

Biases caused by different models for the neutral atmosphere delays in VLBI, GPS, and DORIS analysis



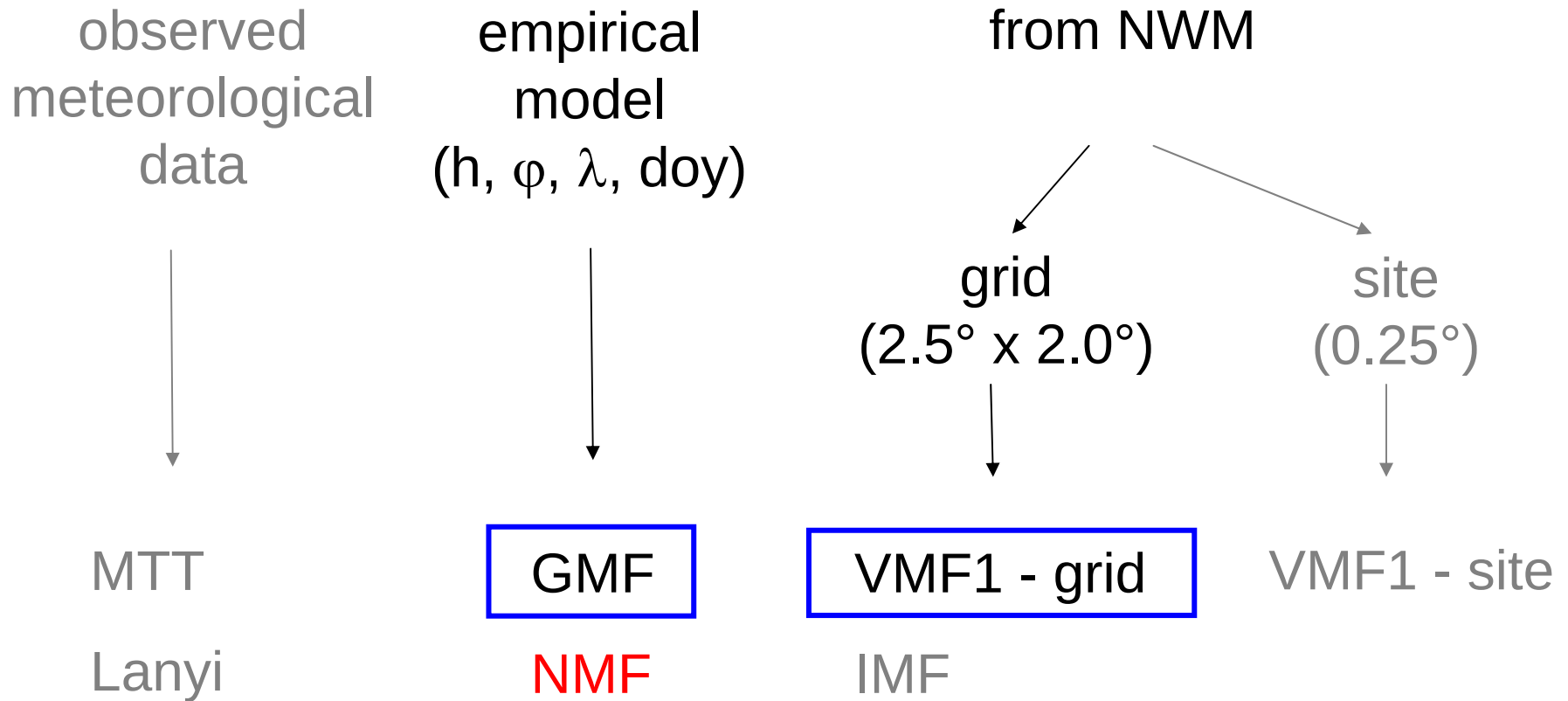
Johannes Böhm

Unified Analysis Workshop, 5-7 December 2007, Monterey

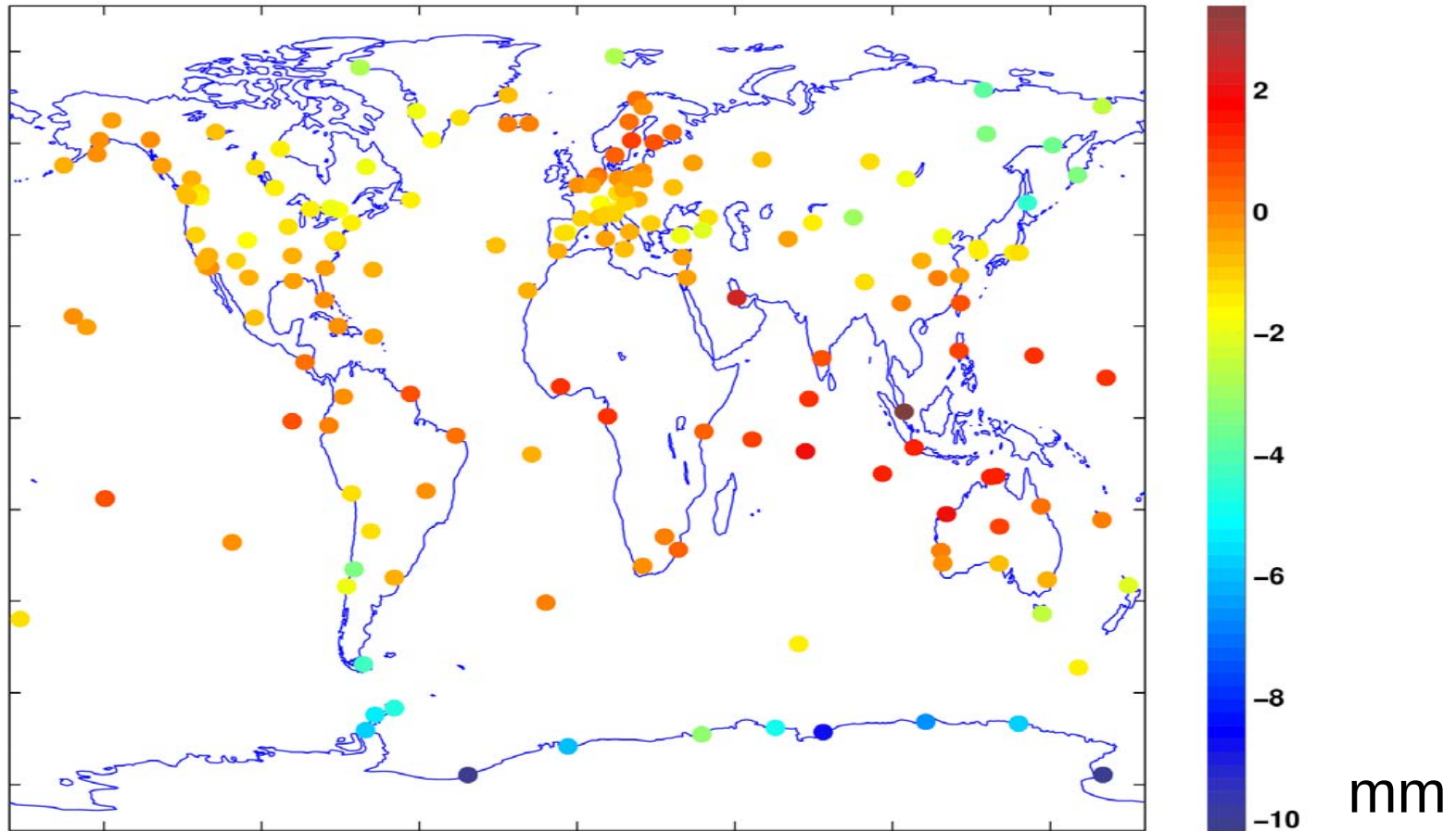
Troposphere delay modelling

$$D_L(e, a) = m_h(e) \cdot D_{hz} +$$
$$\boxed{} m_w(e) \cdot D_{wz} +$$
$$\boxed{m_g(e)} \cdot [\boxed{G_N} \cdot \cos(a) + \boxed{G_E} \cdot \sin(a)]$$

Mapping functions

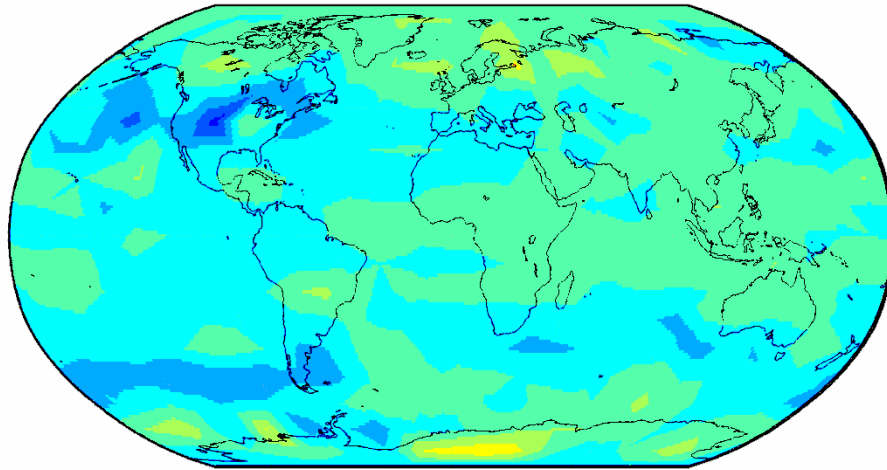


Height biases NMF vs. VMF1 - Grid

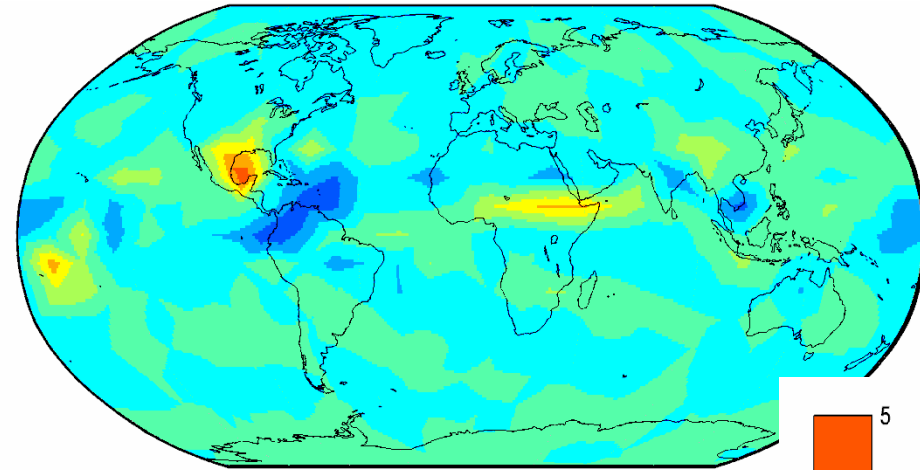


Steigenberger et al. (GPS reprocessing 1994 – 2005)

Height bias GMF vs. VMF1 - Grid



hydrostatic



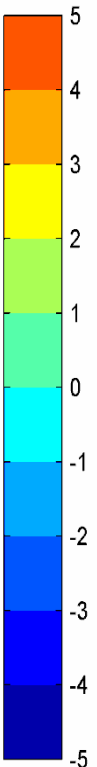
wet

Biases due to

- resolution of GMF (SH 9x9)
- time period

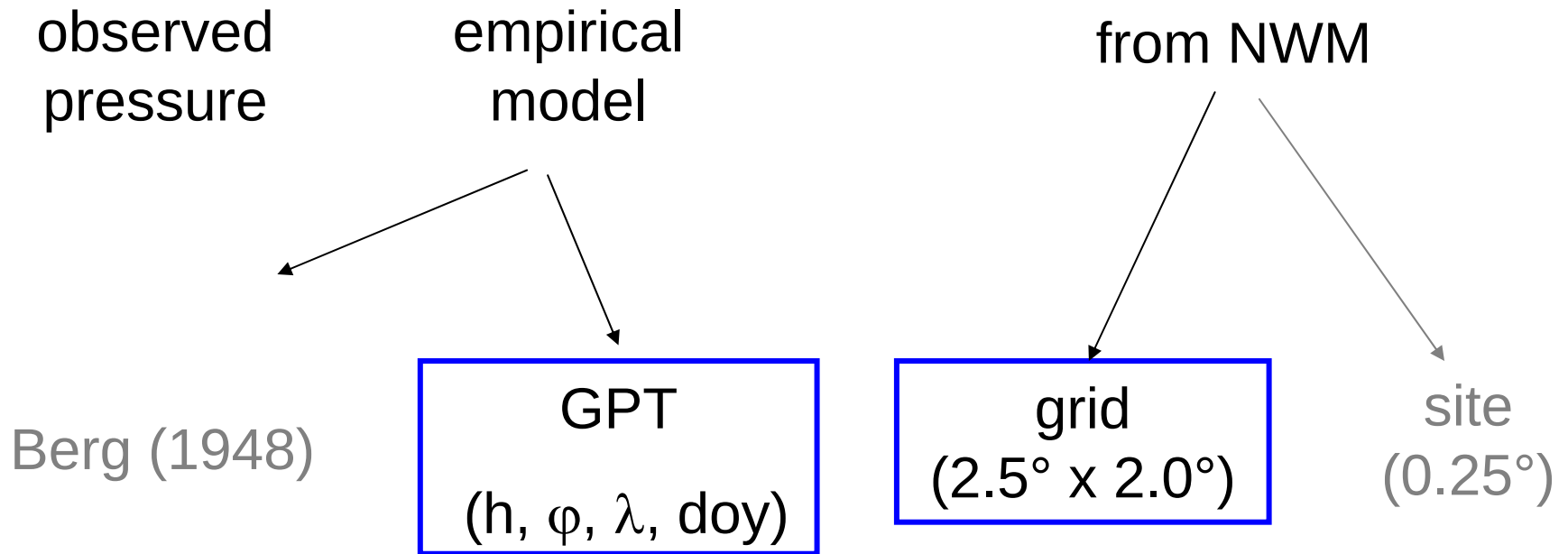
Rule of thumb

mm

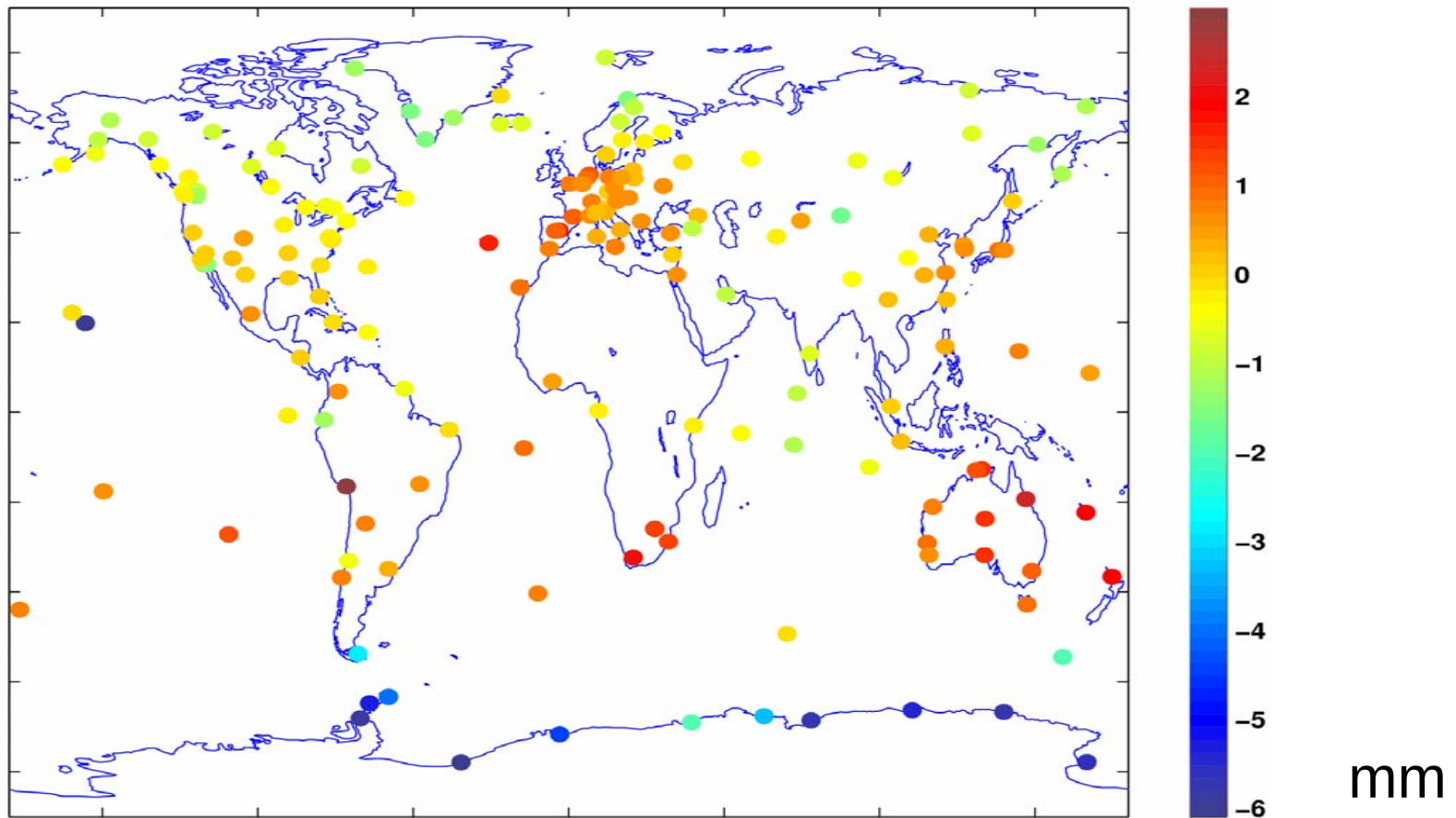


A priori hydrostatic zenith delays

(can be determined from pressure values at the sites)

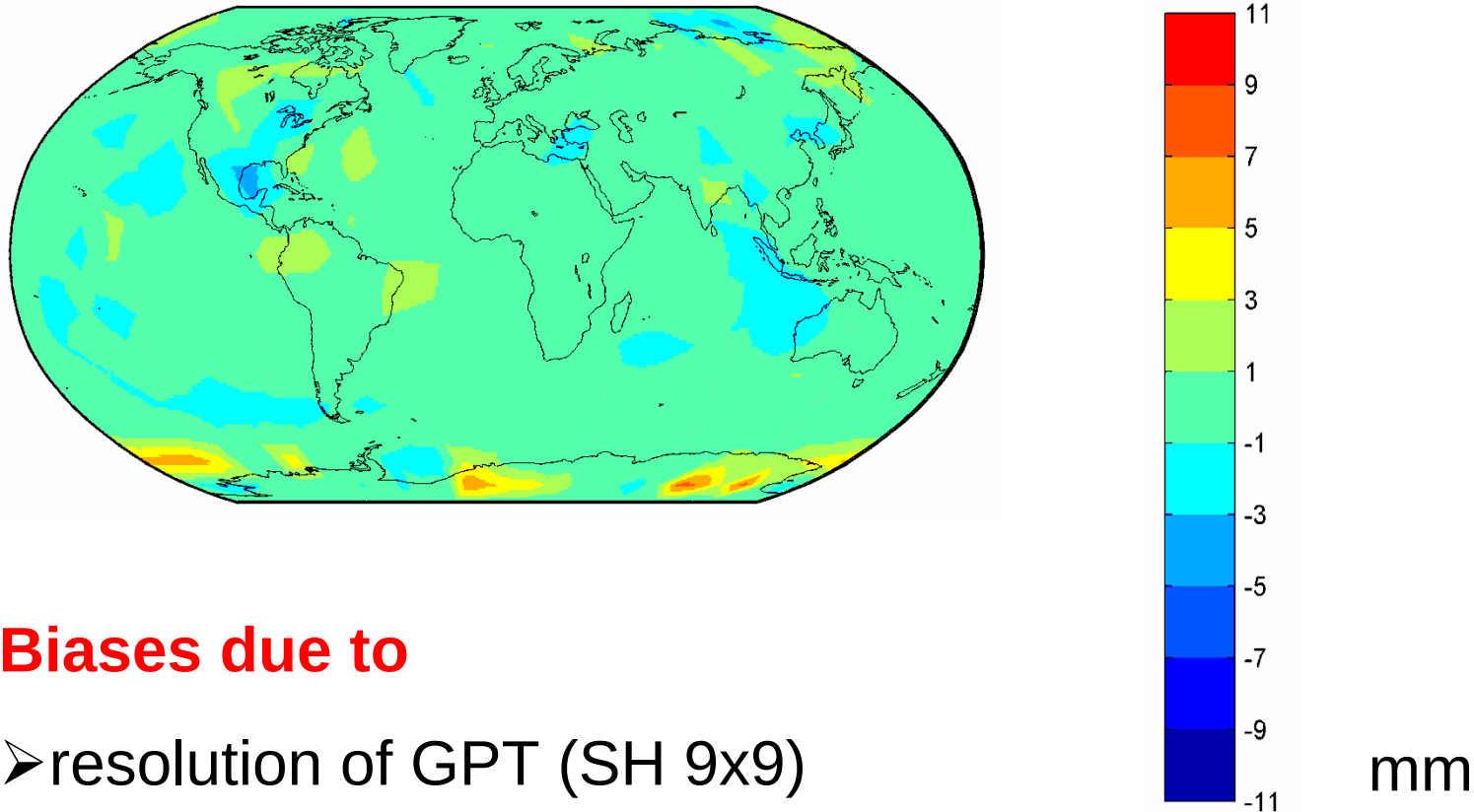


Height biases Berg vs. ECMWF grid



Steigenberger et al. (reprocessing 1994 – 2005)

Height biases GPT vs. ECMWF grid



Biases due to

- resolution of GPT (SH 9x9)
- time period

Rule of thumb

A priori wet zenith delays

- ❑ ... do not introduce biases (if mapped with the wet mapping function)
- ❑ ... could be useful for GPS ambiguity resolution
- ❑ ... not used in VLBI analysis
- ❑ ... might ask for different constraints

- ❑ Could be determined from
 - meteorological sensors
 - NWM grids (e.g. ECMWF)
 - GPT (plus humidity)

Troposphere gradients

- ❑ Troposphere gradients have to be estimated in GPS and VLBI analysis. (DORIS?)
- ❑ There is a clear correlation with horizontal station components (e.g. detection of erroneous local ties by Krügel et al. 2007).

Gradient mapping function

- ▣ Needs to be identical for combination at normal equation level.

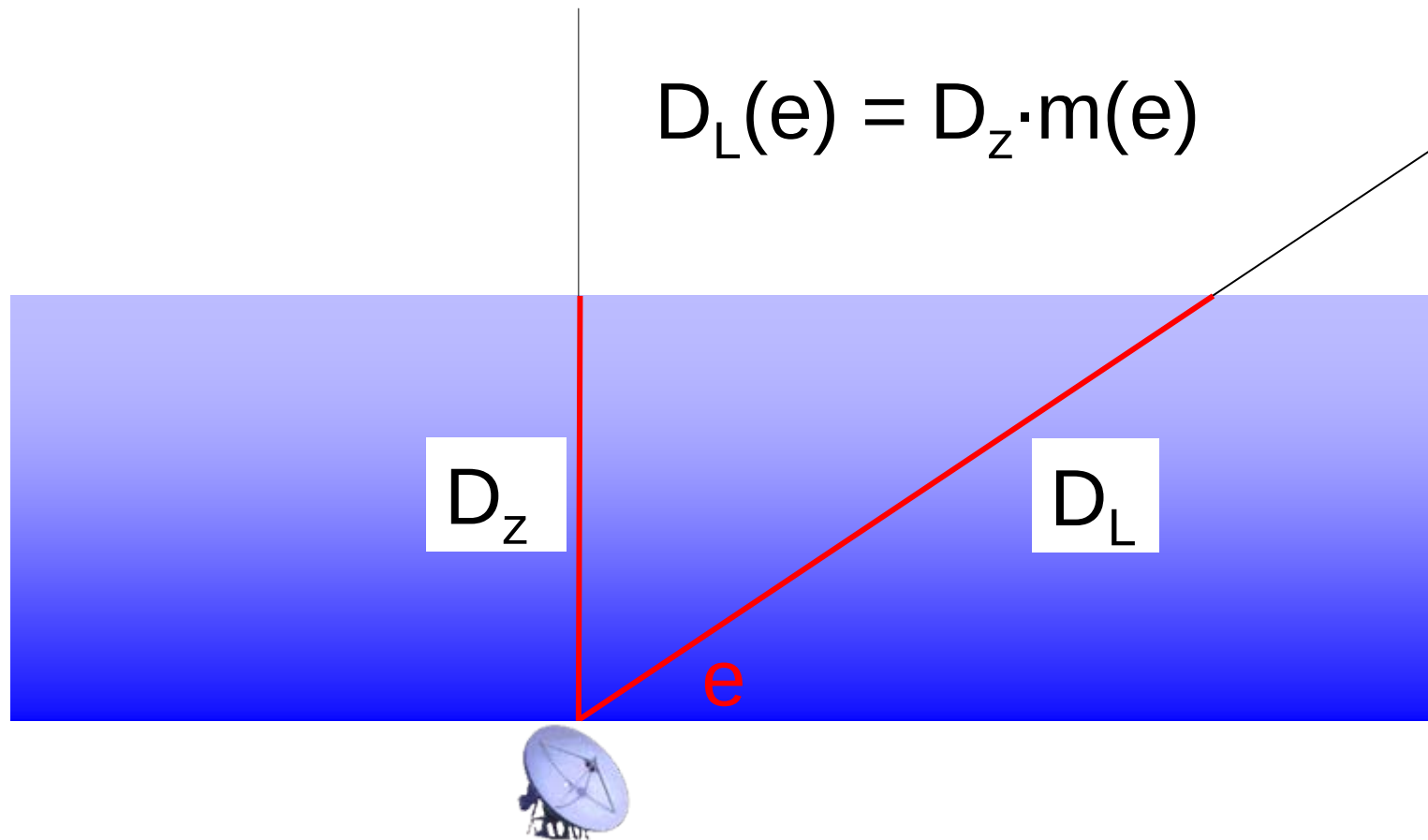
A priori gradients

- e.g. as used by GSFC (Dan MacMillan)
- There is an impact on estimated radio source coordinates (because of the constraints on the a priori source coordinates).
- There is a rather small impact on horizontal components of estimated station positions.

Remarks

- ❑ It might not be possible to use the best models available for a combined troposphere right from the start.
- ❑ There are influences from different cut off elevation angles and down-weighting strategies.
- ❑ VMF1 should be used together with atmosphere loading.
- ❑ Thanks for your attention!

Mapping functions



Mapping function errors

Example: wrong mapping function

