LOD estimation from DORIS data

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Recent IDS EOP products – IGN and INA series

- LOD a priori constraints 3 ms/day
- formal error around 2 ms/day (data from 2013)
- LOD differences relative to IERS C04 at the level of ms

GOP LOD initial testing solution (4 weeks in 2013)

- loose LOD a priori constraints 200 ms/day
- formal error 3.4 ms/day
- Mean 10.5 ms/day, RMS 2.9 ms/day (relative to IERS C04)
- full orbit parameterization including 1-per rev. Harmonics in cross and along track (1 per daily arc)

SLR,GNSS – LOD estimated with accuracy of 0.1 ms/day or better

Hypothesis: LOD could be estimated from the DORIS data with much better accuracy when not adjusting the cross track harmonic acceleration amplitudes.

Time derivative of the ascending node in dependence on the once per revolution periodical acceleration in cross track

$$\dot{\Omega} = \underbrace{F(a, e, i, ..)}_{\pm \text{ constant}} \sin(u)\ W'$$

Beutler (2005)

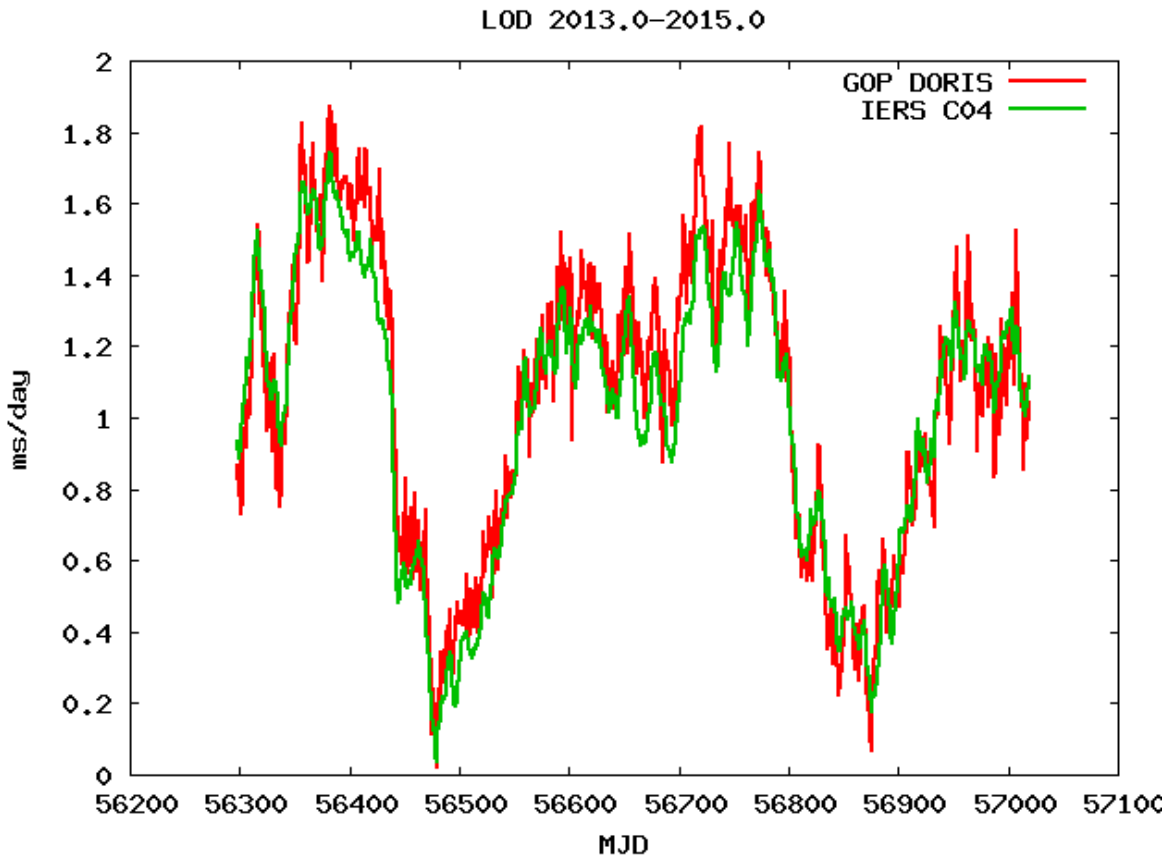
$$W' = C\cos(u) + S\sin(u)$$

Cross track once per revolution acceleration parameterized by „two amplitudes“

$$\sin(u)\ W' = \underbrace{\frac{1}{2} C\sin(2u) - \frac{1}{2} S\cos(2u)}_{\text{Periodical}} + \frac{S}{2}$$

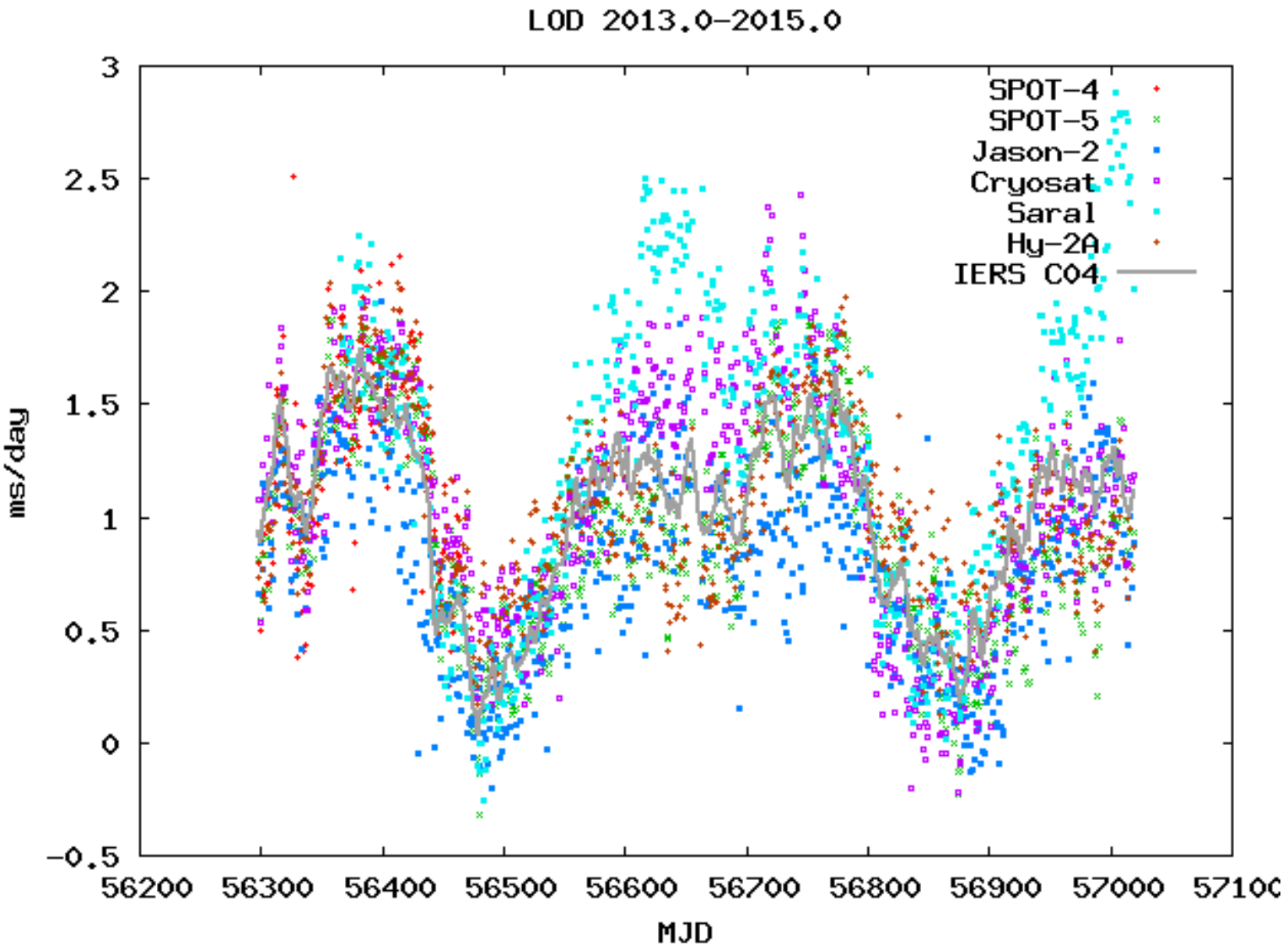
GOP LOD estimation campaign

- Data span 2013.0 – 2015.0
- loose LOD a priori constraints 200 ms/day
- Cross track harmonics not adjusted
- formal error **0.041** ms
- Mean w.r.t. IERS C04 **0.050** ms, RMS **0.116** ms



GOP LOD estimation campaign

• **Single satellite solutions**



Comparison to IERS C04 and formal errors

Solution	Mean (ms)	RMS (ms)	Formal Std. (ms)
DORIS/combined	**0.050**	**0.116**	**0.041**
DORIS/SPOT-4	0.027	0.309	0.164
DORIS /SPOT-5	-0.067	0.230	0.097
DORIS /Cryosat	0.082	0.292	0.096
DORIS /Jason-2	-0.202	0.269	0.146
DORIS /Hy-2A	0.044	0.265	0.099
DORIS/Saral	0.326	0.423	0.097

Annual and semiannual amplitudes

Solution/Amplitude	Annual (ms)	Semiannual (ms)
IERS C04	**0.408**	**0.330**
DORIS/combined	**0.424**	**0.346**
DORIS /SPOT-5	0.447	0.323
DORIS /Cryosat	0.552	0.286
DORIS /Jason-2	0.392	0.228
DORIS /Hy-2A	0.317	0.332
DORIS/Saral	0.812	0.298

Summary and comparison

GOP DORIS LOD estimation w.r.t IERS C04 – Mean 0.050 ms, RMS 0.116 ms

- Combined IDS solution could be more accurate than this initial GOP solution.

- Accuracy of LOD estimation by SLR (GNSS)?

  - Gambis et al. 2006 – SLR accuracy aprox. 0.1 ms, GNSS aprox. 0.25 ms
  - ILRS official product info – ILSR(A) Mean 0.003 ms, RMS 0.47 ms, ILRS(B) Mean -0.003 ms, RMS 0.54 ms
  - Sosnica 2014 SLR (LEO) Mean -0.004 RMS 0.106 ms, SLR (Lageos) Mean 0.006 ms, RMS 0.57 ms, SLR (comb) Mean 0.006 ms, RMS 0.56 ms, GNSS Mean -0.003 ms, RMS 0.38 ms

Thanks for the attention ……..