



Pressure Loading Issues in VLBI Analysis

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Overview



- Effect of topography on atmospheric loading
- Reference pressure
- Comparison of observation level and 24-hour average correction
- Conclusions



Topography Effect



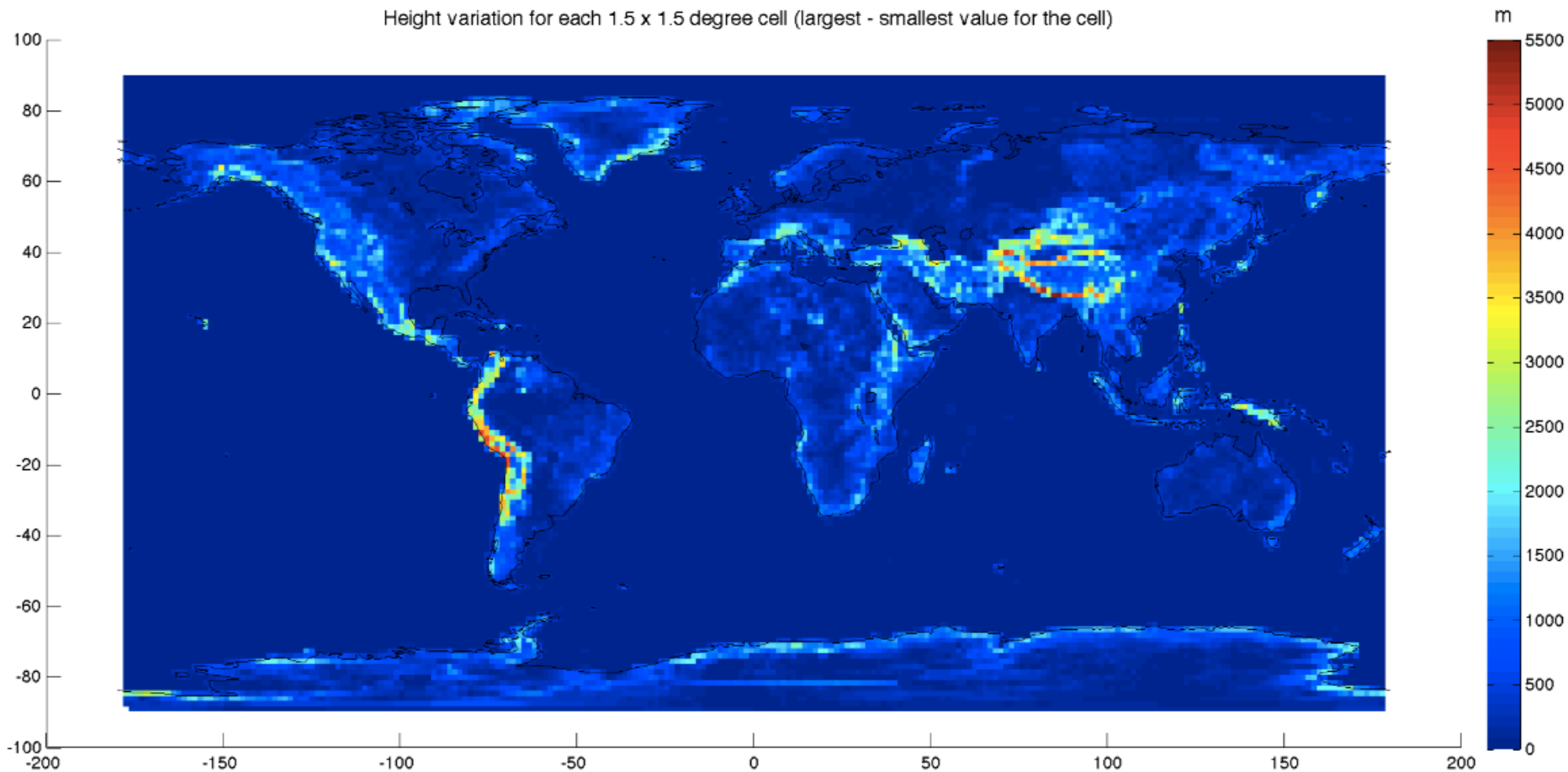
- Calculation of Pressure loading normally done with horizontal resolution of the NWM
 - ECMWF (1.5 deg)
 - NCEP (2.5 deg)
- Error due to topography variation within NWM cells
 - van Dam et al. (2010) for NCEP
 - used ETAPO2 topography resampled at 0.25 deg
 - height adjusted ECMWF pressure to topography heights
- We investigated the effect with ECMWF for VLBI sites



Topography Effect

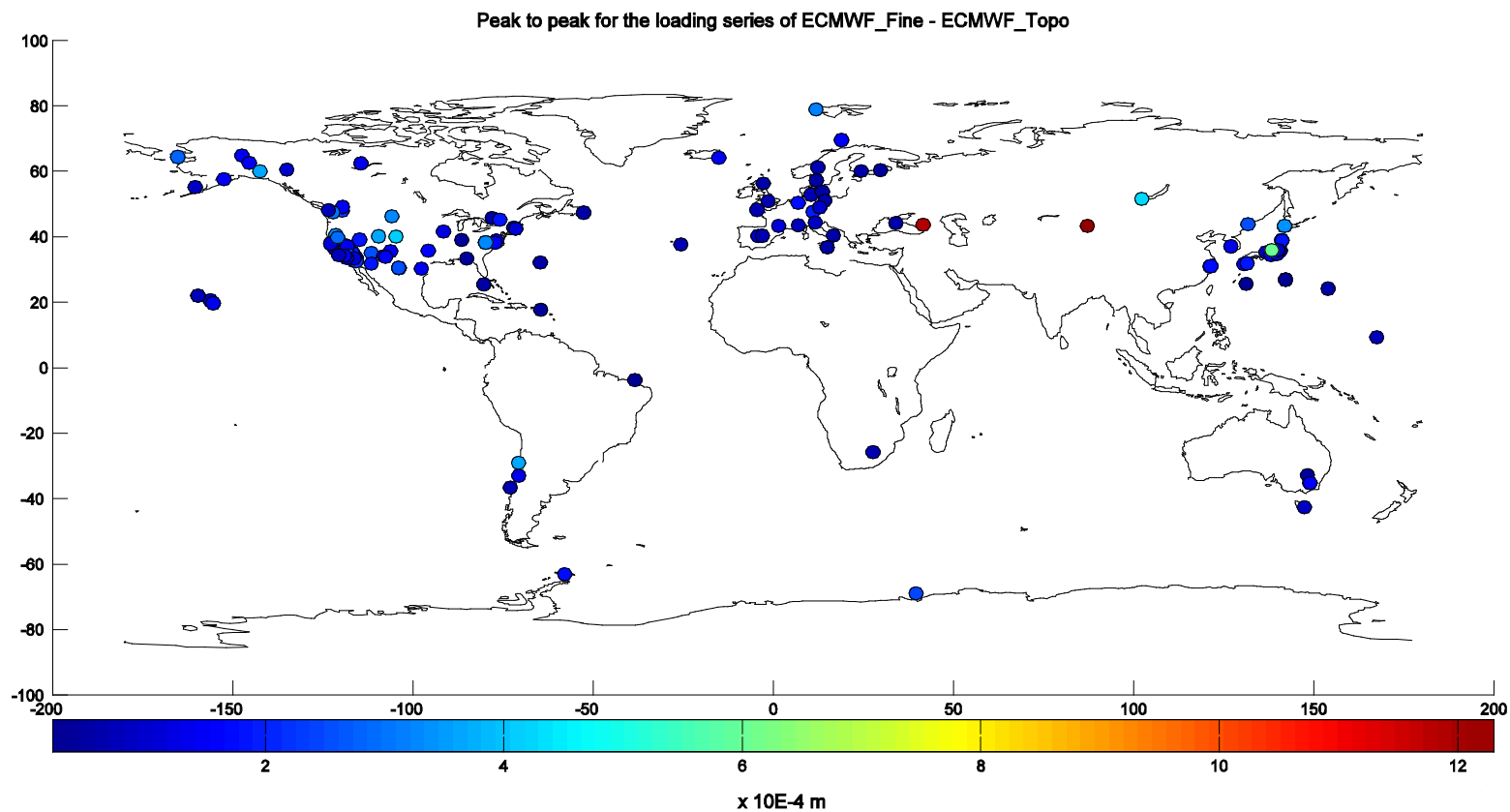


Height variation for each 1.5 x 1.5 degree cell (largest - smallest value for the cell)





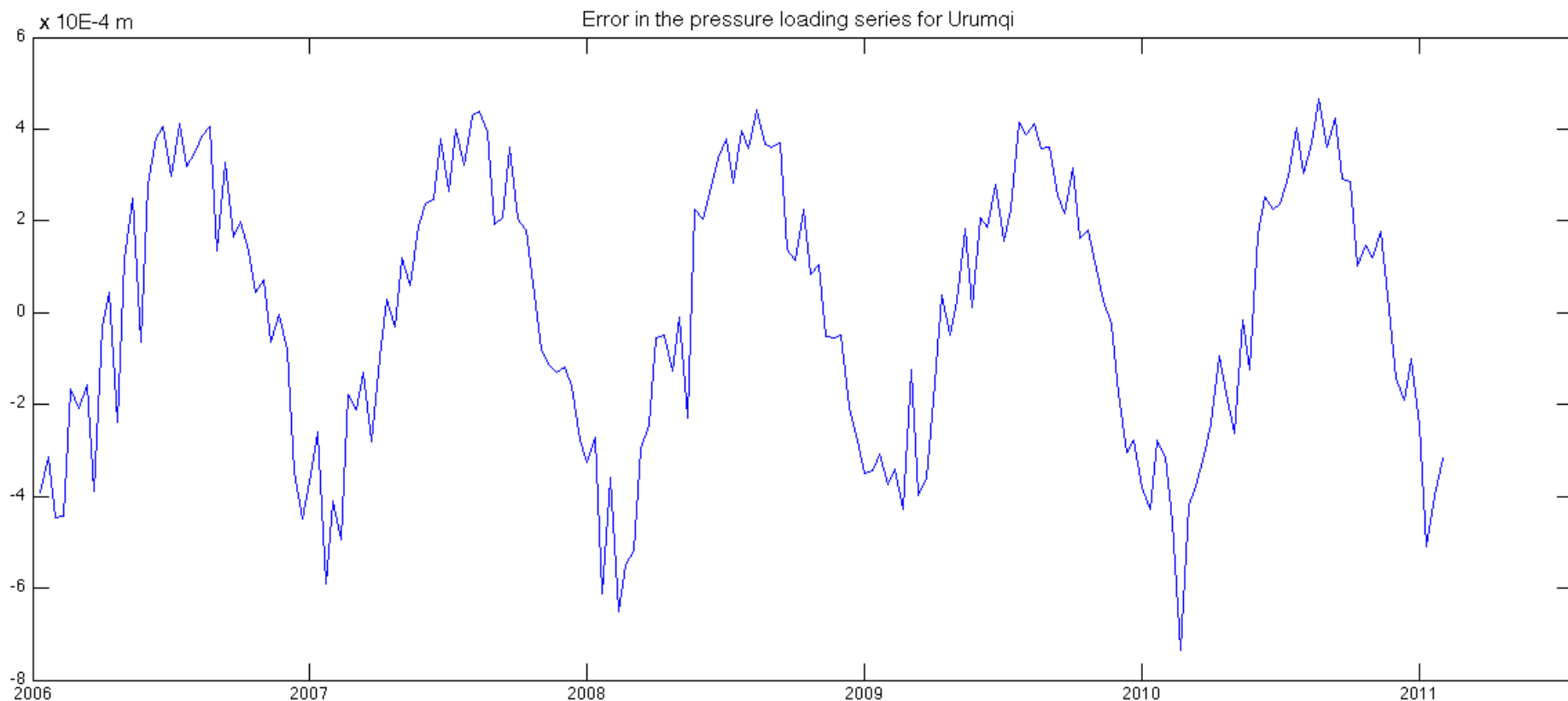
Topography Effect



Peak-to-peak variation of topography effect



Topography Effect



Largest effect at Urumqi: peak-to-peak 1.2 mm



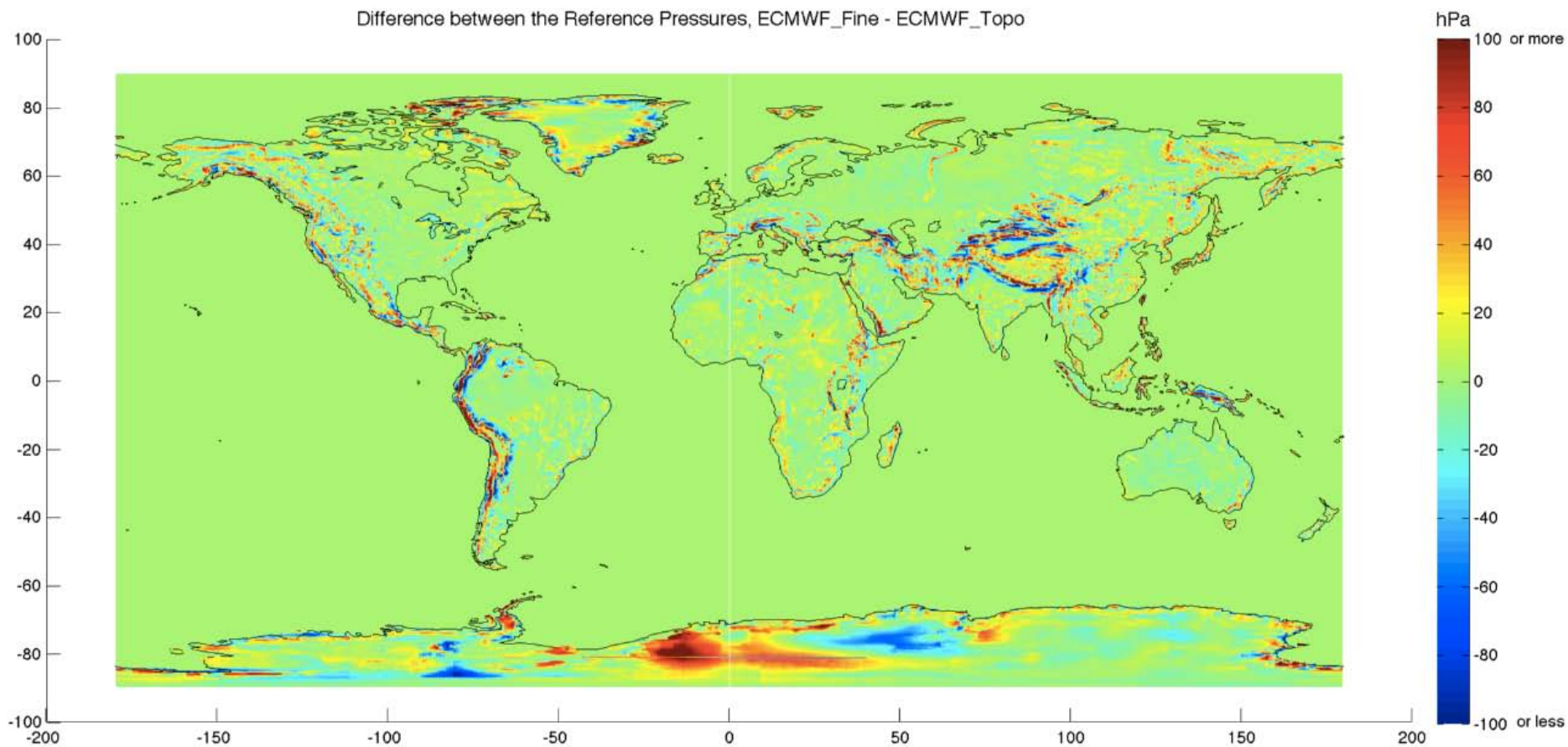
Reference Pressure

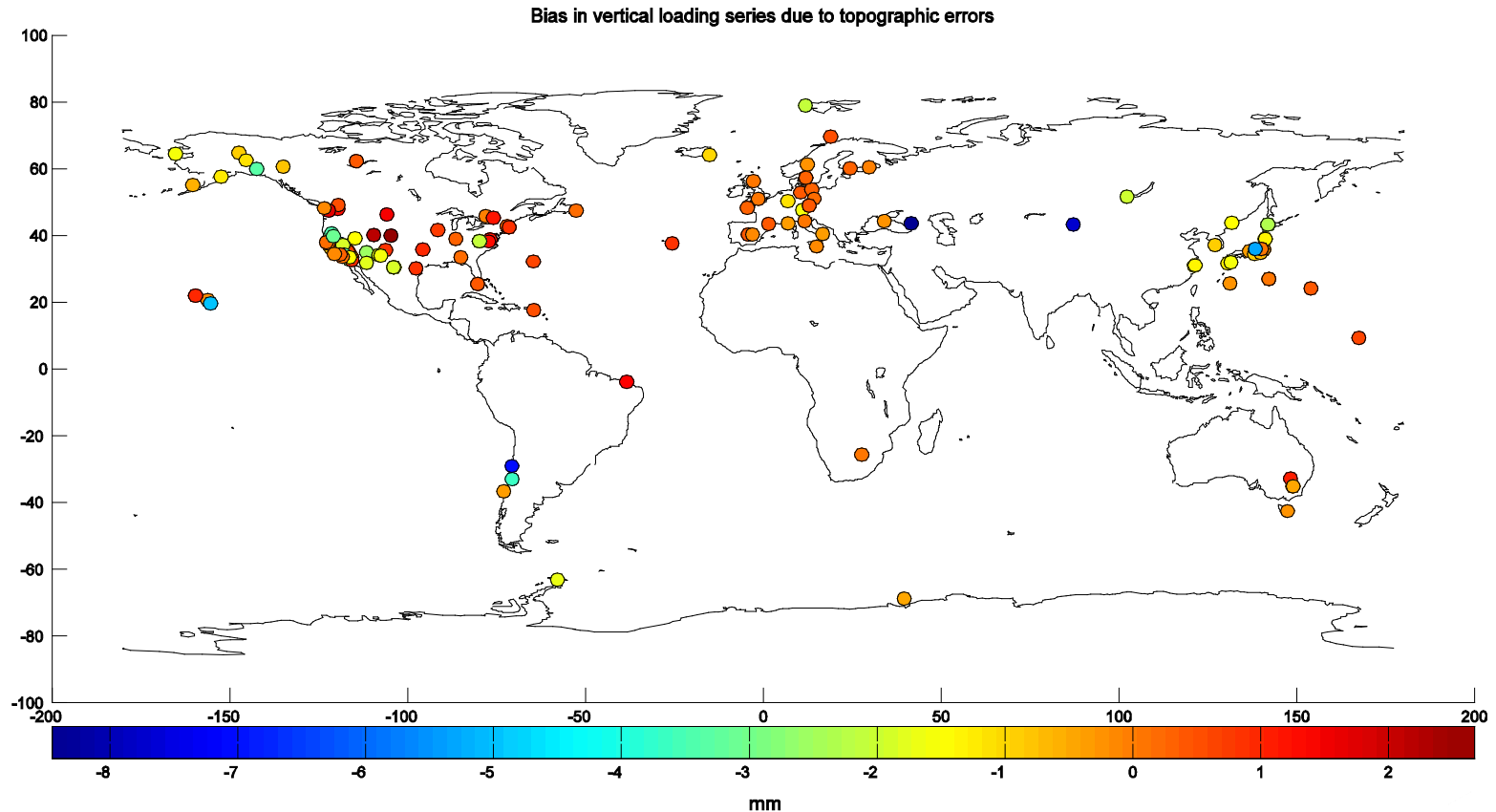


- Calculation of Pressure loading assumes a reference pressure level
- Differences in reference pressure level
=> Biases in station vertical coordinates
- We investigate the bias between two reference pressure fields:
 - (1) ECMWF surface pressure field (averaged over 20 years)
 - (2) ECMWF surface pressure adjusted to ETAPO2 topography surface height (averaged over 20 years)



Reference Pressure





ECMWF surface – Topography surface loading bias

Why shouldn't we just use the reference pressure corresponding to the surface pressure we are using to compute the loading?



Observation vs. Session Level

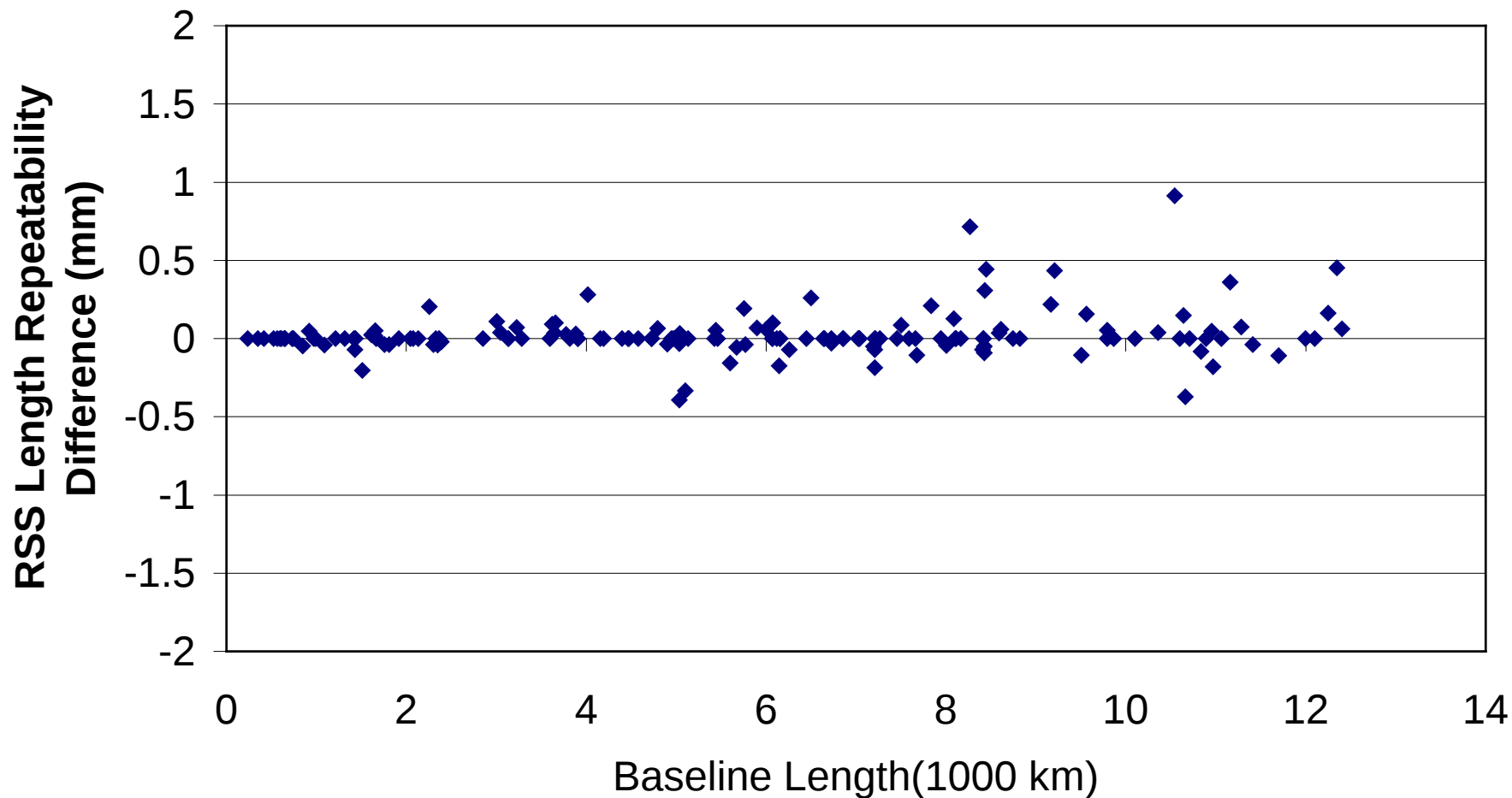


- Variance of geodetic series is reduced if pressure loading correction is applied
- Combination solutions (e.g., ITRF2005, ITRF2008) required technique input to neglect pressure loading since not all techniques apply it.

Question: Does observation level correction reduce WRMS scatter of geodetic series more than a daily-average (24-hour session average for VLBI) correction?

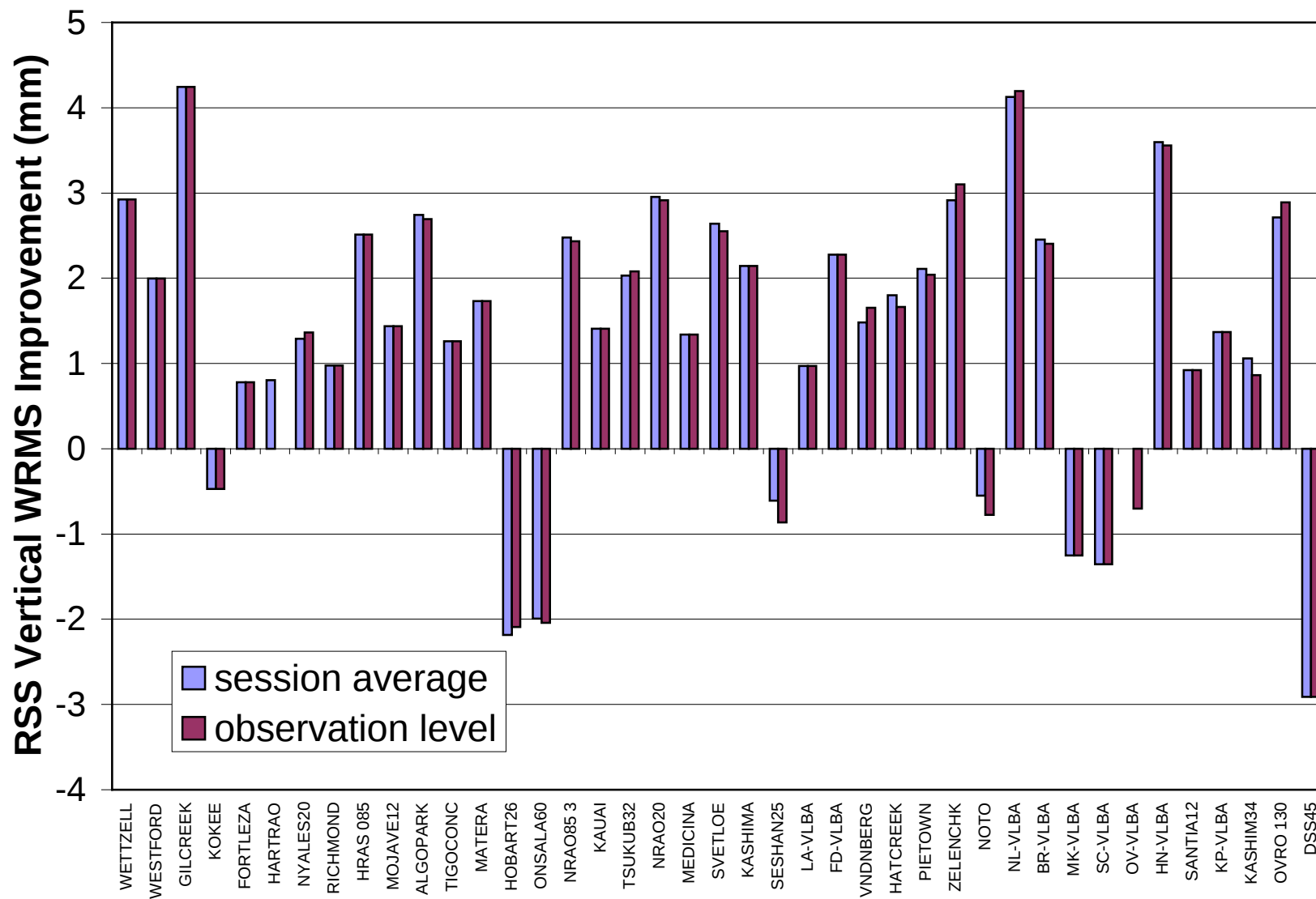


Observation Level - Session Average





Nontidal Pressure Loading





Conclusions



- Vertical loading effect of topography variation (0.25 deg) within ECMWF cells less than 0.5 mm most VLBI sites and at most 1.2 mm peak-to-peak
- Reference pressure for convolution loading calculation should be the mean (say 20-year) of pressure on the surface (NWM or topography corrected).
- In general, observation level nontidal correction does not reduce baseline length and UEN site coordinate RMS scatter by more than the 24-hour average correction
 - a few exceptions need to be investigated
- S1 and S2 tidal models have to be applied at the observation level
- NNT/NNR conditions must be applied after the 24-hour average correction is applied