Attempts to Extend the Ny-Ålesund Radiosonde Dataset Backwards

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Temperature Increase in Ny-Ålesund

Annual Mean Temperature / °C

+1.3 +/- 0.7 K/decade

update of Maturilli et al., ESSD 2013
Seasonality of Temperature Increase

Winter: Polar Night Conditions

- **Incoming solar shortwave radiation**
- **Reflected solar radiation**
- **High clouds**
- **Reflected by the surface**
- **Outgoing longwave radiation**
- **Low clouds**

**Earth's surface**
Increase in Winter Thermal Radiation

Increase in Winter Thermal Radiation

1993 Ny-Ålesund homogenized radiosonde data set
Difference due to 100% RH Correction

without – with correction

geopotential height / km

relative humidity / % RH

time / years
Homogenized Ny-Ålesund Radiosonde Dataset

corrected RH

relative humidity / % RH

gopotential height / km

time / years

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10

0 20 40 60 80 100

94 96 98 00 02 04 06 08 10 12 14
Homogenized Ny-Ålesund Radiosonde Dataset

"Merged RH"

merged:

RH wrt water

< -35°C RH wrt ice
Relative Humidity - Winter Season

Seasonal Mean (DJF)

with 100% RH correction
Temperature - Winter Season

Seasonal Mean (DJF)

geopotential height / km

Temperature / °C

time / years

-80 -70 -60 -50 -40 -30 -20 -10 0 10

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10

Specific Humidity - Winter Season

Seasonal Mean (DJF)

with 100% RH correction
Integrated Water Vapor, Seasonal Mean (DJF)

90th-percentile

linear fit, slope=1.4±2.6 kgm⁻²/decade

95% confidence interval

with 100% RH correction
Integrated Water Vapor, Annual Mean

![Graph showing increasing trend in integrated water vapor with 95% confidence interval and linear fit slope of 0.8±2.2 kg m⁻²/decade, with 100% RH correction.]
Increase in Atmospheric Moisture

Ny-Ålesund, winter season:

- increase in surface temperature
- increase in surface LW radiation
- increase in column temperature
- increase in column water vapor

“local effect”

Arctic sea ice retreat
- more open water
- latent heat exchange

transport

change in atmospheric circulation
Summary

- Observation of climate change in the Arctic motivates the assembly of a homogenized Ny-Ålesund radiosonde dataset

- RS80-A data are corrected for time lag, contamination, temperature calibration error, sensor icing etc. [applying Wang et al., 2002; Miloshevich et al., 2004]

- RS90 data are corrected for time lag and radiation error [applying Miloshevich et al., 2004; Kivi et al., 2009]

- RS92 data are GRUAN-processed [applying Dirksen et al., 2014]; 100% relative humidity correction applied

It is planned to publish the homogenized 1993-2014 radiosonde data with 50m height resolution (100m in stratosphere) as doi-referenced supplementary dataset to a scientific paper.