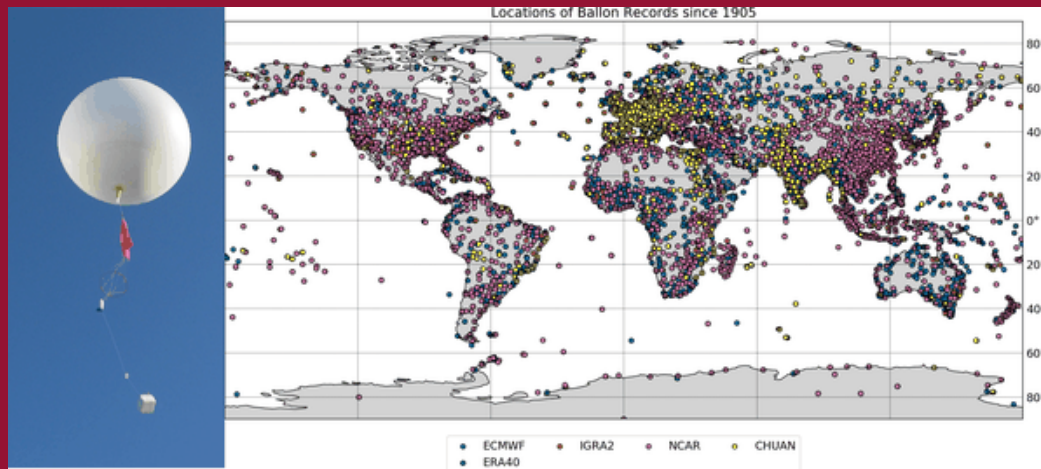


Copernicus Early Upper Air Service

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Climate Change



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Motivation

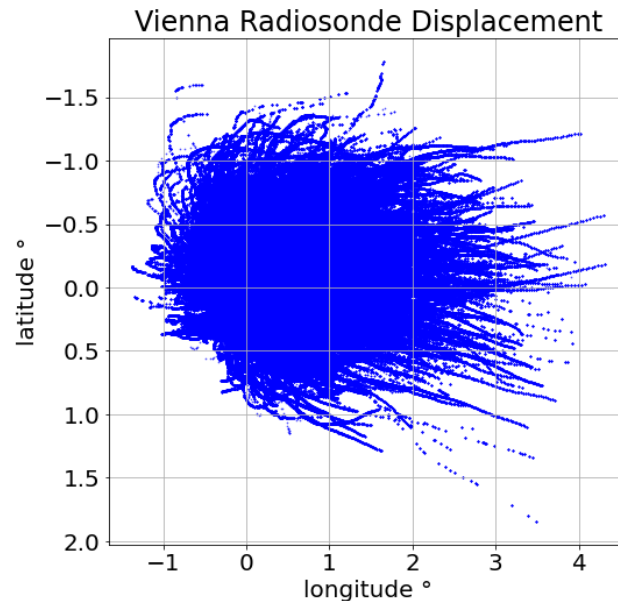
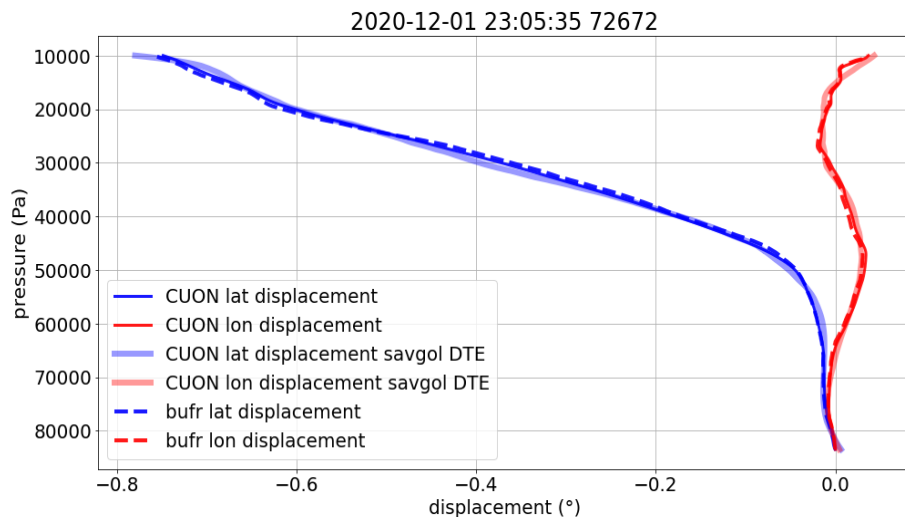
- **What is it?**
 - **Upper air** (radiosonde and pilot) data served via modern data portal
 - **Comprehensive:** All radiosondes, back to 1905
- **Recent Results**
 - Improve lat/lon/release time data
 - Improve metadata (e.g. instrument change timing) via departure statistics
 - Homogeneity adjustments for temperature, wind, humidity as far back as possible, using statistical methods (RAOBCORE/RICH)
- **Plans**
 - **Still in test phase, not yet public, search for “insitu-comprehensive-upper-air-observation-network”**
 - **Intended to support production of ERA6**
 - **Move to Copernicus Data Store 2.0 in 1.5 years.**



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Displacement from observed wind profile

- Displacement of balloon can be calculated from observed winds
- Very good agreement with displacements from GPS measurements

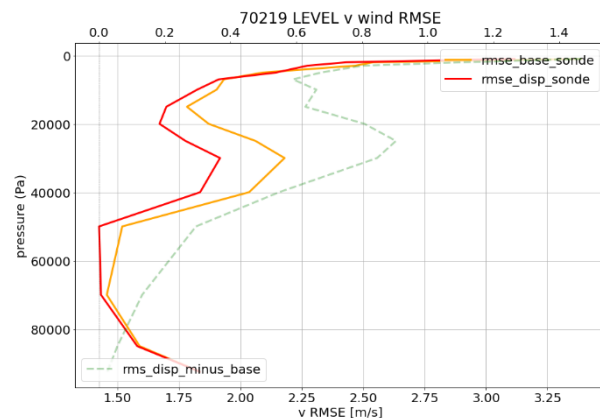
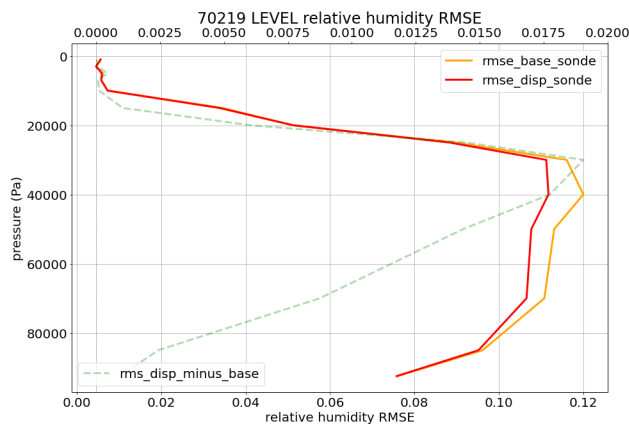
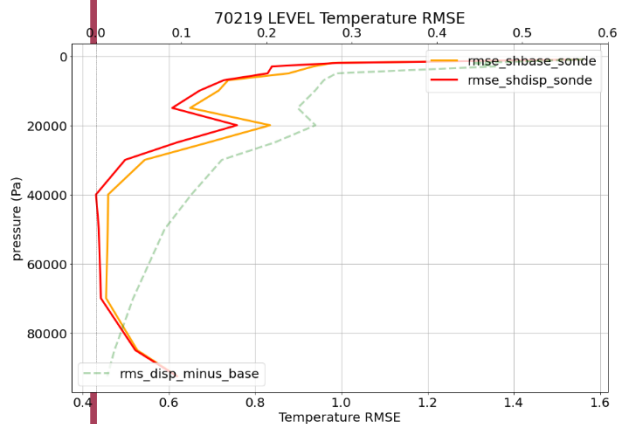




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Benefit of accurate location

- Smaller RMS of offline calculated background departures from ERA5
 - Clear benefit for all measured variables
- Effort to determine also exact release time, not nominal ascent time
- Shown are statistics over year 2020



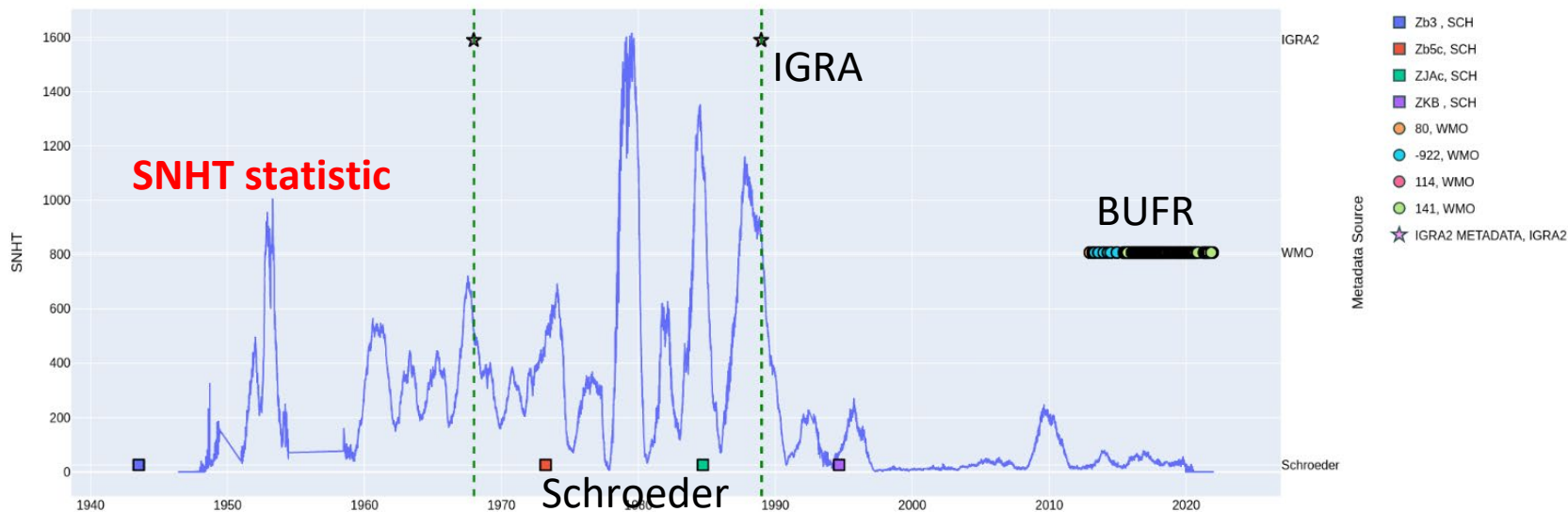


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Analysis of Metadata

- Metadata from IGRA, S. Schroeder (TAMU) and BUFR codes
- Complementary, incomplete, SNHT statistics useful for better timing

Sensors Time Series - 70414 Shemya, Alaska





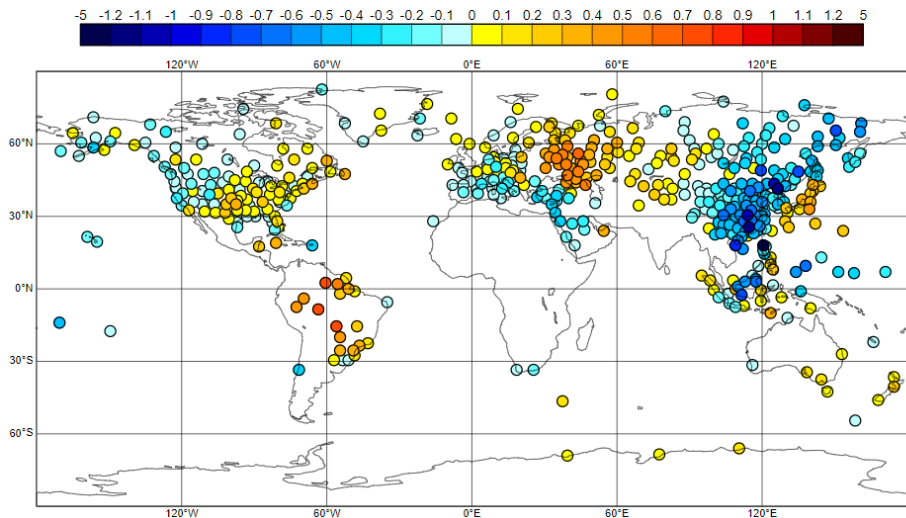
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Improved Day-Night Differences

- Measured day-night differences far smaller today than in 1970s
- Large radiation errors back then

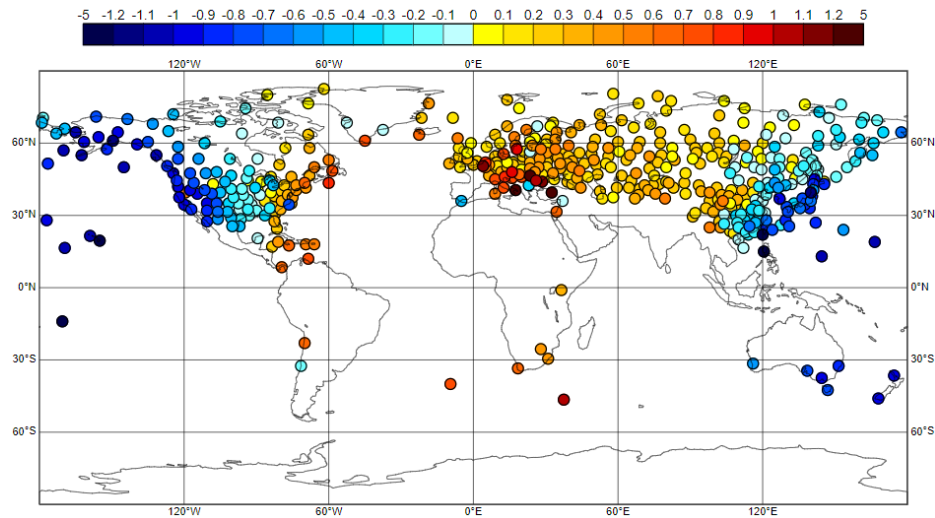
2018-2019

Temperature Difference [K], tm, 12h-00h, exp02, 2018-2019, 100 hPa
508 Stations, Cost: 453.31, 1.0



1970-1979

Temperature Difference [K], tm, 12h-00h, exp02, 1970-1979, 100 hPa
492 Stations, Cost: 1092.68, 1.0



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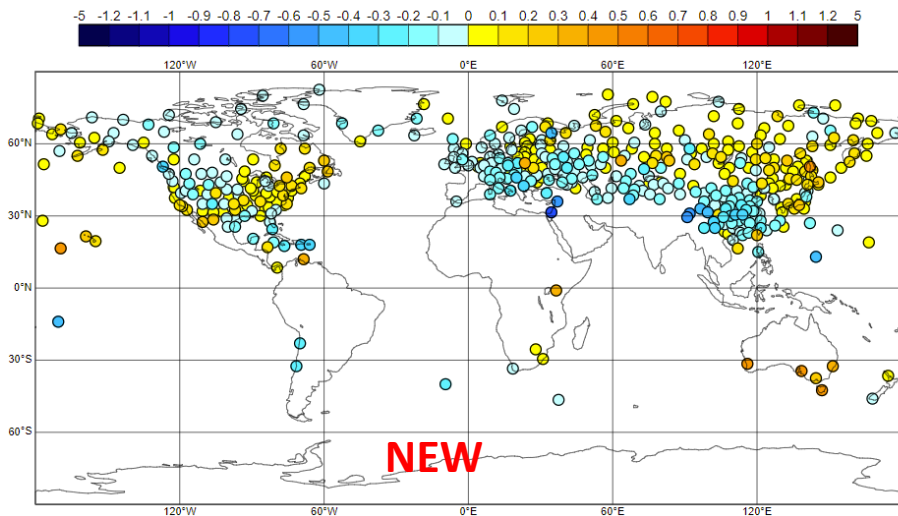
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Improved Day-Night Differences

- Prior versions of RAOBCORE/RICH temperature adjustments reduced day night differences, but not at all stations → incoherent picture (right)
- Latest version does a much better job

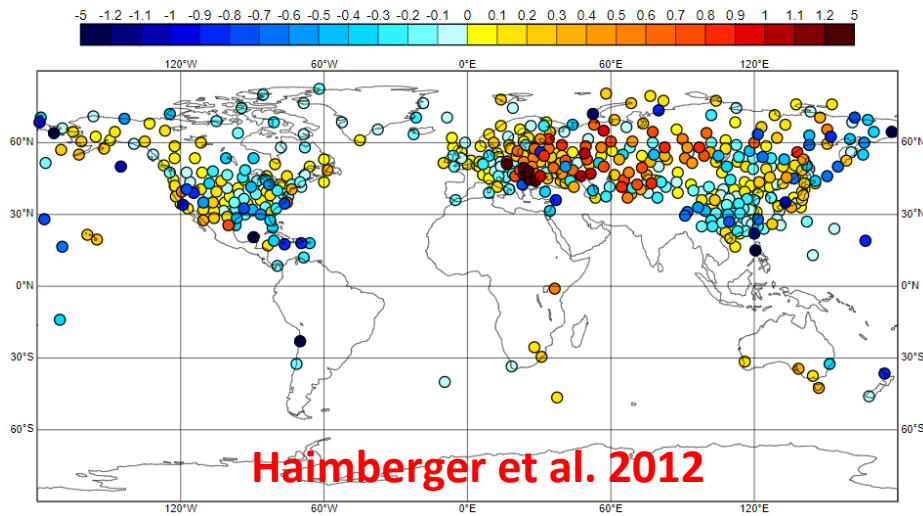
1970-1979

Temperature Difference [K], tmcrr,12h-00h, exp02, 1970-1979, 100 hPa
492 Stations, Cost: 147.68, 1.0



1970-1979

Temperature Difference [K], tmcrr,12h-00h, exp03, 1970-1979, 100 hPa
492 Stations, Cost: 2241.65, 1.0



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