

Uncertainty validation of ROM SAF tropospheric specific humidity profiles using collocated GRUAN radiosondes

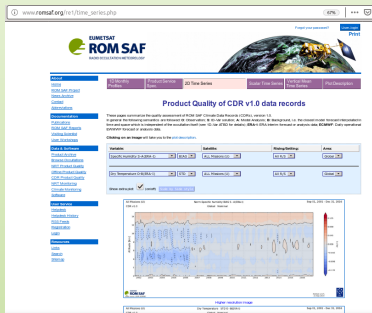
J. K. Nielsen, H. Gleisner, S. Syndergaard and K. B. Lauritsen

ROM SAF

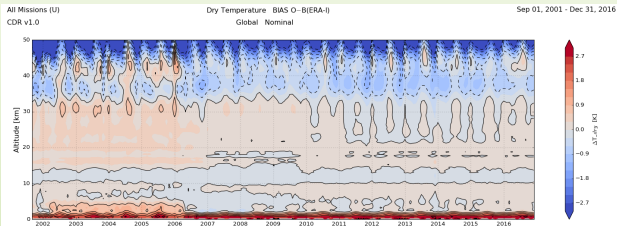
May 2019


Reprocessed Radio Occultation Data Set

> 10^7 profiles
> 10^6 validation plots
Bending angle
Refractivity
Dry temperature
Temperature
Spec. humidity
Pressure
Surface pressure
+ gridded data

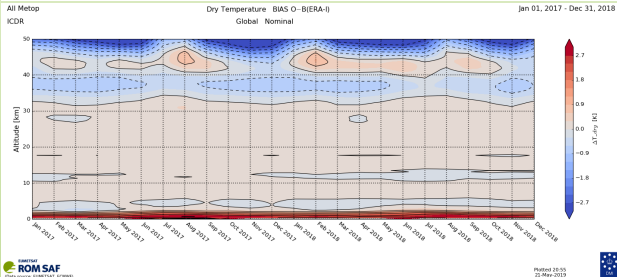


Dry temperature – ERA-I forecast



CDR :  (Data source: ERA-Interim)

Plotted 13:08
25-Sep-2018

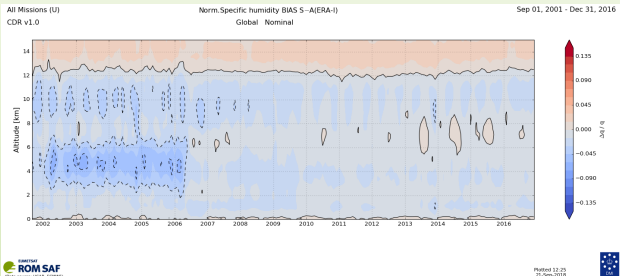


ICDR:  (Data source: EUMETSAT, ECMWF)

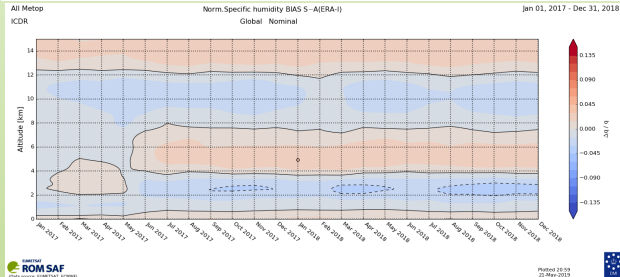
Plotted 20:55
22-May-2019



Specific Humidity – ERA-I analysis



CDR :



ICDR :

This is an application of GRUAN as reference

Accurate stratospheric RO temperatures has been dealt with elsewhere.

We do not expect high accuracy as known to RO in the stratosphere. Tropospheric q is very hard to measure from space.

C. Borger et al.: Comparison of MUSICA IASI and GRUAN water vapour profiles

4995

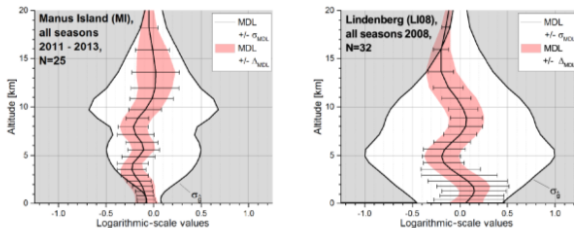
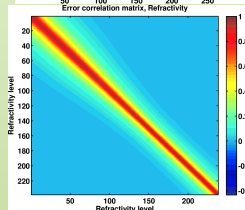
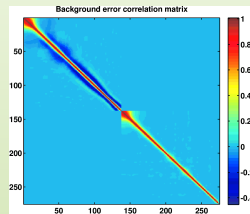
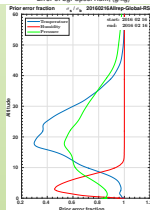
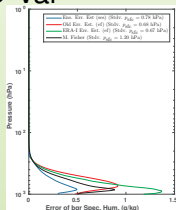


Figure 11. Vertical profiles of retrieval skill scores calculated according to Eqs. (16)–(19) for the MI and LI08 ensembles. The black line and error bars represent the mean difference and the 1σ scatter between IASI and smoothed GRUAN data (MDL and $\pm\sigma_{\text{MDL}}$). The red shaded area around MDL is the 1σ scatter expected due to MUSICA IASI and GRUAN errors ($\pm\Delta_{\text{MDL}}$). The grey shaded area represents the area beyond the 1σ variability of smoothed GRUAN data (area beyond $\pm\sigma_g$).

Specific humidity retrieval from space.

Method: 1D-Var



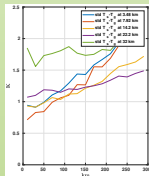
I.e., it is a tropospheric humidity product.

GRUAN humidity comparison method

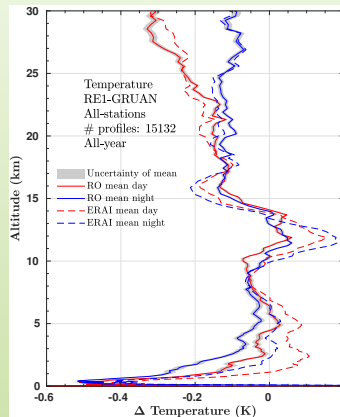
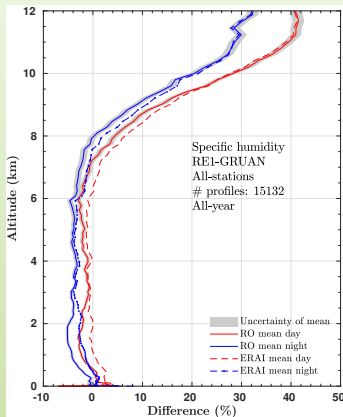
- ▶ 16552 collocations 2006-2016. dist < 300km, t < 3 h
- ▶ Interpolation to 100 m grid

For standard deviation:

- ▶ Train box filter (MCMC): $\min\{q_{\text{RO}} - F(q_{\text{GRUAN}})\}$
- ▶ GRUAN \rightarrow F. Filter width = 0.5 - 2.0 km.
- ▶ Standard deviation \rightarrow Collocation distance linear regression
- ▶ Extrapolation to zero distance.



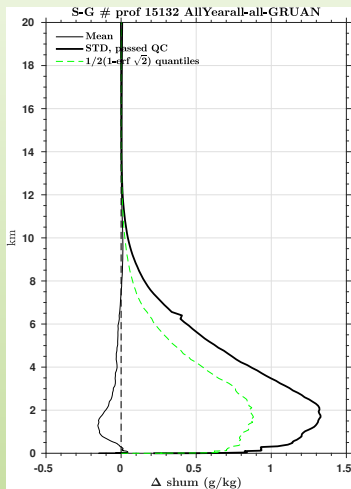
The biases (global)



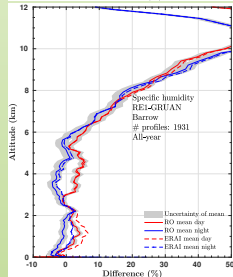
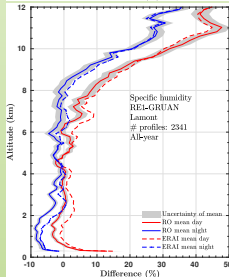
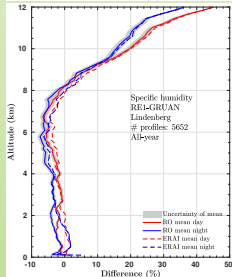
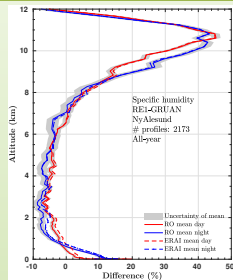
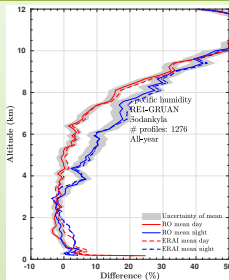
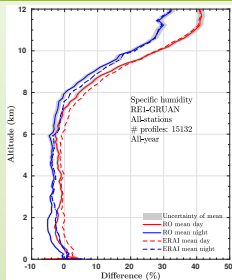
$$u = \frac{1}{N} \sqrt{\sum u_{\text{GRUAN}}^2 + \sum u_{\text{RO}}^2}$$

(Memo: add collocation error $\approx \times 2$)
 But still $k > 2$...

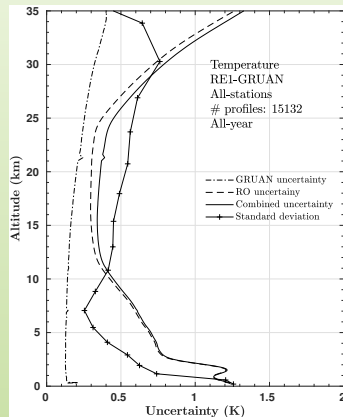
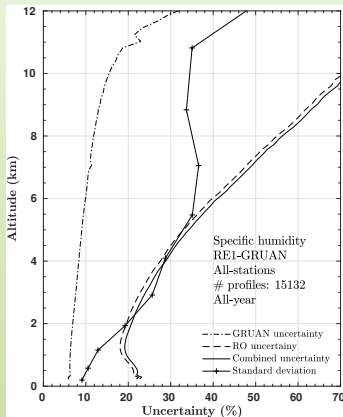
Absolute values for reference



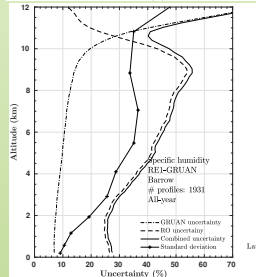
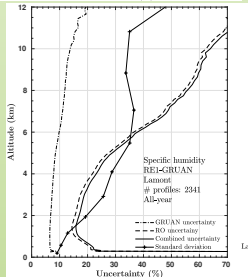
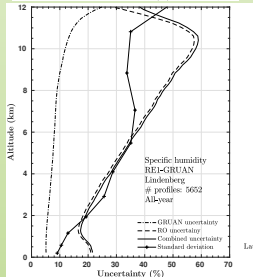
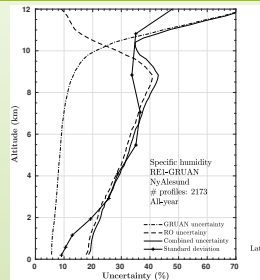
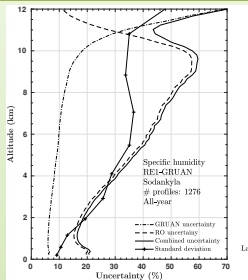
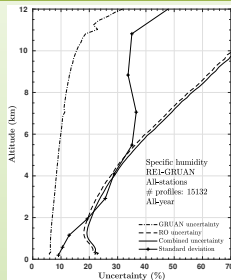
Selected Stations, Specific Humidity



Uncertainty: Expected and observed STDV



Selected Stations, Specific Humidity STDV



Conclusions

- ▶ 35% wet ERA-I bias at 12 km. Well known, not interesting.
- ▶ 4% dry nighttime 1D-Var bias at 3-7 km.
- ▶ 2-3 % night-day difference.
- ▶ RO enhance ERA-I biases in upper/lower troposphere
- ▶ Specific humidity uncertainty consistent.
- ▶ Stratospheric temperature background uncertainty may be too low.

Next page! ->

EUMETSAT ROM SAF - IROWG 2019

Konventum, Helsingør (Elsinore), Denmark

19 - 25 September 2019

www.romsaf.org/romsaf-irowg-2019

Joint EUMETSAT ROM SAF User Workshop and IROWG Workshop

An international workshop for atmospheric remote sensing by radio occultation methods and the use of radio occultation data in atmospheric physics, meteorology and climate.

Taking place in September 2019 in Denmark at [Konventum hotel and conference centre](#), located in the beautiful surroundings of Elsinore in the north of Zealand just two steps from the waterline with a view to Sweden.



Important dates:

- Registration and abstract submission: open
- Abstracts submission deadline: 15 June 2019
- Abstracts acceptance notification: 5 July 2019
- Deadline for registration: 5 August 2019

Programme committee:

Sean Healy, ECMWF, UK (IROWG, Co-chair)

Ulrich Foelsche, Wegener Center, Austria (IROWG, Co-chair)

Axel von Engel, EUMETSAT, Germany (EUMETSAT, Co-chair)

Kent B. Lauritsen, DMI, Denmark (ROM SAF, Co-chair)

Sponsored by:



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