

# Model and analysis standards

Laurent Soudarin, Hugues Capdeville (CLS)  
Jean-François Crétaux, Jean-Michel Lemoine (CNES)

GINNS/DYNAMO software (GRGS)

Since Jan. 2007, 1 processing for 2 objectives

- CRC/GRGS
  - Common standards for GPS, SLR and VLBI
  - Weekly combined NEQ (weekly station coordinates, 6h EOP, tropospheric bias per pass)
- IDS
  - Weekly combined solutions in free-network (weekly station coordinates, daily EOP)

# Models and corrections (1)

- Gravity field = EIGEN\_GL04S\_ANNUAL → EIGEN\_GL04S, w/o annual and semi-annual terms?
- Tidal forces :
  - Solid earth: model of IERS2003 conventions
  - Ocean: FES2004 (with admittance)
  - Atmosphere: Biancale&Bode
- Atmospheric gravitational attraction: computed from 6h ECMWF 3D pressure grids over land, inverted barometer model over the ocean
- Atmospheric density = DTM94
- Solar radiation pressure:
  - albedo +IR pressure values interpolated from 6-hour grids from ECMWF
- Satellite Center of Mass – Antenna Phase Center: applied from CDDIS data files
- Satellite physical model = IDS → UCL models?

## Models and corrections (2)

- Station displacements:
  - atmospheric loading= from 6h ECMWF 3D pressure grids
  - ocean loading= Amplitudes and phases from FES2004
  - Solid earth : Wahr model (IERS Conventions 2003)
  - Pole tide : applied (IERS, 2003)
- Troposphere:
  - Dry and wet a priori ZTD interpolated from 6-hour grids derived from ECMWF meteorological model (available from 2002)
    - DORIS met data or GPT for data before 2002?
  - Mapping function: Guo & Langley
    - Horizontal gradients?
    - Estimated coefficients of the mapping function (study in progress)?

- EOP: a priori IERS04 polar motion  
no polar rate, no UT1 rate

→ estimate Polar rate? UT1 rate?

- Arc lengths: 3.5 days → 1 day ?

# History of the new processing configuration

Data: 2002 to current

period	start	end	# conf.	series	satellite	# GINS version	earth gravity model	oceanic response	atmospheric tide
2	02/01/05	30/09/06	conf3	conf3	Spot-2,-4,-5,Jas,Env	7.1	EIGEN-GL04S	MOG2D	Haurwitz & Cowley
3	01/10/06	28/02/07	conf4	CRC07a	Spot-2,-4,-5	7.2	EIGEN-GL04S_ANNUAL		
				CRC07A	Jas,Env	7.2d1			
4	28/02/07	28/07/07	conf5	CRC07c	Spot-2,-4,-5,Jas,Env	7.2d1		IB	
5	29/07/07	08/12/07	conf6	CRC07d	Spot-2,-4,-5,Jas,Env	7.2d1			
1	06/01/02	01/01/05	conf6	CRC07e	Spot-2,-4,-5,Jas,Topex	7.2d1			
				CRC07E	Env	7.2d2			
6	09/12/07	...	conf7	CRC07f	Spot-2,-4,-5,Jas,Env	7.2d2			Biancale & Bode

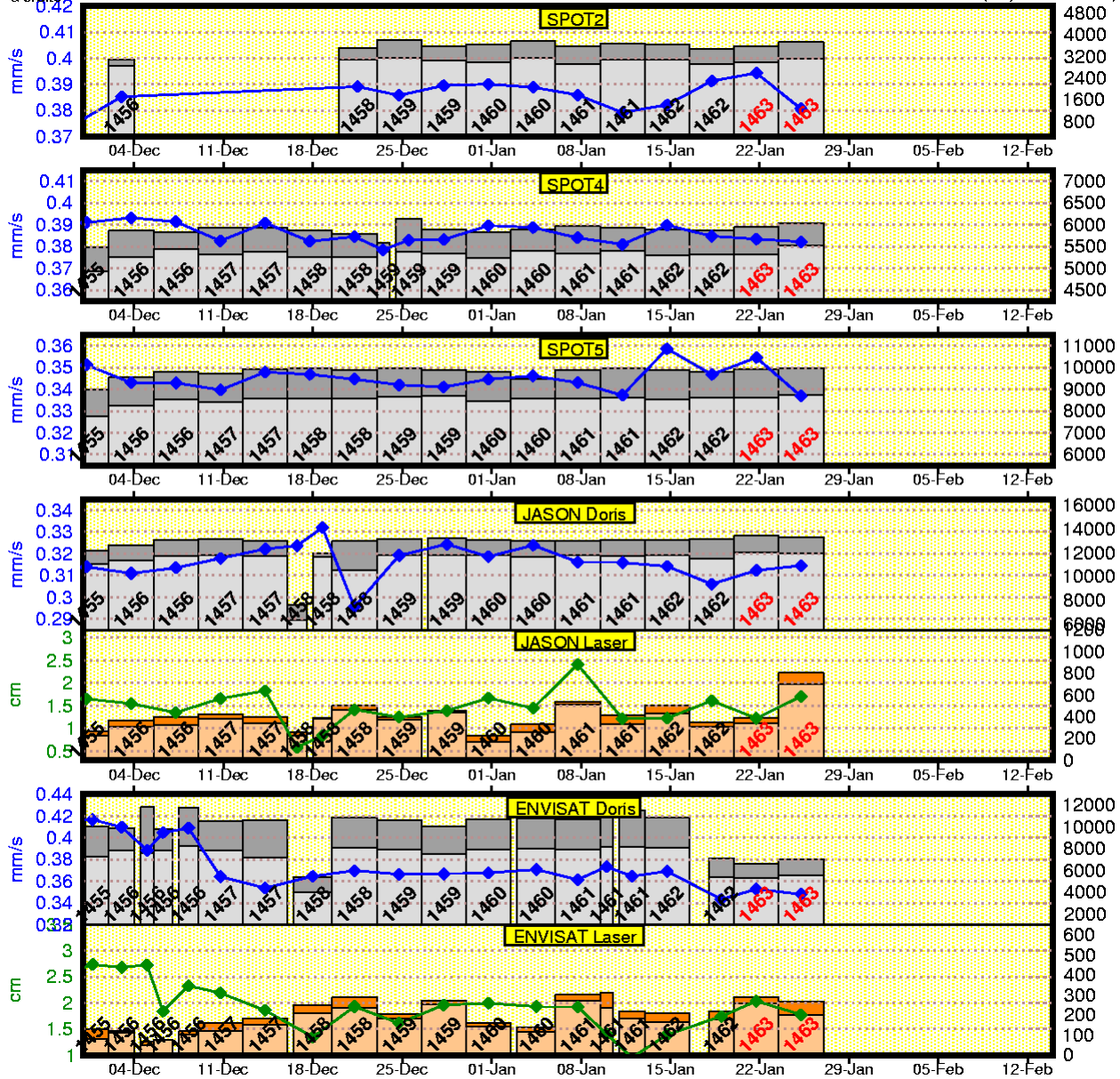
- switch conf5/conf6: minor evolution (name of ocean loading file)
  - CRC07e = CRC07d but w/o arc margins
  - GINS 7.1 and 7.2d1: wrong version for Envisat attitude model
- Envisat 02/01/2005-08/12/2007 should be reprocessed with GINS 7.2d2

RMS des restitutions d'orbite

# Statistiques Orbitales

■ manoeuvre d'inclinaison   
 ■ manoeuvre plan   
 ■ ARC arcs traités depuis dernière semaine

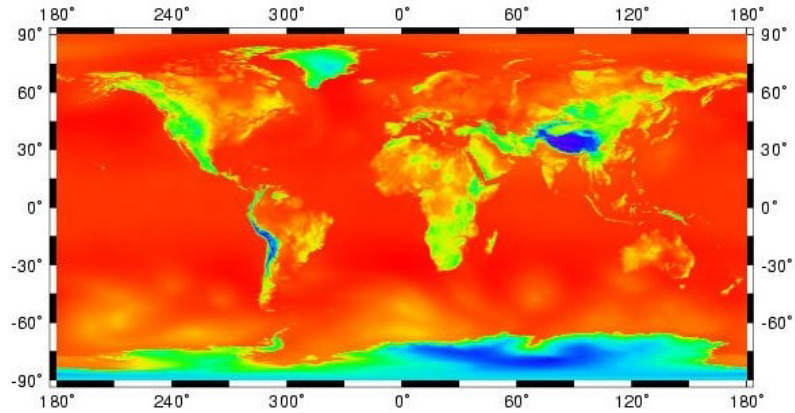
Nbr de mesures tot. et valid. par jour (moyenne sur l'arc)



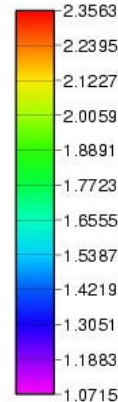
Dry

Allongement troposphérique sec (ECMWF)

15/08/2006 H00



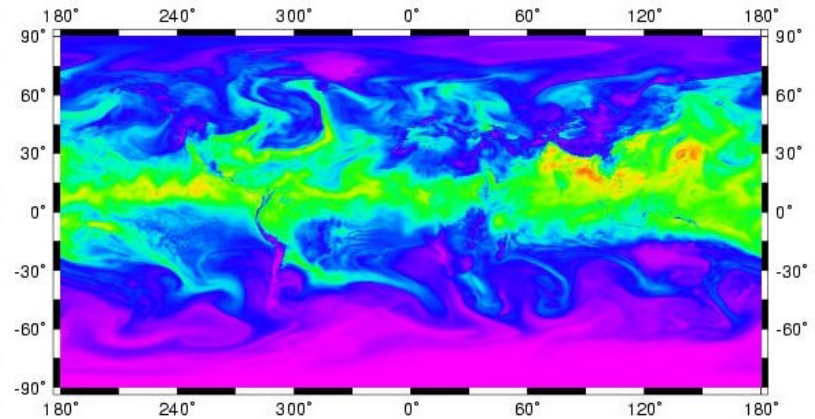
Legende [m]



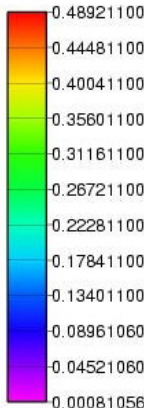
Wet

Allongement troposphérique humide (ECMWF)

15/08/2006 H00



Legende [m]



$$f(\Phi) = \frac{1 + \frac{a_1 + a_2 \cdot z + a_3 \cdot \cos(\varphi)}{1 + \frac{b}{1 + c}}}{\sin(\Phi) + \frac{a_1 + a_2 \cdot z + a_3 \cdot \cos(\varphi)}{b}}$$

$$\sin(\Phi) + \frac{b}{\sin(\Phi) + c}$$

Dry function

a1=1.18972  
a2=-0.026855  
a3=0.10664  
b=0.0035716  
c=0.082456

Wet function

a1=0.61120  
a2=-0.035348  
a3=0.01526  
b=0.0018576  
c=0.062741

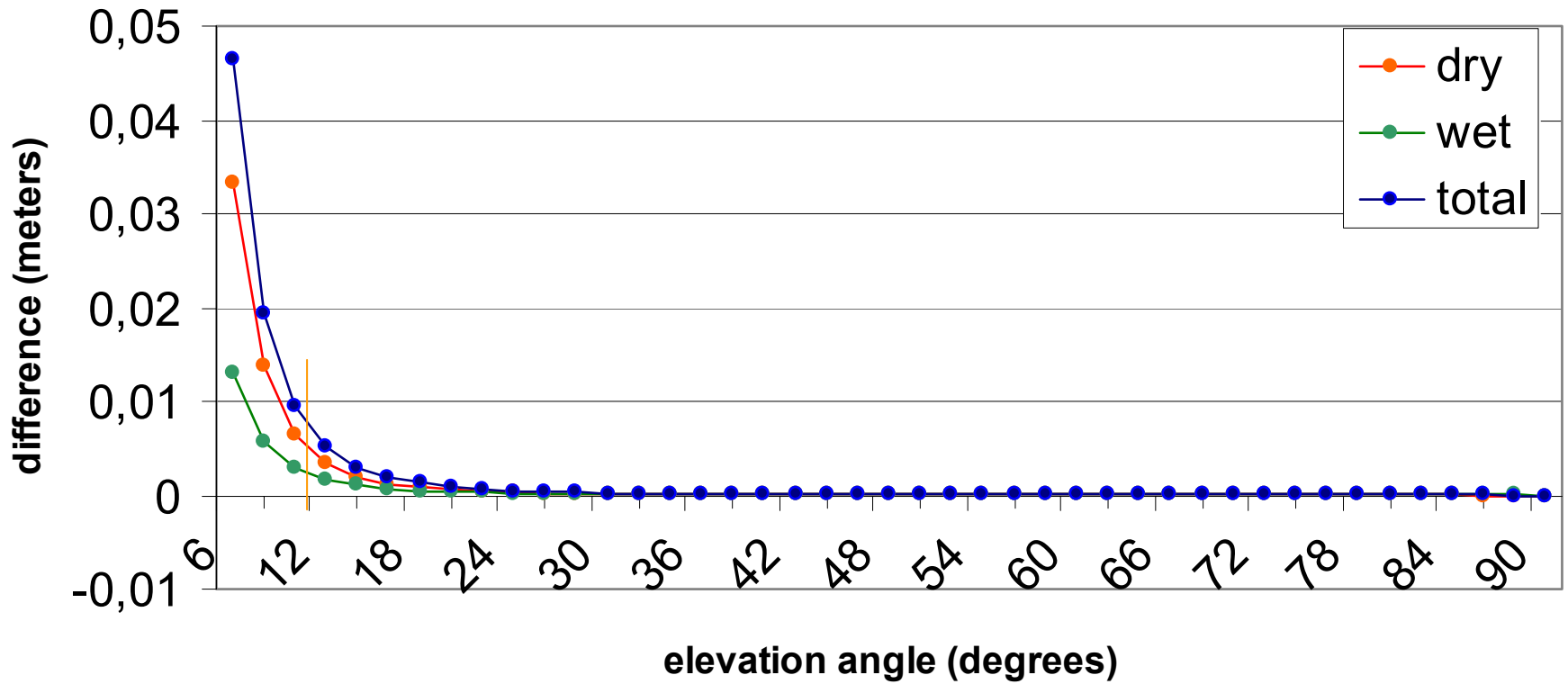
Guo. J. and R.B. Langley (2003), *A new tropospheric propagation delay mapping function for elevation angles down to 2°*.

Proceedings of ION GPS/GNSS 2003, 16th International Technical Meeting of the Satellite Division of the Institute of Navigation, Portland, OR, 9-12 September 2003; pp. 376-386

[gauss.gge.unb.ca/papers.pdf/iongpsgnss2003.guo.pdf](http://gauss.gge.unb.ca/papers.pdf/iongpsgnss2003.guo.pdf)

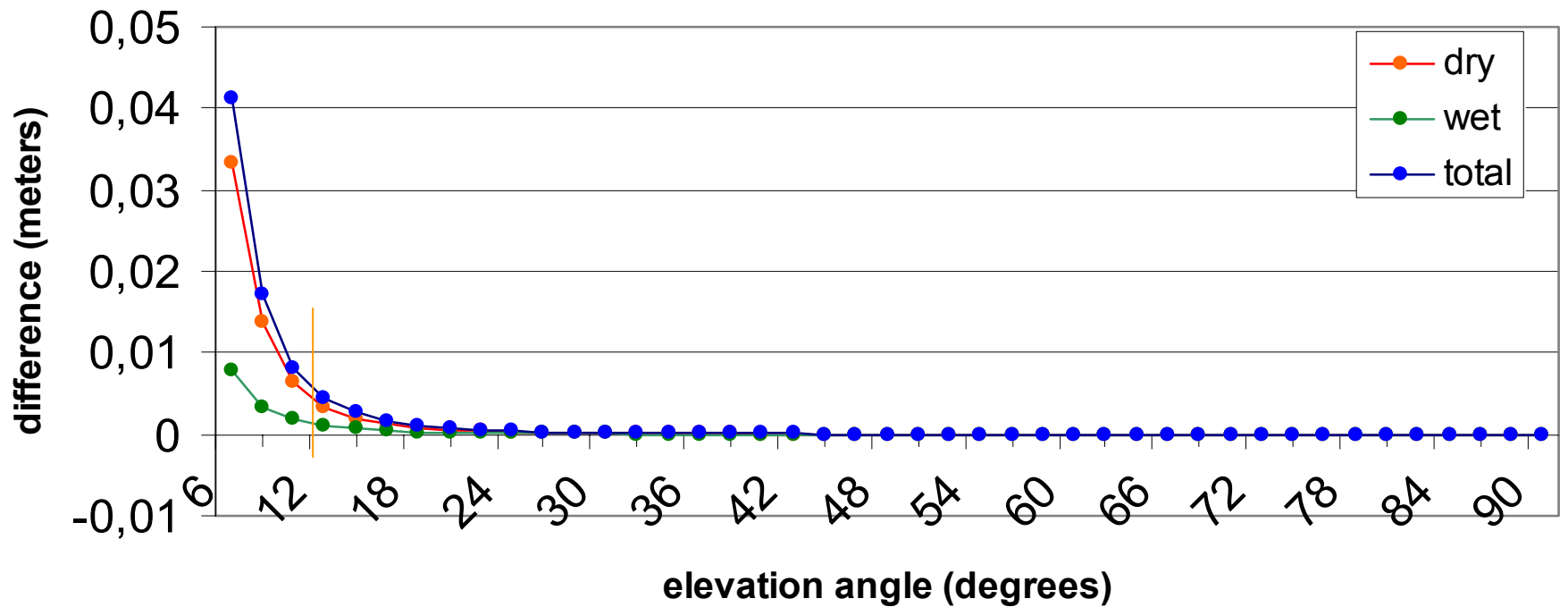


# Tropospheric delay differences between GMF and Guo&Langley's mapping function



ZTD  $\Delta L^z_d = 2.239$  m  $\Delta L^z_w = 0.448$  m

# Tropospheric delay differences between GMF and Guo&Langley's mapping function



ZTD  $\Delta L^z_d = 2.239$  m  $\Delta L^z_w = 0.267$  m