



TECHNISCHE
UNIVERSITÄT
WIEN
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VIE_MOD station corrections

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mod_qu

TRF

ITRF2005 VTRF2005
 ITRF2008 VTRF2008
 Other:

CRF

ICRF Ext 2 ICRF2
 Other:

Ephemerides

JPL 405
 JPL 421

Station corrections

solid Earth tides
 tidal ocean loading FES2004.mat
 tidal atmosphere loading s12_cm_noib_leonid.mat
 non-tidal atmosphere loading
 pole tide
 linear (IERS 2003) cubic (IERS 2010)
 thermal antenna deformation

Pressure and temperature

always GPT External (.trp) file
 use met data from NGS file (GPT only as backup)

A priori troposphere gradients

no model APG (Böhm) DAO (MacMillan)

Mapping function

VM1 GMF

Quality code limit

0

Ionosphere

from NGS external file

Cut-off Elevation angle

0

Outliers

Use outlier file

TRF

c04 05 predefined EOP
 c04 08
 include a priori nutation offsets dX, dY
include high frequency ERP
 ocean tides interpf (Conventions)

Libration

xp,yp (10 terms)
 UT1 (11 terms)




Interpolation

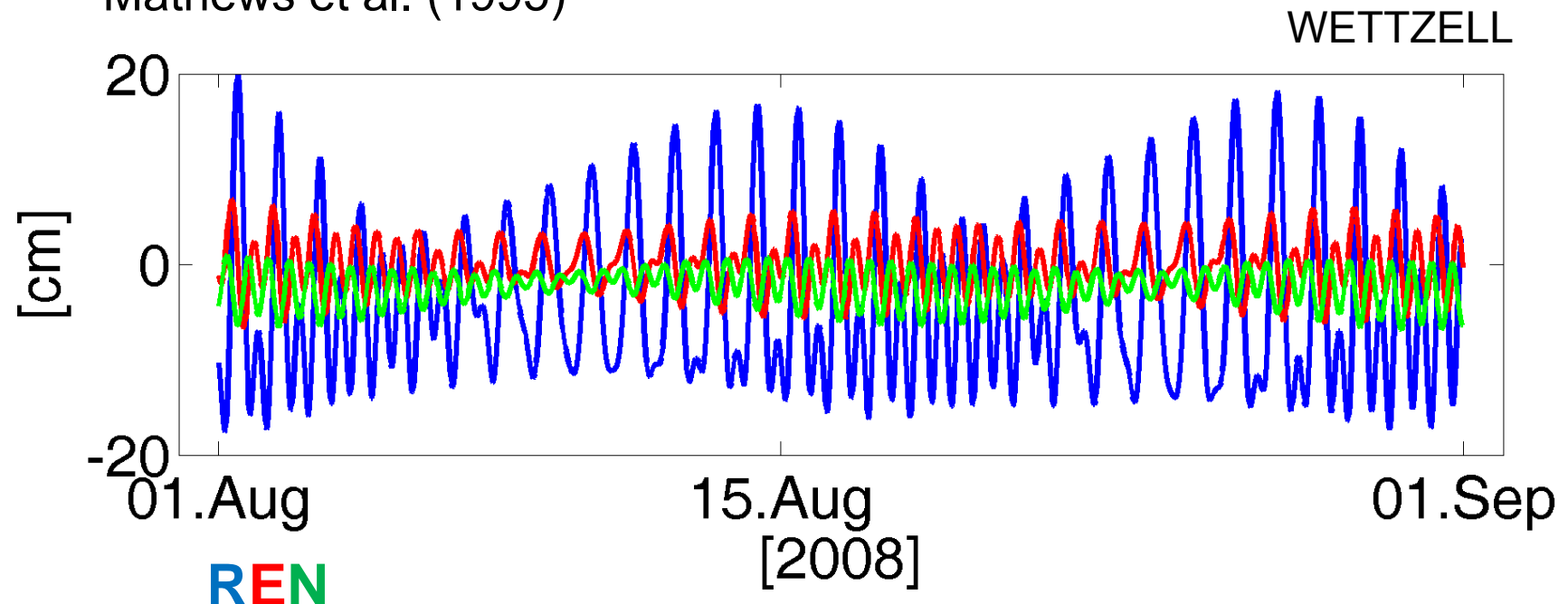
linear lagrange
 Tidal UT variations (Defraigne & Smits)

Precession/Nutation Model

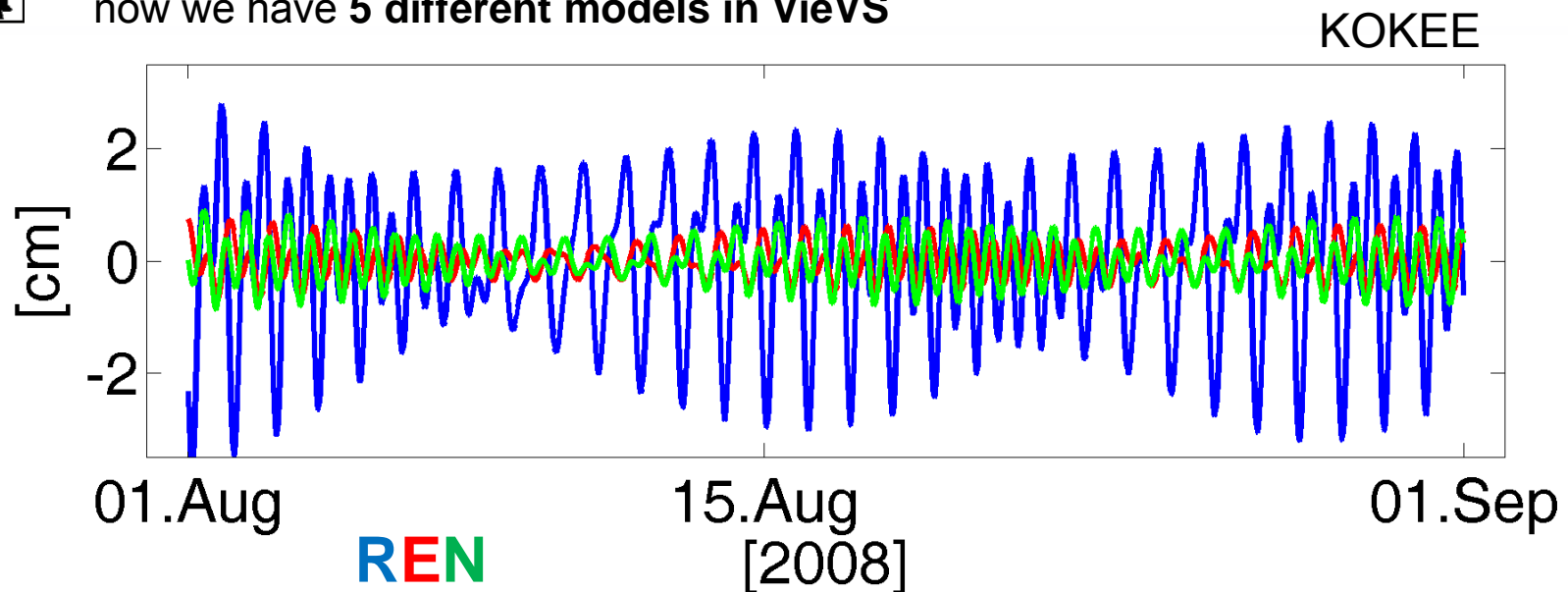
IAU 2000A IAU 2006/2000 A

OK

- 
 caused by gravitational forces of the **Moon and Sun**
- 
 the radial displacement can reach up to **40 cm** during one day
- 
 the site displacement is modelled according to the IERS Conventions 2010 using multiple h and l parametres employed by Mathews et al. (1995)

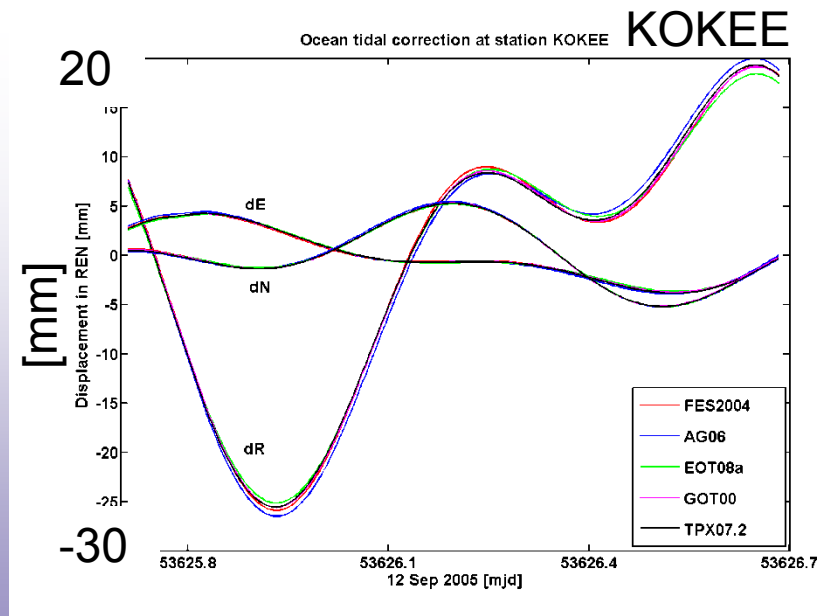
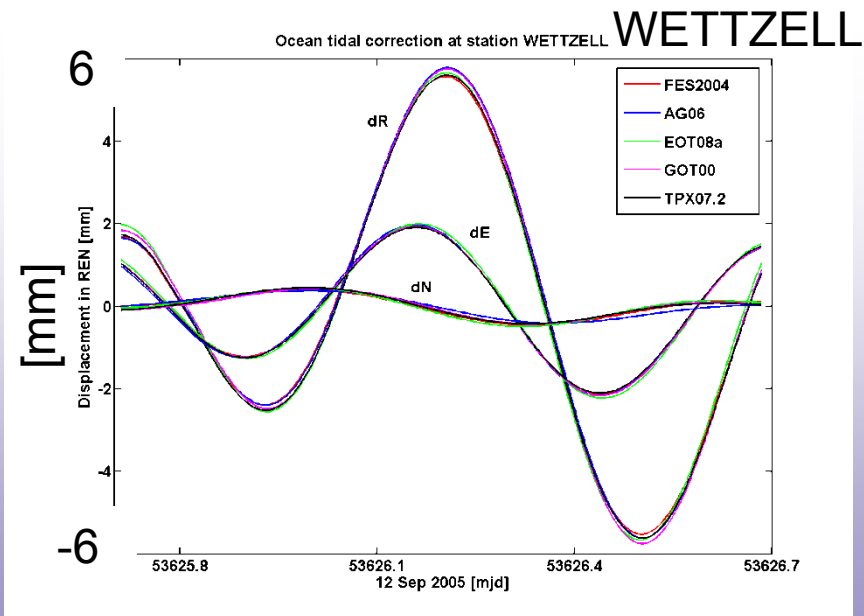


- ▶ ocean tides **redistribute water mass** and cause associated load on the crust - the deformation may reach **10 cm**
- ▶ the external ocean loading files contain site-dependent amplitude and phase of the tidal waves in the REN system
- ▶ the models contain **11 main tidal waves** ($M_2, S_2, N_2, K_2, K_1, O_1, P_1, Q_1, M_f, M_m, S_{sa}$)
- ▶ **Conventional IERS 2010** method for computing of the displacement is an implementation of **342 lesser tides** whose amplitudes and phases are found by **spline interpolation** of the tidal admittances based on the 11 main tides (fortran program is provided by D. Agnew)
- ▶ now we have **5 different models in VieVS**



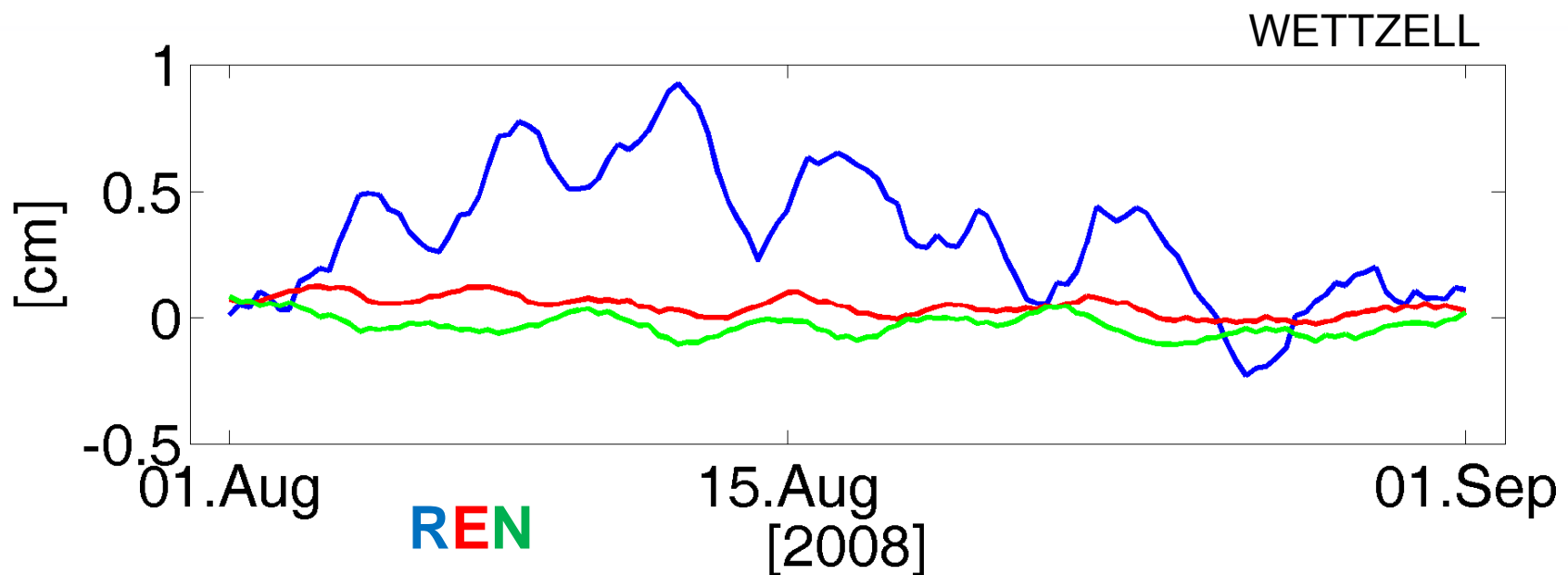
Tidal Ocean Loading (comparison)

model	reference	input	resolution
TPX07.2	Egberg et al. (2002)	inverse hydrodynamic solution from T/P altimetry+GRACE	0.25° x 0.25°
GOT00	Ray (1999)	T/P	0.5° x 0.5°
FES2004	Letellier (2004)	numerical model	0.125° x 0.125° DEFAULT
EOT08a	Savcenko et al. (2008)	Multi-mission altimetry	0.125° x 0.125°
AG06	Andersen (2006)	Multi-mission altimetry	0.5° x 0.5°

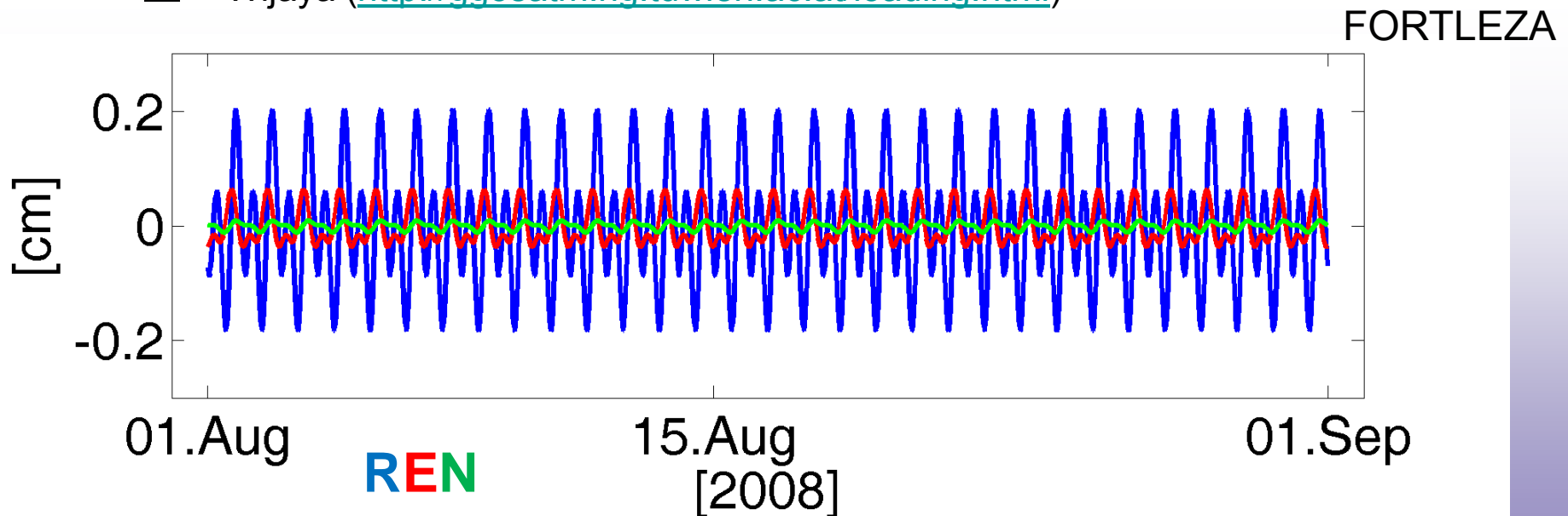


VieVS/ATM/

- ▣ caused by pressure changes due to **air mass movements**
- ▣ at mid-latitude stations are possible vertical crustal displacements of up to **25 mm**
- ▣ we use atmosphere pressure loading time series with a **6 hour resolution** provided by Goddard VLBI group which are available on the Web at <http://gemini.gsfc.nasa.gov/aplo> (Petrov & Boy, 2004)
- ▣ external file contains: station, time, deformation in REN system

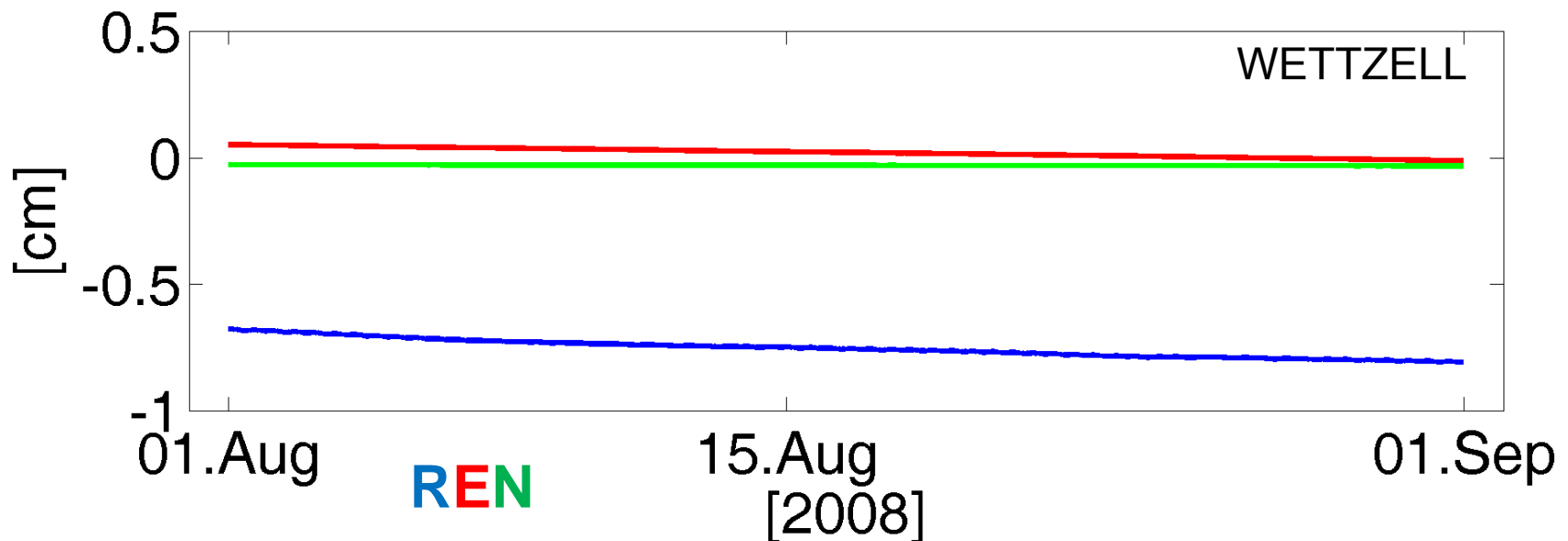


- ▶ caused by **diurnal heating of the atmosphere** (→ surface pressure oscillations → periodic motions of the Earth's surface)
- ▶ the displacement is modelled with **two tidal waves, S1 and S2**
- ▶ external file with cosine and sine components for the Up, North, East deformation
- ▶ **3 models in VieVS**
 - ▶ Petrov (http://gemini.gsfc.nasa.gov/aplo/aplo_s1_s2_noib_1.0x1.0deg.nc)
 - ▶ van Dam (<http://geophy.uni.lu/ggfc-atmosphere/tide-loading-calculator.html>)
 - ▶ Wijaya (<http://ggosatm.hg.tuwien.ac.at/loading.html>)



Pole tide

- ▶ caused by variations in the geocentric position of the Earth's rotational axis → **variation in the centrifugal potential**
- ▶ the variation of station coordinates can amount to a couple of **centimeters**
- ▶ the instantaneous pole coordinates are corrected for a secular wander of the mean pole
- ▶ in **Conventions 2003** was the mean pole path approximated by **linear model**, in **Conventions 2010** is a **cubic model** (valid till 2010) derived by the IERS Earth Orientation Centre and a linear model for extrapolation after 2010
- ▶ the displacement vector due to a change in the centrifugal potential is obtained using Love numbers appropriate to the frequency of the pole tide ($h=0.6027$, $l=0.0836$)





Thank you for your attention!