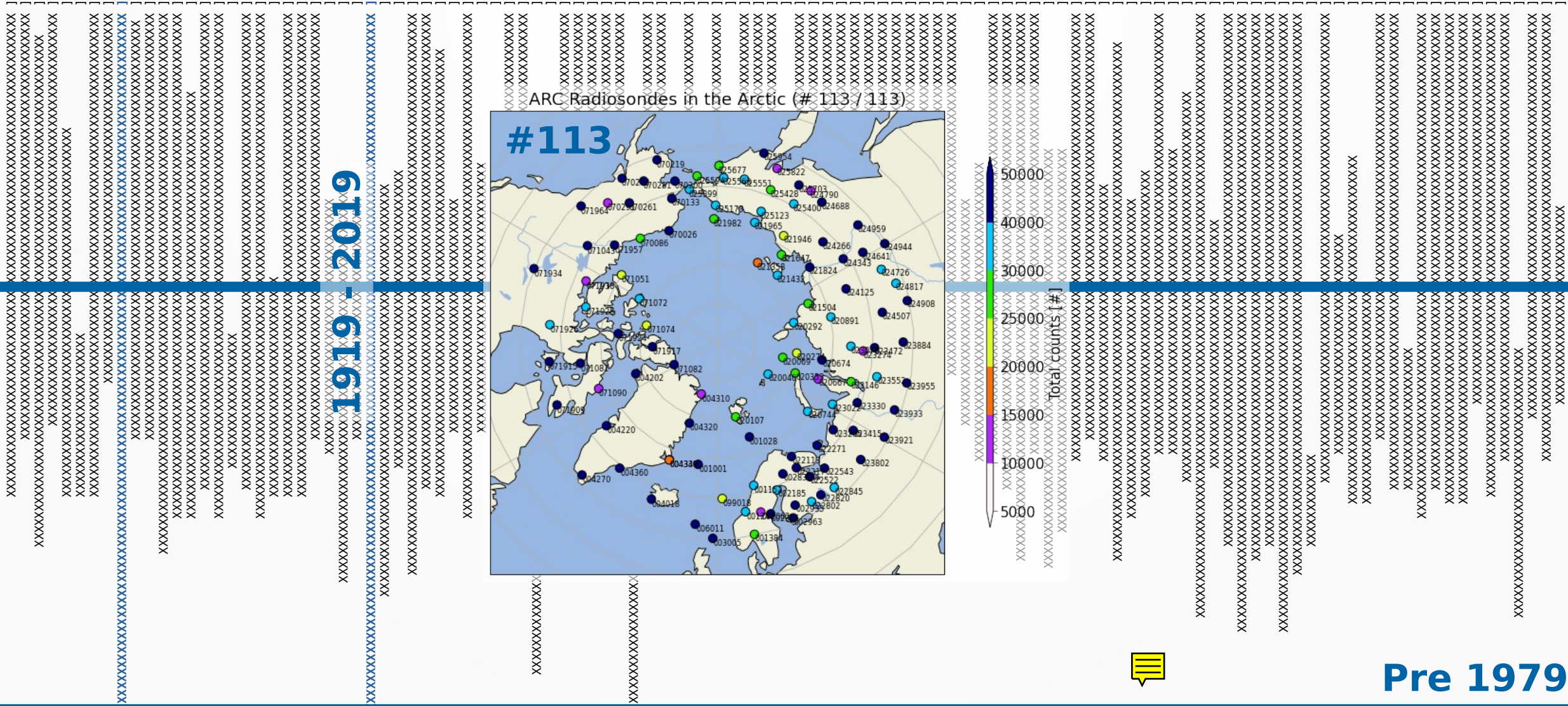
**@M. Blaschek, F. Ambrogi, L. Haimberger**

EGU 2020 - CL2.12 Exploiting Polar Observations to Improve  
Weather and Climate Predictions





# 113 Radiosondes in the Arctic Annual Availability 1919 – 1979 [2019]



Pre 1979

001001  
001028  
001152  
001241  
001384  
002062  
002185  
002365  
002836  
002935  
002963  
003005  
004018  
004202  
004220  
004270  
004310  
004320  
004339  
004340  
004360  
006011  
020046  
020069  
020107  
020274  
020292  
020353  
020667  
020674  
020744  
020891  
021358  
021432  
021504  
021647  
021824  
021946  
021965  
021982  
022113  
022217  
022271  
022522  
022543  
022802  
022820  
022845  
023022  
023078  
023146  
023205  
023274  
023330  
023345  
023472  
023552  
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024726  
024790  
024817  
024908  
024944  
024959  
025123  
025173  
025399  
025400  
025428  
025551  
025563  
025594  
025677  
025703  
025822  
025954  
070026  
070086  
070133  
070200  
070231  
070261  
070291  
071043  
071051  
071072  
071081  
071082  
071090  
071909  
071915  
071917  
071924  
071926  
071934  
071938  
071957  
099018

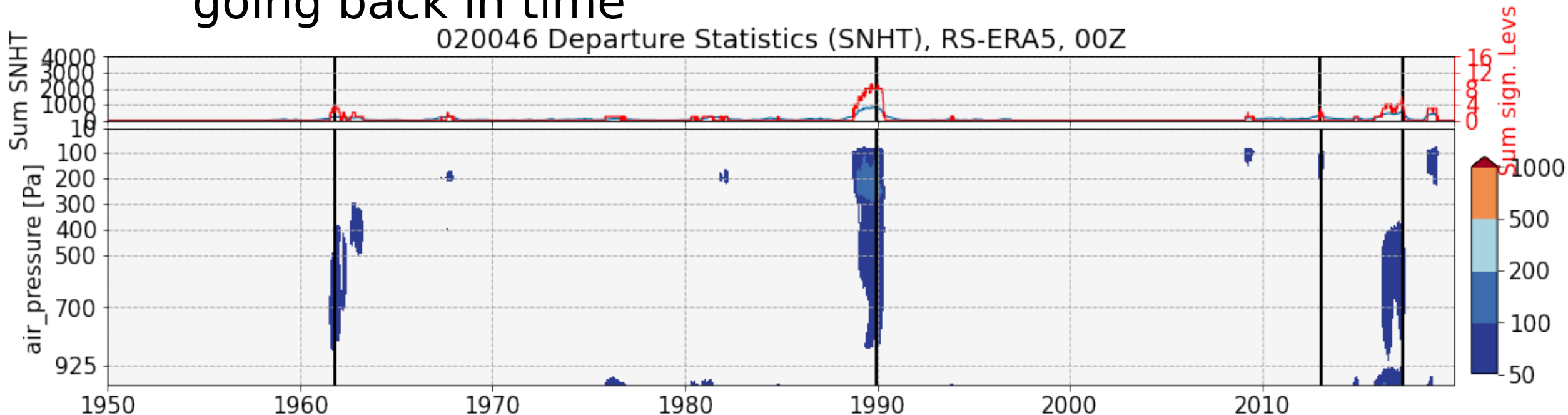
# Long-term Radiosondes - Characteristics

- Since **1940s** (some are earlier)
- Operational **changes** in sonde type, instrumentation, technology
- Problems: **discontinuities**, data **gaps**, sensitivity **biases**
- Needs:
  - Merging, QC, **Adjustments**
- Goal:
  - Long-term homogenized radiosonde timeseries
  - As a Copernicus Climate Change Service (C3S 311c Lot2)
- Why the Arctic?
  - Measuring humidity is challenged at low temperatures or at low humidity
  - Interested in Water Vapour Transport

# Methodology – Adjustments

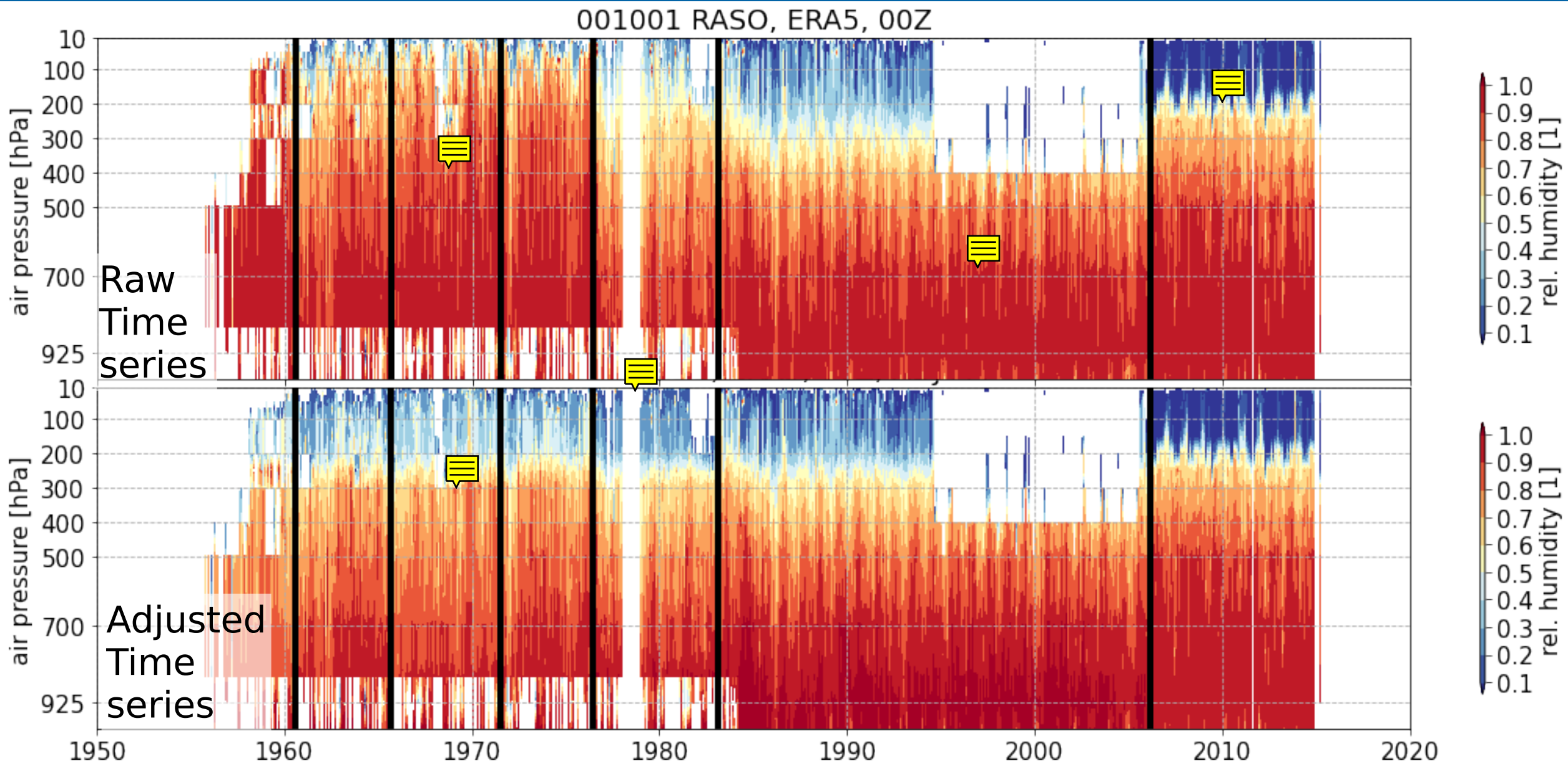
#4

- Use Reanalysis (online/offline) for departure analysis and adjustment procedure
  - Apply Standard Normal Homogeneity Test (SNHT) on departures
  - Adjust departures according to detect breakpoints going back in time





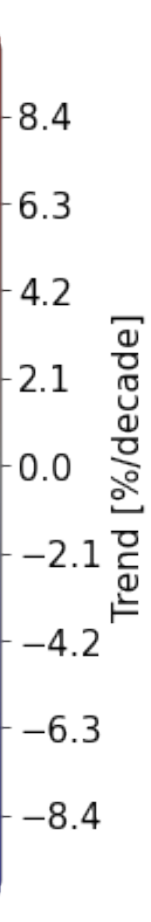
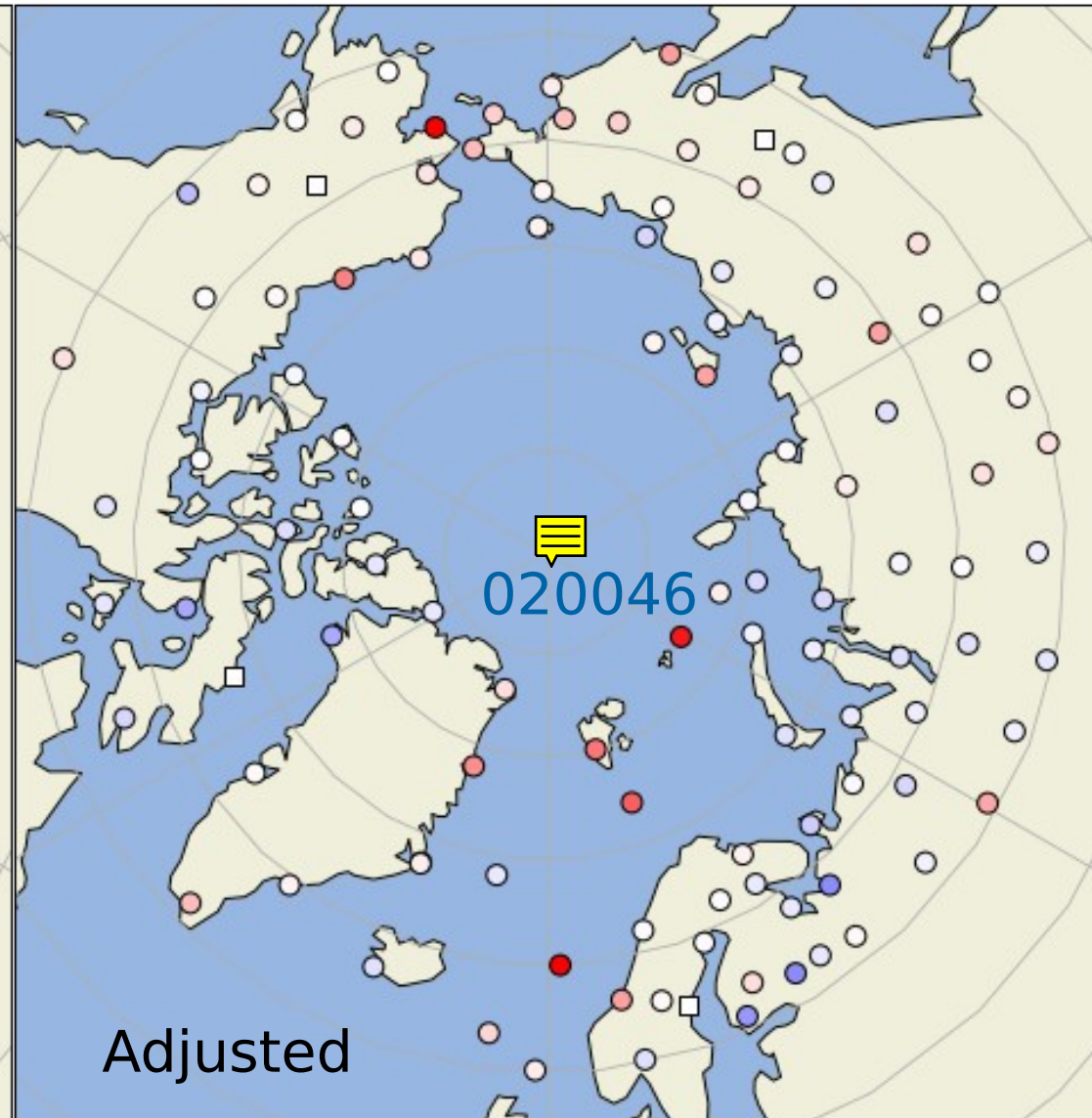
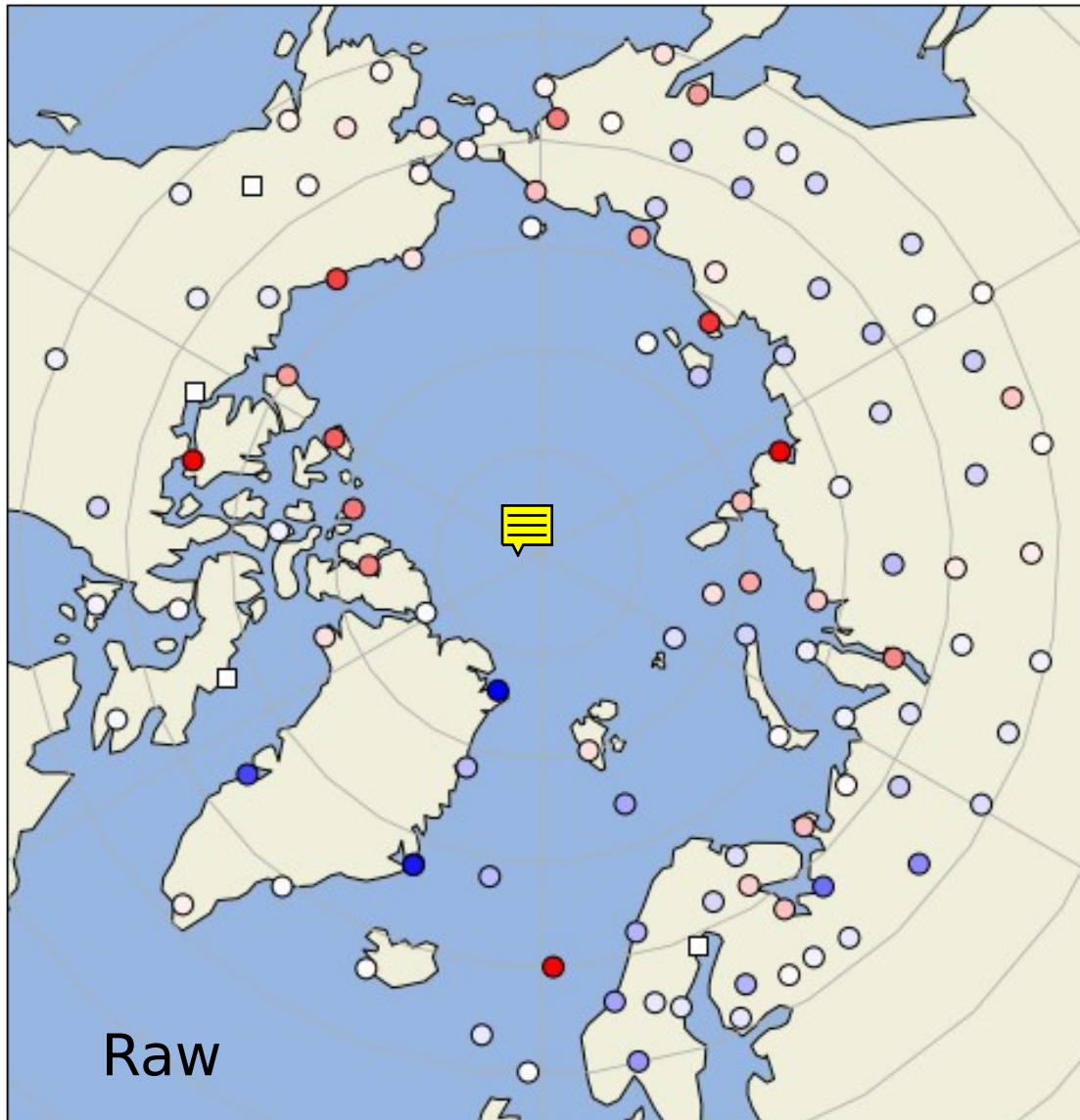
# Adjusting rel. Humidity



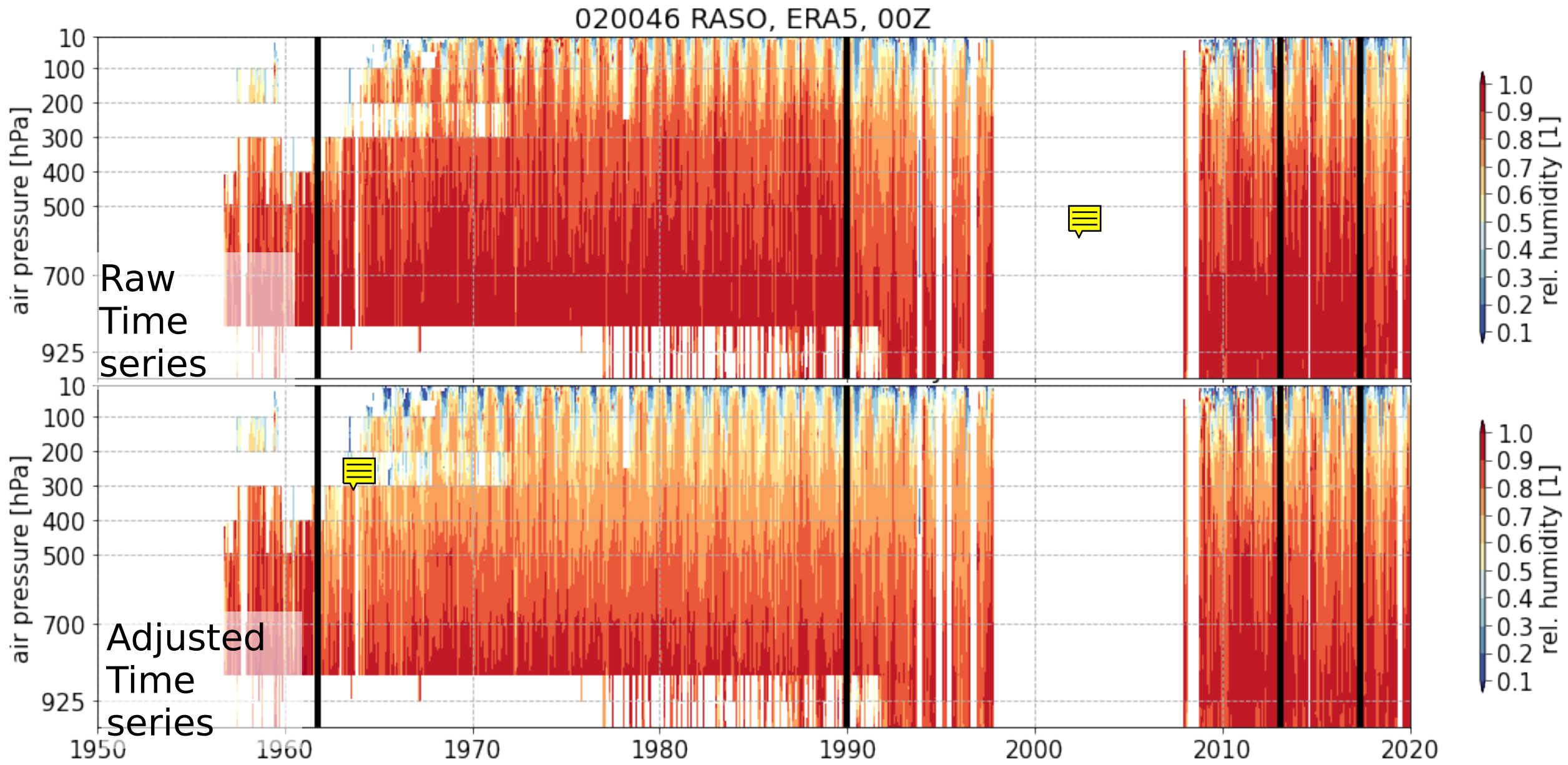
# Trends – RH – RAW - ADJ

ARC RH Trends 1950 - 2020 (# 108 / 112)

ARC RH Trends 1950 - 2020 (# 108 / 112)



# Trends – Improvements/Trend Worsens





# Conclusions – Outlook

- Long-term radiosonde timeseries can be homogenized and yield more **consistent trends**
- Data **gaps pose a challenge** (can result in spurious trends)
- Relative humidity needs more attention as for example temperature or wind
- Estimates of long-term **tropospheric water vapor** (e.g. TPW) **require homogenized timeseries** with consistent data availability, especially the level information (**missing 925hPa before 1984**)

Consolidated timeseries will be in the CDS, including adjustments and departure timeseries for further investigation and calculation of derived products.



# Stay tuned for updates



# Thanks :)

@ M. Blaschek

L. Haimberger & F. Ambroggi

**CDS Data Store – Comprehensive upper-air observation network from 1905 to present**

Locations of Balloon Records since 1905

