Comparison of GRUAN profiles with radio occultation bending angles propagated into temperature space

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Overview

Motivation

- Both GRUAN and RO[1] data are assumed to be of reference quality
  $\rightarrow$ they should be consistent

[1] Radio Occultation

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  $\rightarrow$ they should be consistent
- A comparison can reveal uncorrected biases, retrieval problems, and underestimated uncertainties

[1] Radio Occultation

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- The method used here was developed to calculate RS[2] temperature bias corrections on a station-by-station basis [Tradowsky, 2015]

[2] Radiosonde

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- Assumption: B_{RO} and B_{RS} are equally representative of true values at RO/RS locations
  $\rightarrow$ NWP forecast bias does not vary over separation distance

[2] Radiosonde

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  - Calculated from the spread of the departures for different cut-off impact heights in the RO retrieval
  - Individual for every upper-air station
- Comparison of structural uncertainty is similar to the structural uncertainty in more conventional RO retrievals (see [Steiner et al., 2013, Ho et al., 2012])

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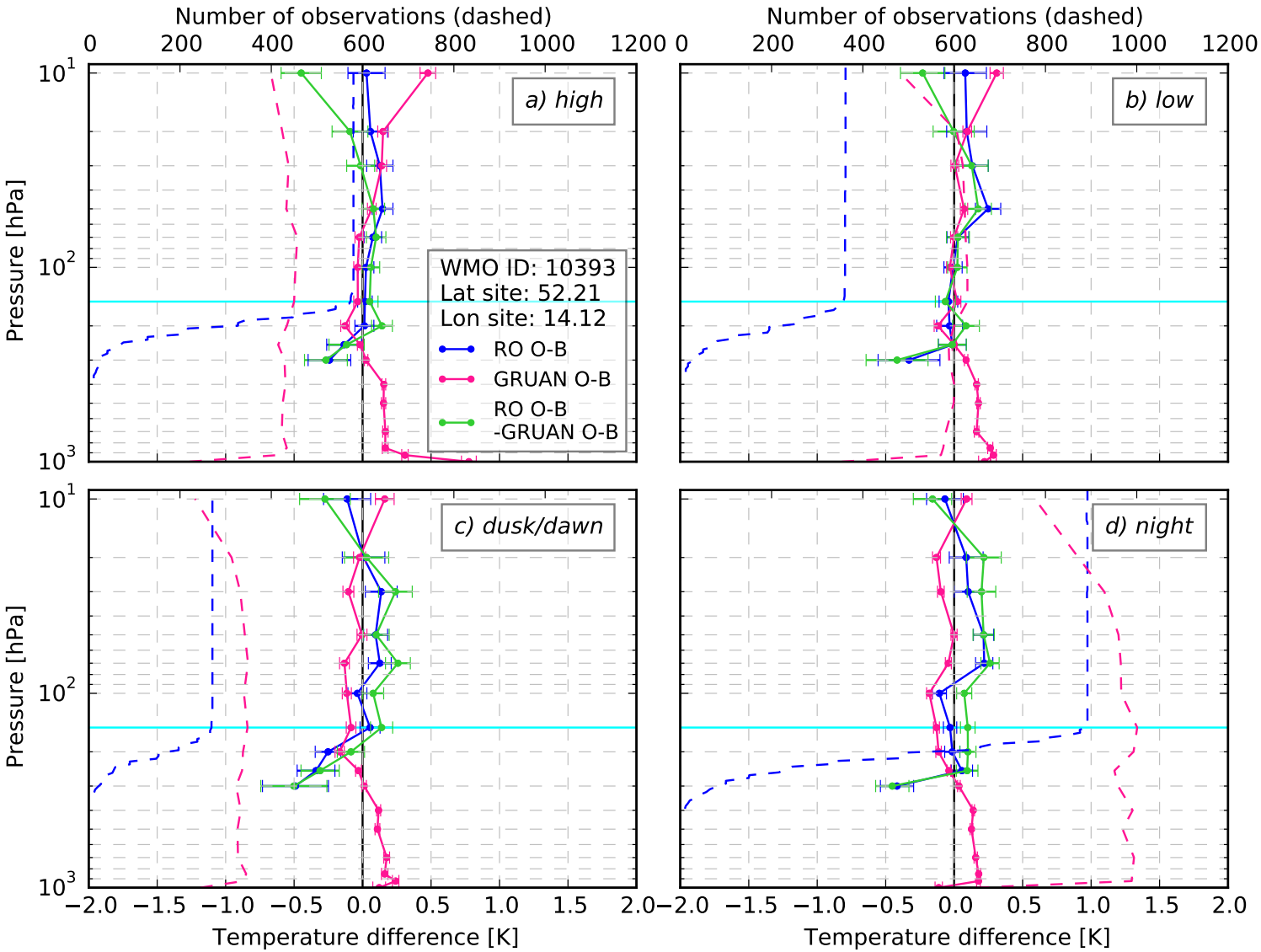
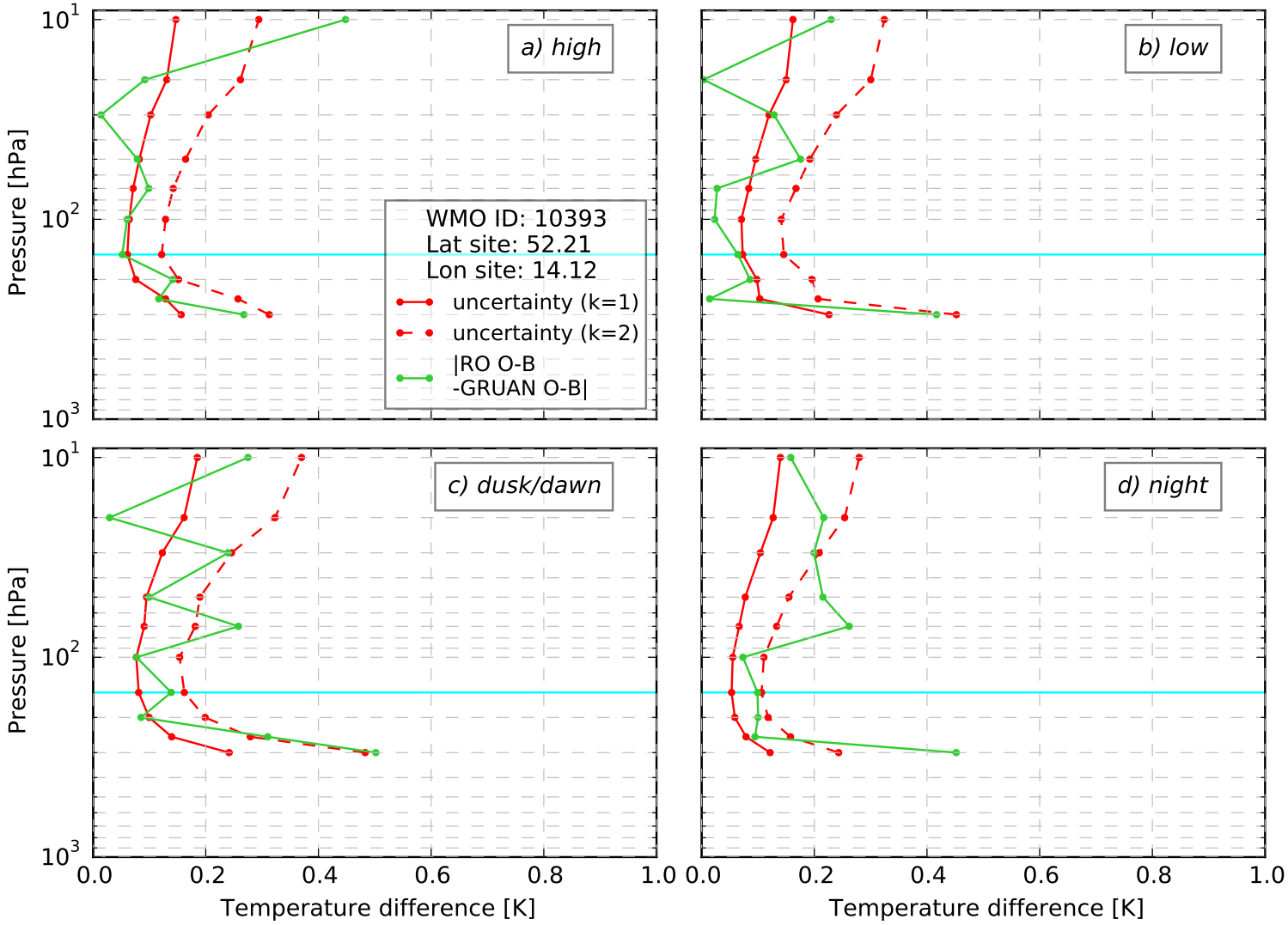
- Comparison performed for **Lindenberg**, Cabauw, **Barrow**, **Southern Great Plains**, **Sodankylä**, Nye Alesund

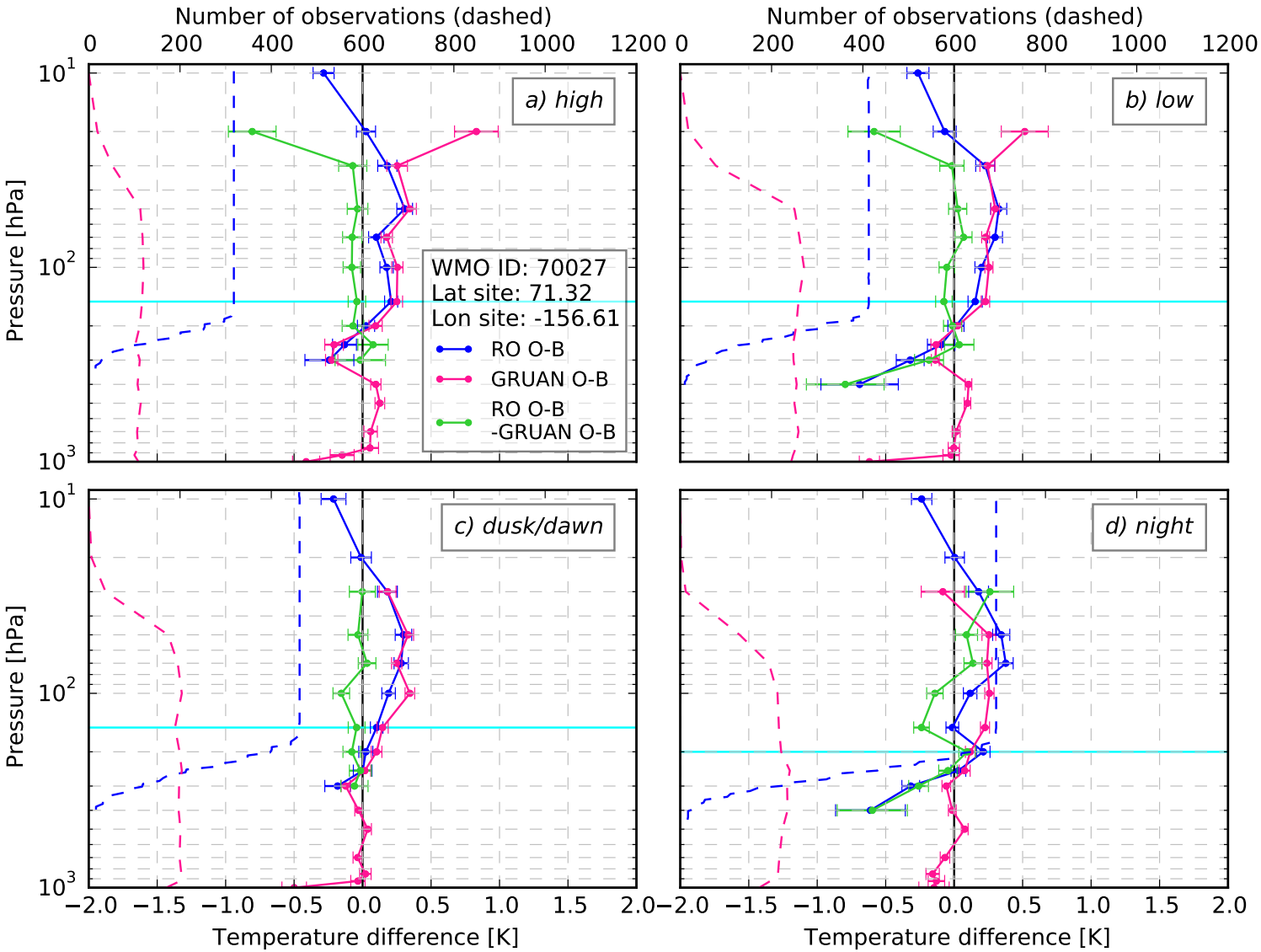
GRUAN - RO comparison Lindenberg



GRUAN - RO uncertainties Lindenberg



GRUAN - RO comparison Barrow



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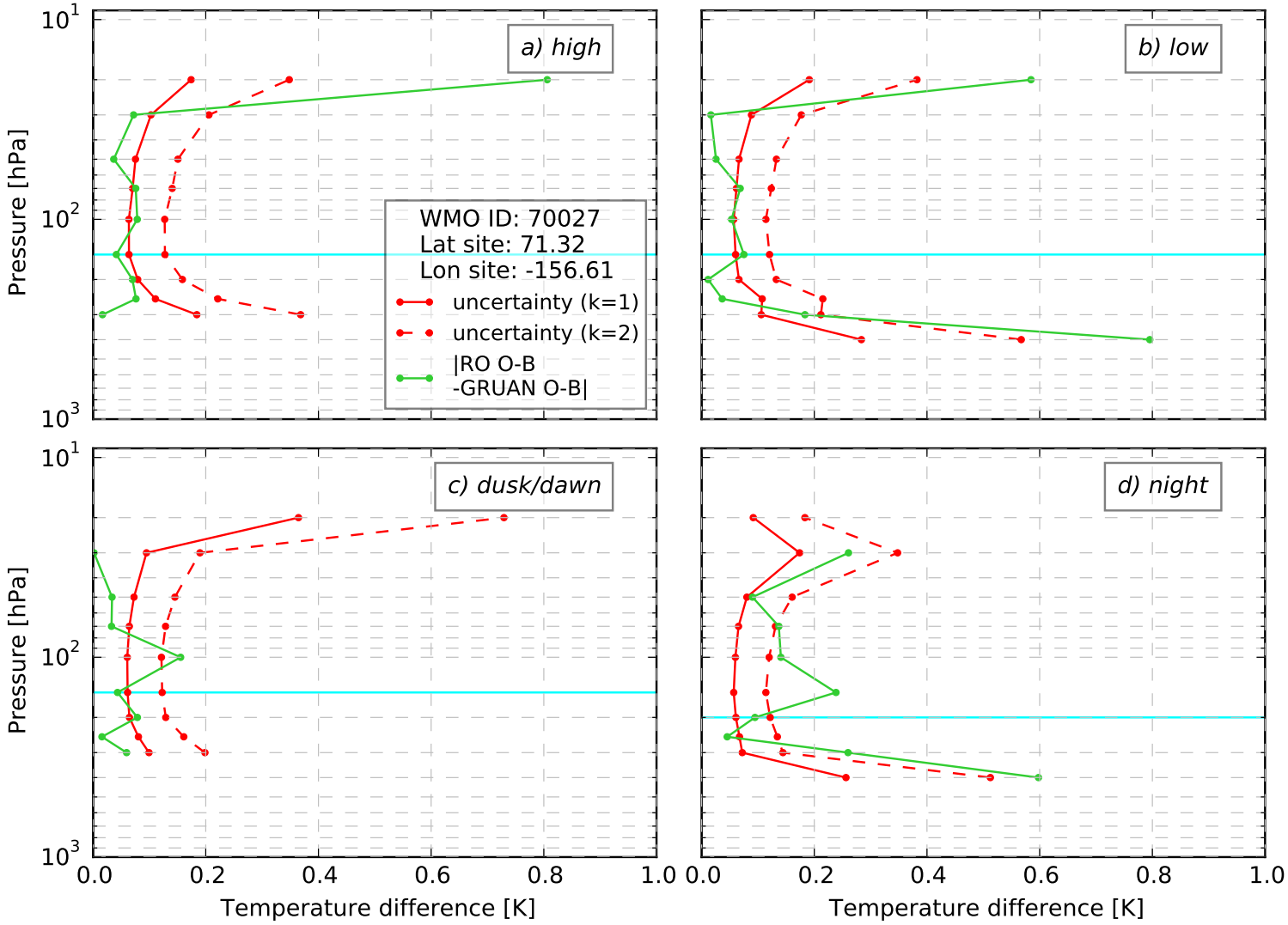
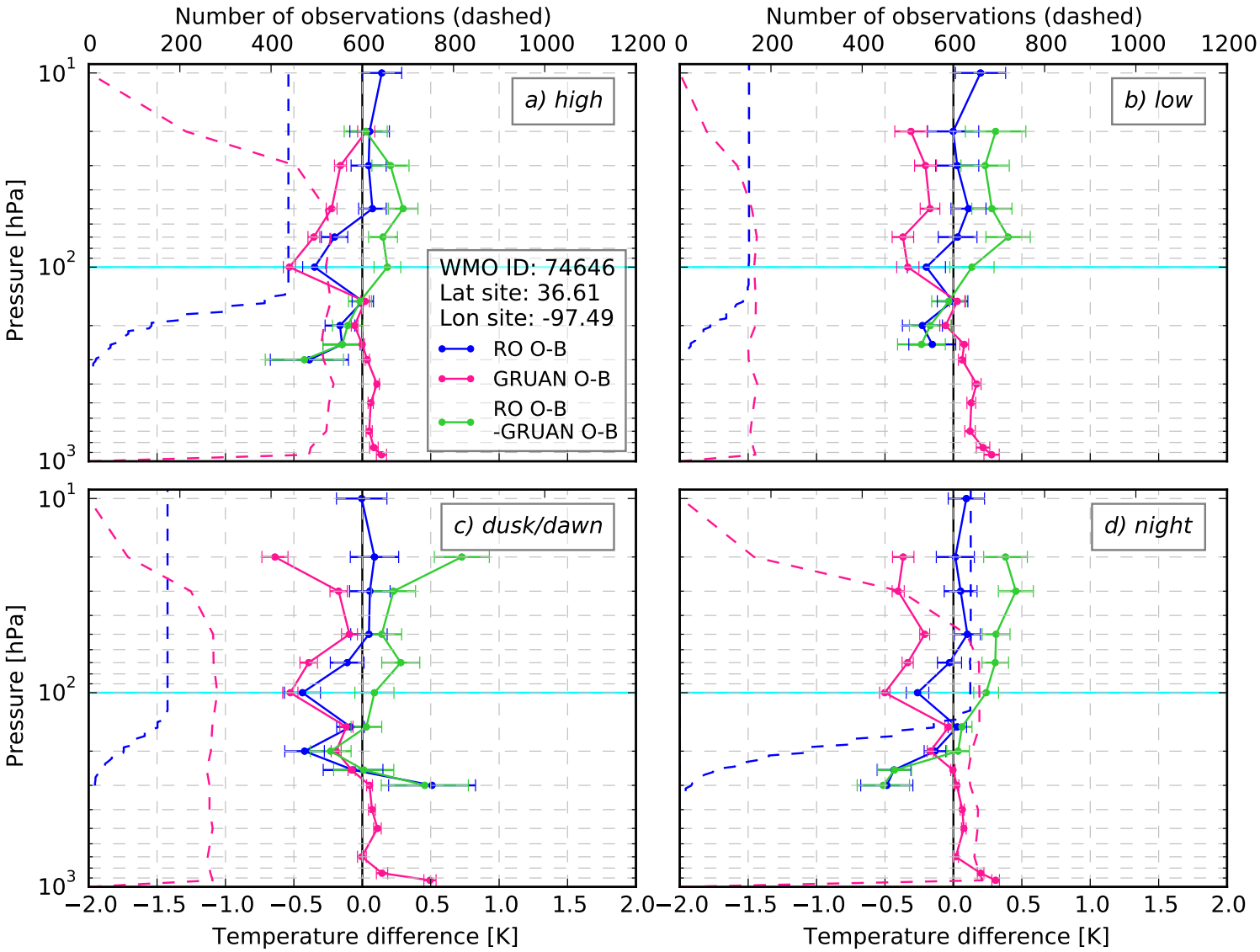


GRUAN - RO comparison Southern Great Plains



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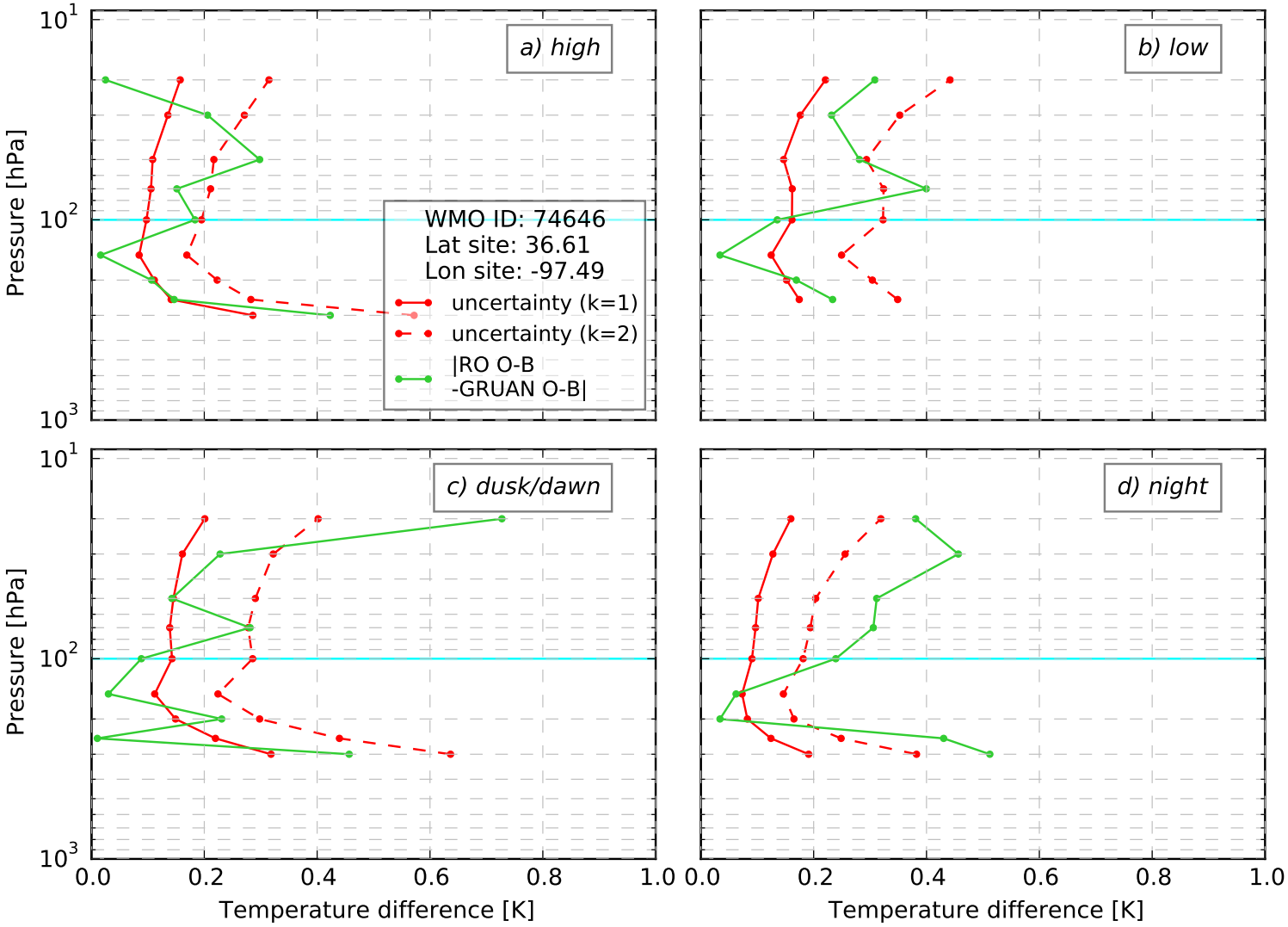
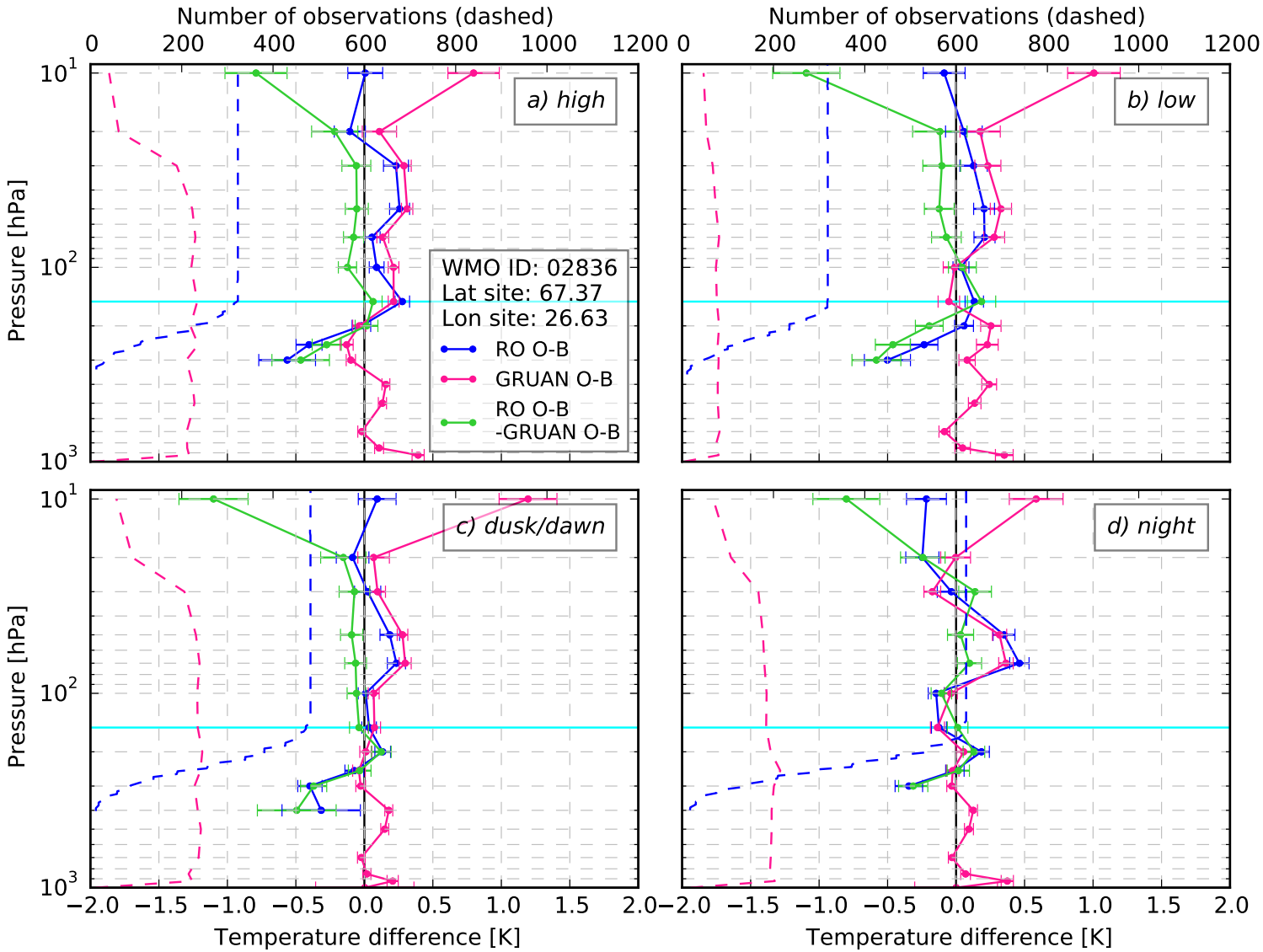
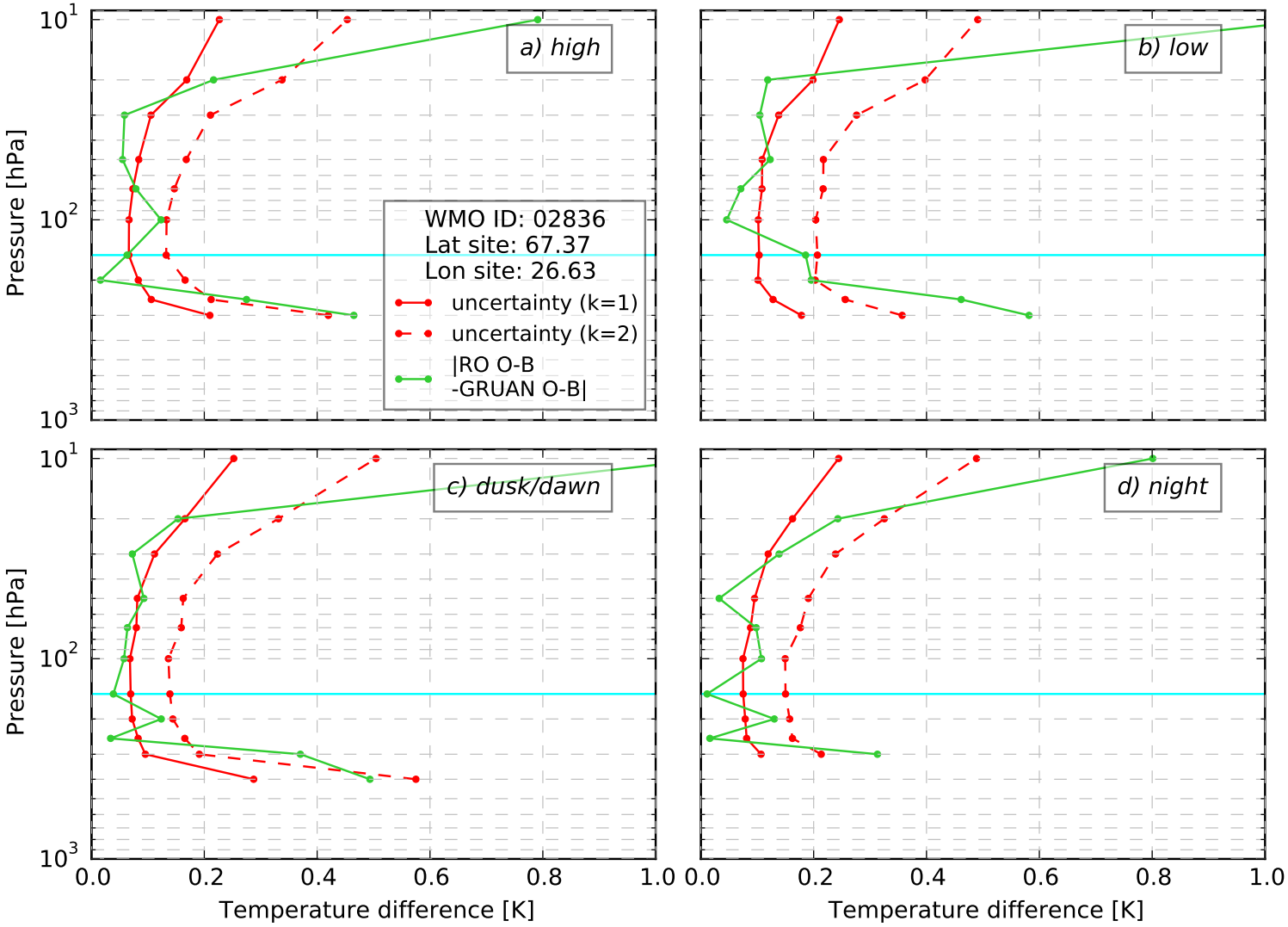


GRUAN RO comparison Sodankylä



GRUAN - RO uncertainties Sodankylä



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- Reason for differences at nighttime at highest levels unclear. Any suggestion?
- At many stations: GRUAN warmer than RO at the highest level during daytime $\rightarrow$ a warm bias in the GRUAN RS92 version 2 data?
- GRUAN temperature higher than RO at top of the profile was also found by [Ladstädter et al., 2015]
- Same analysis with GRUAN RS92 version 3 data would be interesting

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Thank you for your attention!

GRUAN - RO comparison Cabauw

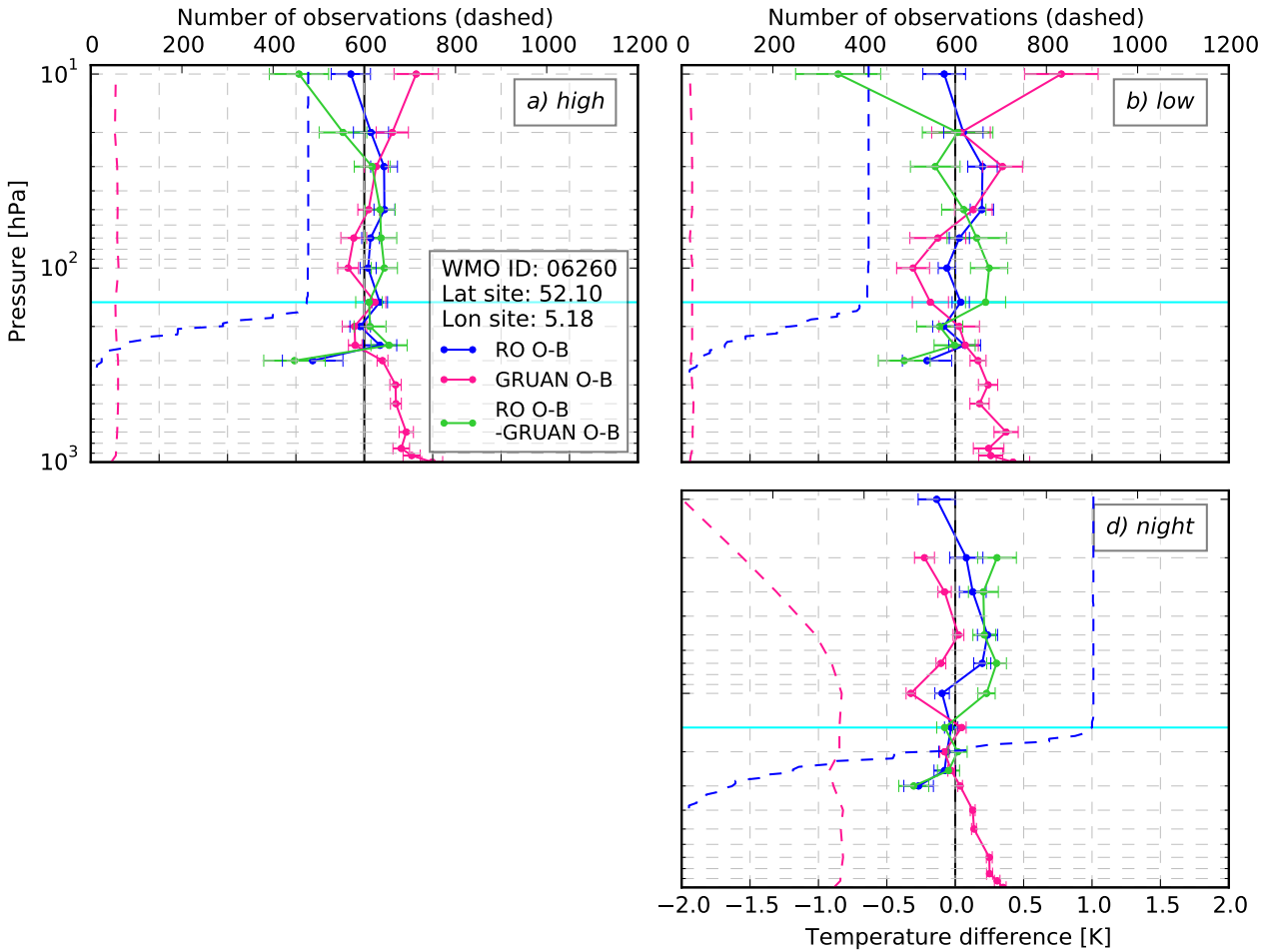

Figure 1: As Fig.**??**, but for the GRUAN site Cabauw.

GRUAN - RO uncertainties Cabauw

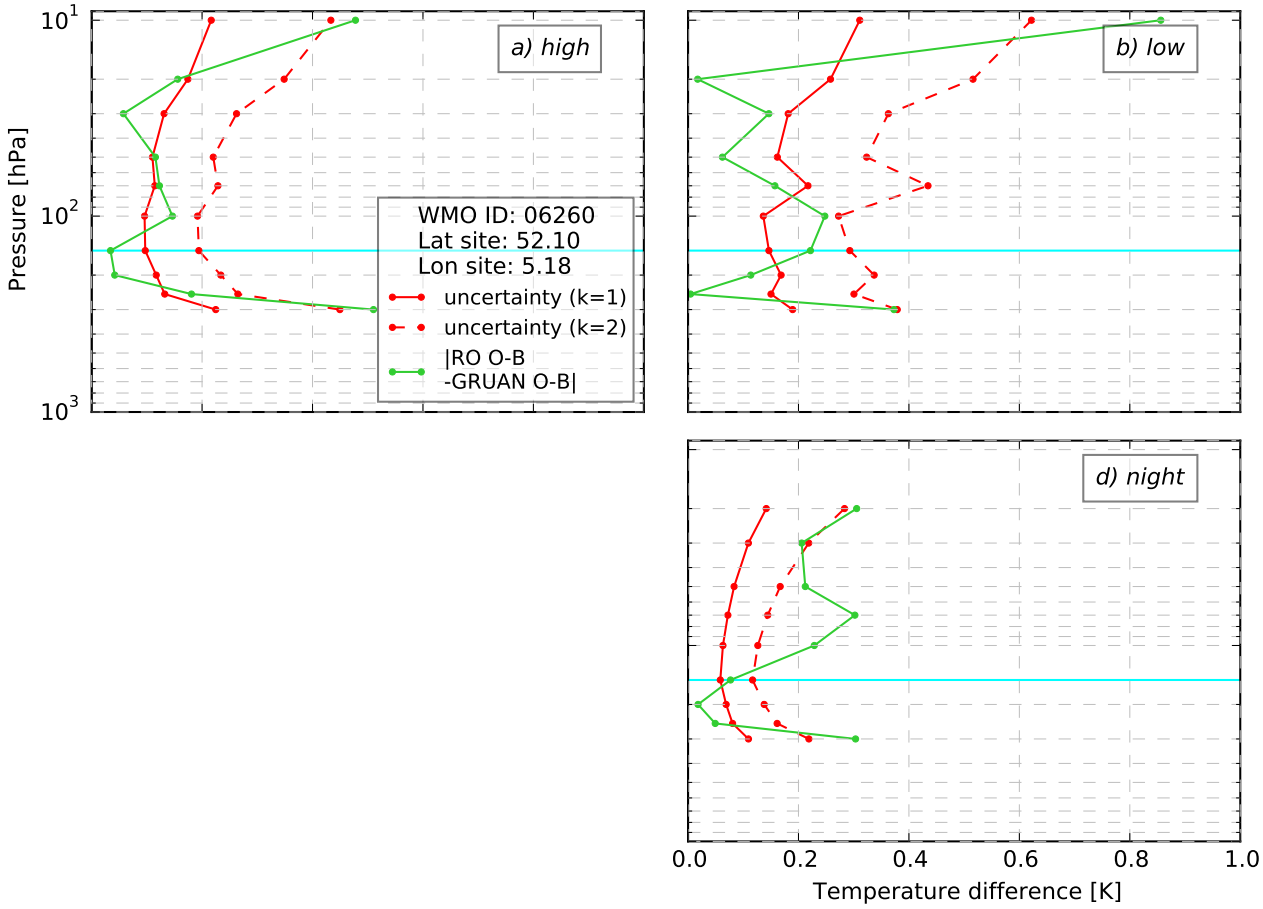

Figure 2: As Fig **??**, but for Cabauw.

GRUAN RO comparison Ny Ålesund

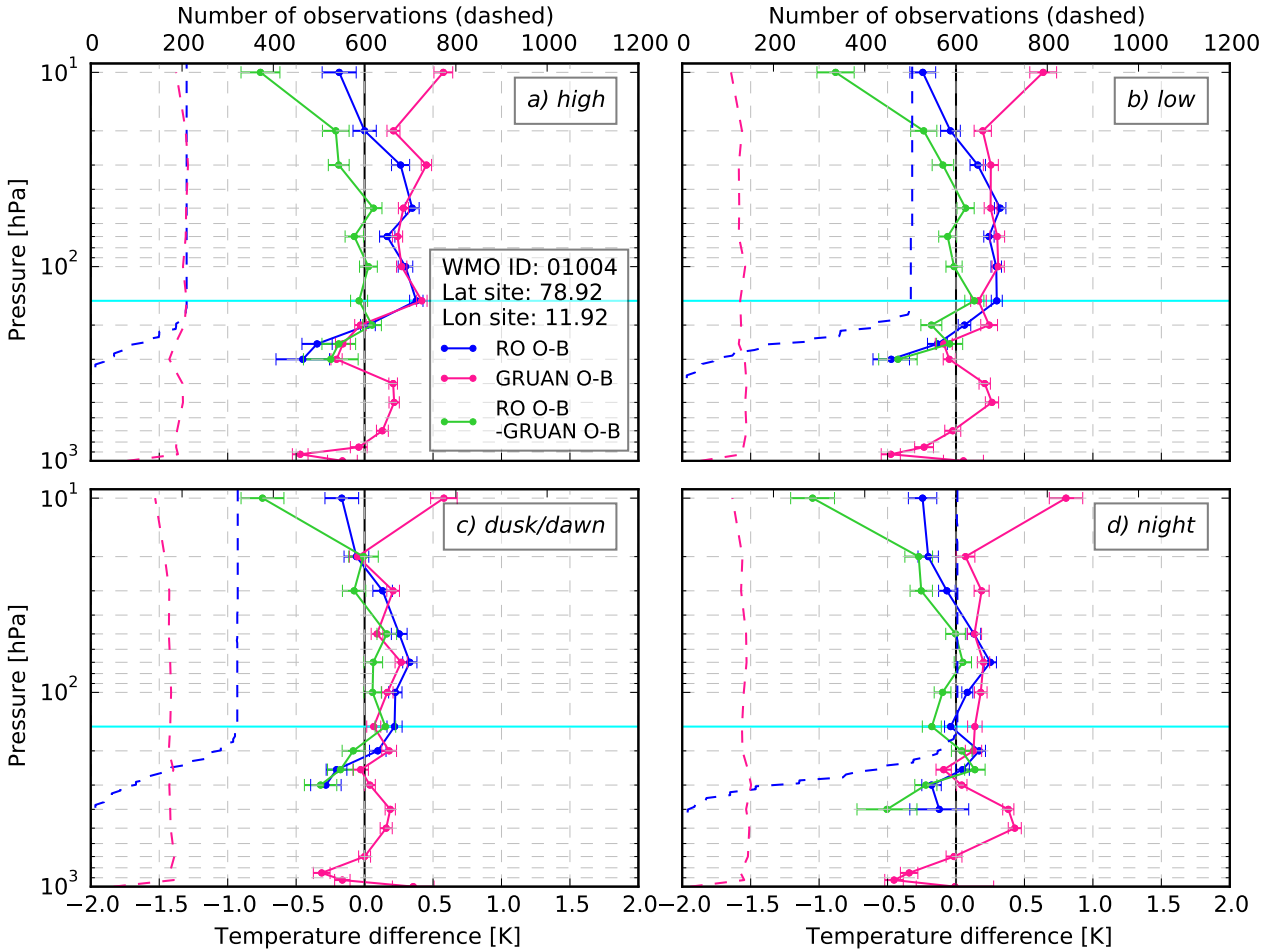

Figure 3: As Fig.**??**, but for the GRUAN site Ny Ålesund

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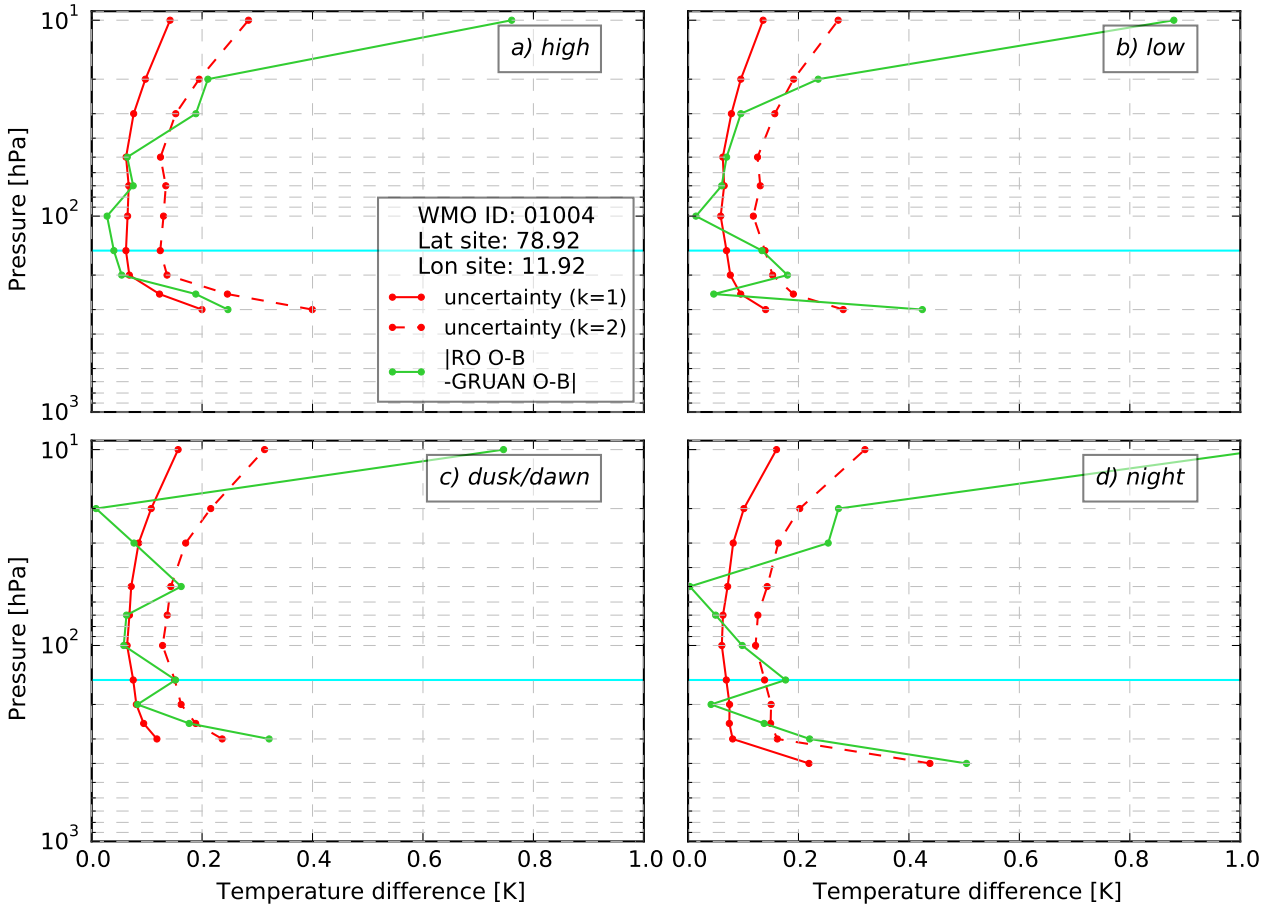

Figure 4: As Fig **??**, but for Ny Ålesund.

Uncertainty estimation in the RO retrieval 2

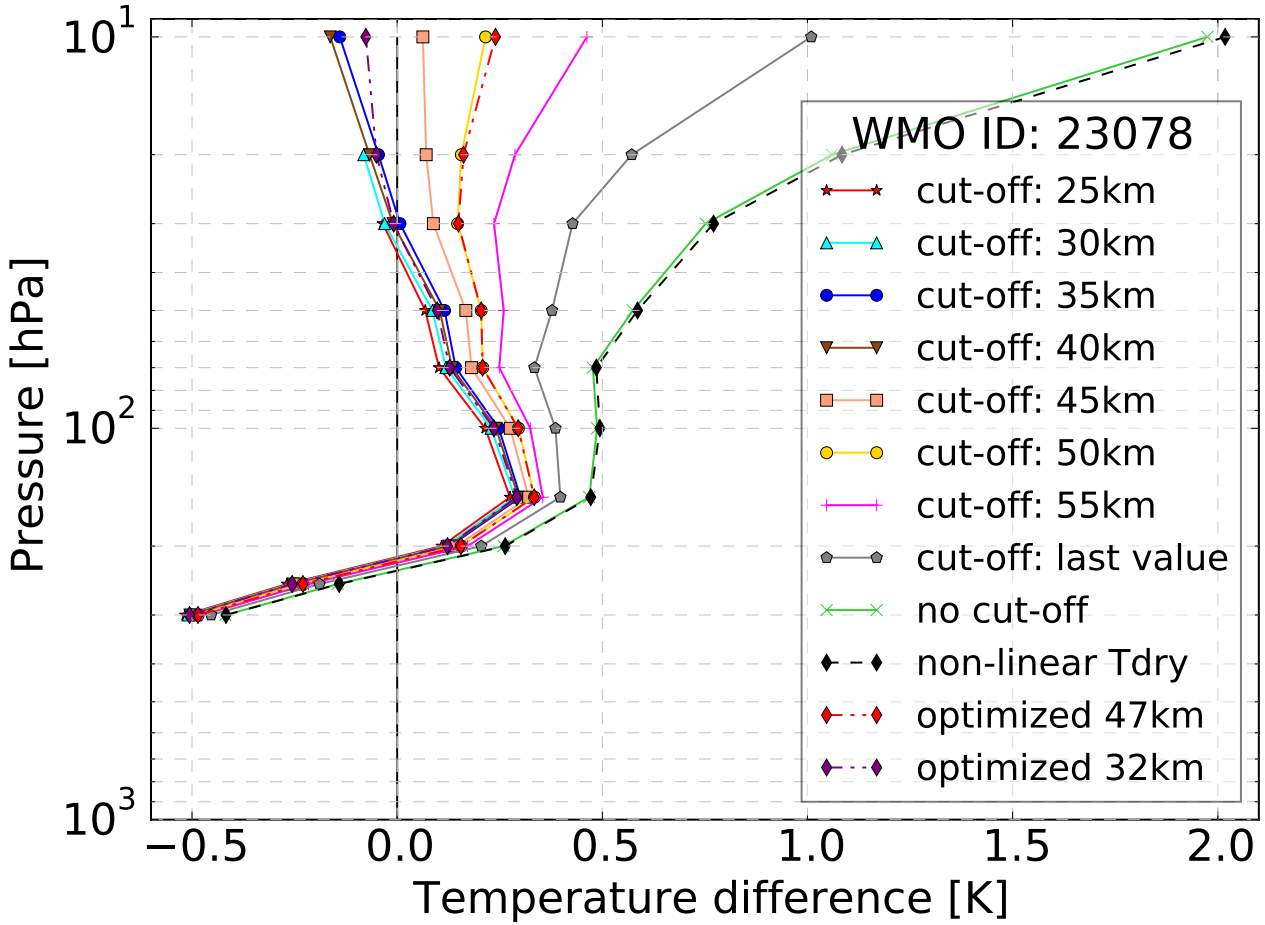

Figure 5: Sensitivity of the mean Tdry departure to different upper cut-off impact heights. The mean Tdry departure is calculated from up to 842 RO profiles within a 500 km radius around the example site 23078 in western Russia. Also shown is Tdry departure calculated with the non-linear retrieval (black dashed) and the Tdry departures calculated using statistical optimization with 50% of the background BA used at 32 km (purple dash-dotted) and at 47 km (red dash-dotted), respectively.

Uncertainty estimation in the RO retrieval 3

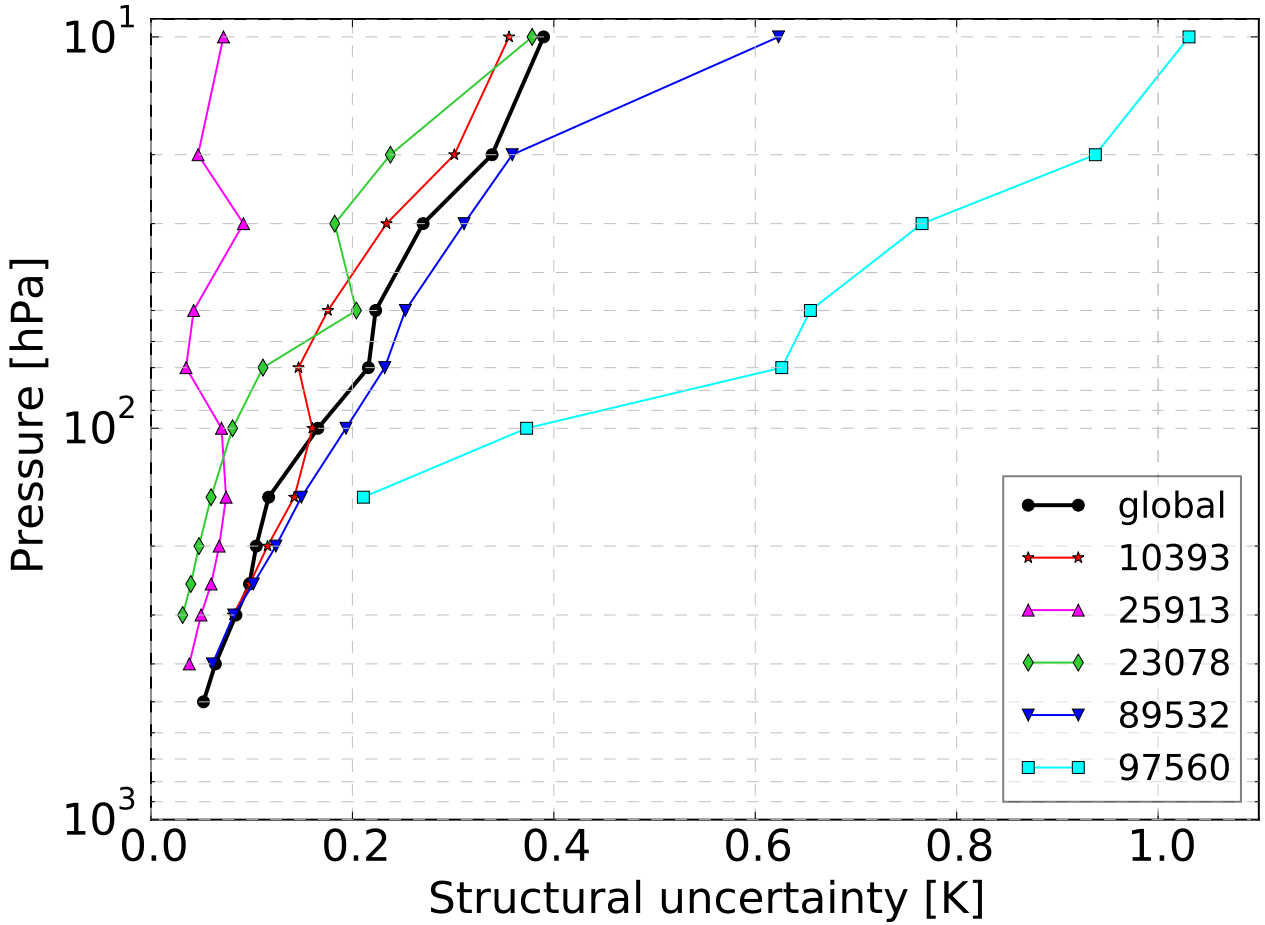

Figure 6: Basic estimate of the structural uncertainty in the RO departures based on the range of the Tdry departures calculated from BA departures with different upper impact height cut-offs between 20 km and 50 km.