Next GDR-F POD Standards

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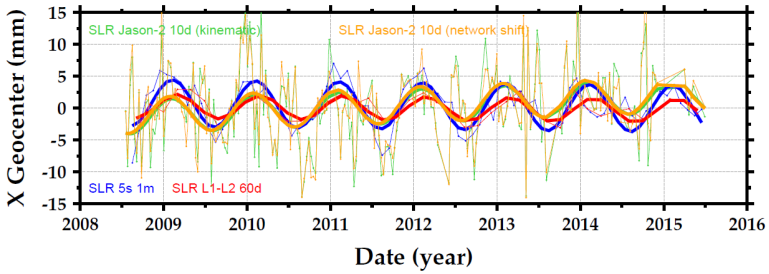
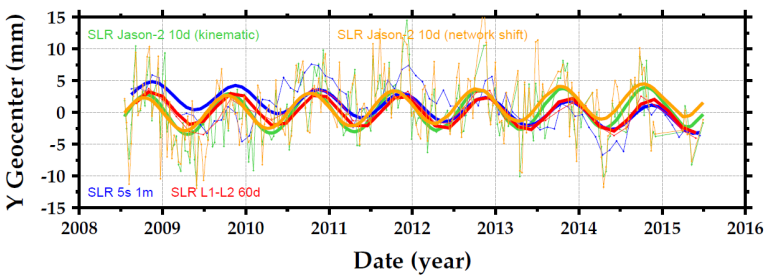
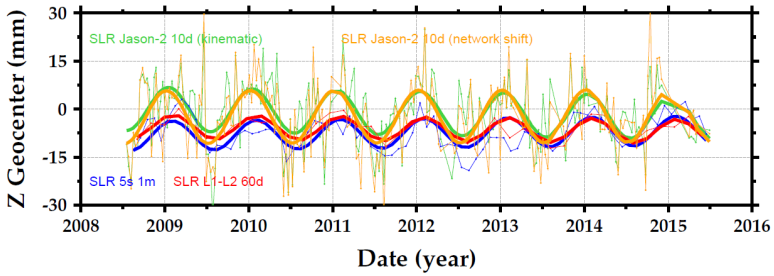
Status on DORIS-Derived Geocenter Motion

KINEMATIC VS NETWORK SHIFT APPROACH

- *Dynamic* (degree-one coefficients of the geopotential) <=> *kinematic* approach (translation parameters in fixed network) / *network shift* approach (fiducial-free network)
- SLR-based solutions







- SLR biases are adjusted per station/arc (unconstrained) in the Jason-2 time series
- Z geocenter : Effect of station biases ? Unexpected constraints ?

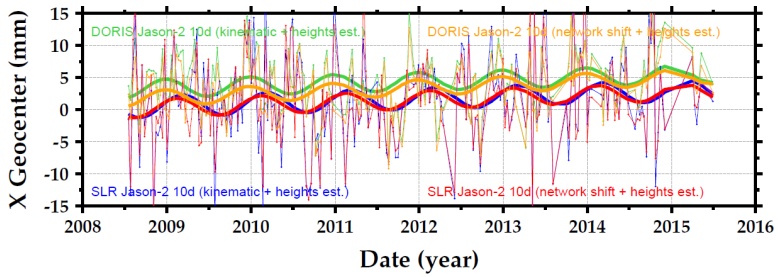
KINEMATIC VS NETWORK SHIFT APPROACH

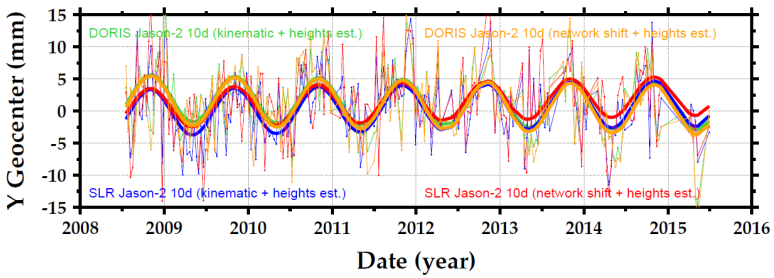
- 1 : SLR Jason-2 kinematic, 10-day estimates
- 2 : SLR Jason-2 network shift, 10-day estimates
- 3 : SLR (5 sat) Cheng et al., 2013 ITRF2005, monthly estimates
- 4 : SLR (L1-L2) Cheng et al., 2013 ITRF2005, 60-day estimates

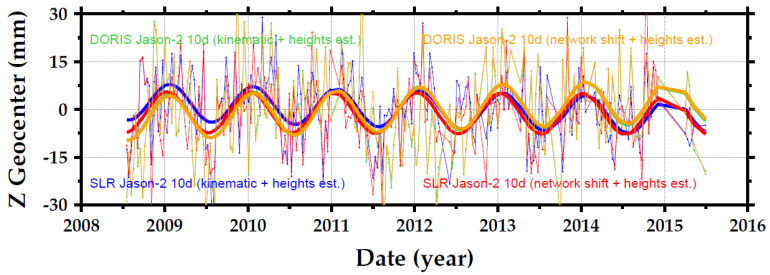
Solution	X (amp)	X (ph)	Y (amp)	Y (ph)	Z (amp)	Z (ph)
1	2.6	35	3.2	294	6.8	16
2	2.8	27	2.7	282	8.2	7
3	3.7	38	2.1	323	4.6	33
4	1.9	59	2.6	320	3.8	36

SLR VALIDATION OF DORIS-DERIVED GEOCENTER

- Error sources affecting SLR and DORIS station vertical coordinates should be mitigated
- Improved consistency with heights estimated







- Vertical errors mitigation result in lower and higher annual amplitude of the X and Y geocenter, respectively

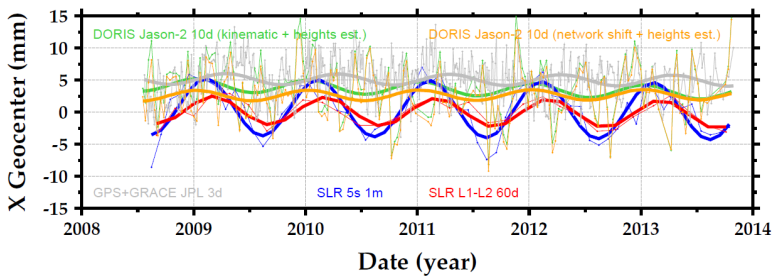
SLR Validation of DORIS-Derived Geocenter

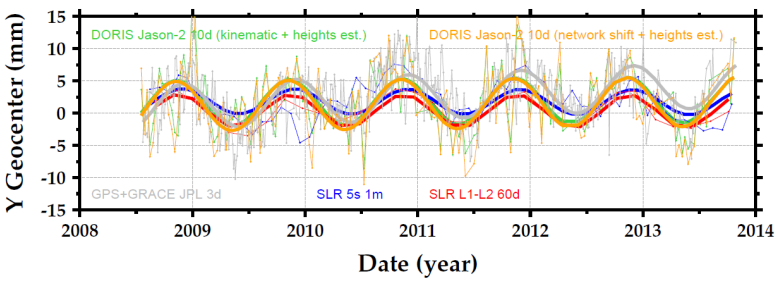
- 1 : DORIS Jason-2 kinematic (heights est.), 10-day estimates
- 2 : DORIS Jason-2 network shift (heights est.), 10-day estimates
- 3 : SLR Jason-2 kinematic (heights est.), 10-day estimates
- 4 : SLR Jason-2 network shift (heights est.), 10-day estimates

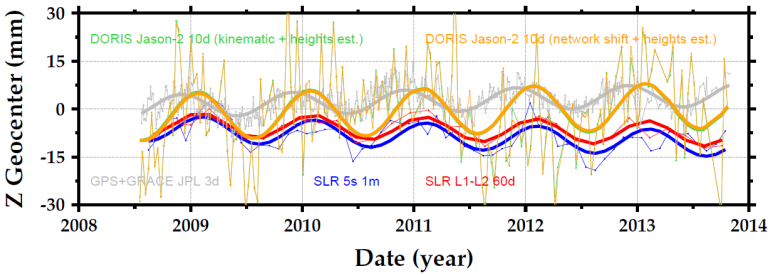
Solution	X (amp)	X (ph)	Y (amp)	Y (ph)	Z (amp)	Z (ph)
1	1.5	1	3.6	307	7.0	20
2	1.2	0	3.8	307	6.7	21
3	1.7	67	3.6	305	5.8	23
4	1.4	43	3.1	304	6.4	9

Comparison to Independent Estimates

- GPS ground network + GRACE geocenter solution from Haines et al. (2015)
- GPS independent solution corroborates the findings about seasonal amplitudes of the X and Y geocenter







- Well-known problem of the prevalence of spurious signals at draconitic periods in GPS-based geocenter motion
- Trends in DORIS-derived geocenter motion (X : ~ 0.2 mm/y, Y : ~ -0.4 mm/y, Z : ~ 0.9 mm/y) are also consistent with modeling studies of Métivier et al. (2016)

Comparison to Independent Estimates

- 1 : GPS+GRACE JPL, 3-day estimates
- 2 : DORIS Jason-2 kinematic (heights est.), 10-day estimates
- 3 : DORIS Jason-2 network shift (heights est.), 10-day estimates
- 4 : SLR (5 sat) Cheng et al., 2013 ITRF2005, monthly estimates
- 5 : SLR (L1-L2) Cheng et al., 2013 ITRF2005, 60-day estimates

Solution	X (amp)	X (ph)	Y (amp)	Y (ph)	Z (amp)	Z (ph)
1	0.8	105	3.5	335	3.5	335
1	1.0	12	3.5	314	7.4	25
2	0.8	8	3.8	311	7.2	26
3	4.4	41	1.9	333	4.0	40
4	2.2	65	2.6	321	3.8	33

GDR-F POD Standards

Updated Measurement Models

- Displacement of reference points
  - ITRF/DPOD/SLRF2014 (ITRF/DPOD/SLRF2008)
  - FES2014 ocean loading (FES2012)
- Geocenter variations
  - Non-tidal : DORIS-only estimation based on Jason-2 (seasonal SLR-only model from J. Ries) – *article in preparation, to be submitted to Journal of Geophysical Research : Solid Earth*
- Propagation delays
  - Instruments phase center location improvement
  - GPT2/VMF1 troposphere correction model (GPT/GMF)

IMPROVED PARAMETERIZATION/PRE-PROCESSING

- DORIS
  - Use of low-elevation data (below 10°) + weighting law definition
  - Horizontal tropospheric gradients adjusted
  - Relativistic corrections for DORIS on-board frequency
- GPS
  - Improved data-screening
  - MOE : combine GPS and DORIS measurements (DORIS-only), with Earth Orientation Parameters from JPL solution at IGS (IERS predictions) ; for DORIS-only missions, use in-house determination from the DORIS satellite constellation ; IERS predictions still used for MOE extrapolations
  - POE : ambiguity-fixed (ambiguity-float) solutions for Jason-3

UPDATED DYNAMIC MODELS

- Geopotential
  - Updated mean gravity field model from CNES/GRGS (EIGEN-GRGS/RL03-v2.MEAN-FIELD)
  - FES2014 ocean tides (FES2012)
  - Atmospheric gravity : 3-hr dealiazing products (6-hr NCEP pressure fields + tides from Biancale-Bode model)
- Surface forces
  - SRP model updates

Summary

CONCLUSION

- DORIS-derived geocenter motion
  - Need to use Jason-2 (or Jason-3 and latter Jason-CS/Sentinel-6, maybe in combination with SWOT – inclination of 78° and draconitic period of 78.5 days) as a *"geocenter-dedicated"* mission for DORIS (inclination much below 90°, draconitic period not close to one solar year, no fixed attitude)
  - Should make a recommendation at next Unified Analysis Workshop for using DORIS-based geocenter motion (in complement to SLR estimates) in the future ITRF origin realizations
- Preliminary GDR-F orbit solutions will be presented at next OSTST
  - Sentinel-3B could be a good candidate to start with the GDR-F POD standards (immediately after having switched Sentinel-3A from GDR-E to GDR-F, for validation purposes), or else OSTM/Jason-2 and Jason-3 (depending on Sentinel-3B launch delays)