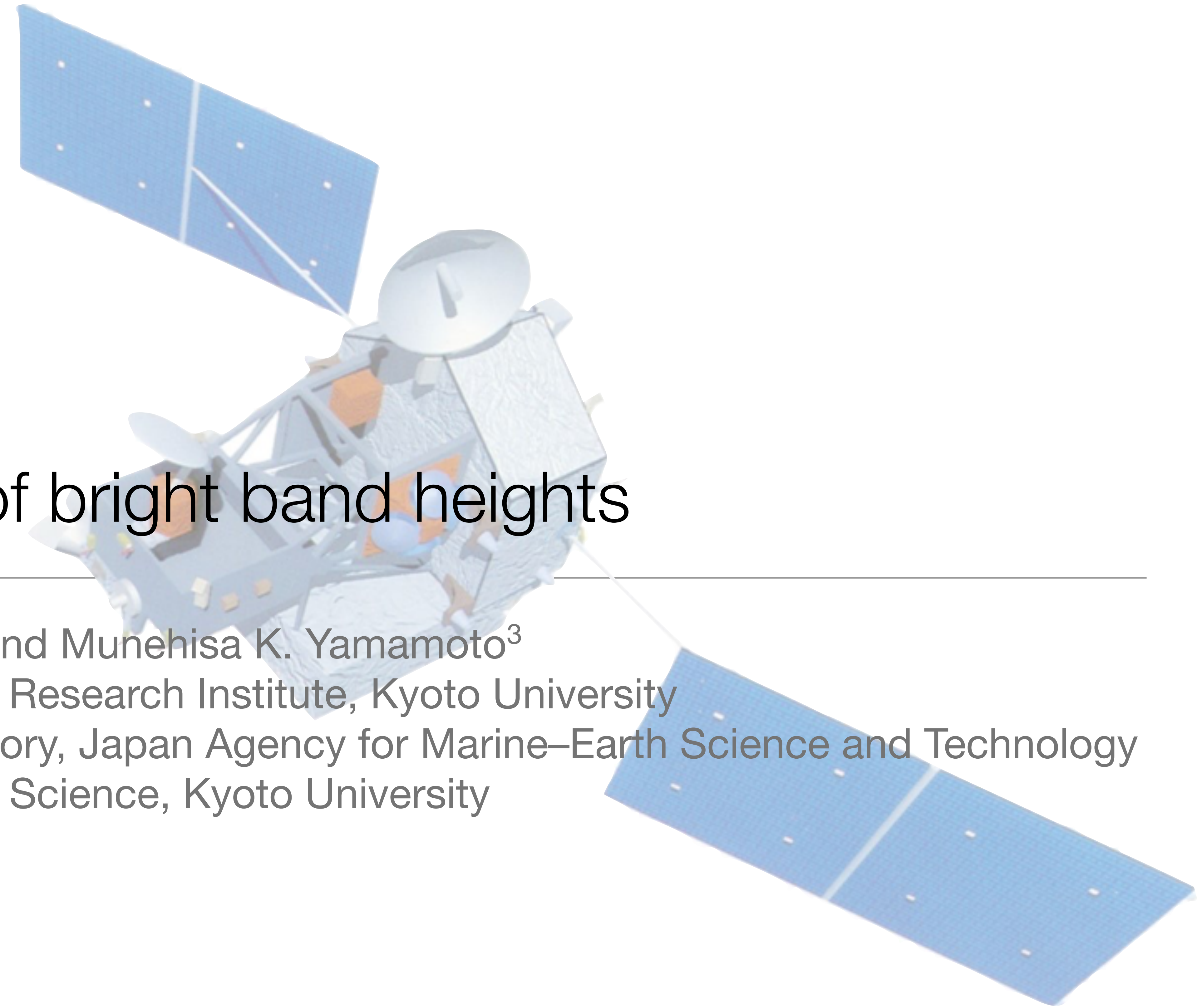

Assimilation of bright band heights

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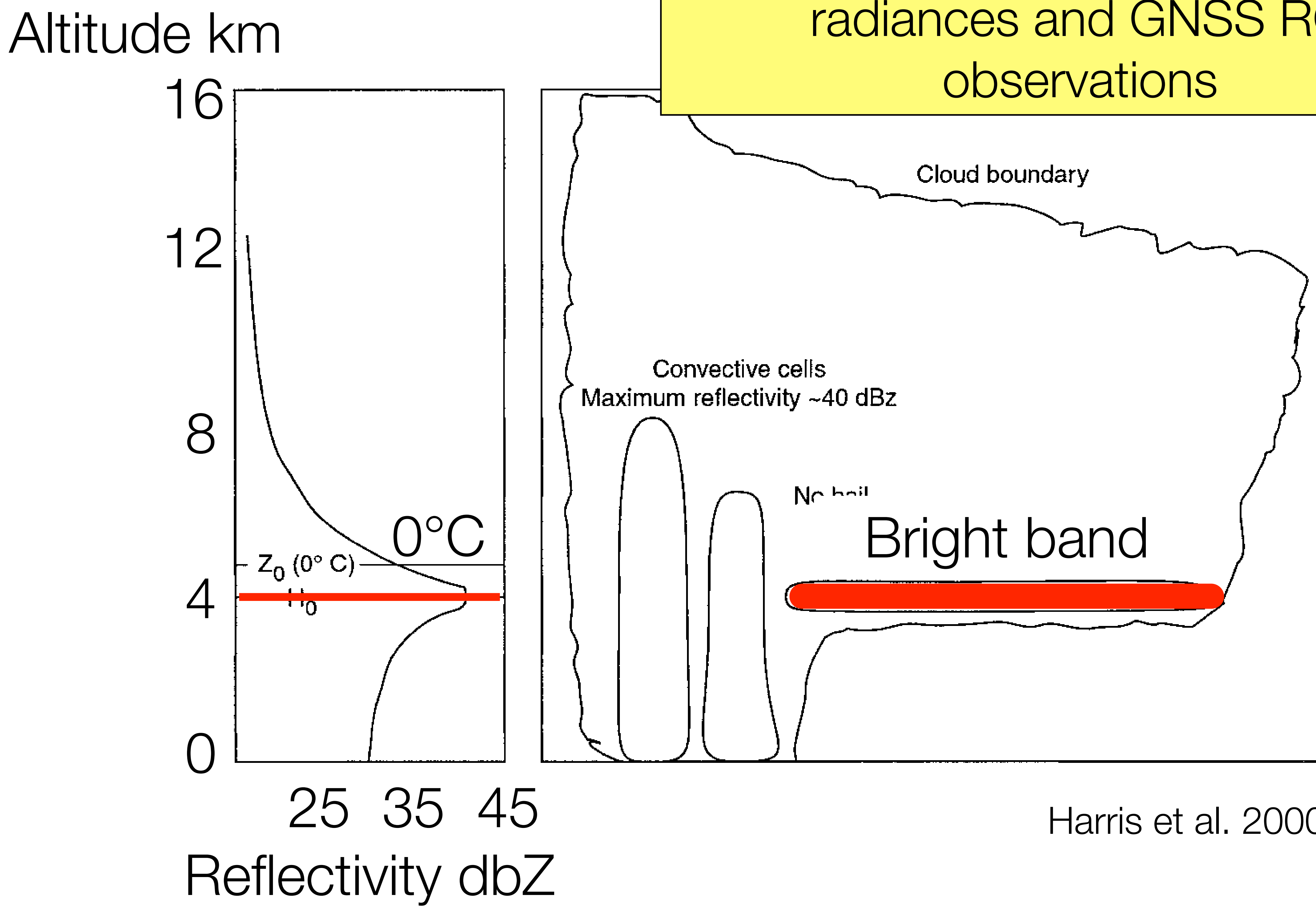
3 Graduate School of Science, Kyoto University

26 February 2015
The 4th International Symposium on Data Assimilation 2015
AICS, Kobe, Japan

Bright band heights

directly measured, cloud area data complementary to conventional radiances and GNSS RO observations



Harris et al. 2000

Bright band heights and 0°C height in reanalysis

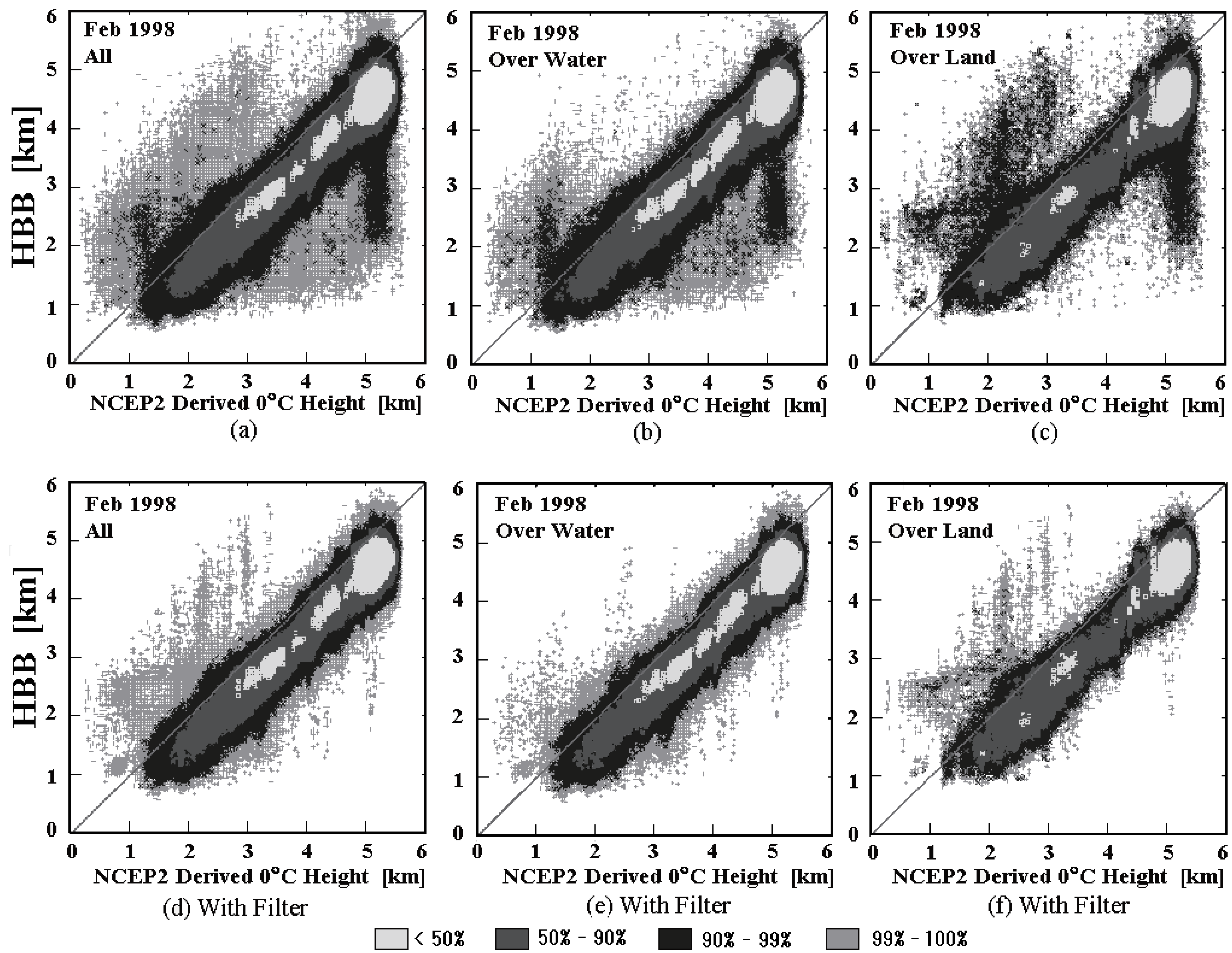
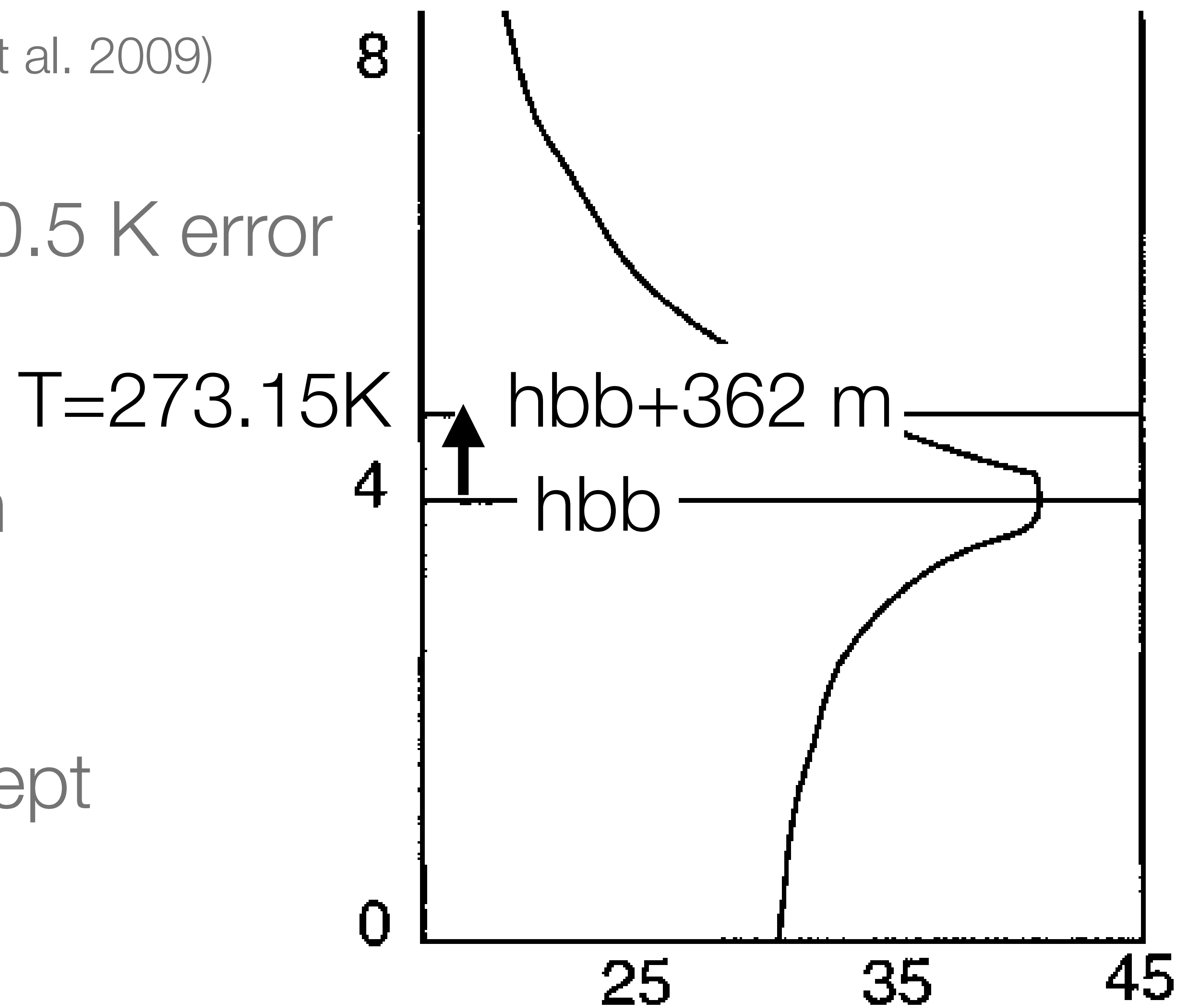


Fig. 4. Scatterplot of HBB versus NCEP2 derived 0°C height (HfreezeNCEP2) in February 1998. Upper panels depict the original case, and lower panels, the case after applying the simple filter explained in the text. Panels (a) and (d) present scatterplots using all the data (over water+land); panels (b) and (e), the scatterplots using the data over water; and panels (c) and (f), the scatterplots using the data over land. Data points were prepared in the form of a two-dimensional histogram with a grid interval of 0.02 km × 0.02 km.

Awaka et al. 2009

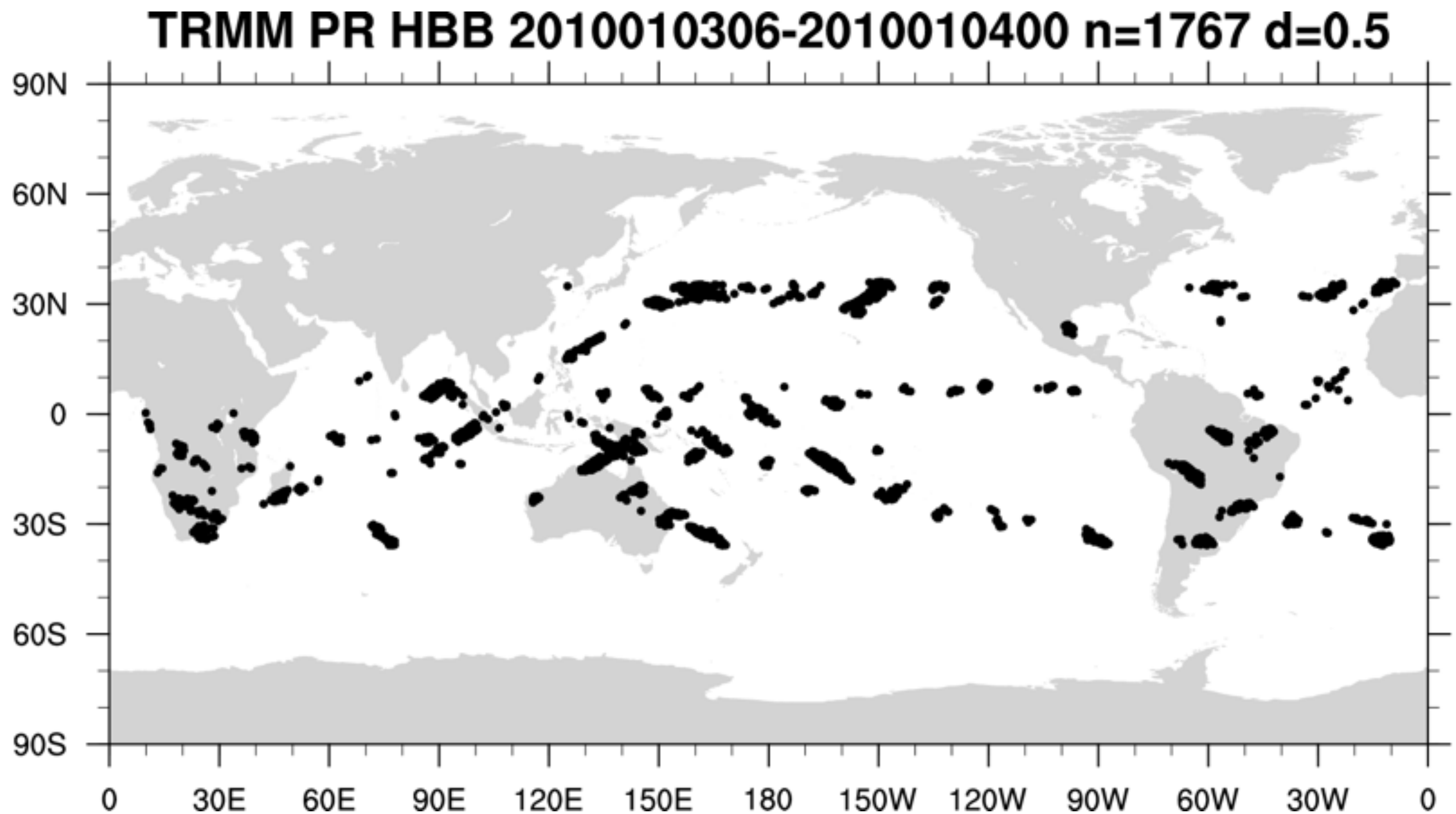
Bright band heights as 0°C temperature observations

- TRMM PR 2A23 (Awaka et al. 2009)
- 0°C observations with 0.5 K error at hbb+362 m
- Superobservations with a radius of 0.5°
- modified LETKF to accept height level data



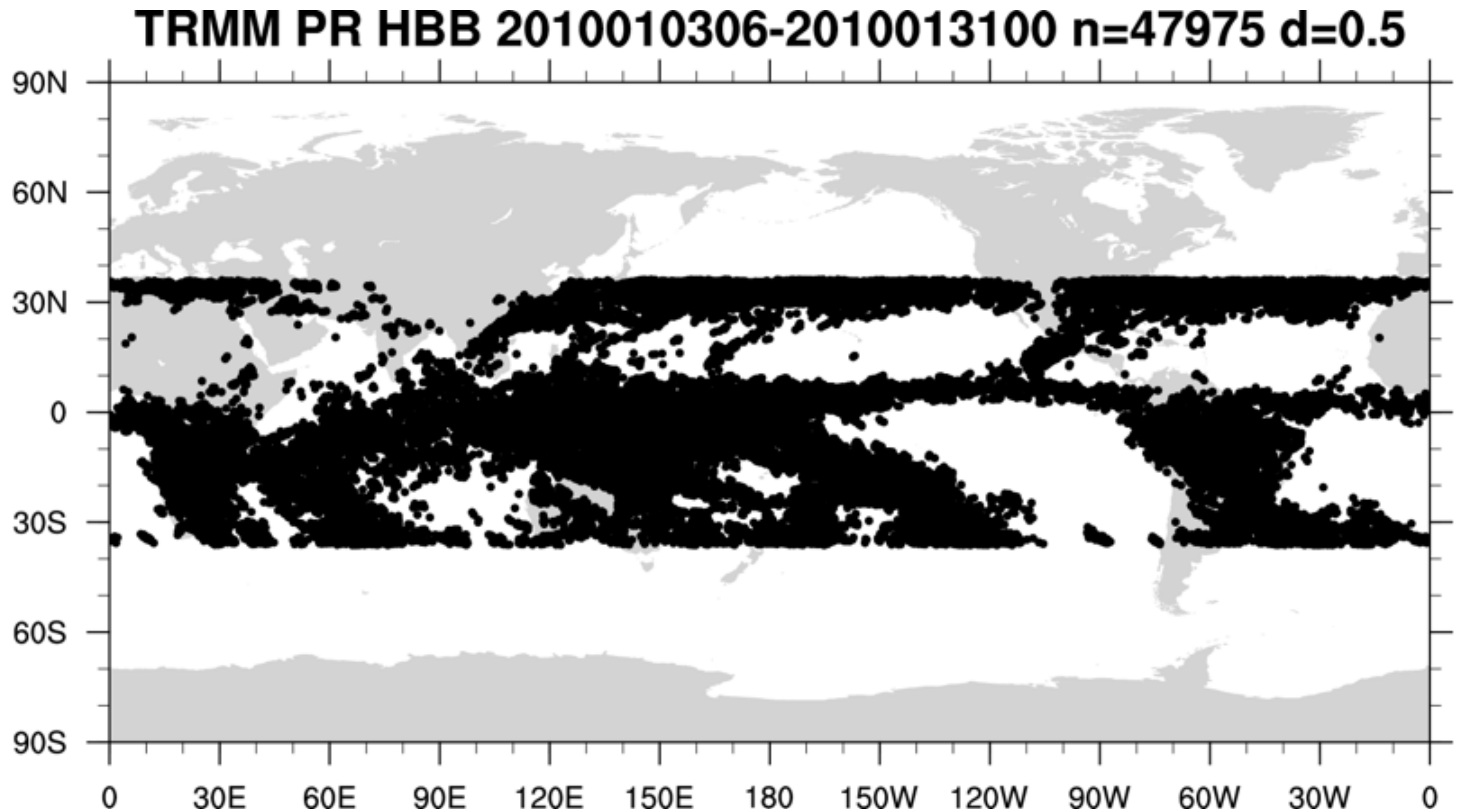
Bright band height superobservations for a day in Jaunuary 2010

82133 original reduced to 1767 superobs



Bright band height superobservations for 28 days in Jaunuary 2010

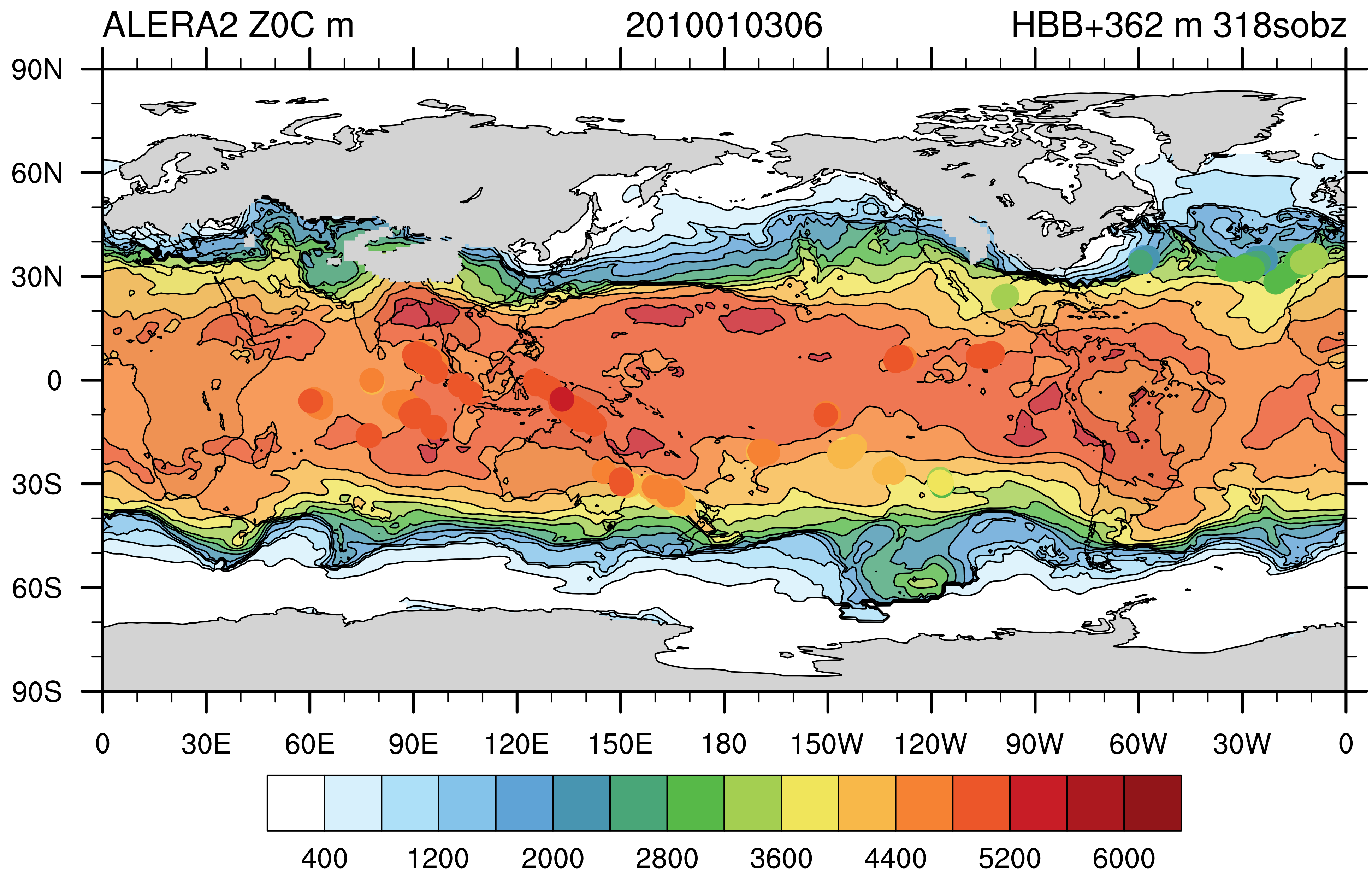
2170037 original reduced to 47975 superobs



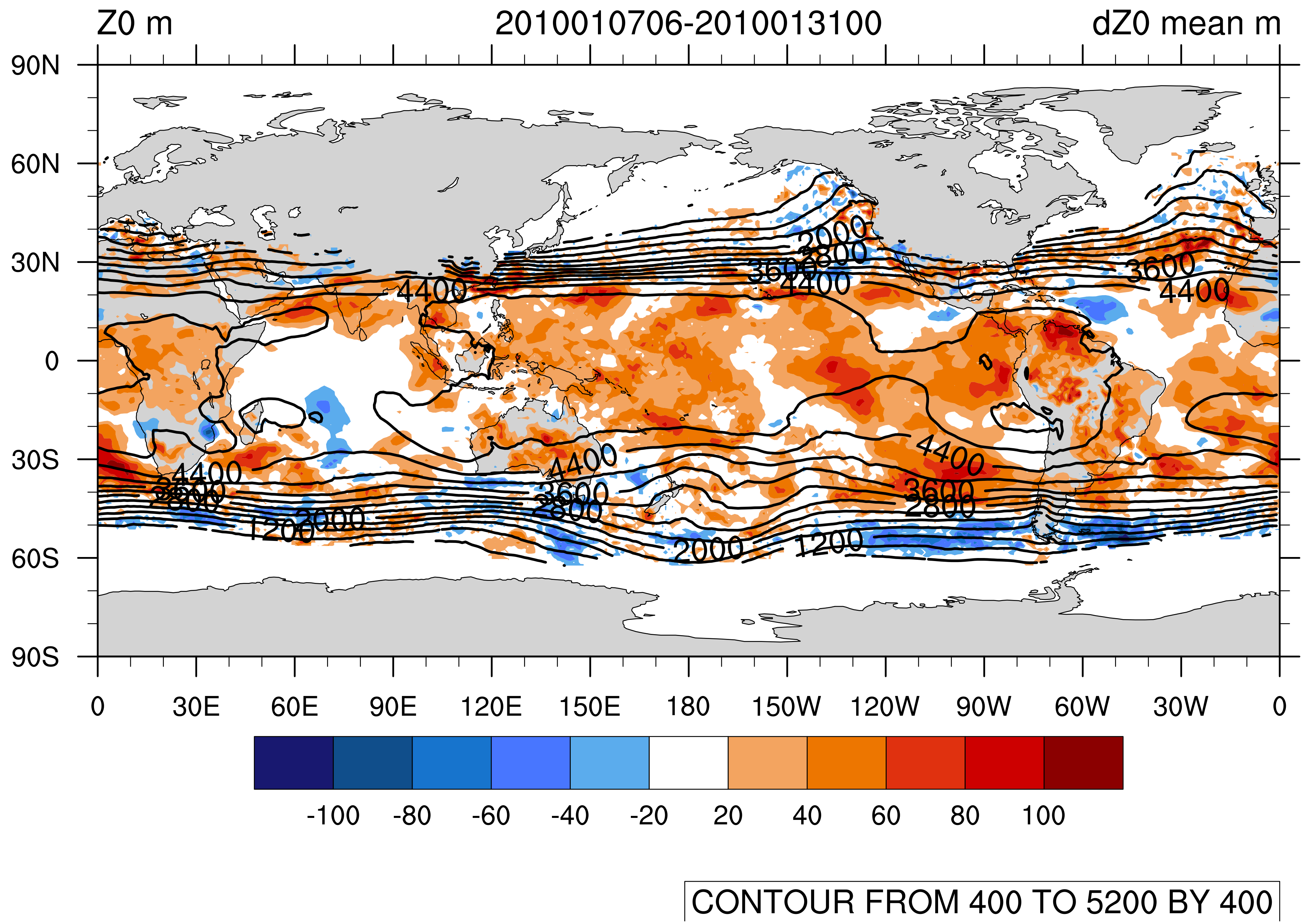
Observing system experiments

- Reference: ALERA2 stream2008 (available from JAMSTEC)
- AFES 3.6 T119L48（1°x1°, 48 levels）63 + 1 members
- Covariance localization: 400 km/0.4 ln p
- 10 % multiplicative spread inflation
- NCEP PREPBUFR archived at UCAR
- daily OISST (Reynolds et al. 2007)
- from 0 UTC 3 January to 0 UTC 31 January 2010

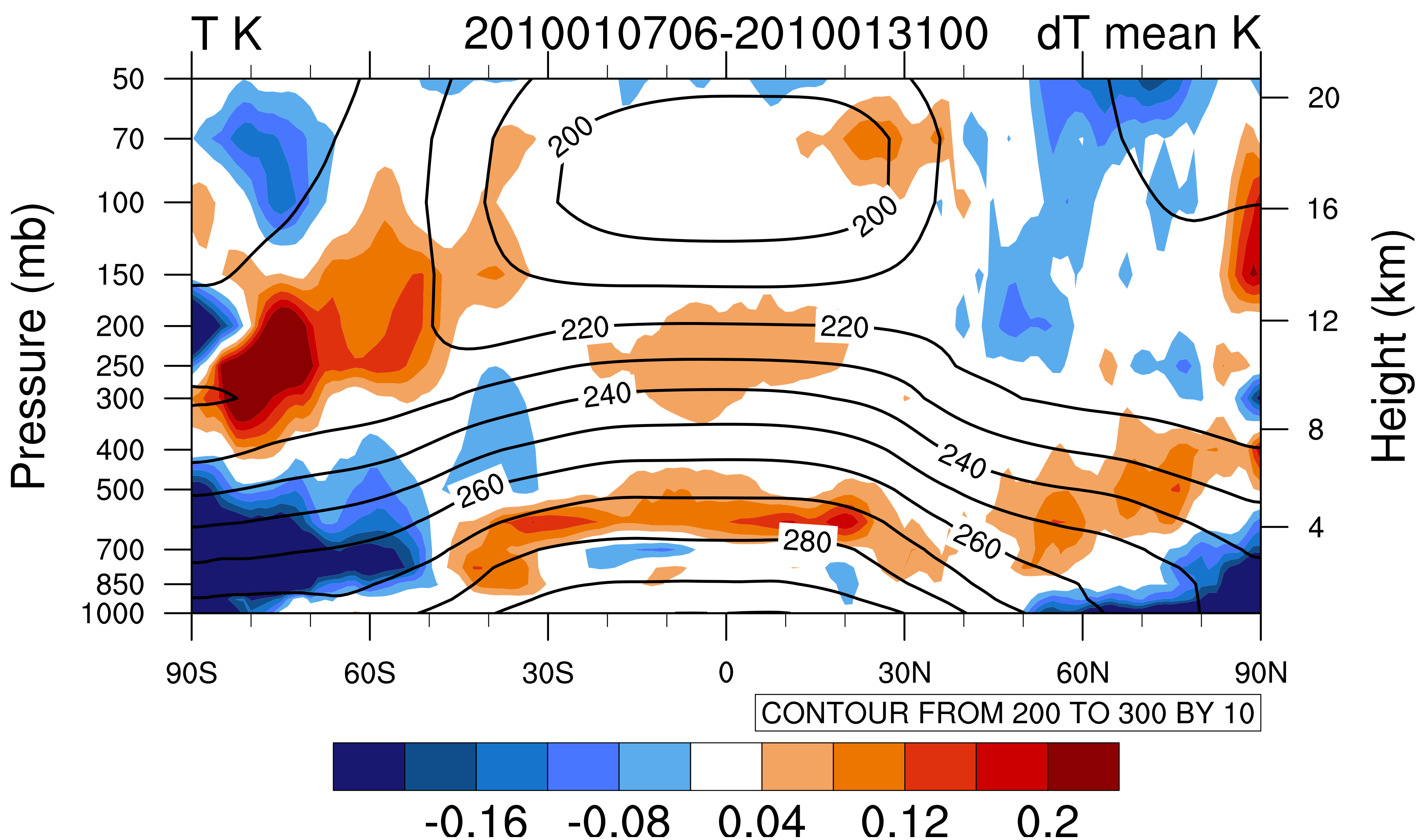
ALERA2 0C height and bright band heights in 6 UTC ±3 h window on 3 January 2010



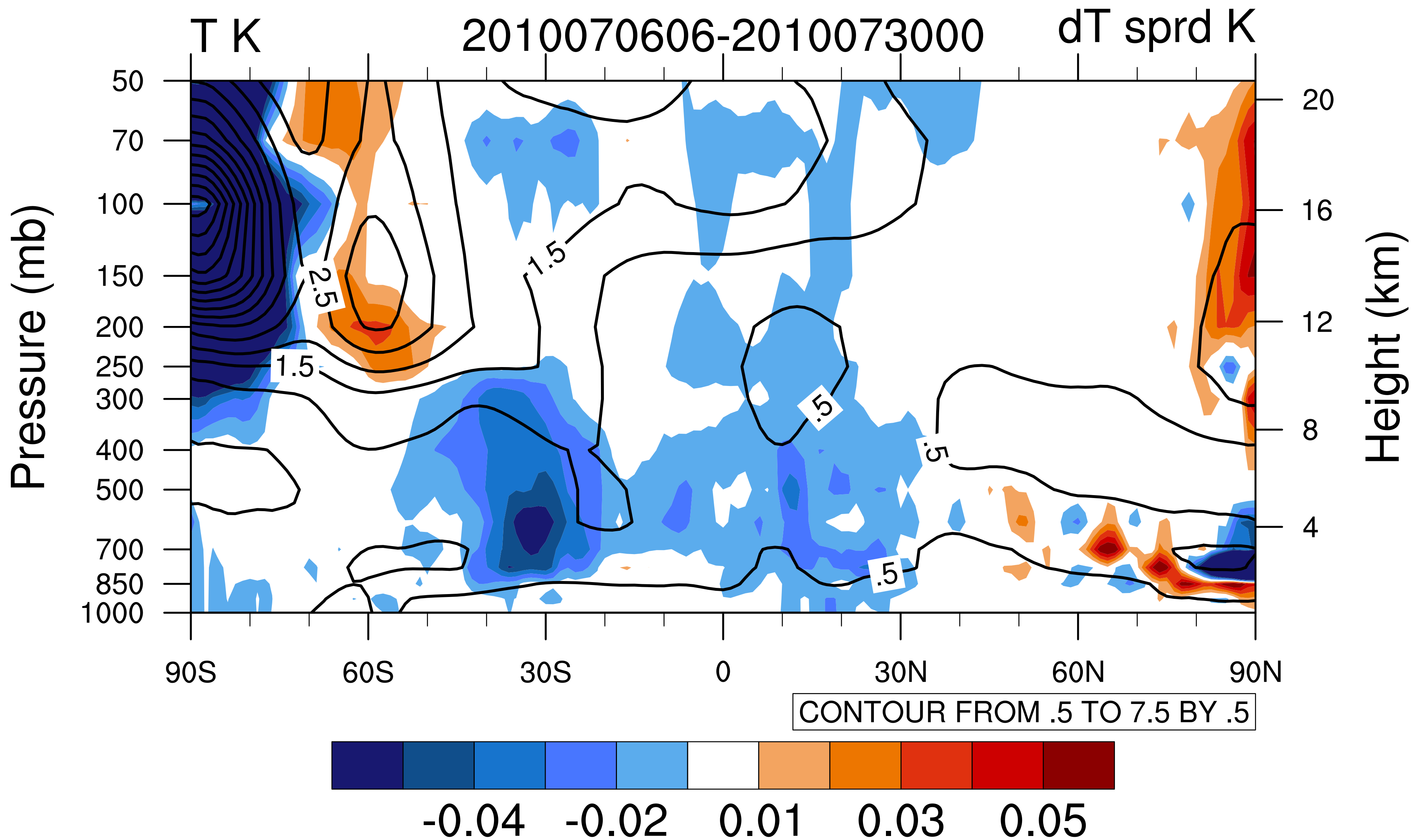
Impact on the freezing level height



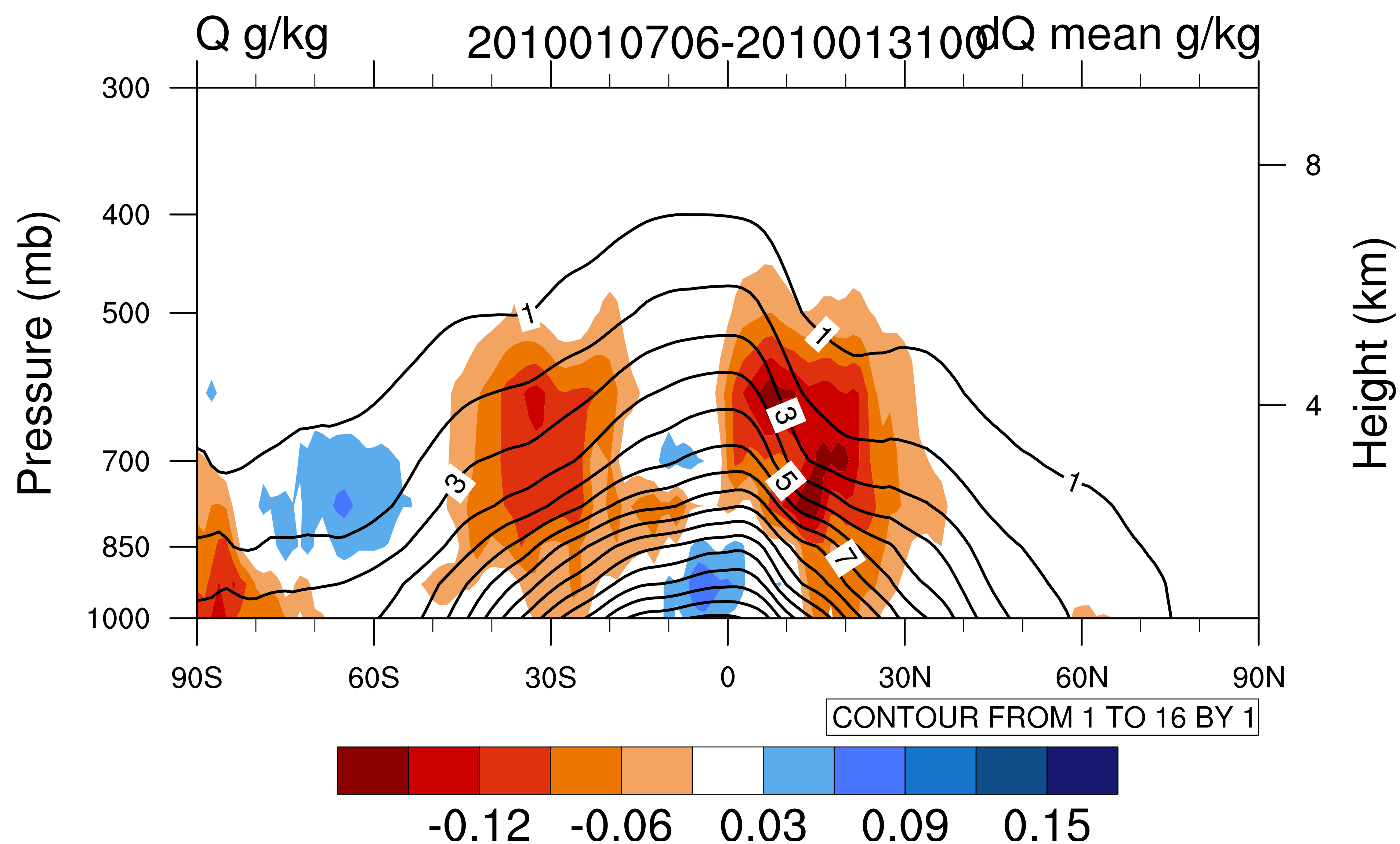
Impact on ensemble mean temperature



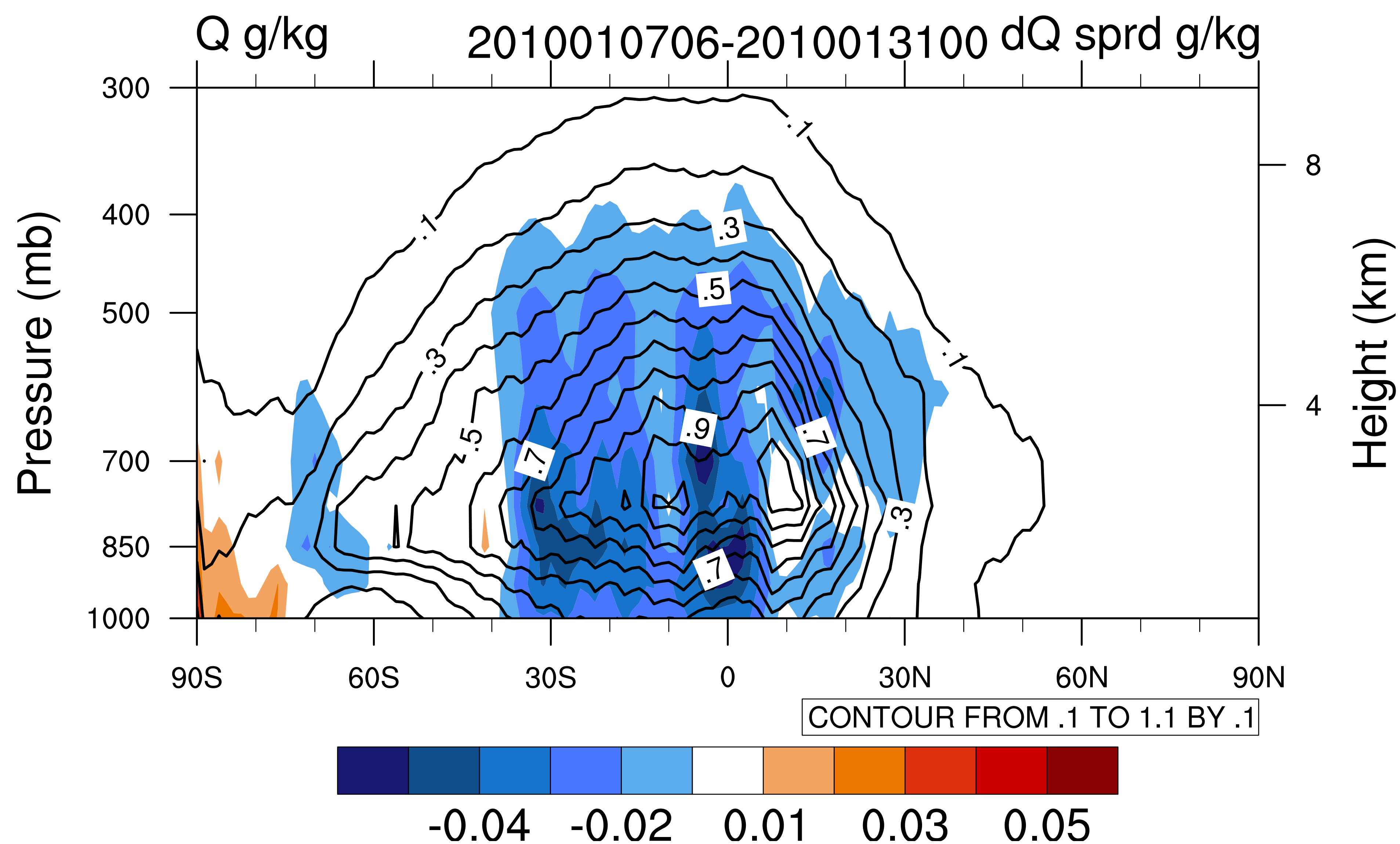
Reduction in *T* analysis ensemble spread



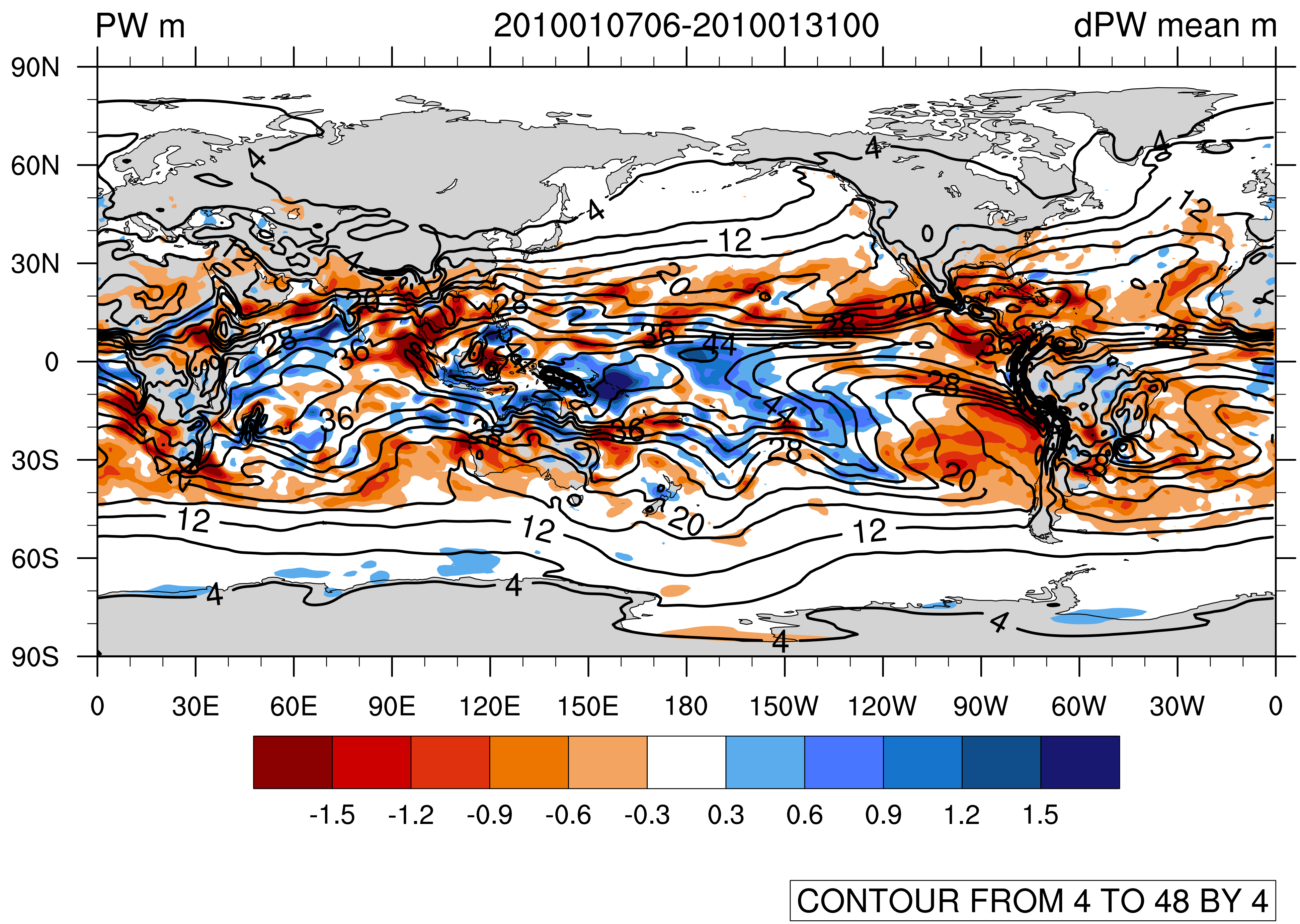
Impact on ensemble mean humidity



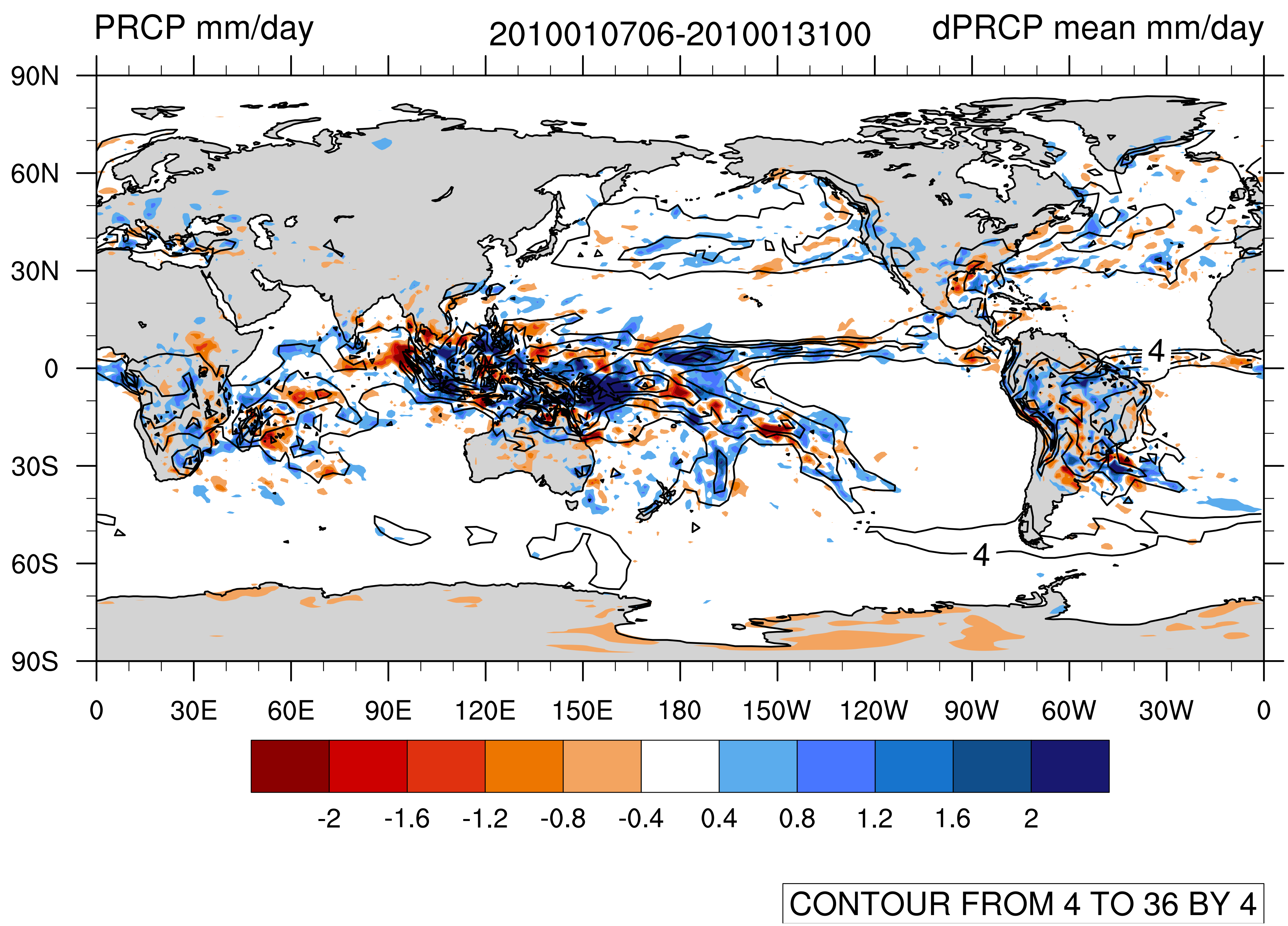
Reduction in Q analysis ensemble spread



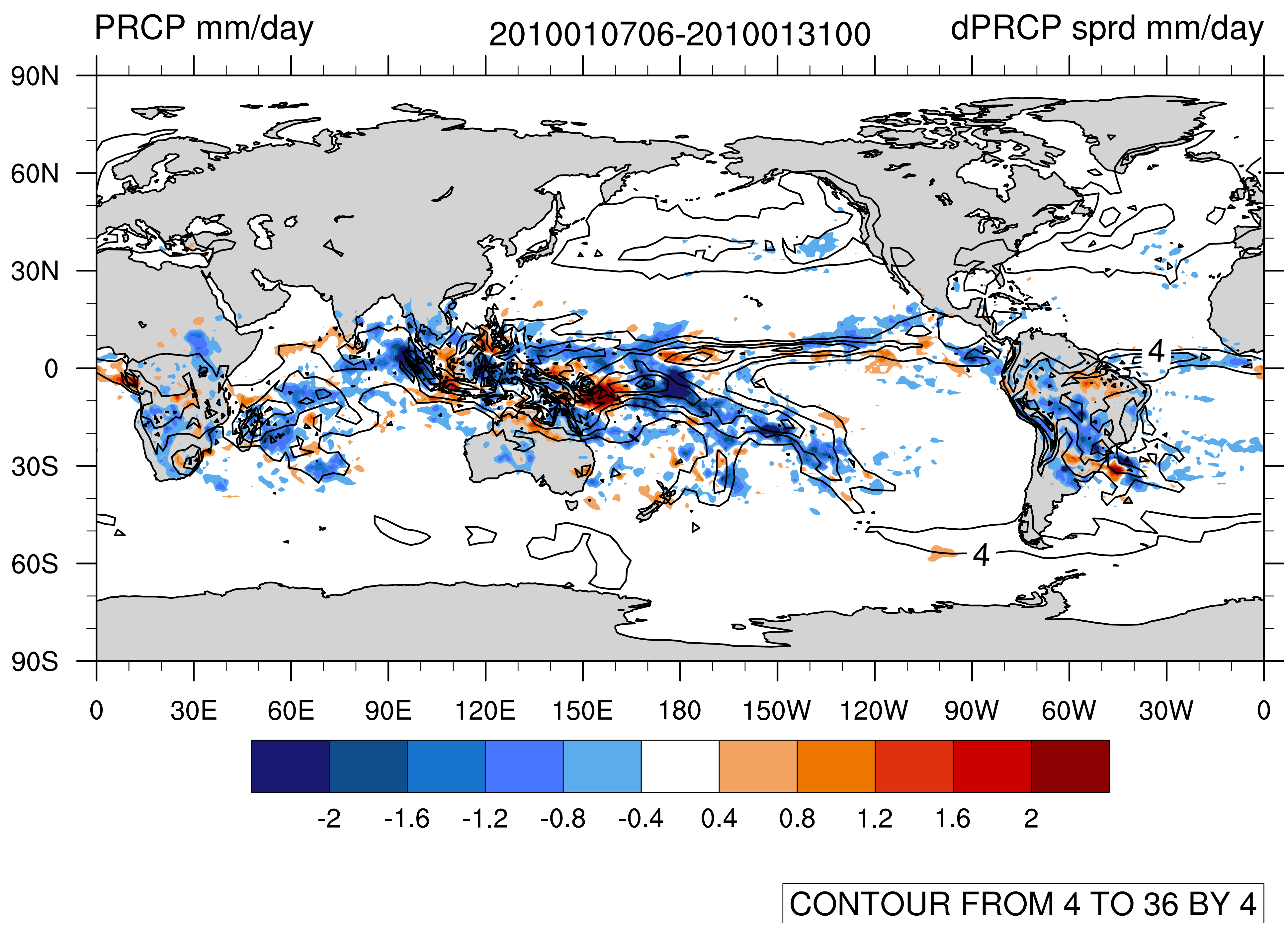
Impact on precipitable water



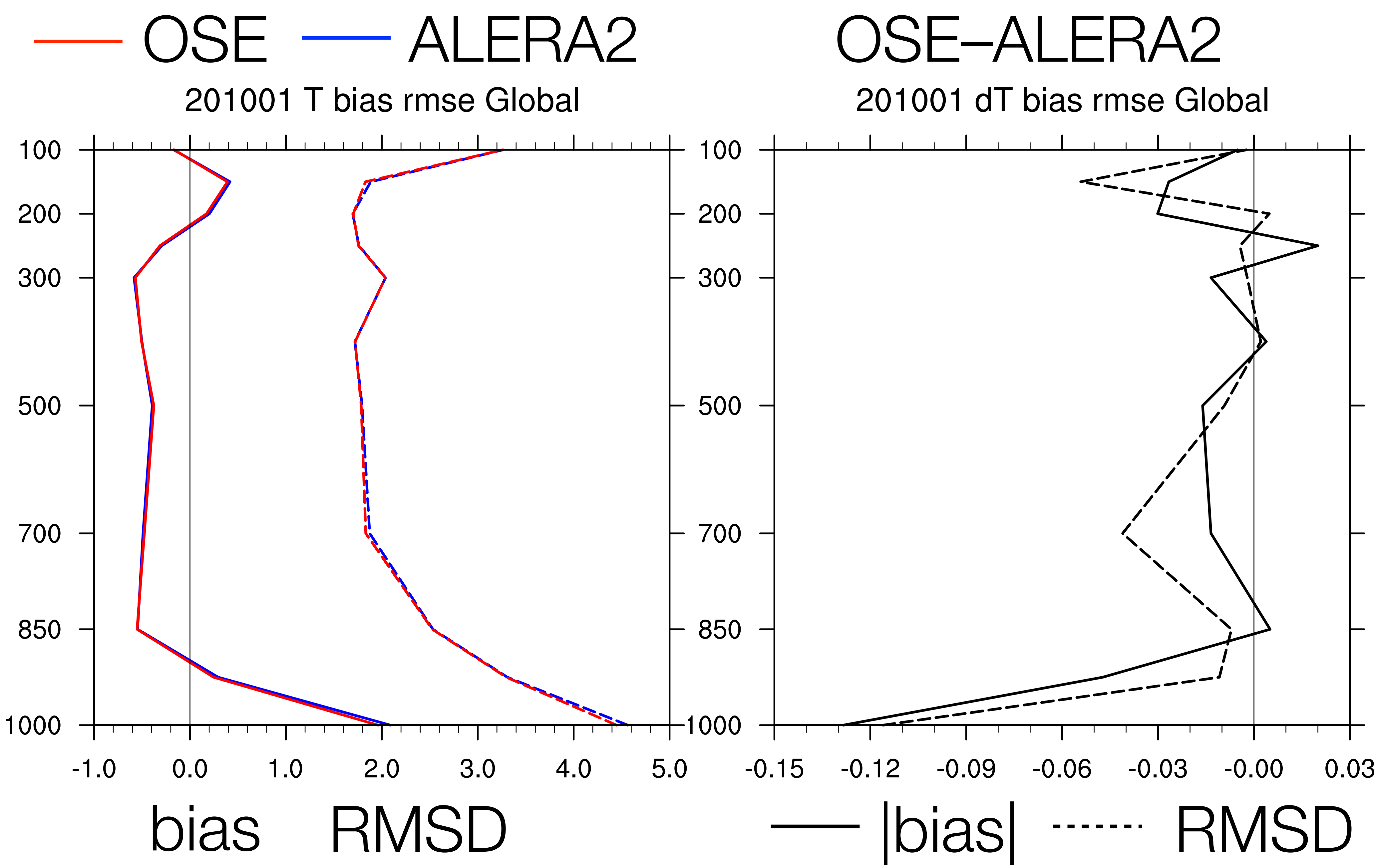
Impact on precipitation



Reduction of precipitation ensemble spread



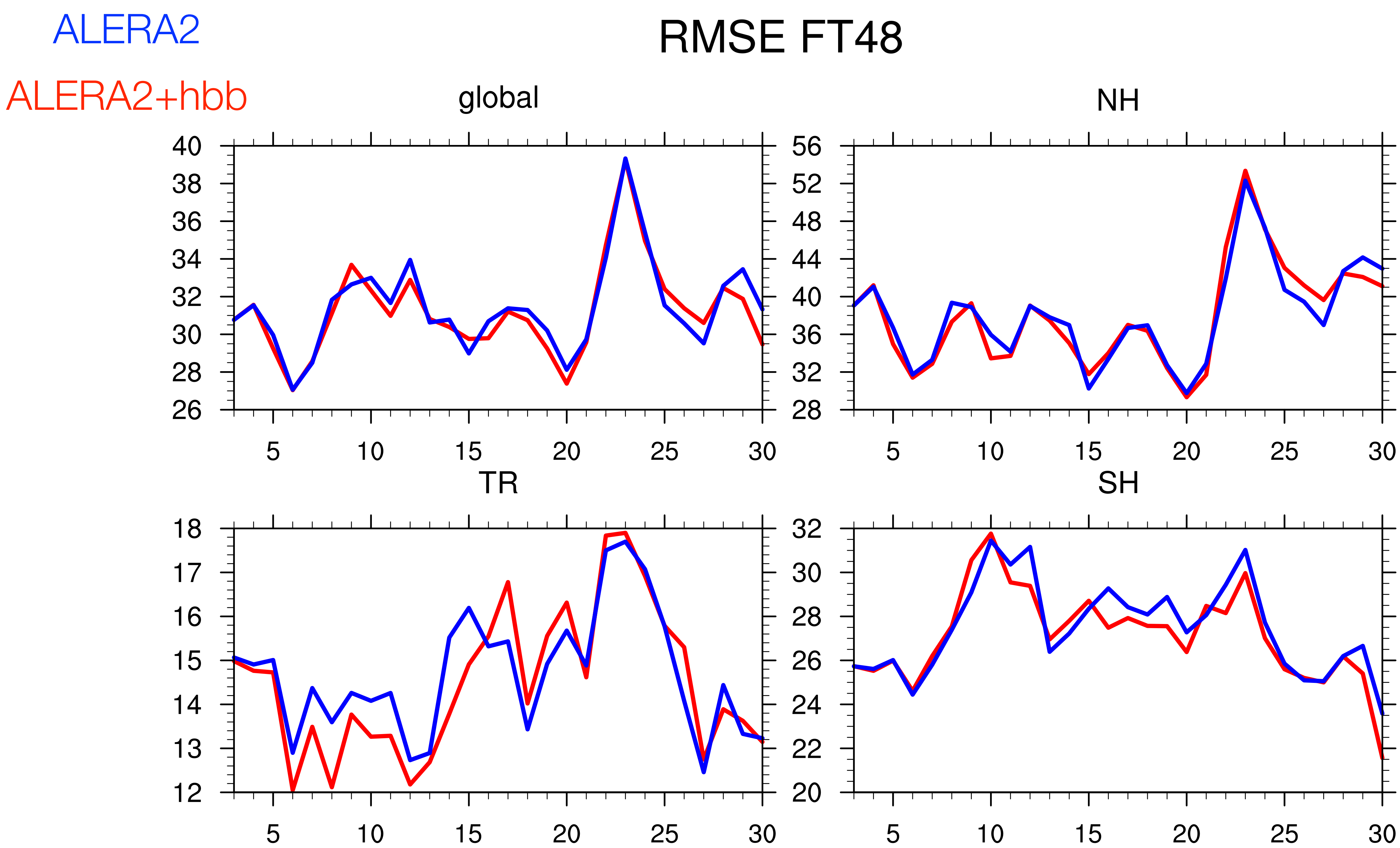
Comparison against radio sondes (global T)



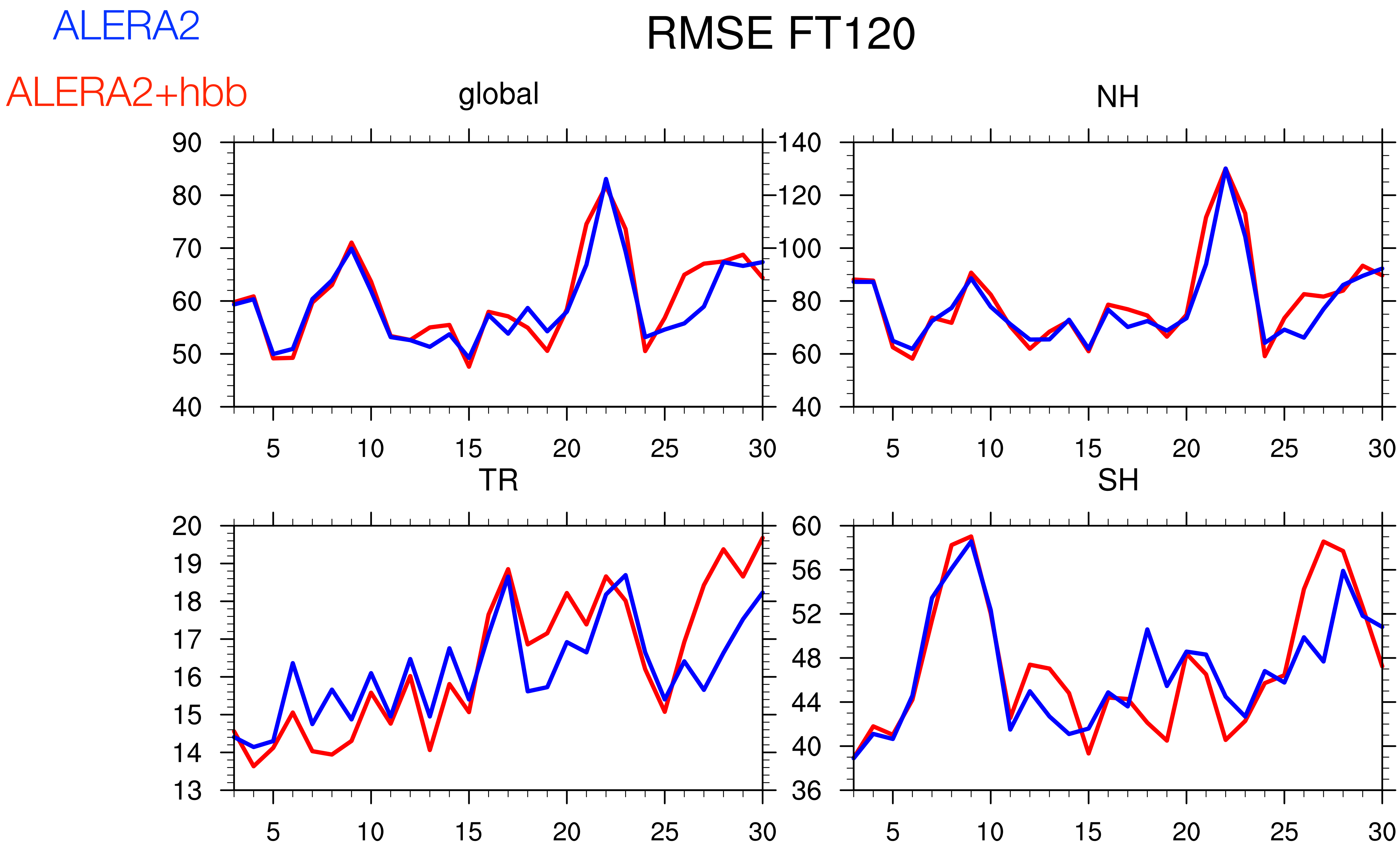
Forecast experiments

- 10-day forecasts initialized at 12 UTC everyday during 3–30 January 2010
- Compare forecasts from ALERA2 with bright band heights (hbb) against those from ALERA2
- Verified against JRA-55

Daily FT48 RMSE against JRA-55

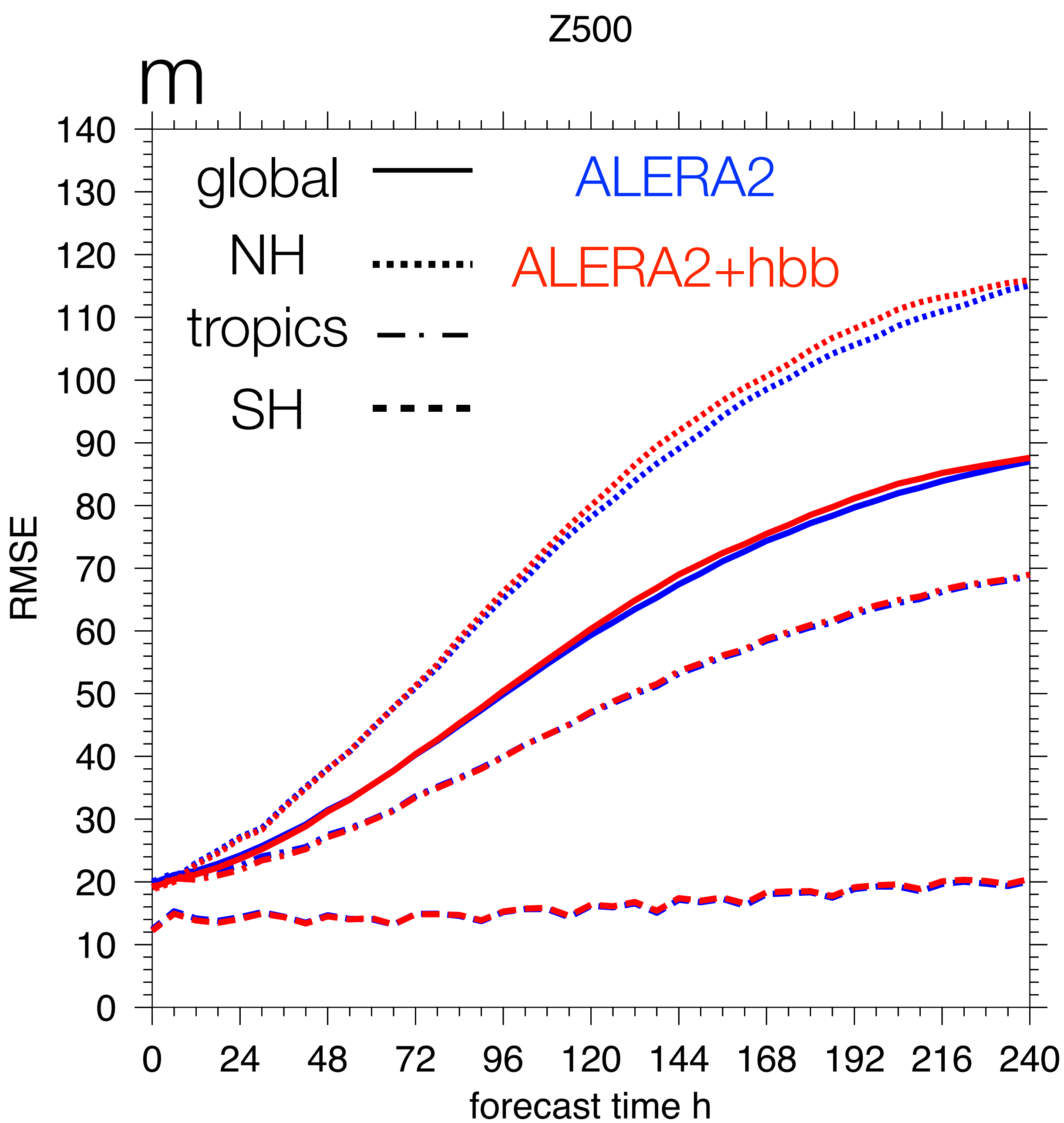


Daily FT120 RMSE against JRA-55

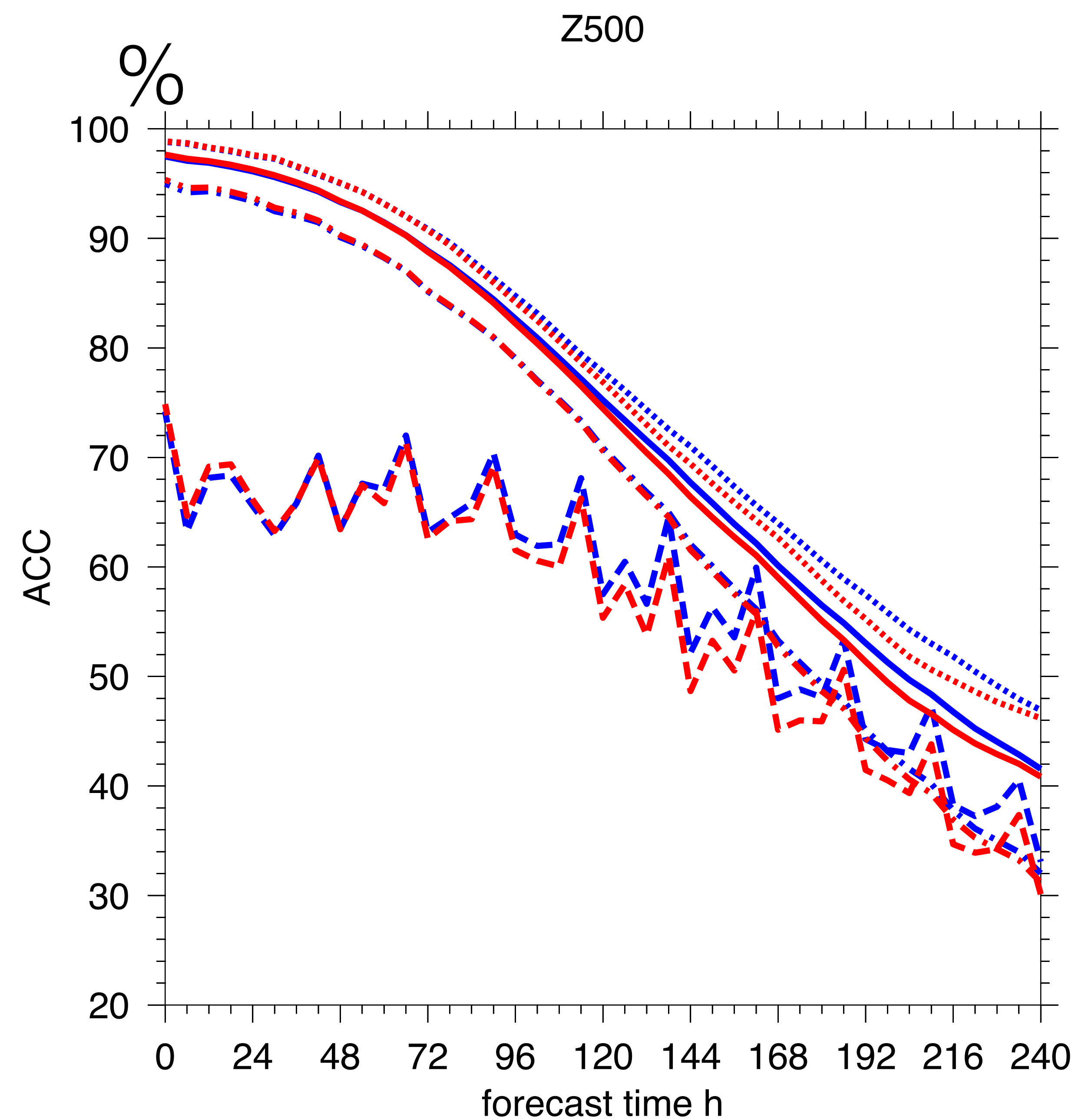


Verification of Z500 against JRA-55

RMSE

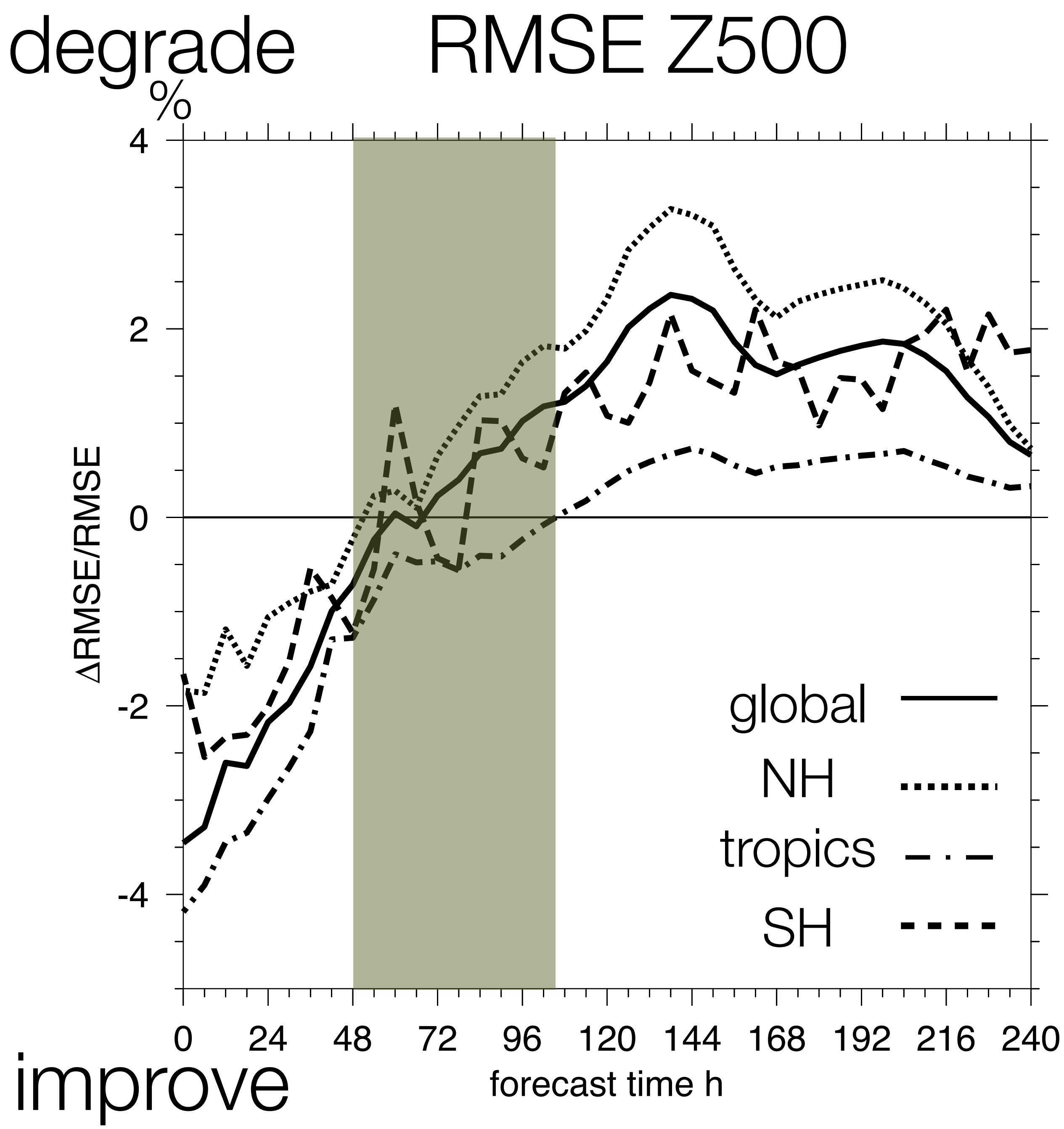


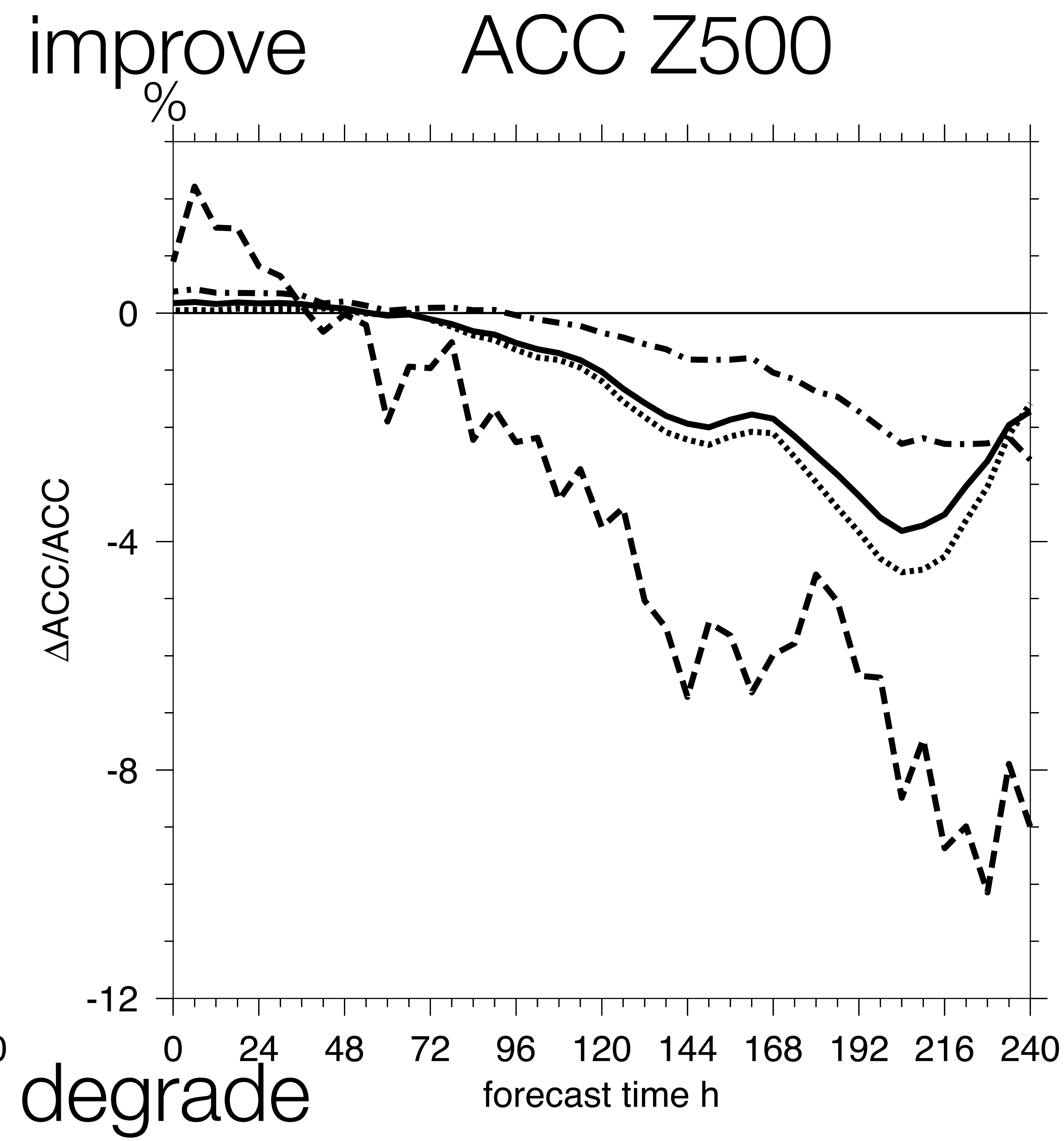
ACC



Improvement rate against JRA-55

ALERA2+hbb–ALERA2





Summary: Bright band heights

- can be regarded as 0°C temperature observations at heights several hundred m above.
- warms the middle troposphere,
  reduces analysis ensemble spread.
- influences precipitation by drying subtropics and moistening the tropics.
- improves the analysis, but may have negative impacts on forecast with the current configurations.
- from GPM may have a larger impact in midlatitudes.