



Update on Task Team 3 : Measurement Scheduling and Related Activities

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TT3 Scheduling - Objectives

- to develop defensible, quantifiable, scientifically-sound guidance for GRUAN sites on measurement schedules and associated site requirements, in order to meet all GRUAN objectives including :
 - climate trend detection
 - satellite calibration/validation
 - studies of local meso-scale processes and events
- main information sources are from peer-reviewed literature, GRUAN documentation, and currently unpublished studies of which the group is aware. Some limited new analyses where critical gaps exist, using existing data sets.

Update on TT3 activities

- GRUAN Report published summarising peer-reviewed literature on sonde temperature measurements.
 - *GRUAN report 3 'Review of Operational Requirements for Temperature Sonde Measurements', May 2014.*
- Paper published on temporal sampling and diurnal variability in sonde temperature measurements.
 - *Butterfield, D. and Gardiner, T.: Determining the temporal variability in atmospheric temperature profiles measured using radiosondes and assessment of correction factors for different launch schedules, Atmos. Meas. Tech., 8, 463-470, doi:10.5194/amt-8-463-2015, 2015.*
- Revision of DW paper on lower stratospheric water vapour trends.

Report Conclusions for Sonde Sampling Issues

- Sampling twice daily, at 0000 and 1200 UTC, ensures that monthly statistics will be statistically significantly different from those based on four observations per day in only ~5% of the cases.
- Sampling once daily introduces biases in monthly mean temperatures.
- Large errors result from changing from 0000 to 1200 UTC observations (or vice versa).
- Twice-daily sampling must be done at least once every two days to ensure that monthly means are accurate to within 2 K.
- Sampling every two days, or every three days (but not every seven days), yields monthly means and standard deviations that are not significantly different from the true values at least 99.5% of the time.

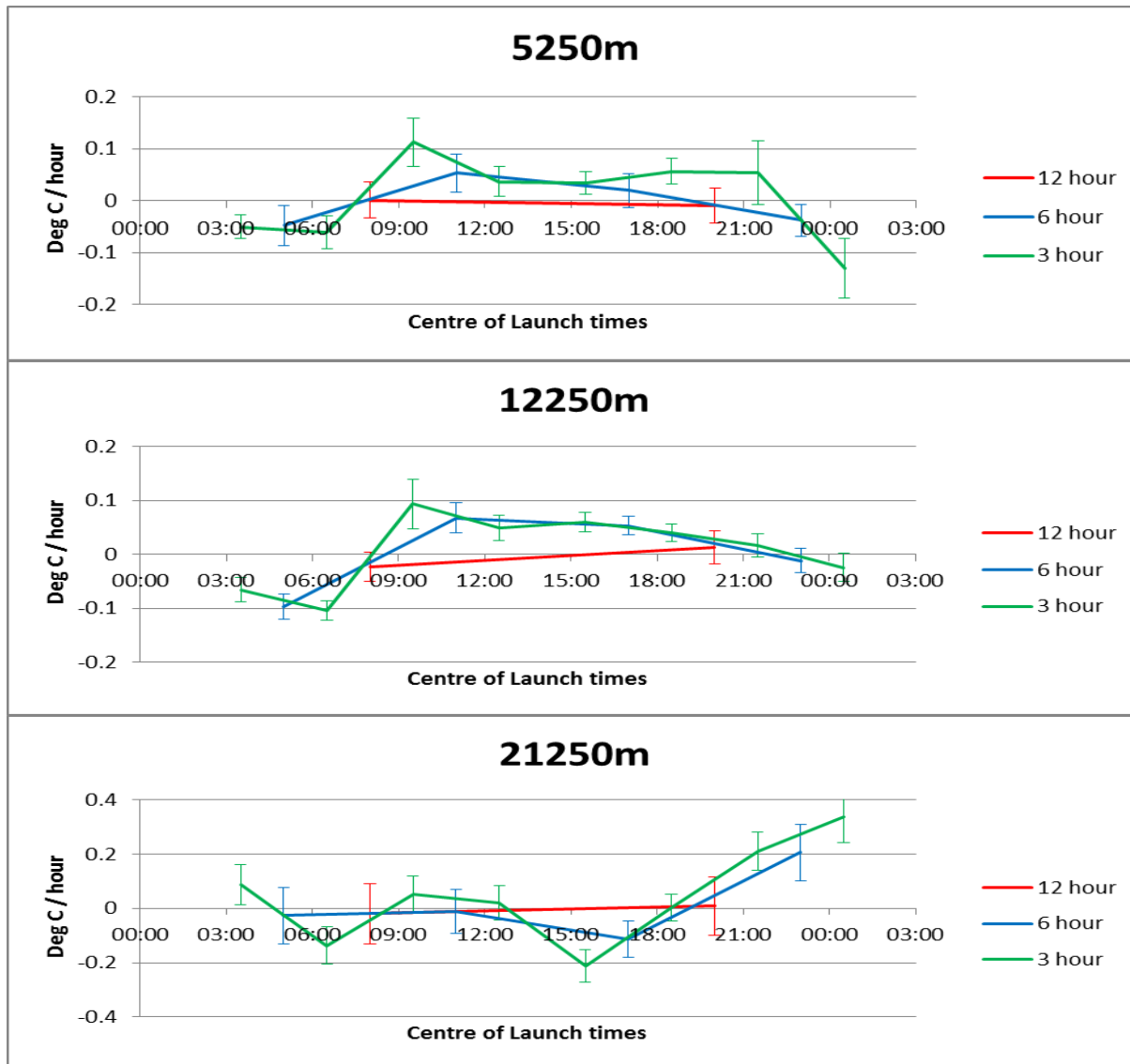
Short-timescale sampling issues

- Difficult / impossible to produce a fixed set of sampling guidelines given the wide potential range of short-timescale applications (for process studies and satellite validation).
- One option is to estimate the increased uncertainty due to non-simultaneous temperature measurements.
- This would enable an appropriate sampling strategy to be put in place for a given requirement / application.
- We have produced estimates for sonde temperature measurements from actual datasets, as a function of time of day, altitude and season.

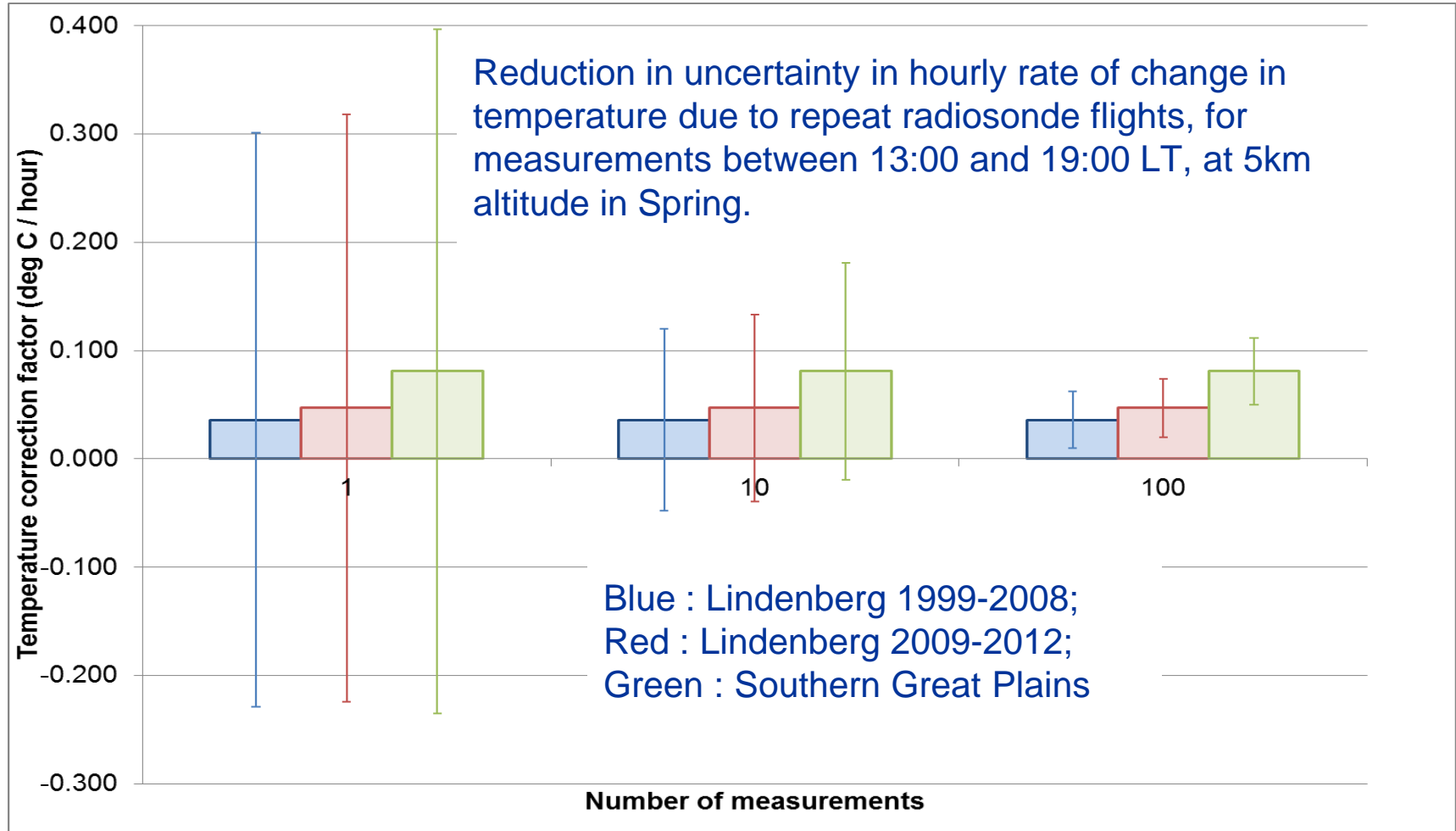
Data sets studied

Launch site	Latitude	Longitude	Start	End	Launches per day	Sonde
Manus	2° 3' S	147° 25' E	24/09/2011	31/03/2012	8	RS92
Lindenberg	52° 12' N	14° 7' E	01/01/1999	31/12/2008	4	RS90
Lindenberg	52° 12' N	14° 7' E	01/01/2009	31/12/2012	4	RS92
Southern Great Plains	36° 36' N	97° 29' W	01/01/2006	31/12/2012	4	RS92

Capture of diurnal variability with different launch frequencies



Output is temporal temperature correction factor (and uncertainty)



LS Water Vapor Trend Study Update

- Paper under revision for re-submission to GRL-Atmospheres.
- Main conclusions of the paper will be unchanged :
 - Because of low natural variability of LS water vapor, a small number of low noise measurements (FPH, MLS) per month is sufficient for revealing trends.
 - There is a small decrease in time to detect trend by increasing the number of measurements from 1 to 7 per month.
 - Trends as a function of pressure level are highly correlated in 10 degree zonal bands.

LS Water Vapor Trend Study Update

- More important to place new stations in different latitude zones than duplicate those in the NA mid-latitudes.
- Due to the much higher random noise, Raman lidar not as attractive as frostpoint or MLS for trend monitoring of LS water vapor.

Next Steps

- Update literature reviews, and relevant conclusions, for temperature and water vapour measurements.
- Complete resubmission of LS water vapour paper.
- Continue and extend assessment of short term sampling issues and temporal co-location uncertainties (linked to GAIA-CLIM project).
- Potential new topic on data scheduling – see SC talk.