METROLOGY ACTIVITIES IN NY-ÅLESUND (SVALBARD)

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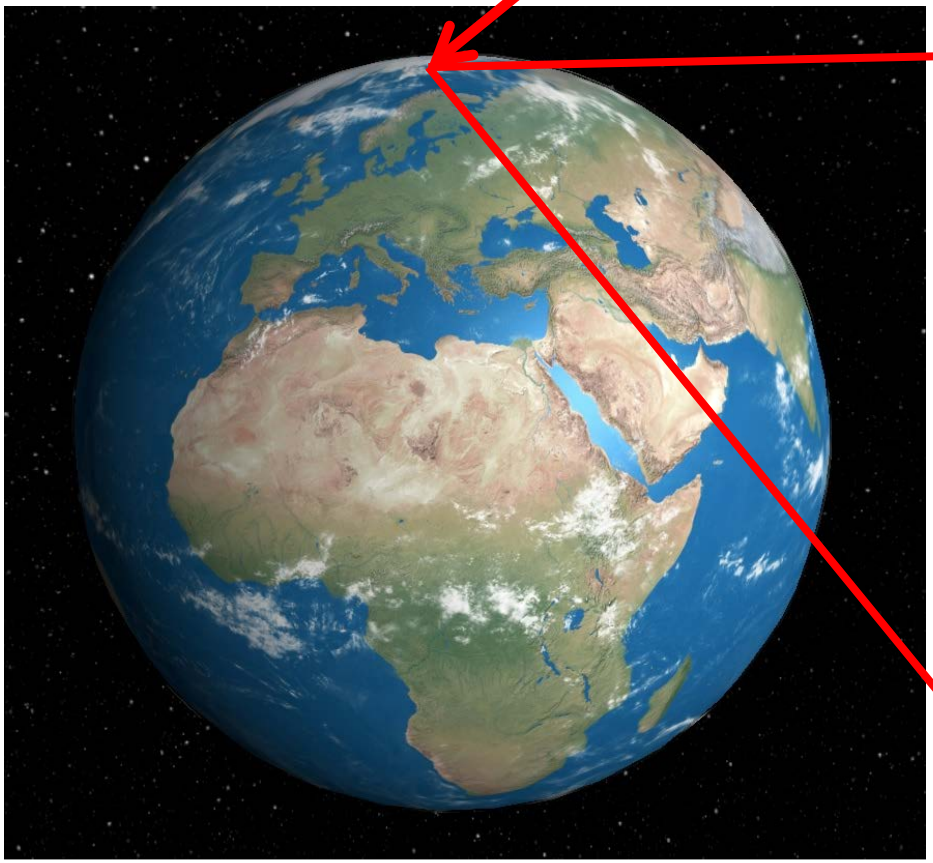
METEOMET

Metrology for Meteorology

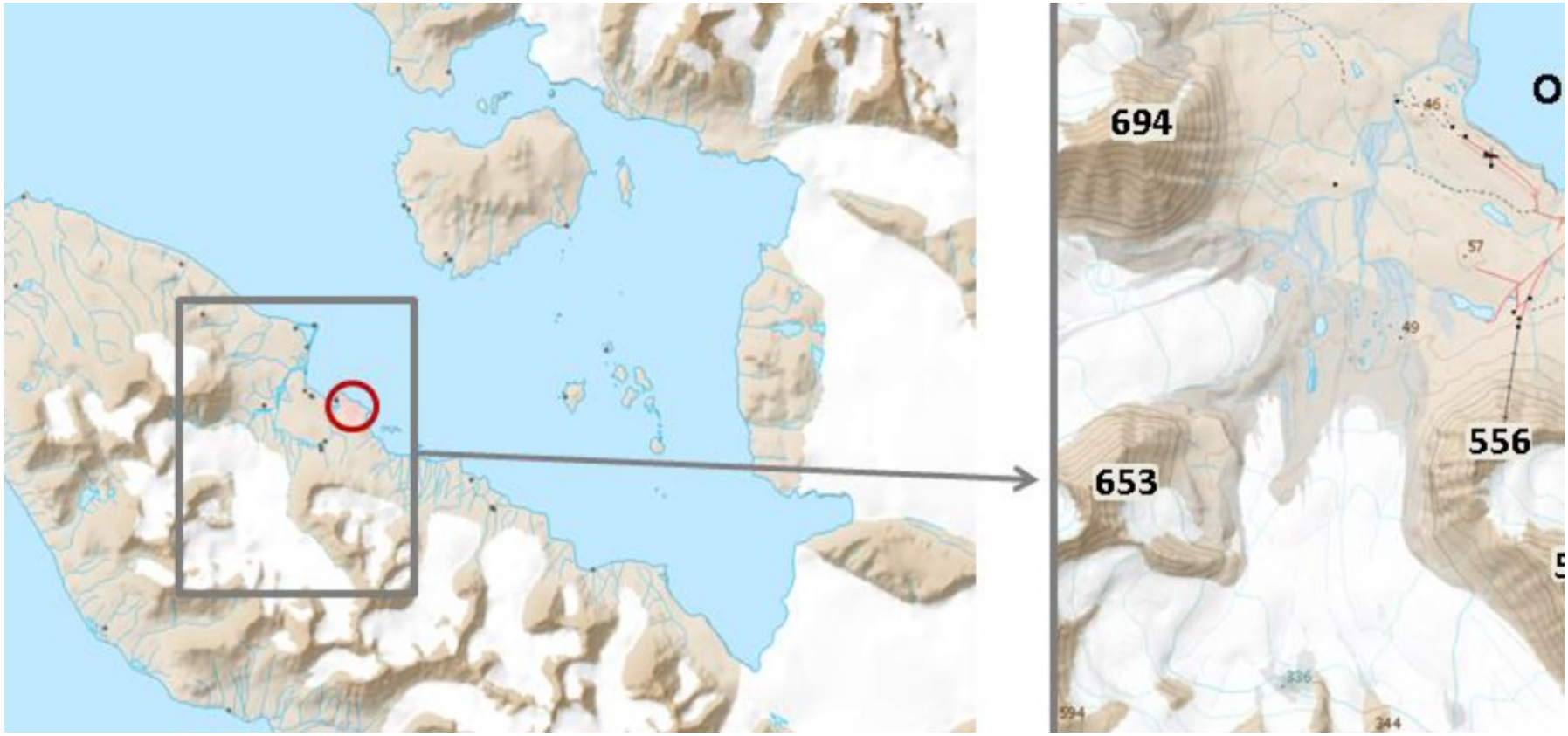
Svalbard Archipelago

78.9°N, 11.9°E



Ny Alesund – Svalbard

78.9°N, 11.9°E



Ny Alesund – Svalbard

78.9°N, 11.9°E

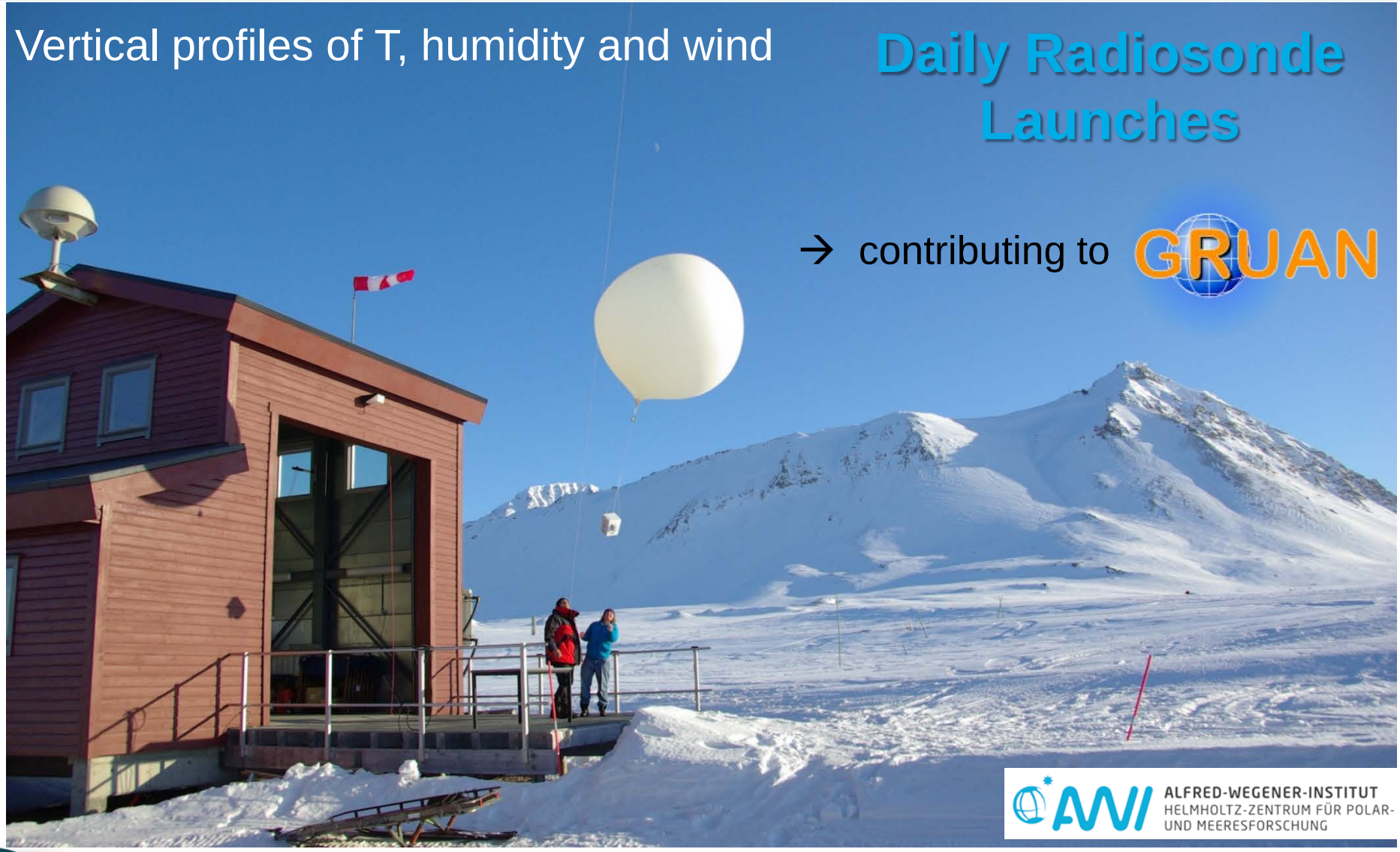
Ny Alesund – Svalbard

78.9°N, 11.9°E

Vertical profiles of T, humidity and wind

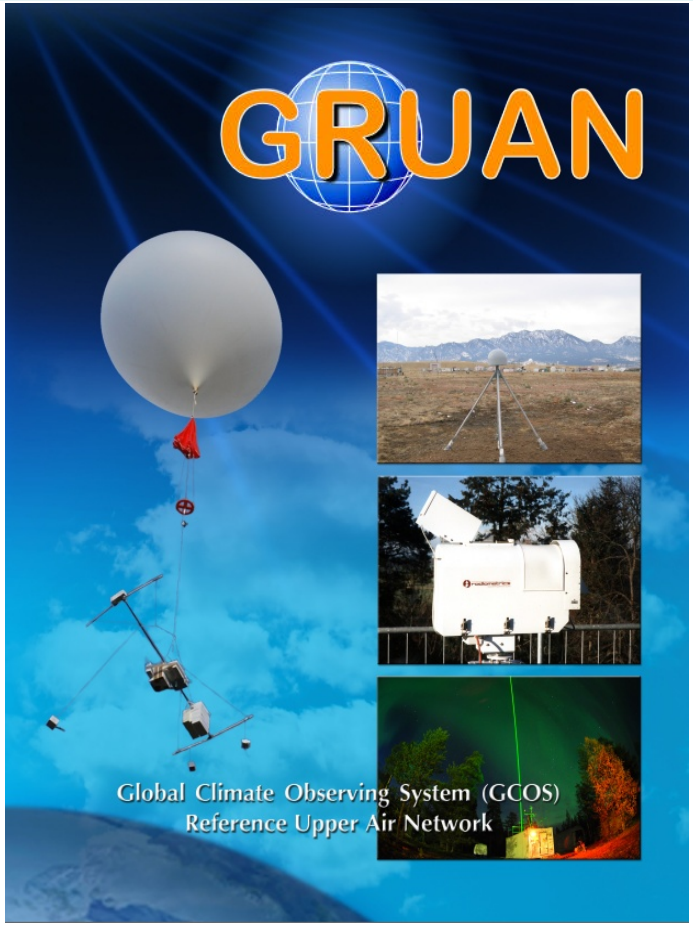
Daily Radiosonde Launches

→ contributing to GRUAN



ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

The Working Group on the GCOS Reference Upper Air Network (GRUAN) was established in recognition of the importance of initiating reference-quality observations of atmospheric column properties, in particular temperature and water vapor, pressure, from the surface into the stratosphere to enhance the monitoring and understanding of climate variability and change.



A long lasting cooperation is being established aiming at fully define uncertainty components and calibration procedures.

Procedures

RS92

Vaisala
Ground Check GC25

surface
pressure

100% rel. humidity + T
SPRH100

GRUAN

rawdata

data
to GTS

launch

ambient
dewpoint + T

ventilated weather hut

surface pressure
ambient temperature

important metadata for uncertainty calculations

- Quantification of Uncertainties
- Managed Change (Instruments)

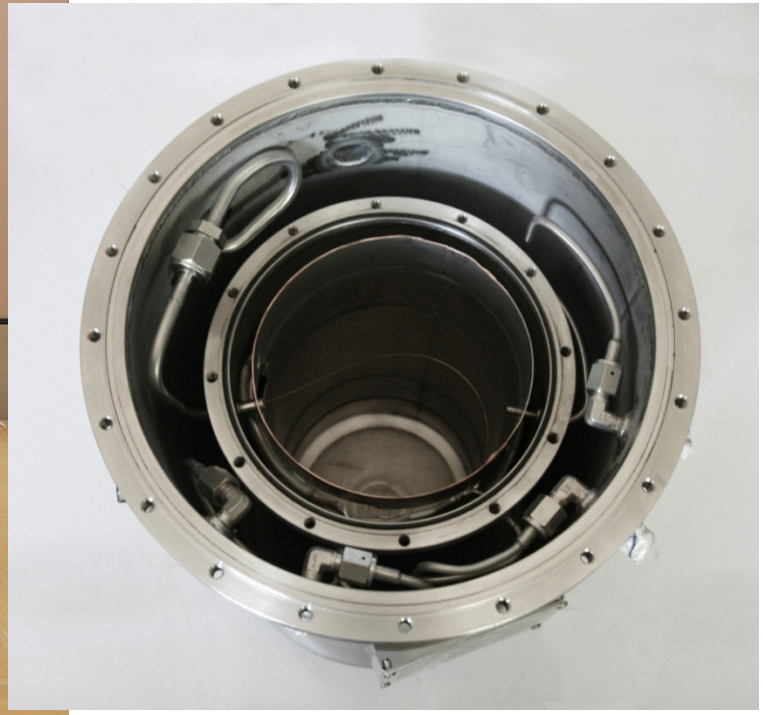
Ground-based reference observing system ⇨ longterm stability, homogeneity and representativeness of the dataset for CLIMATIC research

The ground instrumentation used in the Ny-Ålesund GRUAN procedures has been calibrated during the MeteoMet Arctic campaign

Mission “Polar Metrology” 2014

EDIE 1 - Earth Dynamics Investigation Experiment made at INRiM

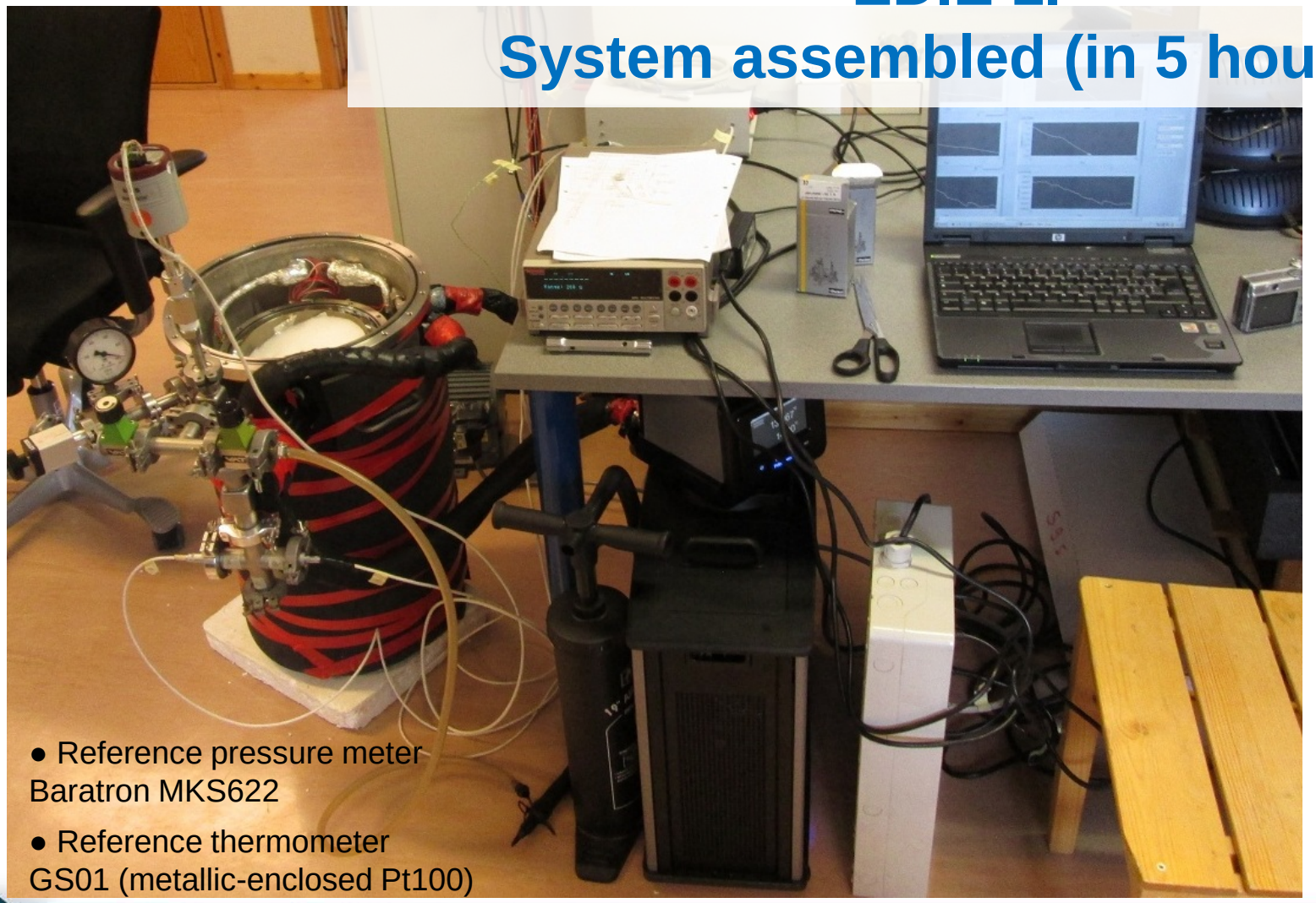
Simultaneous calibration of temperature, pressure



June 2014 EDIE reaches Ny Alesund

EDIE 1

EDIE 1.
System assembled (in 5 hours!)

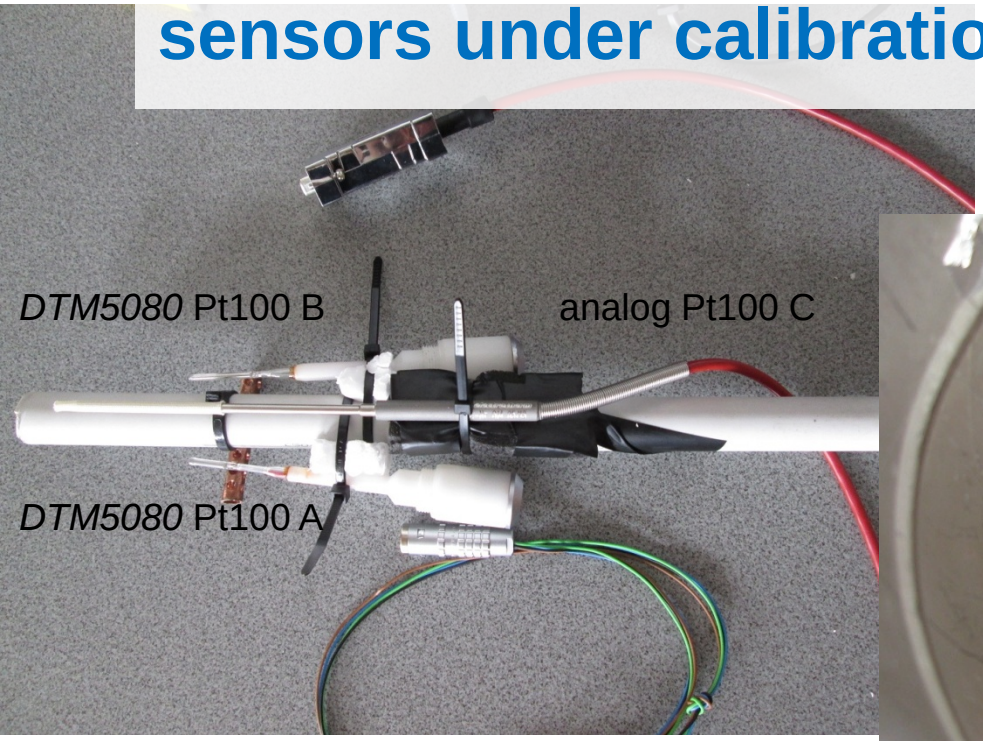


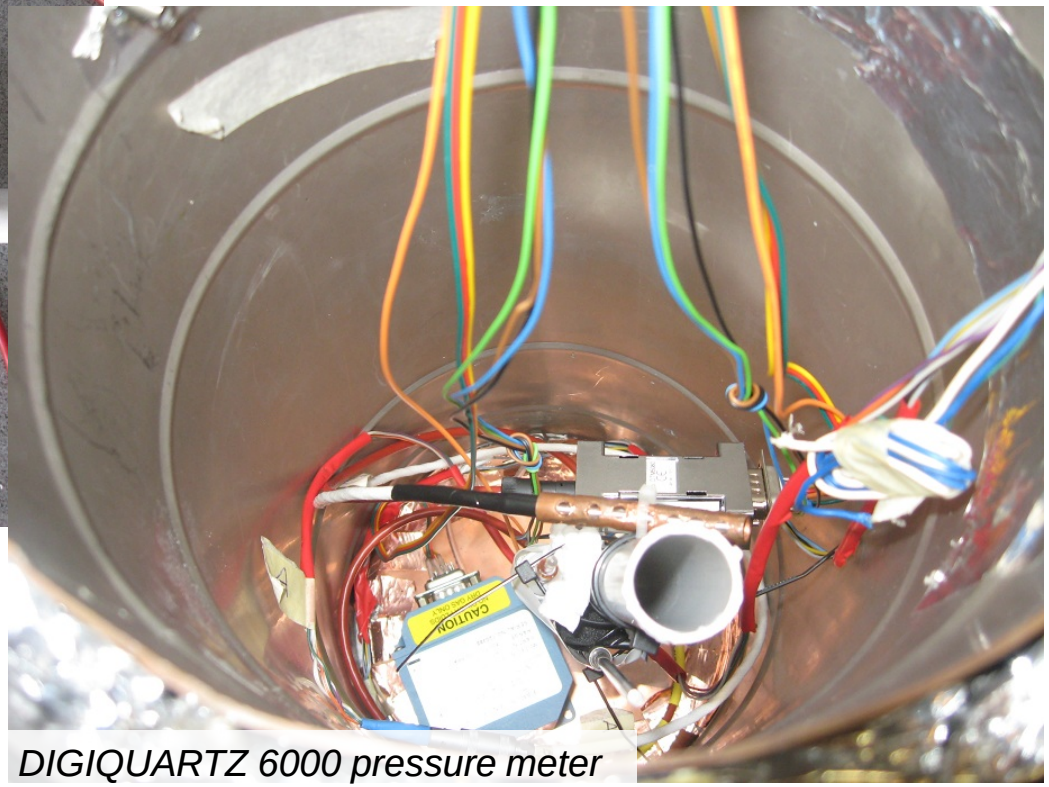
- Reference pressure meter Baratron MKS622
- Reference thermometer GS01 (metallic-enclosed Pt100)

Ice point check of reference temperature sensors

INRiM & AWI People

Inside of EDIE 1
sensors under calibration and reference standard

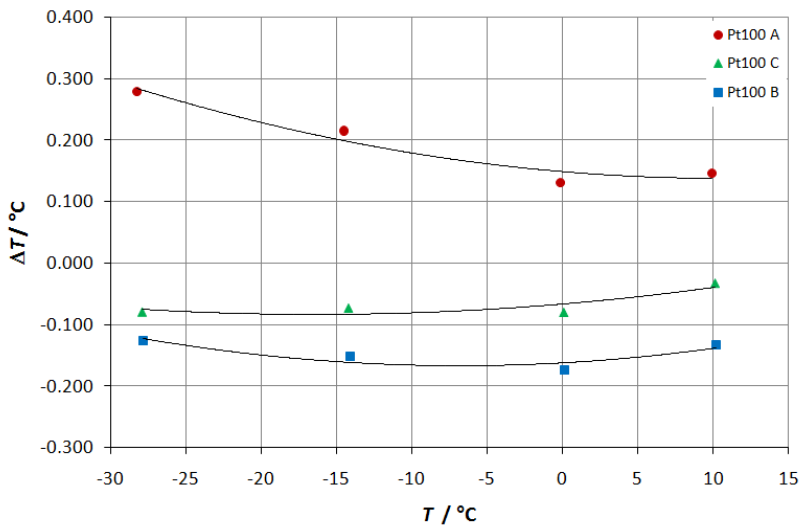




DIGIQUARTZ 6000 pressure meter

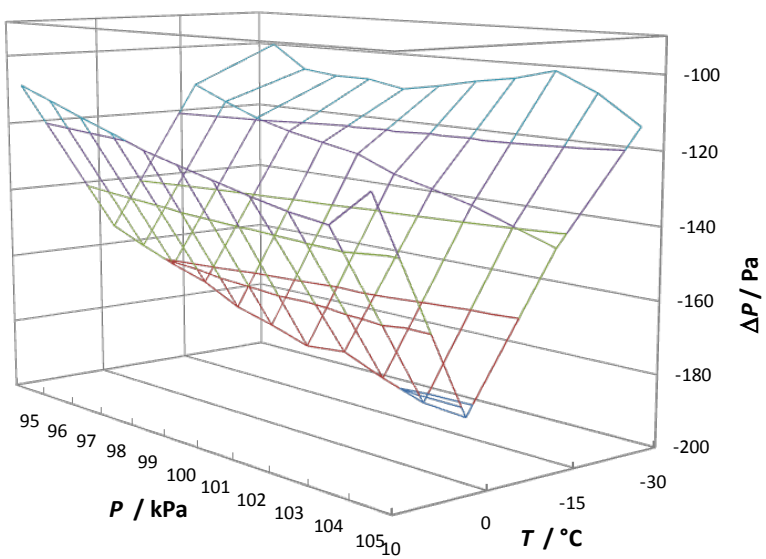
Calibration Range	
Temperature	-30 °C to 10 °C
Pressure	95 kPa to 105 kPa

Calibration curves



$$T_c(T) = T - \Delta T(T) = T + a + bT + cT^2$$

Uncertainty contribution	PT100 A	PT100 B	PT100 C
Temperature reference	0.011 °C	0.011 °C	0.011 °C
Chamber uniformity	0.006 °C	0.009 °C	0.019 °C
Sensor under calibration	0.007 °C	0.008 °C	0.014 °C
Calibration curve	0.026 °C	0.017 °C	0.018 °C
Standard Uncertainty	**0.029 °C**	**0.022 °C**	**0.026 °C**
Expanded Uncertainty (*k*=2)	**0.058 °C**	**0.044 °C**	**0.052 °C**

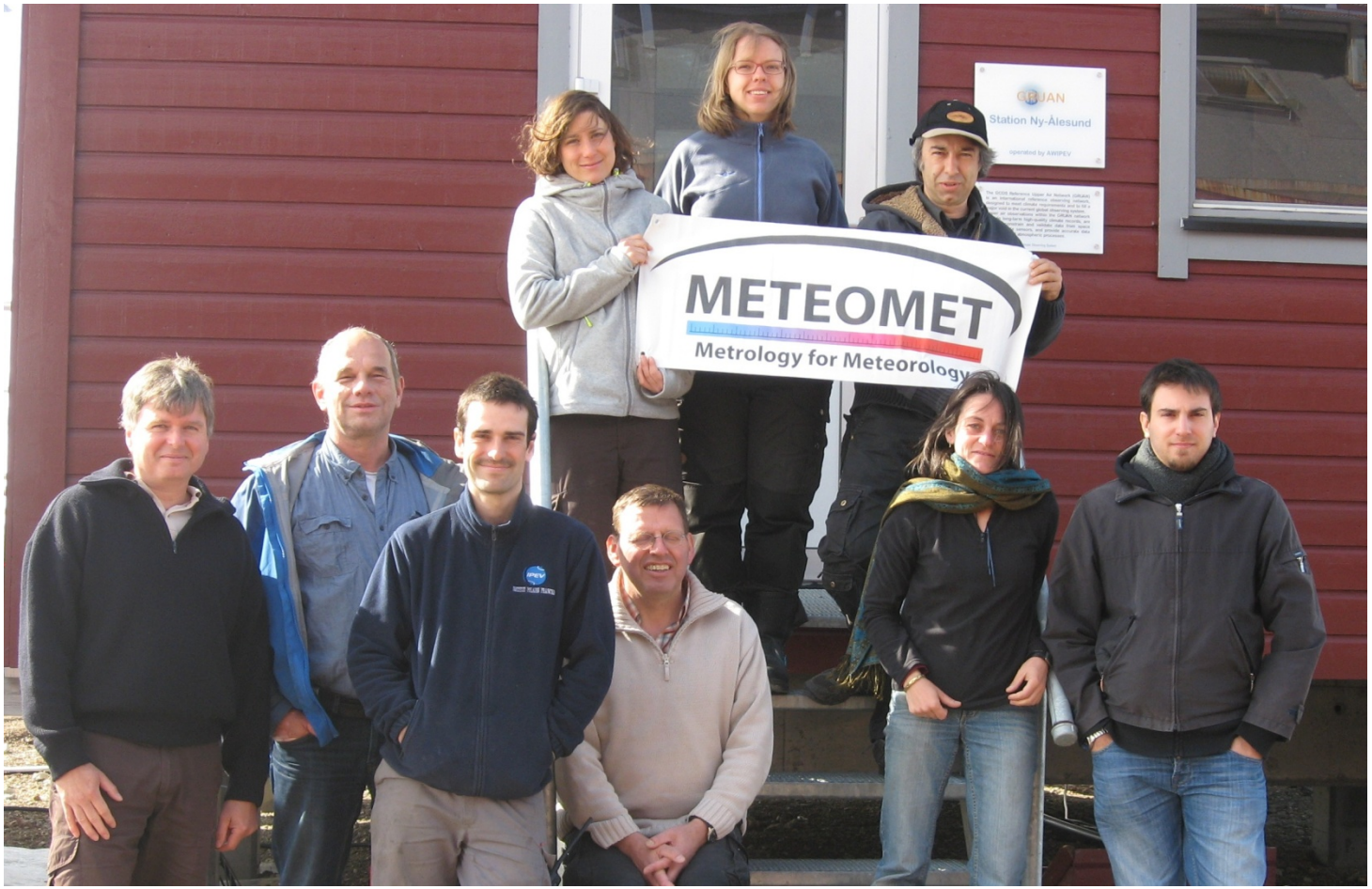


$$P_c(P,T) = P + a + bP + cT + dPT + eT^2$$

Uncertainty contribution	
Pressure reference	0.3 Pa
Chamber uniformity	2.5 Pa
Sensor under calibration	0.3 Pa
Calibration curve	26 Pa
Standard Uncertainty	**26 Pa**
Expanded Uncertainty (*k*=2)	**52 Pa**

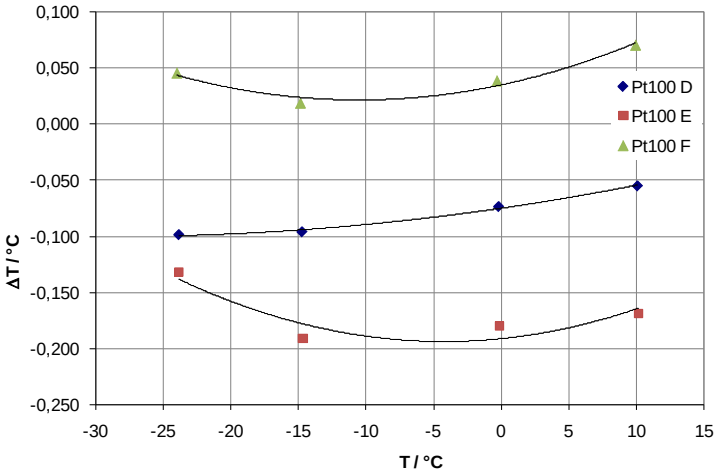

Weather hut with Stevenson screen hosting the radiosonde immediately before launch for ground check against the instruments now calibrated by MeteoMet.
Then…

METEOMET and AWI people at the end of the campaign



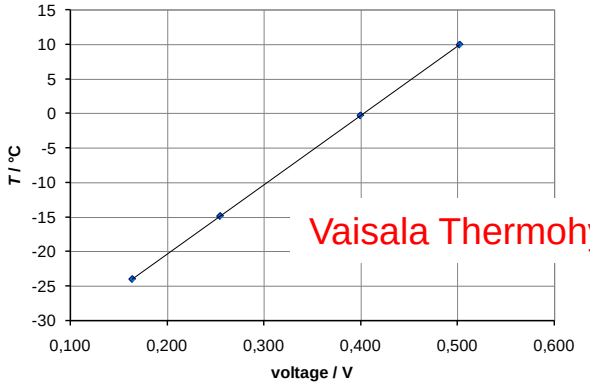
Training course for AWI staff on the use of the calibration chamber, procedures, calibration curves and uncertainties

Second round of calibration of temperature sensors



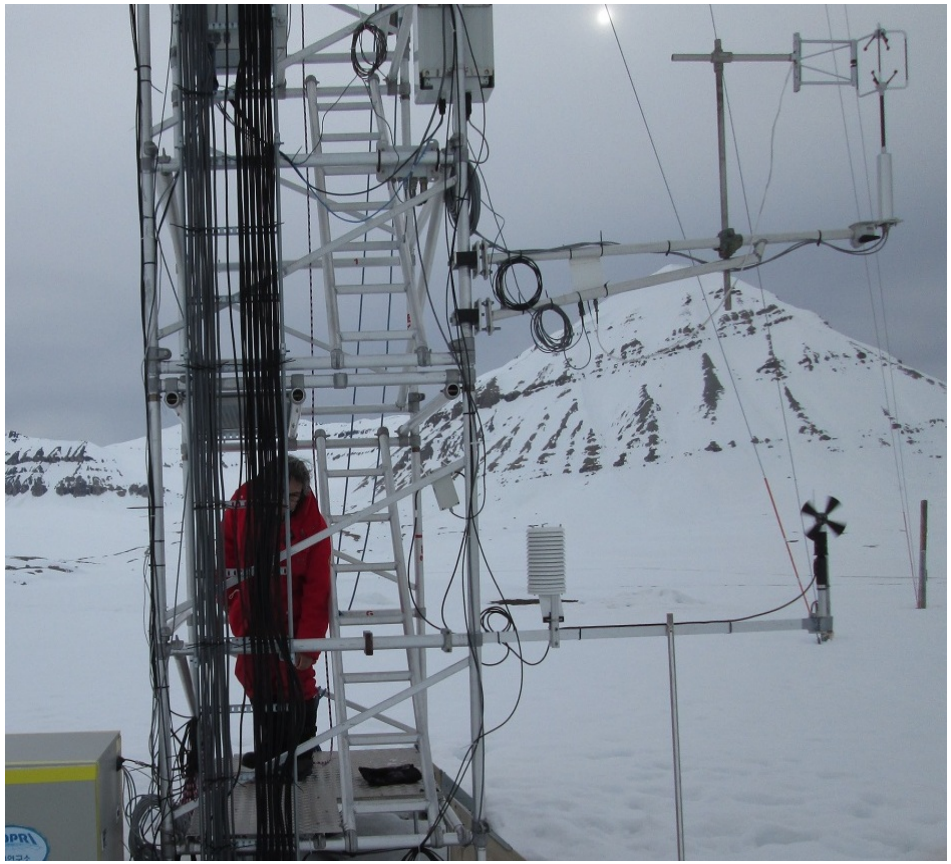
$$T_c(T) = T - \Delta T(T) = T + a + bT + cT^2$$

Uncertainty contribution	PT100 D	PT100 E	PT100 F	TH Vaisala
Temperature reference	0.007 °C	0.007 °C	0.009 °C	0.004 °C
Chamber uniformity	0.009 °C	0.009 °C	0.019 °C	0.011 °C
Sensor under calibration	0.007 °C	0.008 °C	0.014 °C	0.011 °C
Calibration curve	0.026 °C	0.017 °C	0.018 °C	0.003 °C
Standard Uncertainty	**0.014 °C**	**0.023 °C**	**0.017 °C**	**0.012 °C**
Expanded Uncertainty (*k*=2)	**0.027 °C**	**0.046 °C**	**0.033 °C**	**0.025 °C**

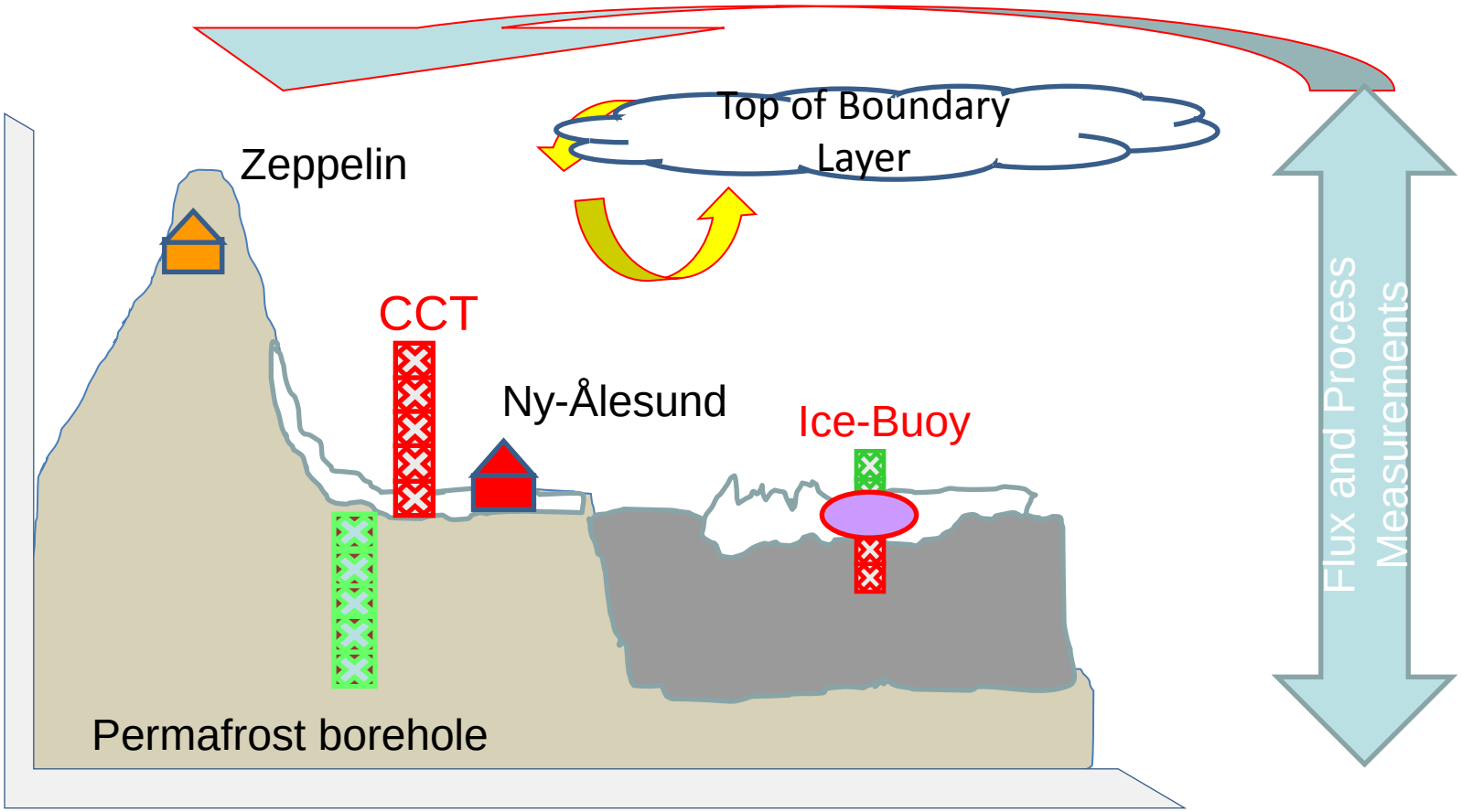


Vaisala Thermohygrometer

The climate Change Tower in Ny Alesund



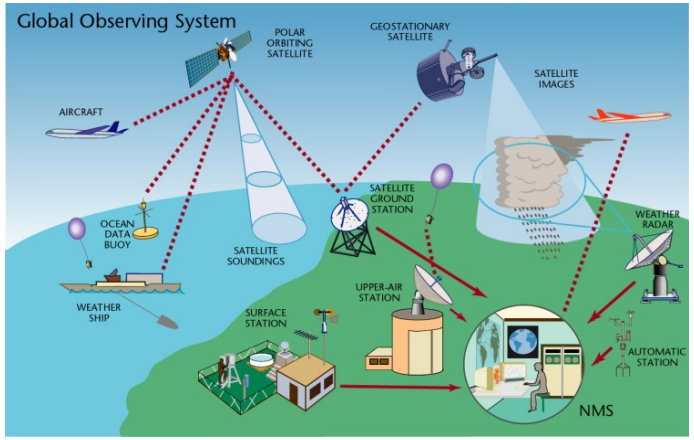
The Climate Change Tower Integrated Project (CCT- IP)



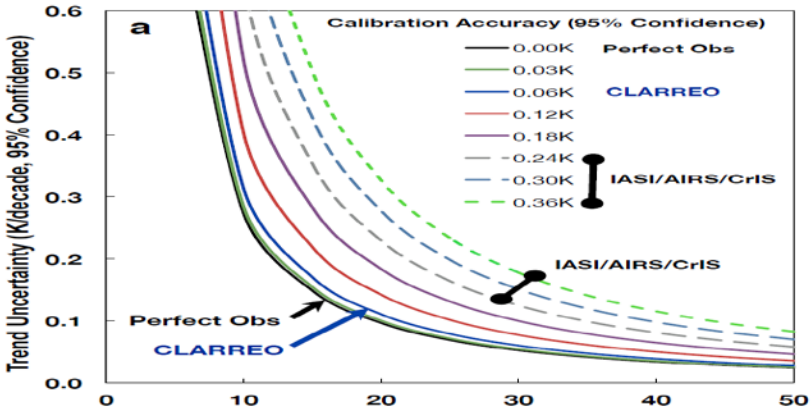
All of them require robust calibration and documented measurement traceability to guarantee full comparability

Calibrations and Uncertainties evaluations
to reach full comparability

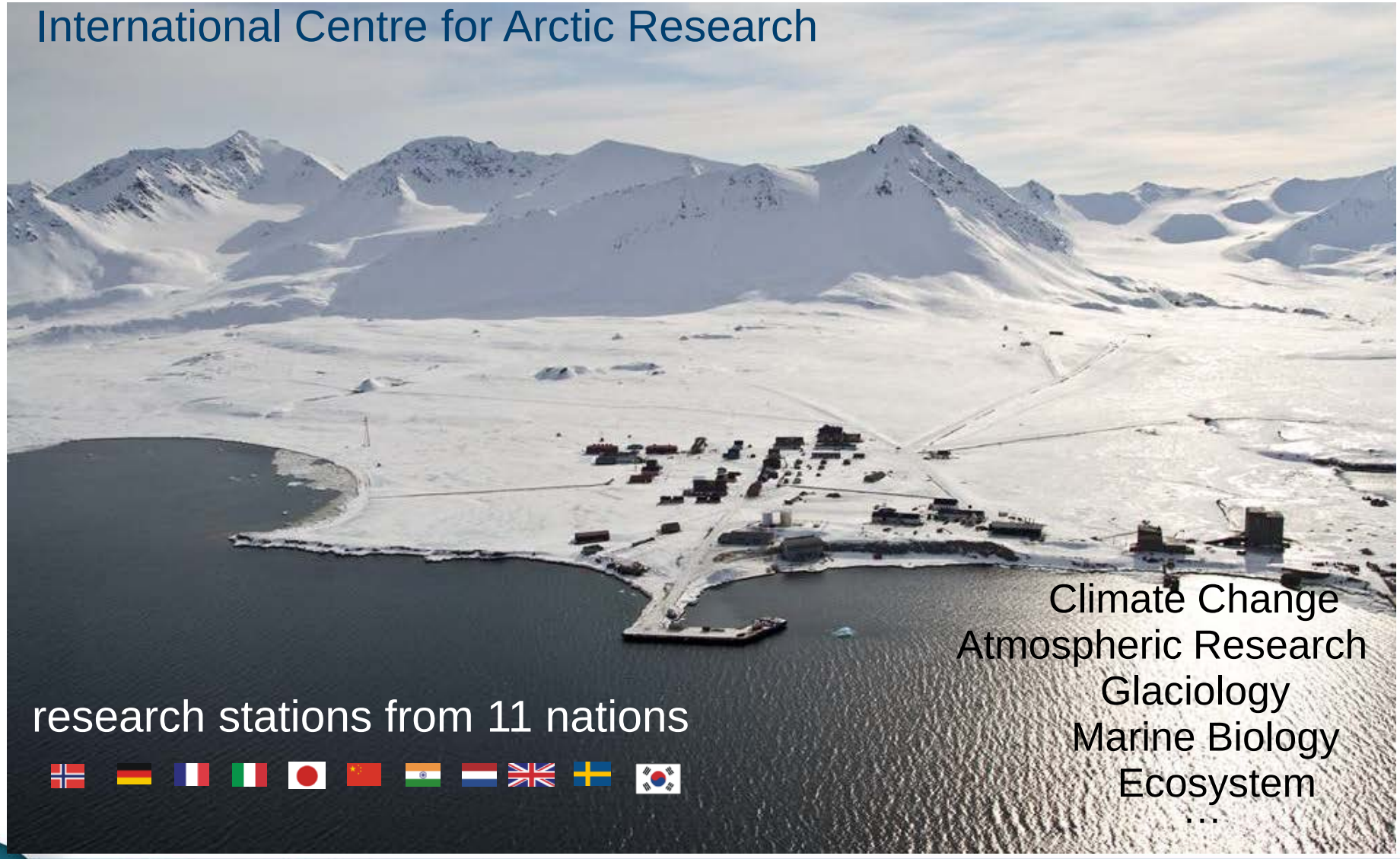
- Comparability on climate-change scales
- Comparability to fundamental physical models
- Comparability across generations
- Comparability across borders & organizations
- Comparability across instrument/measurement types



Accurate Measurements
to Reduce the Time Necessary to Capture a Trend



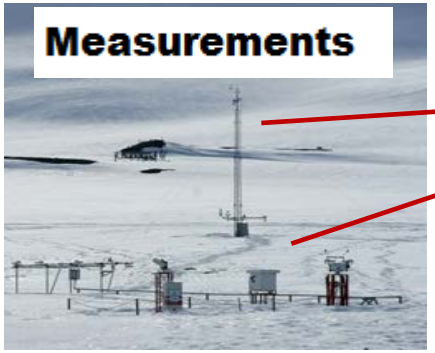
International Centre for Arctic Research



research stations from 11 nations

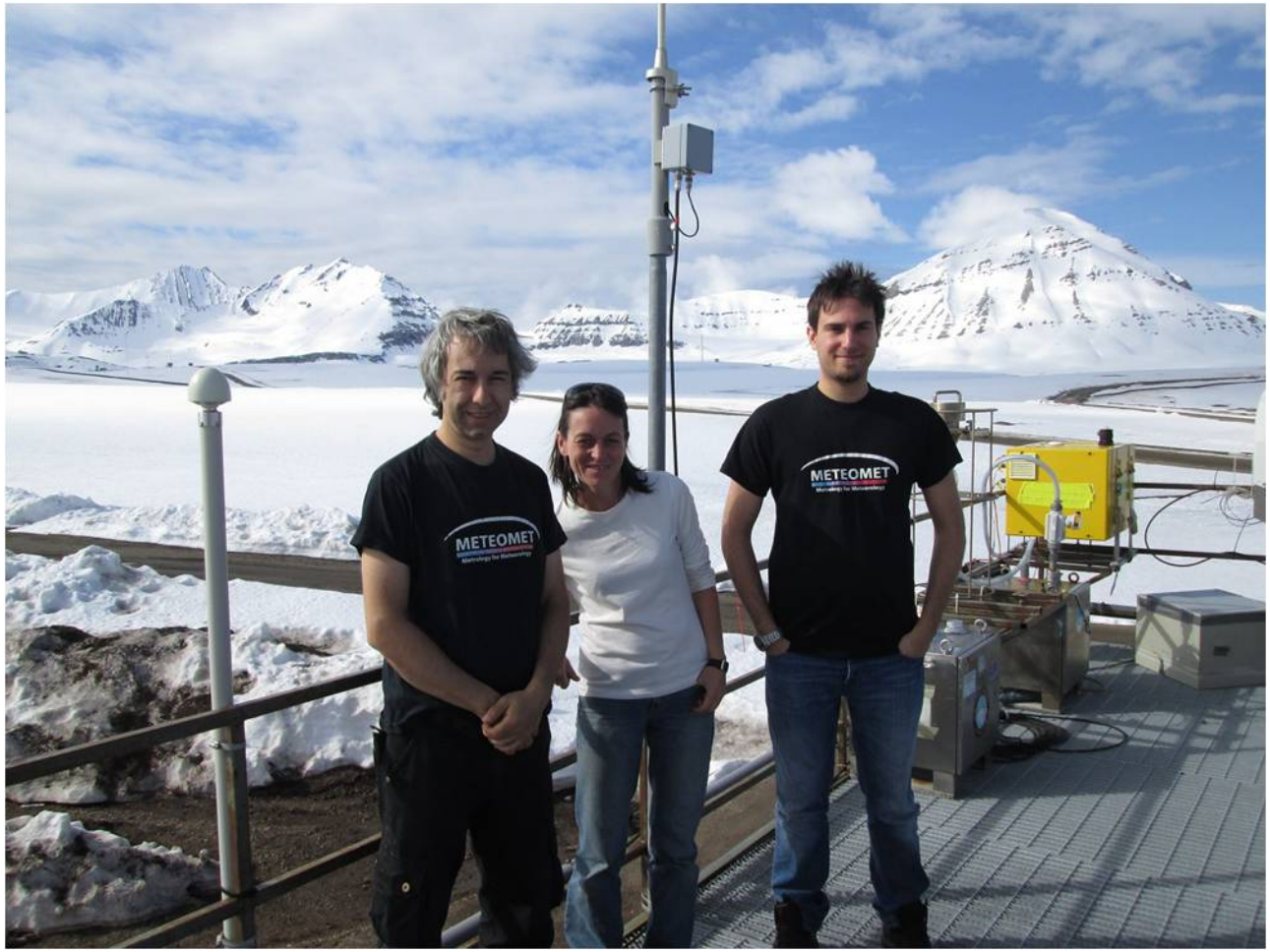
Climate Change
Atmospheric Research
Glaciology
Marine Biology
Ecosystem
…

Under MeteoMet2 we plan to establish
a permanent laboratory for metrology in Svalbard



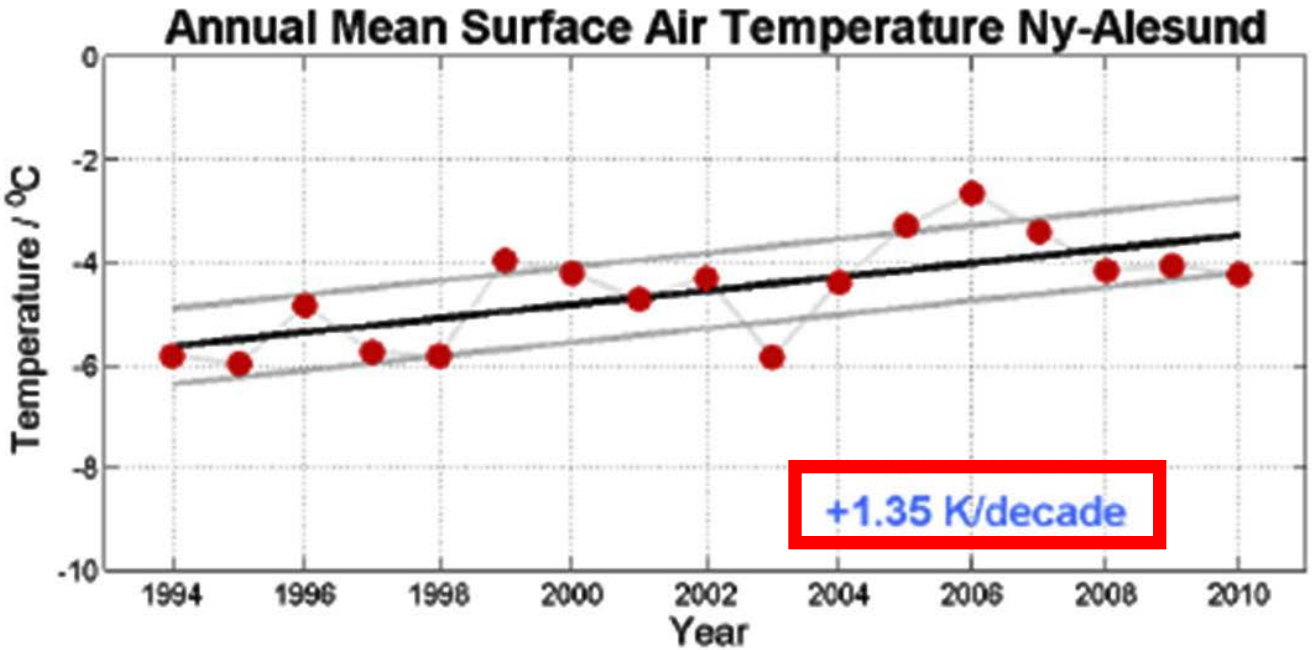
MeteoMet through the coordination of its consortium of National Metrology Institutes, developing specific devices can establish long term direct traceability of the measurements in polar area to primary standards, for

Temperature (air, water, ice, soil, permafrost temperature)
Pressure
Humidity (air humidity and soil moisture)
Radiance (direct solar radiation, albedo…)
Salinity


METEOMET
METEOMET

Task 3.5: Construction of a facility for in situ traceable calibration of weather stations including for special purposes and under extreme environmental conditions (high mountains, polar regions)

The Arctic is considered to be most sensitive to climate change



Climatology and time series of surface meteorology in Ny-Ålesund, Svalbard

M. Maturilli[1], A. Herber[2], and G. König-Langlo[2]

Earth Syst. Sci. Data, 5, 155–163, 2013
www.earth-syst-sci-data.net/5/155/2013/
doi:10.5194/essd-5-155-2013

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METEOMET and AWI people at the end of the campaign