

# GRUAN management of transition away from RS92 radiosonde – summary of developments to date

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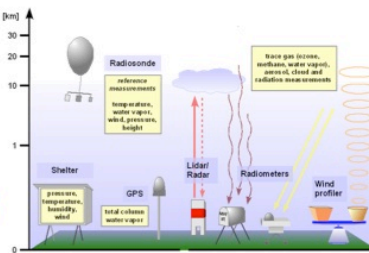


- 17 out of 26 GRUAN sites employ Vaisala RS92
- RS92 will phase out end-2017
- Proper change management is vital to GRUAN
- Major challenge for the network: need for coordinated GRUAN-wide management of this change

**GRUAN goals**

- Maintain consistent observations over decades
- Validation of satellite systems
- Understanding of atmospheric processes
- Numerical weather prediction
- Deliberate measurement redundancy
- Standardization and traceability
- **Quality management and managed change**

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The diagram illustrates various atmospheric measurement instruments and their vertical profiles. A vertical axis on the left shows altitude in km (0, 1, 10, 20, 30). Instruments shown include: Radiosonde (balloon), reference measurements (clouds), long-term, water vapor, wind, pressure, height; GPS (ground-based), total column water vapor; Lidar/Radar (ground-based); Radiometers (ground-based); and Wind profiler (ground-based). A box labeled 'Shelter' contains 'pressure, temperature, humidity, wind'. A box labeled 'Water gas (ozone, methane, water vapor, aerosol, cloud and radiation measurements)' is shown in the upper atmosphere.

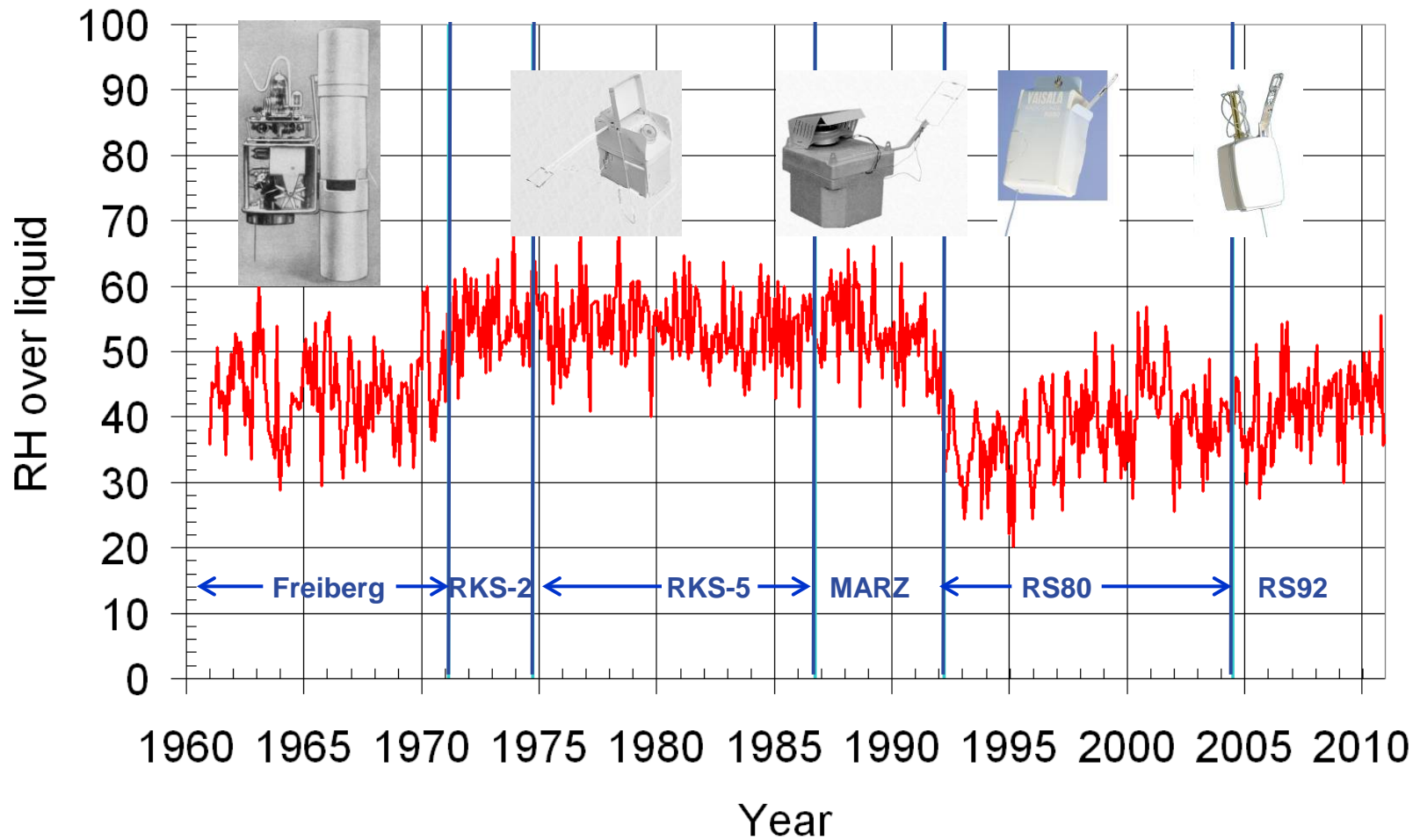
Priority 1: Water vapor, temperature, (pressure and wind)

Priority 2: Ozone, ...

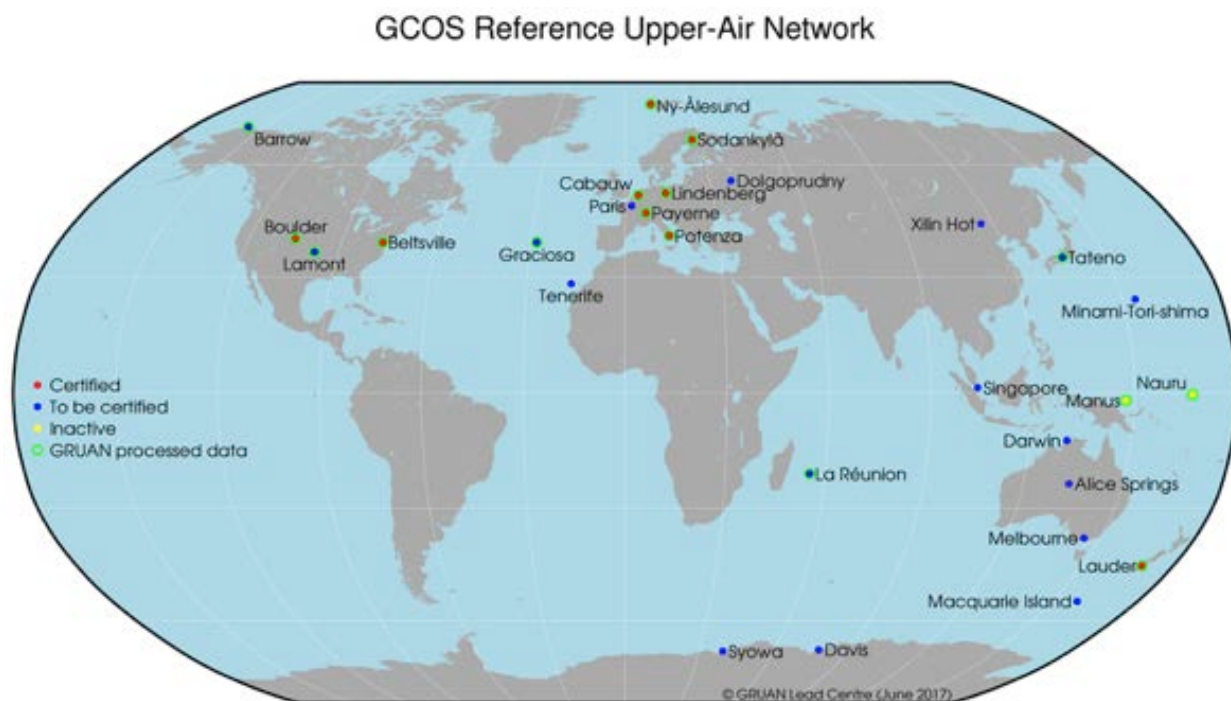
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ICM-8 25 April Boulder

e.g.: Lindenberg 8km (0:00 UT)



Site	Lat
Barrow	71.32
Beltsville	39.05
Boulder	39.95
Cabauw	51.97
Darwin	12.43S
Graciosa	38
Lamont	36.60
Lauder	45.05S
Lindenberg	52.21
Melbourne	37.81S
Ny-Alesund	78.92
Payerne*	46.81
Potenza	40.6
Lamont	36.6
Sodankyla	67.37
Tateno*	36.06
Tenerife	28.32



(\*) RS92 is not site's operational sonde

- Determine all relevant differences between new and old system
  - Biases
  - Uncertainties
  - Calibration & measurement errors

After bias & error correction measurement systems should be consistent: data within uncertainty ranges ( $k=2$ )

$$|m_1 - m_2| < k \sqrt{u_1^2 + u_2^2}$$

- Laboratory characterization
  - (in-situ) Twin soundings
  - Ancillary measurements (e.g. satellite, lidar)
  - Metrology
- 
- Database with all measurements & observations

Many sites have switched to RS41 (consequences for data flow)

TN-7: twin sounding configuration recommendation

ARM proposal RIVAL for RS92-RS41 program



# RS92-RS41 intercomparisons

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Site	Duration	Interval	Remarks
GMAC	?	-	~90
Camborne	2 weeks (Nov 2013)	-	UKMO report
Lamont (SGP)	1 week (June 2014)	-	Jensen et al 2016
Lauder	11/2015 – 11/2016	1 week	after that interleaved
Lindenberg	4 yr. (Dec 2014)	1 week	
Ny Alesund	3/2016 – 3/2018	1 week	
Payerne	2 yr.	1 week	
Potenza	6 months	1 week	
Sodankyla	3 yr. (?)	~4 weeks	
Table Mountain	3 yr.	~4 weeks	total 60
StratoClim	July 2016	daily	RS92-RS41-CFH
Darwin/ Melbourne	TBD		Restructuring of upper air program at BoM





Hamburg (autolauncher, RS41)

Coincident with Metop overpass

(Overpass predictions: A. v Engeln, L. Borg)

~10 soundings on cloud-free days, more to follow

Beltsville & Sterling

Coincident with satellite (nighttime)

~90 RS92

16 RS92+RS41

## Task

Laboratory experiments

Radiation tests

Time-lag

Development GRUAN data product  
for RS41

Twin soundings

Statistical analysis

Ancillary measurements

NPROVS

Metrology

## Lead

LC

LC

LC

LC + TT radiosonde

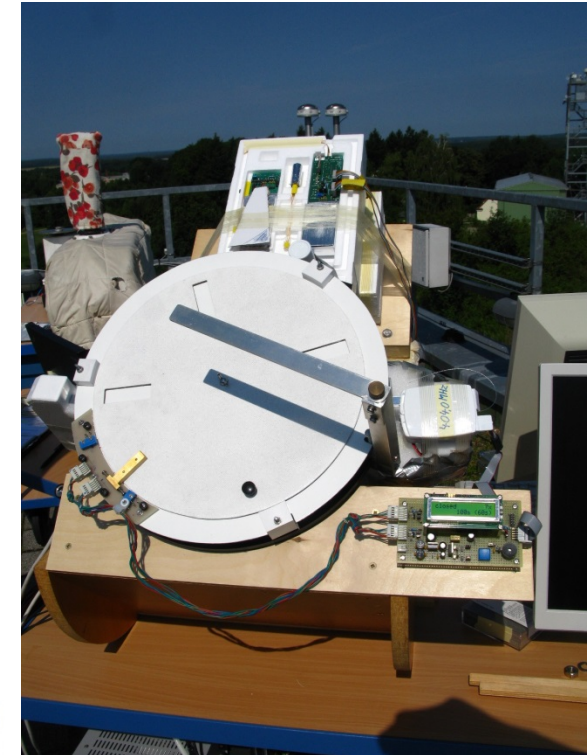
Alessandro Fasso

?

Reale/Sun

Andrea Merlone

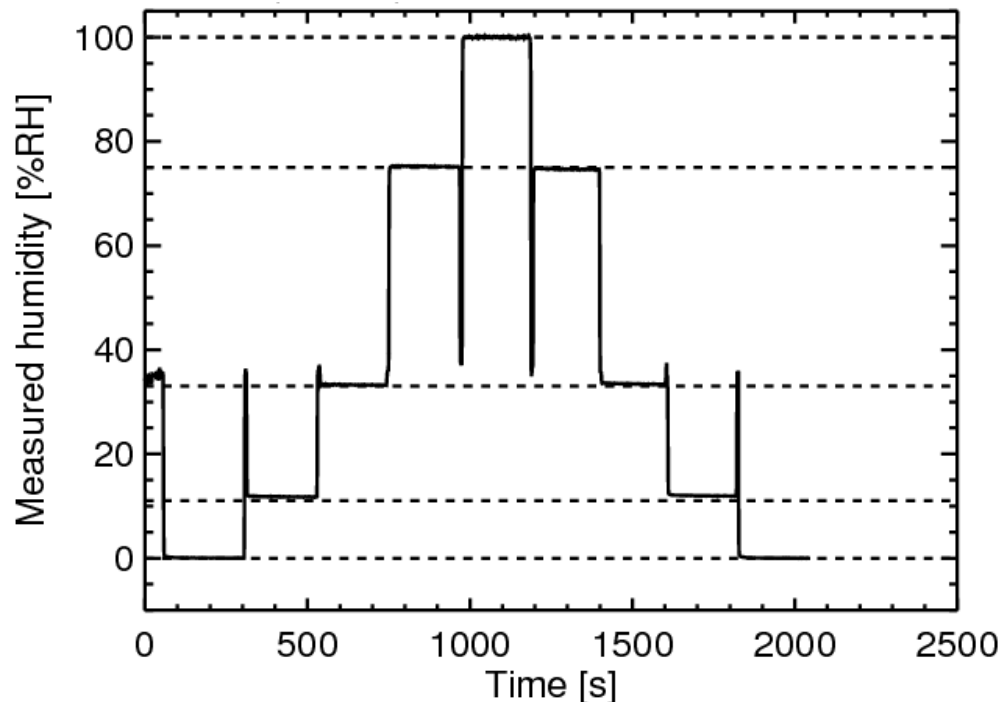
- Experiments under laboratory conditions
  - Calibration (0-100%RH)
  - Radiation (3 – 1013 hPa)
  - Time lag (-80° C -40° C)



Reference saline solutions 0, 11, 33, 75, 100 %RH

~90 sondes tested

Reference temperature sensors in SHC.

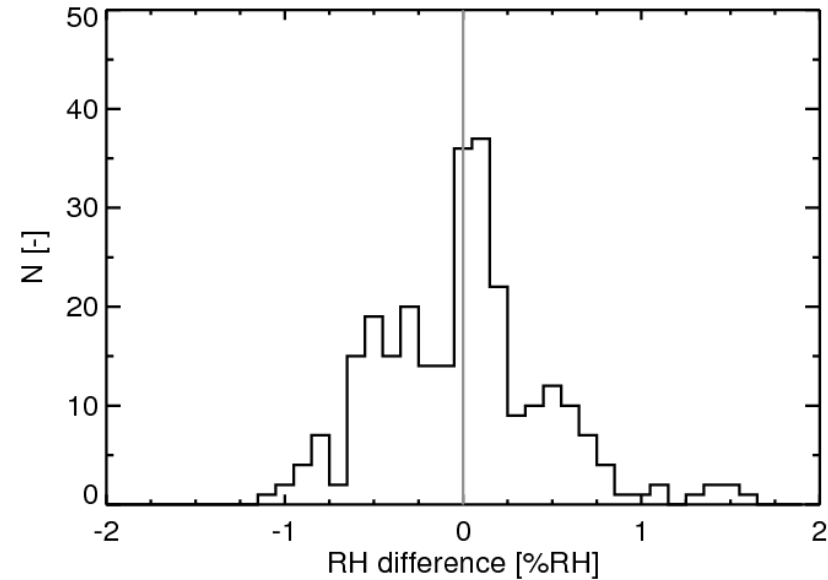
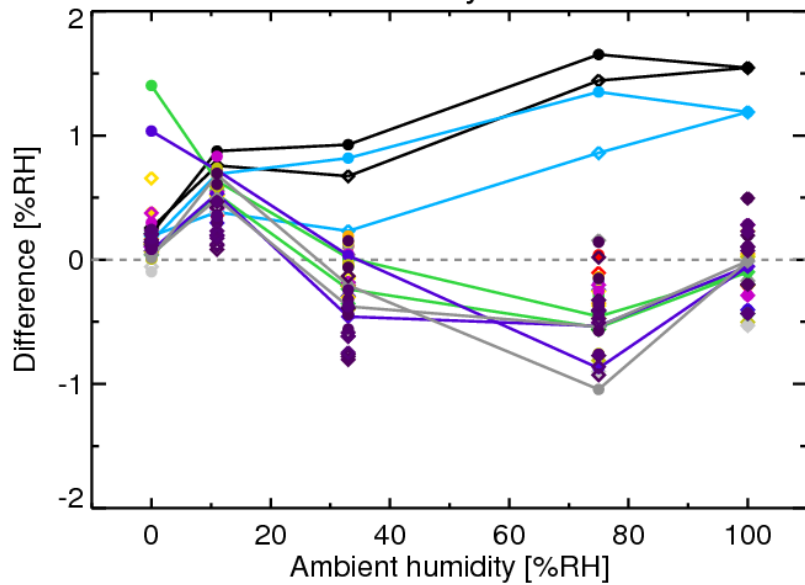


# SHC experiments: results

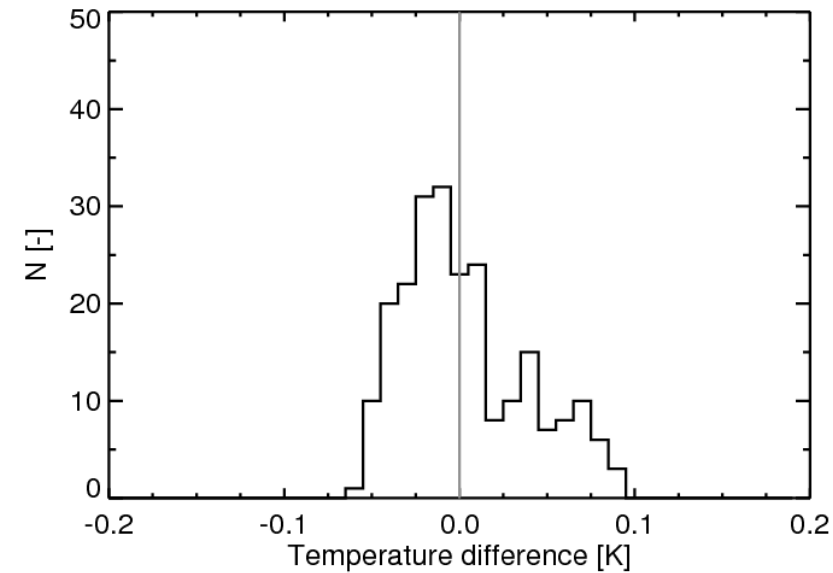
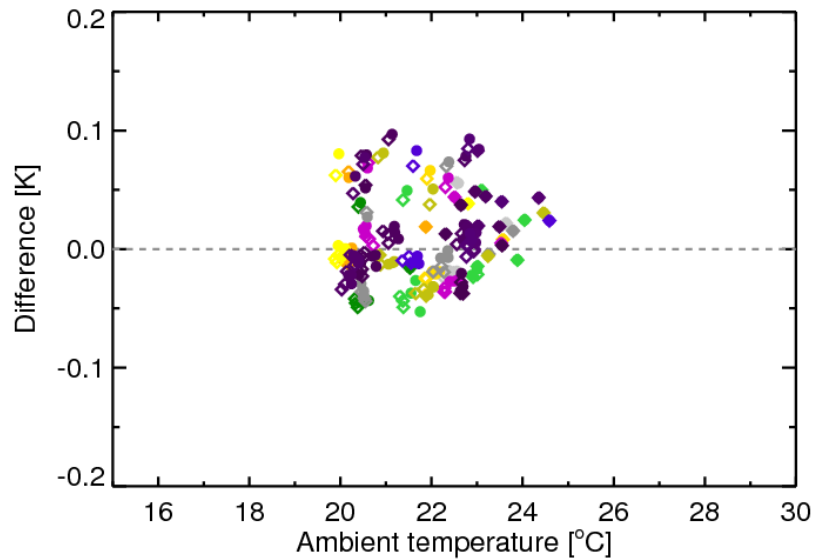
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RH



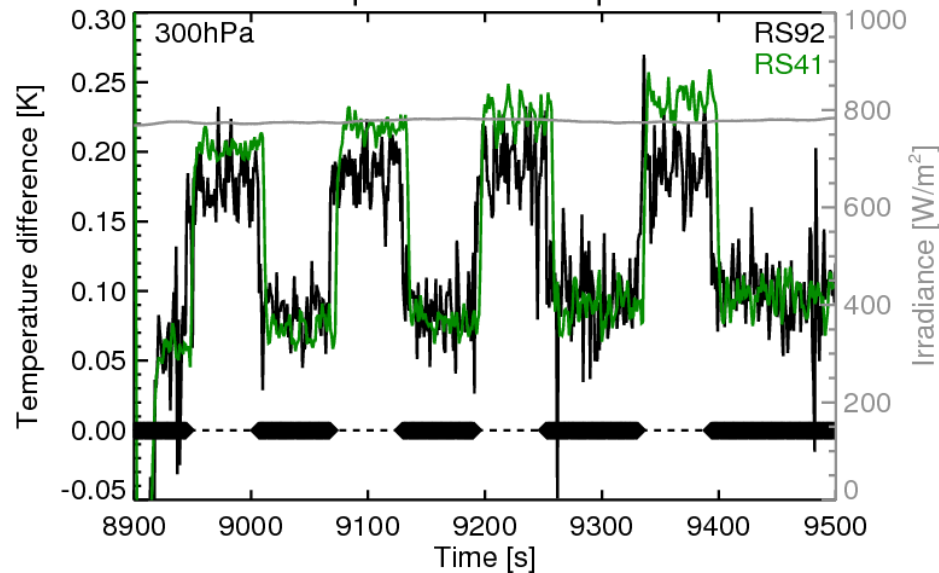
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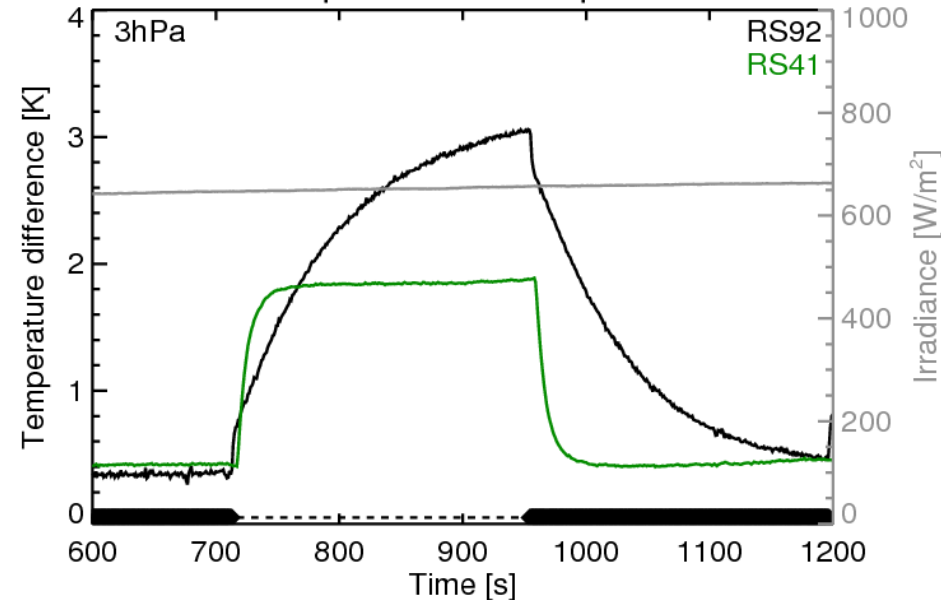
300 hPa:  $\Delta T_{\text{RS41}} \approx \Delta T_{\text{RS92}}$

$p < 30$  hPa:  $\Delta T_{\text{RS41}} < \Delta T_{\text{RS92}}$   
faster equilibrium

Radiation experiments 5 September 2014



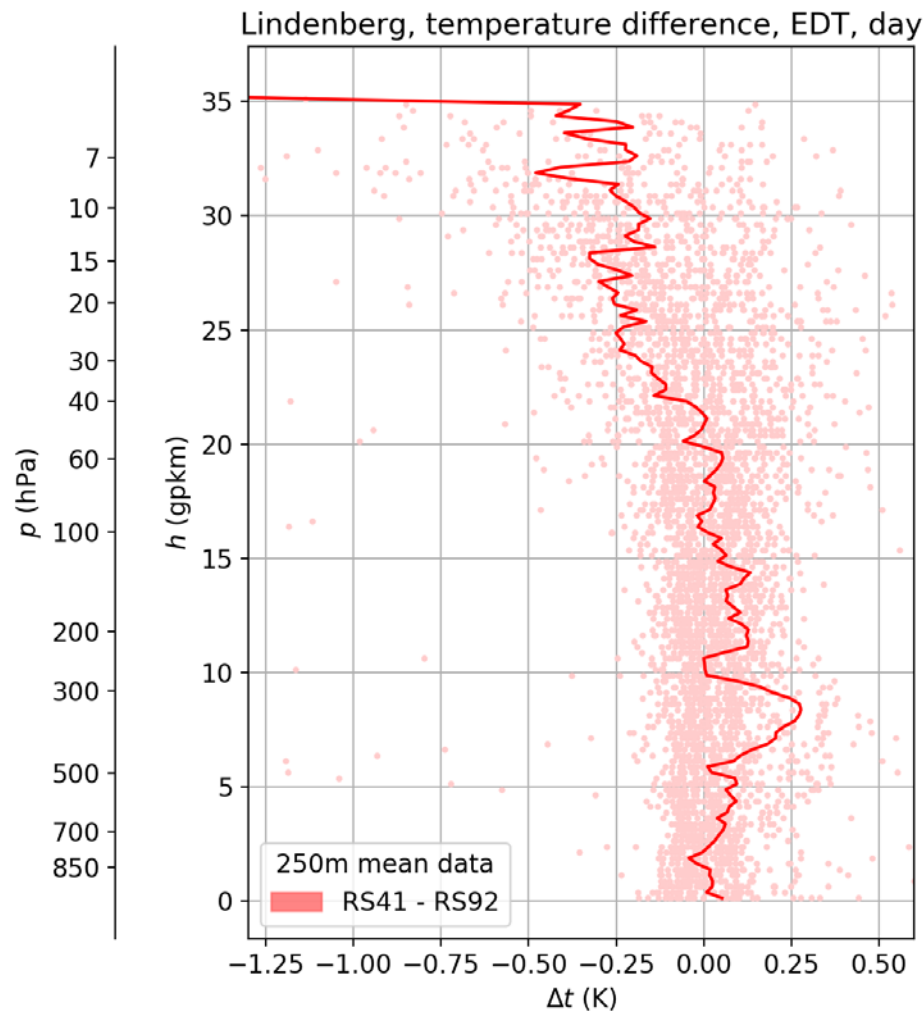
Radiation experiments 5 September 2014





# Preliminary results: Lindenberg

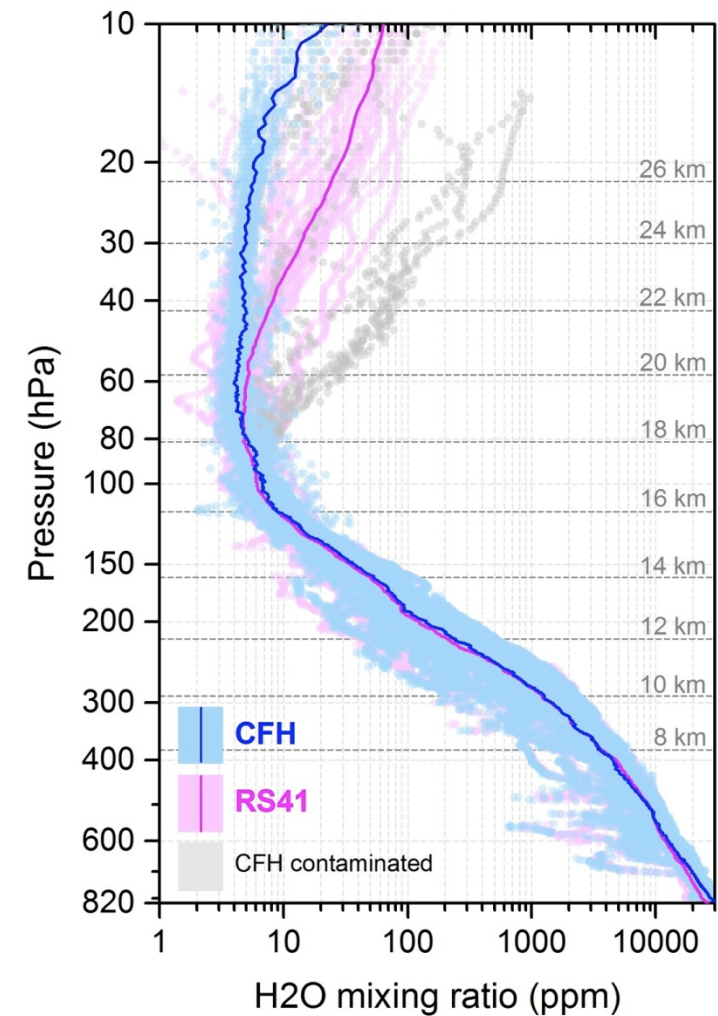
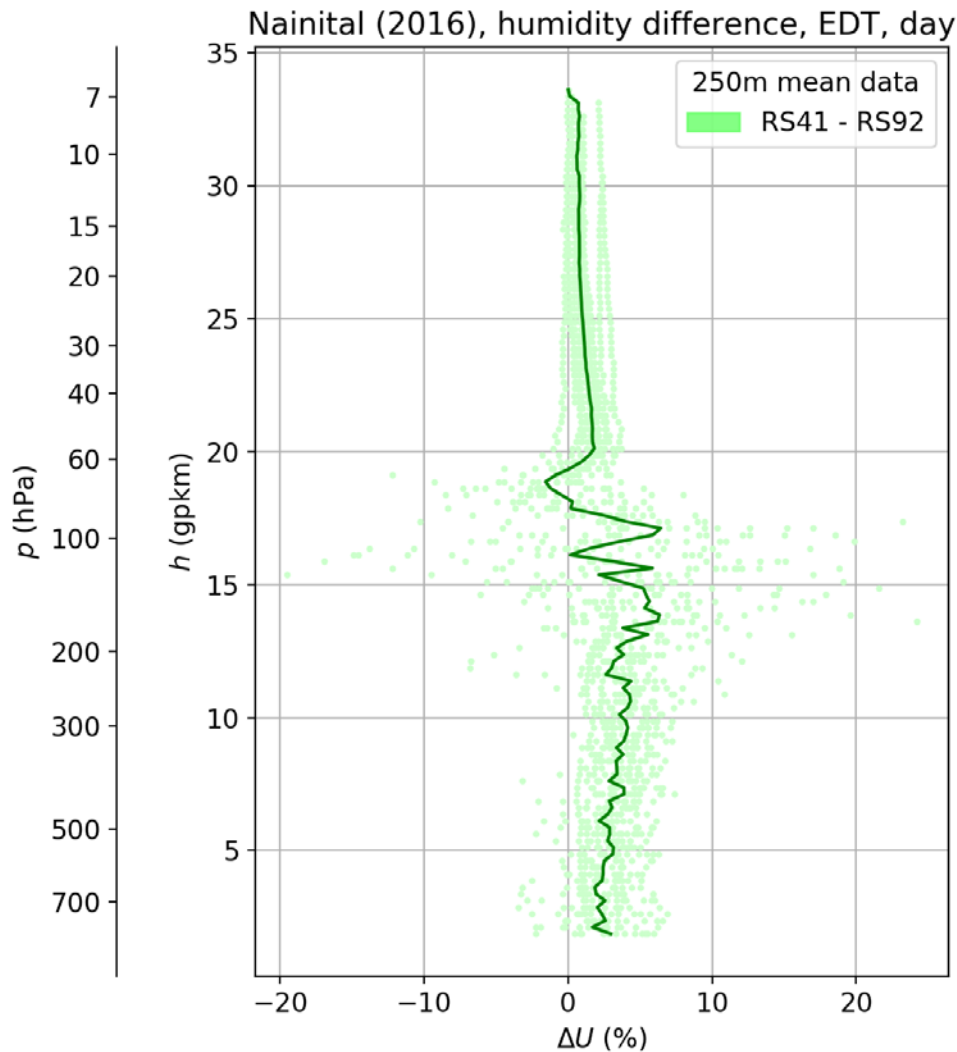
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# Preliminary results: StatoClim

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S. Brunamonti



- Analysis of laboratory data
- Analysis of in-situ intercomparison measurements
- Continuation of intercomparison program
- Continuation of satellite collocated soundings
- Complete paper GRUAN strategy
- Complete measurement database, e.g. include satellite data
- Include other sites (e.g. Metoffice/BAS)

# Questions

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# RS92-RS41 intercomparison studies within GRUAN

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Site	Duration	Interval	Remark
Barrow	?	-	
Beltsville	?	-	
Boulder	?	-	
Cabauw	?	-	
Camborne*	2 weeks (Nov 2013)	-	Vaisala + MetOffice
Darwin	?	-	
Lamont	1 week (June 2014)	-	[Jensen et al. 2015]
Lauder	1 yr.	1 week	
Lindenberg	2 yr. (Dec 2014)	1 week	
Ny Alesund	2 yr. (March 2016)	1 week	
Payerne	2 yr.	1 week	
Potenza	6 months	1 week	
Sodankyla	2 yr.	?	
Table Mountain	2 yr.	~4 weeks*	

\*Table Mountain burst activities



## Hysteresis $< 0.5\%RH$

