Ocean Surface Topography Science Team Meeting (OSTST)

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CNES POE-F precise orbit performances for the current altimeter missions

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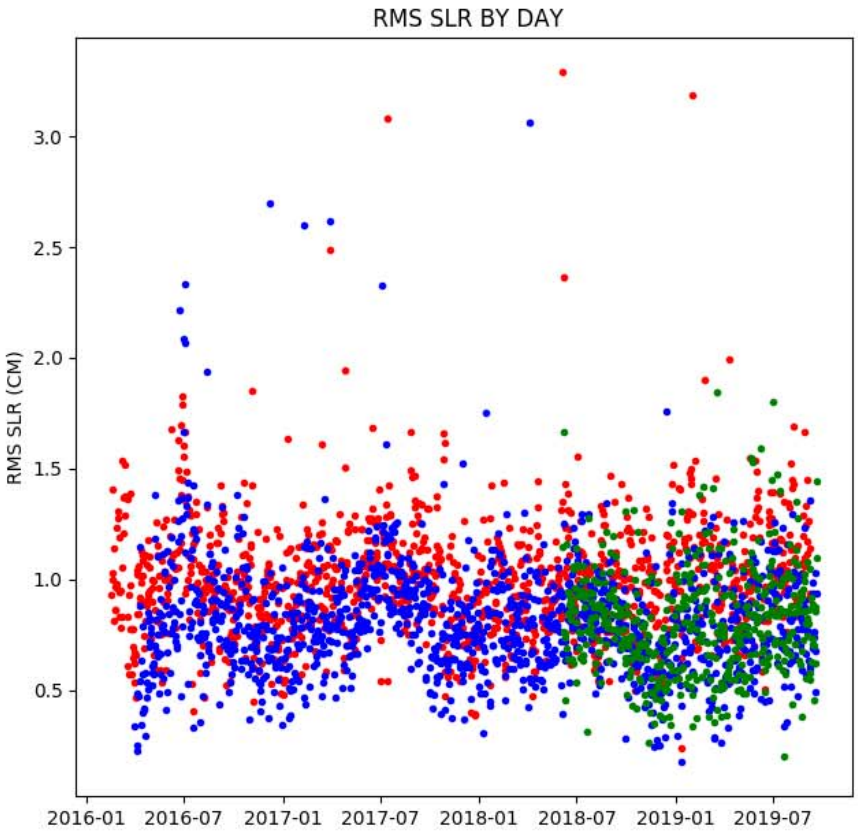
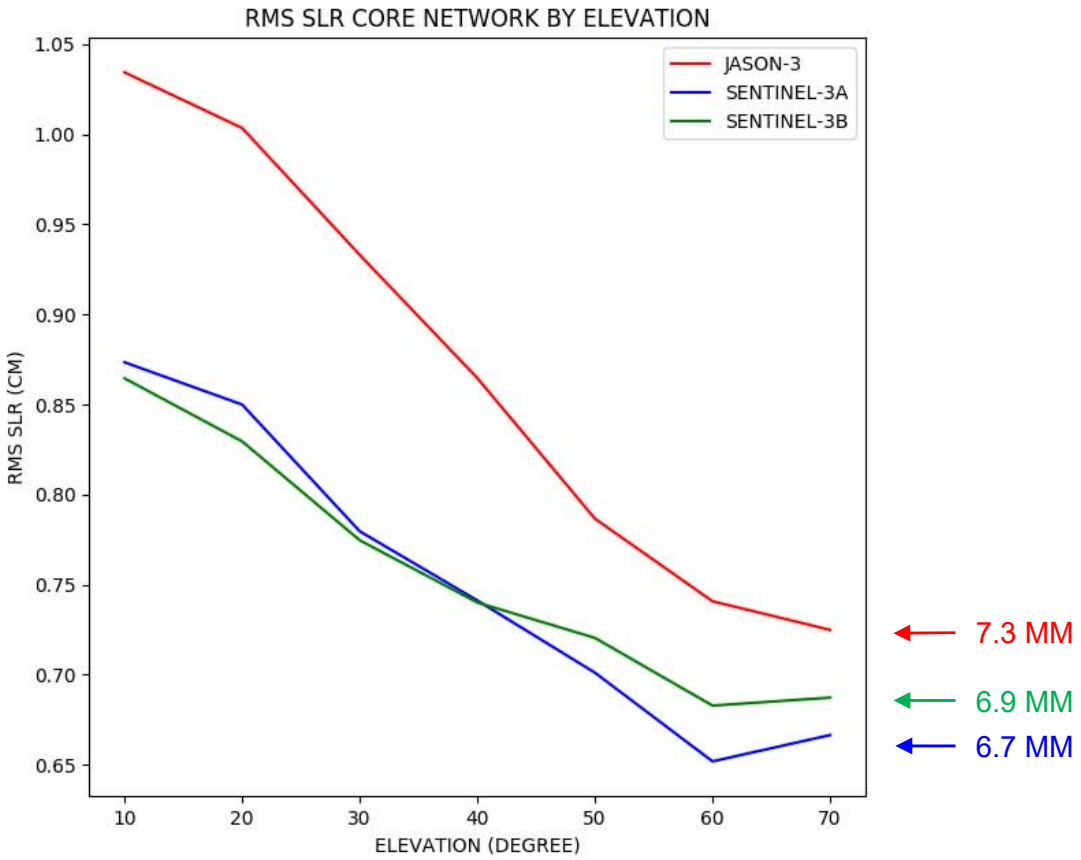
with inputs from Frank Lemoine (GFSC), Shailen Desai (JPL), Lin Mingsen & Peng Hailong (NSOAS)

cnes NOAA NASA EUMETSAT esa

CNES POE-F ORBITS

Reduced dynamic DORIS+GPS (integer ambiguities) orbits / JASON-3 & SENTINEL-3A/B





SLR Core Network of 14 stations + corrected biases (c.f. F. Mercier POD splinter presentation)

DORIS-ONLY CNES POE-F ORBITS

Performance of DORIS-only POE-F reduced dynamic orbits, RMS over 2017 (CM)

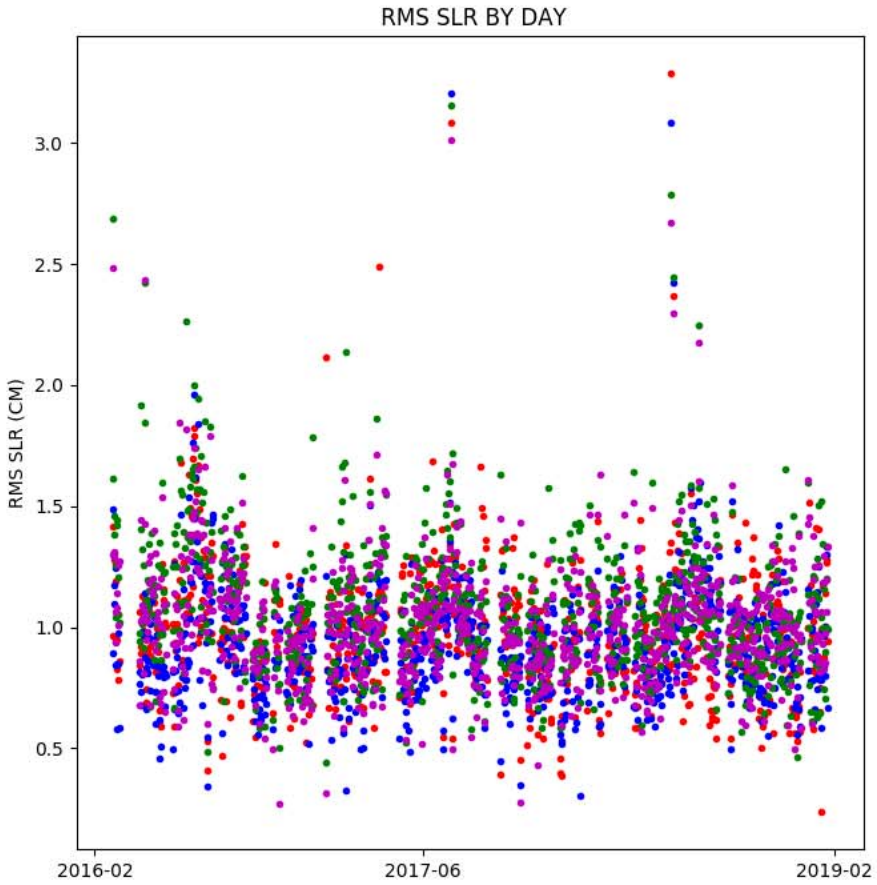
SLR Core Network	CRYOSAT-2	SARAL	JASON-3		SENTINEL-3A	
	DORIS	DORIS	DORIS	GPS	DORIS	GPS
3D	1.18	1.14	1.59	1.06	1.25	0.85
High Elevation (radial)	0.68	0.66	0.89	0.70	0.63	0.54

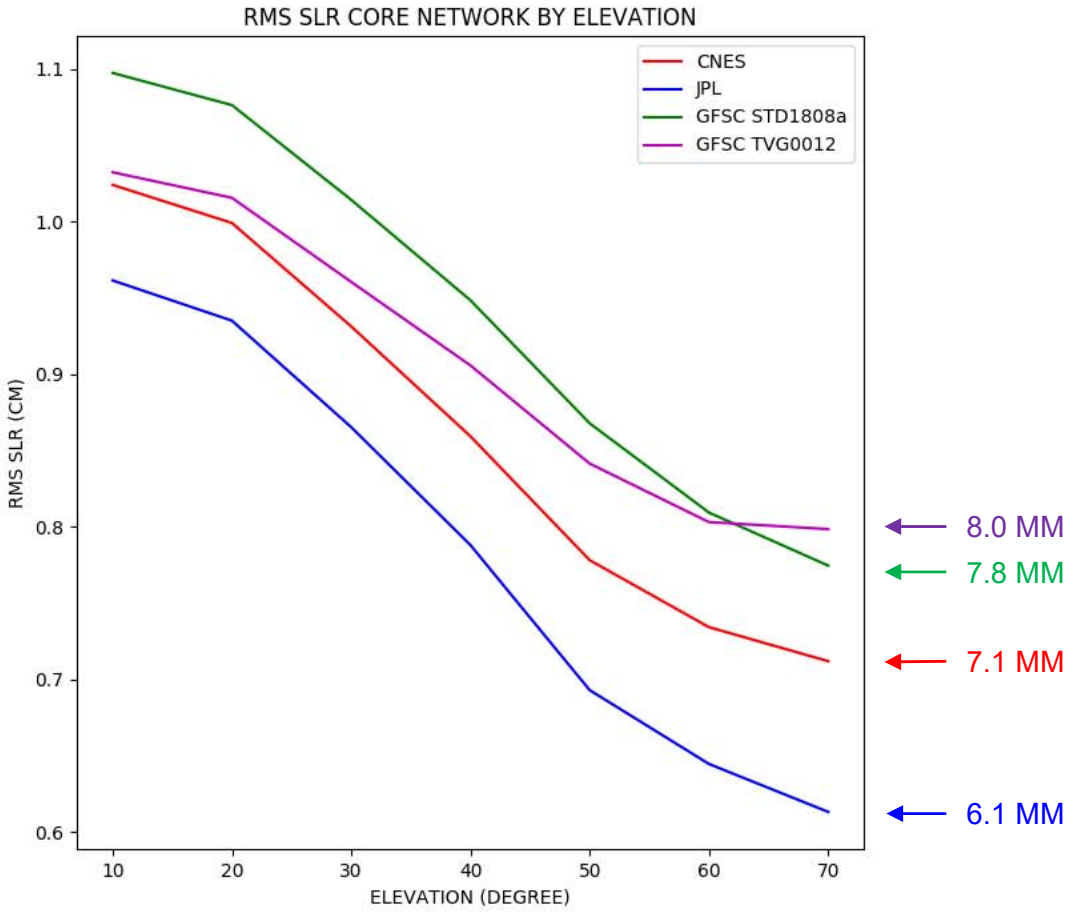
IDS AWG 2019 MUNICH, H.Ait-Lakbir and al. 2019

The POE-F DORIS-only orbit radial performance approaches the GPS-based orbits one's, especially for satellites with small Surface/Mass ratio

GFSC & JPL & CNES ORBIT COMPARISONS

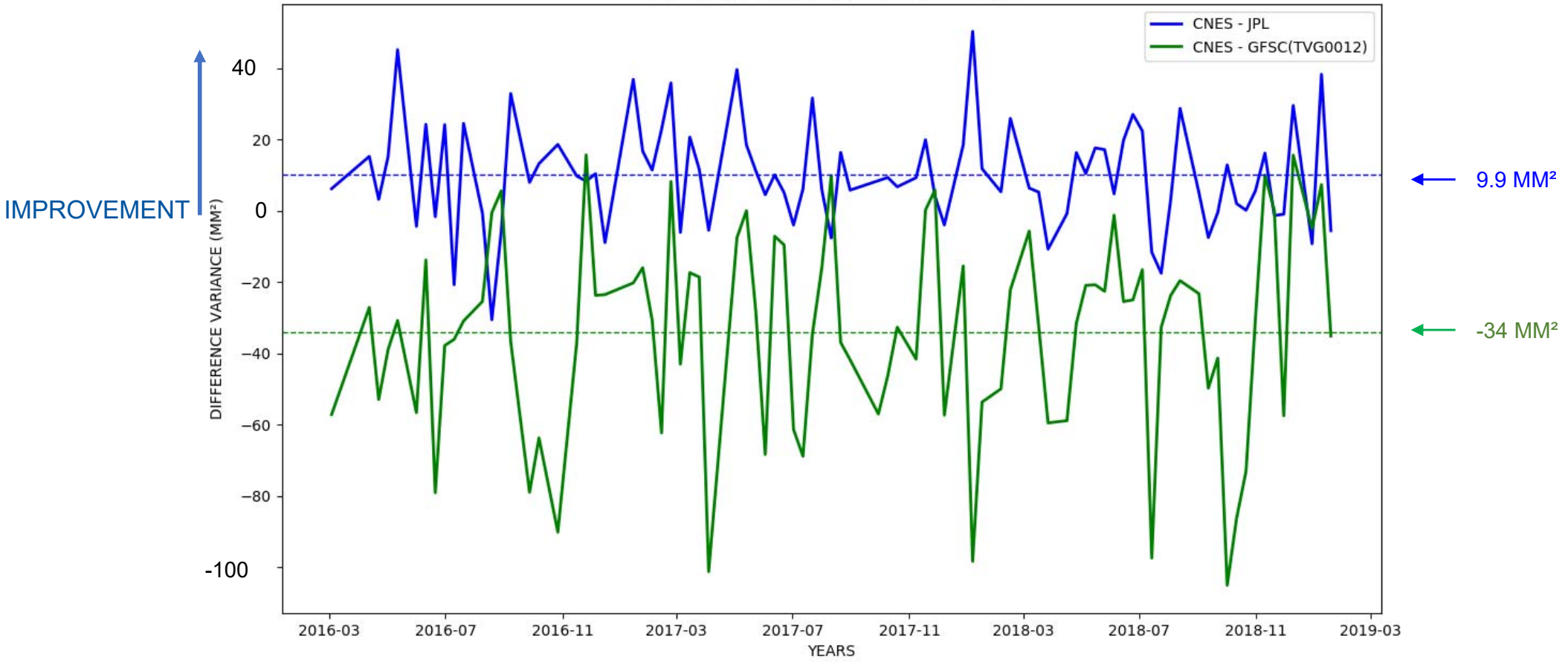
JASON-3 orbits, SLR RMS 14 stations + corrected biases, only common SLR measurements





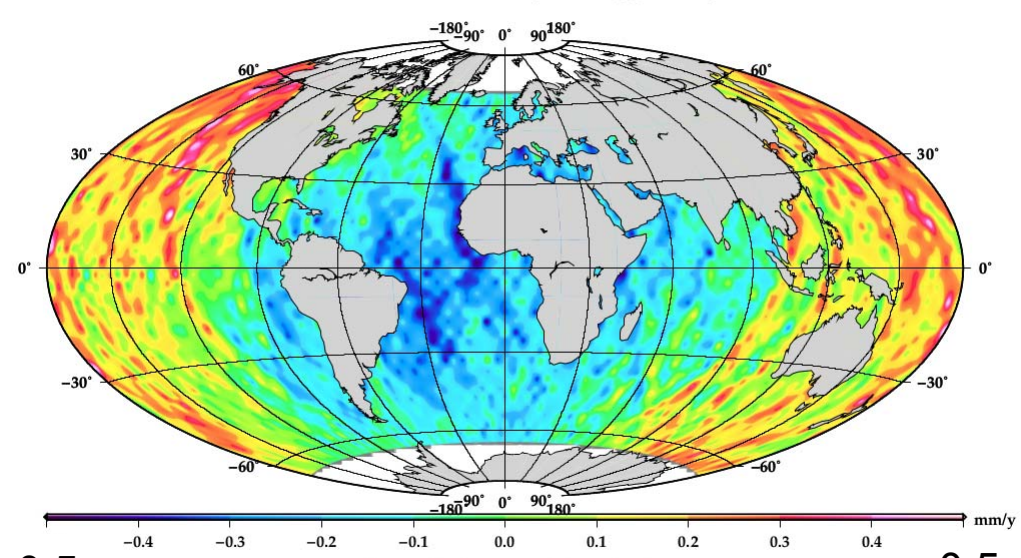
GFSC & JPL & CNES ORBIT COMPARISONS

JASON-3 orbits, difference variance of SSH cross-over

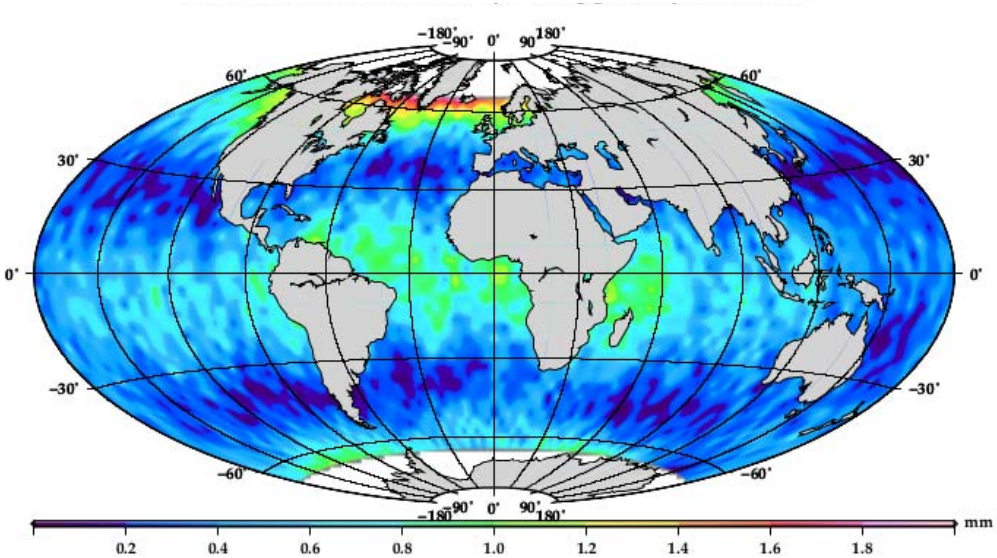


GFSC & JPL & CNES ORBIT COMPARISONS

JASON-3 orbits, geographically correlated radial differences
CNES vs JPL, cycles 001→131



-0.5 drift amplitude (mm/y) 0.5

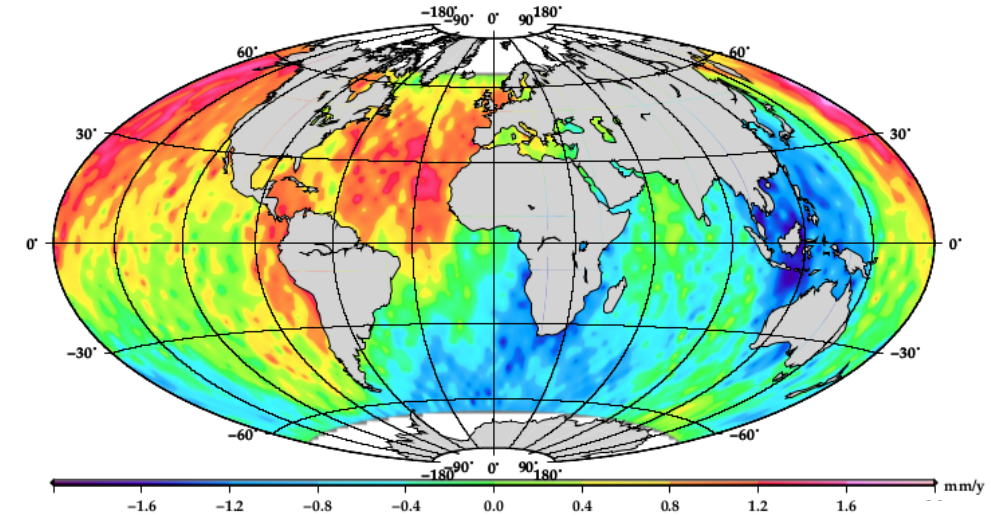


0. annual peridic (mm) 2.

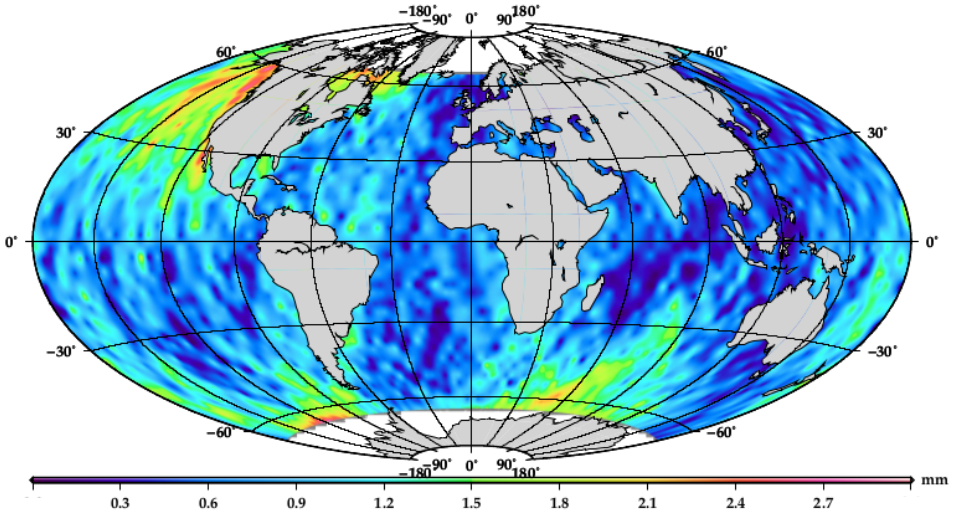
Slight drift/annual periodic differences
Impact of geocenter motion and/or geopotential ?

GFSC & JPL & CNES ORBIT COMPARISONS

JASON-3 orbits, geographically correlated radial differences
CNES vs GFSC TVG0012, cycles 001→108



-2.0 drift amplitude (mm/y) 2.0

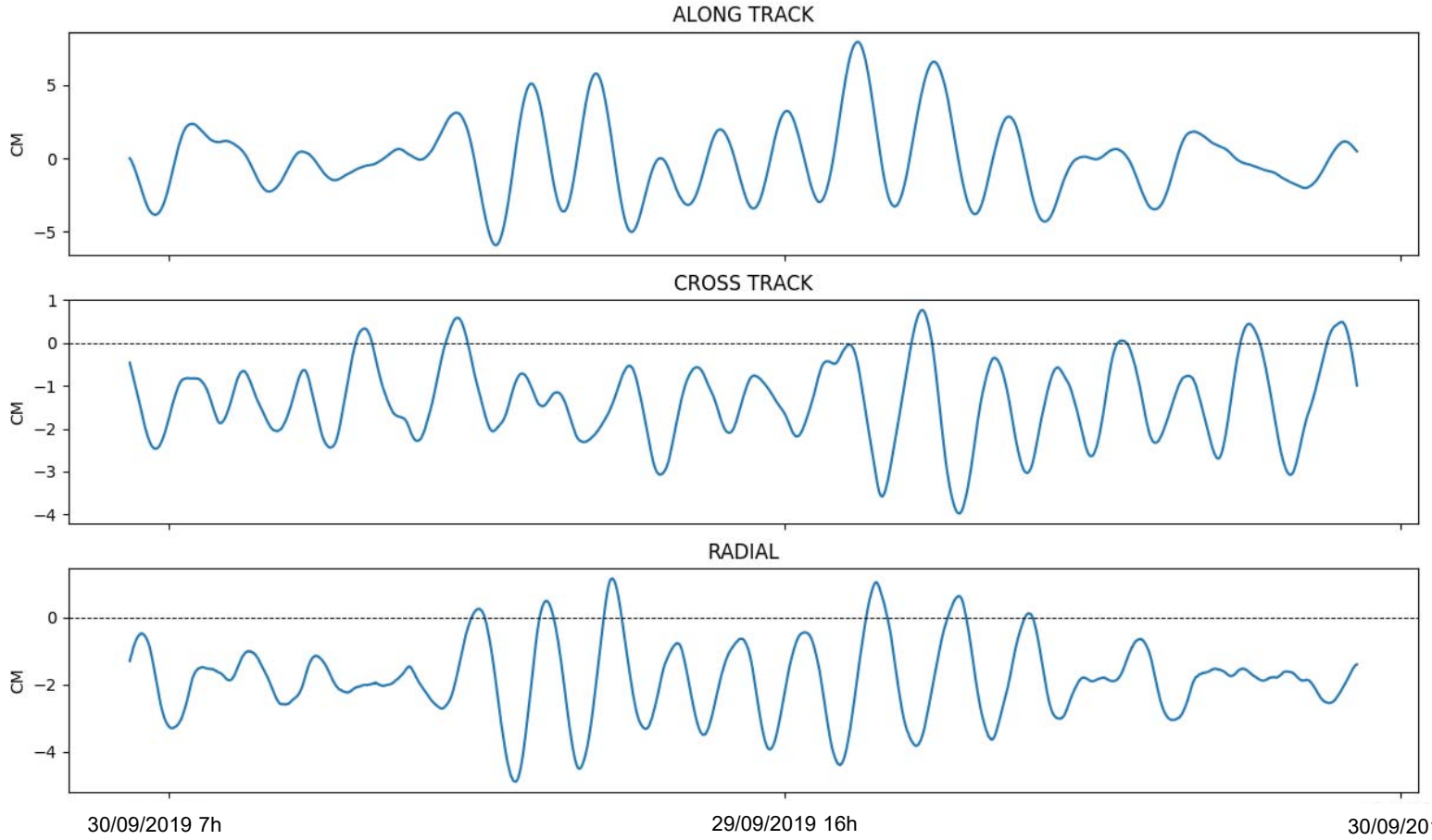


0. annual peridic (mm) 3.

More significant drift/annual periodic differences
Impact of geocenter motion and/or geopotential ?

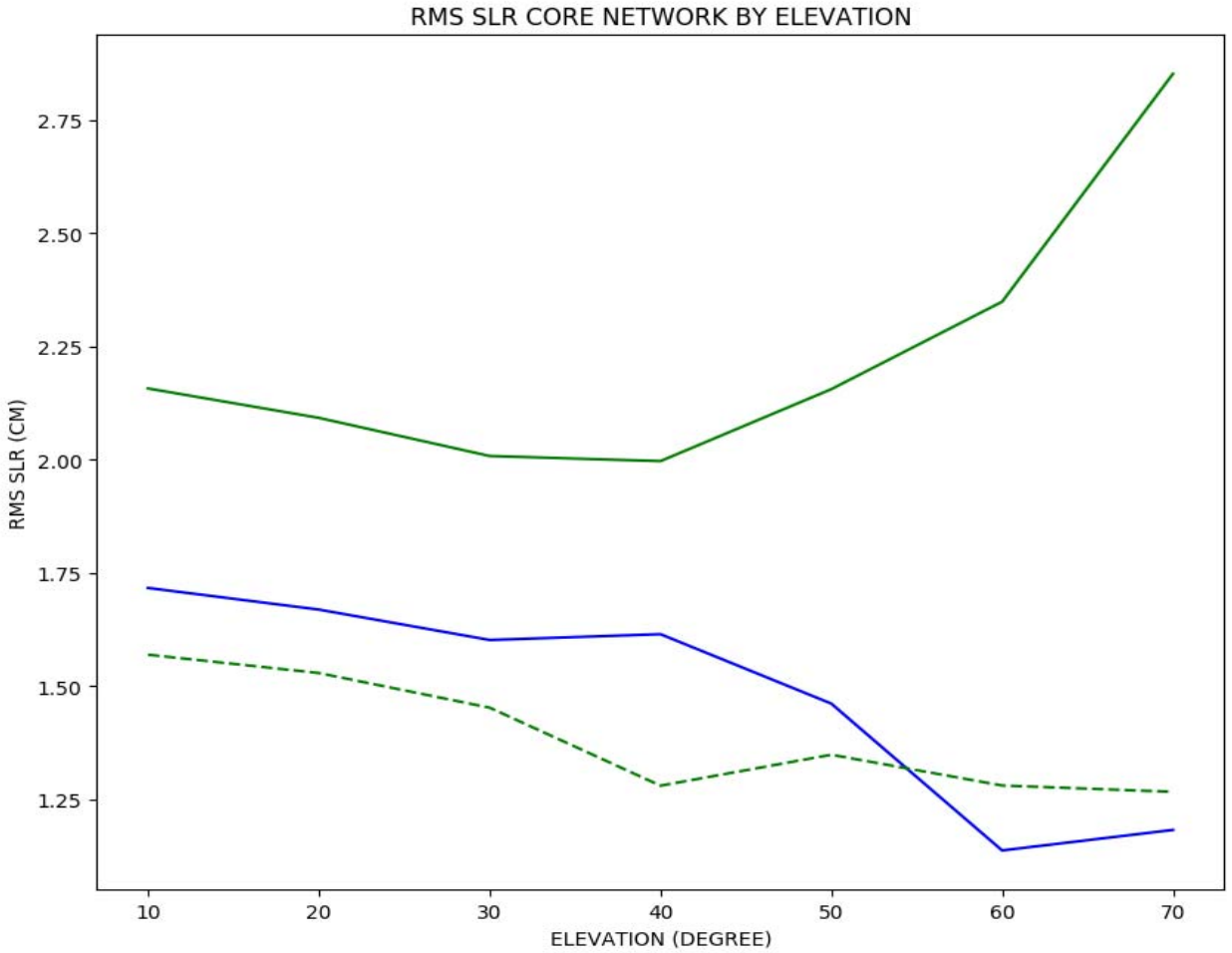
HY-2B MOE GPS-ONLY ORBITS

NSOAS MOE vs CNES MOE POE-F orbit comparisons
good agreement, radial bias of -2cm, cross track bias of -1cm



HY-2B MOE GPS-ONLY ORBITS

SLR core network (14 stations) with station biases corrected



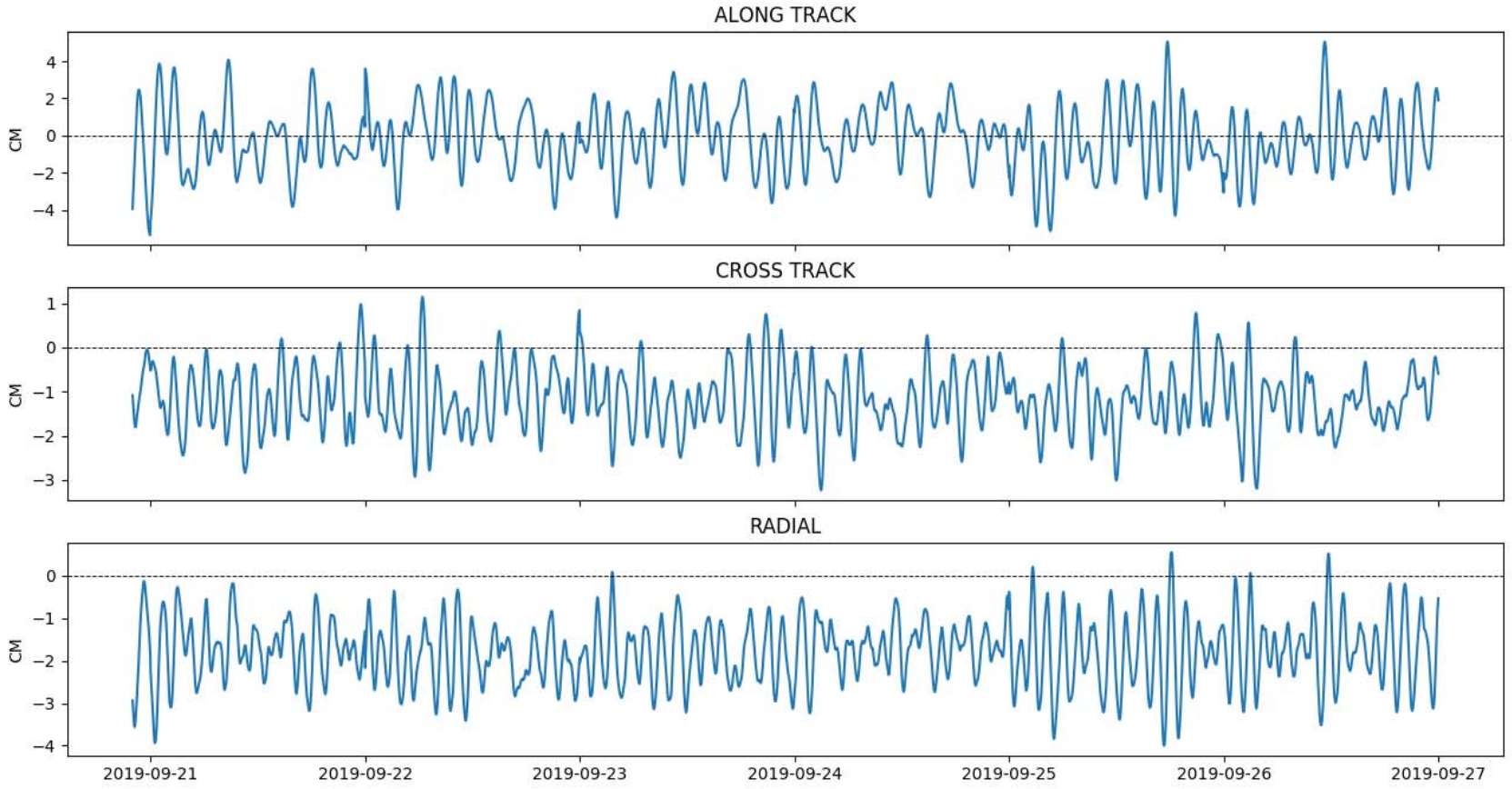
NSOAS MOE orbits

With 2cm radial correction
NSOAS MOE orbits

CNES MOE orbits

HY-2B POE GPS-ONLY ORBITS

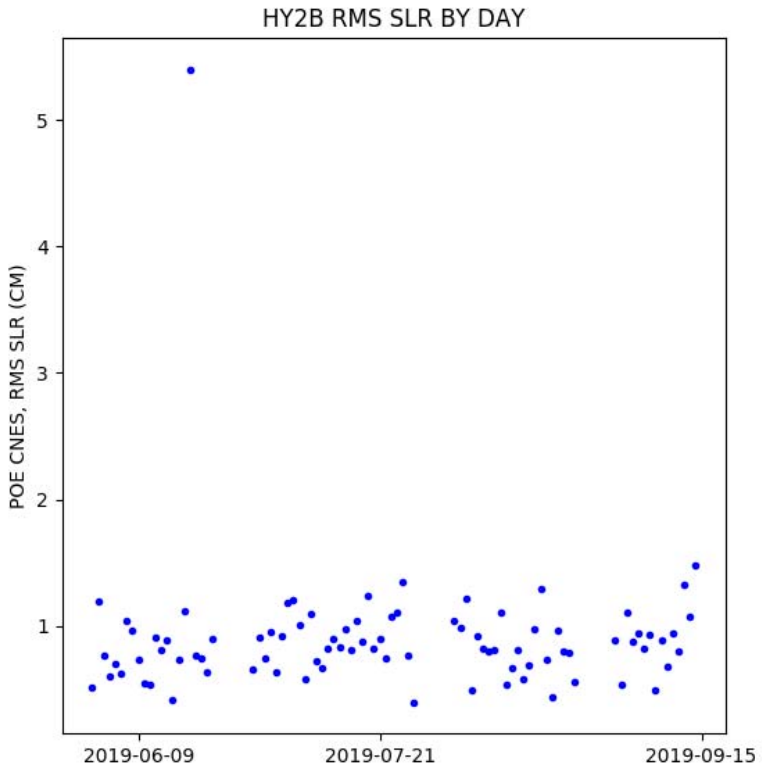
NSOAS POE vs CNES POE POE-F orbit comparisons
same biases than MOE (-1cm in cross track, -2cm in radial)

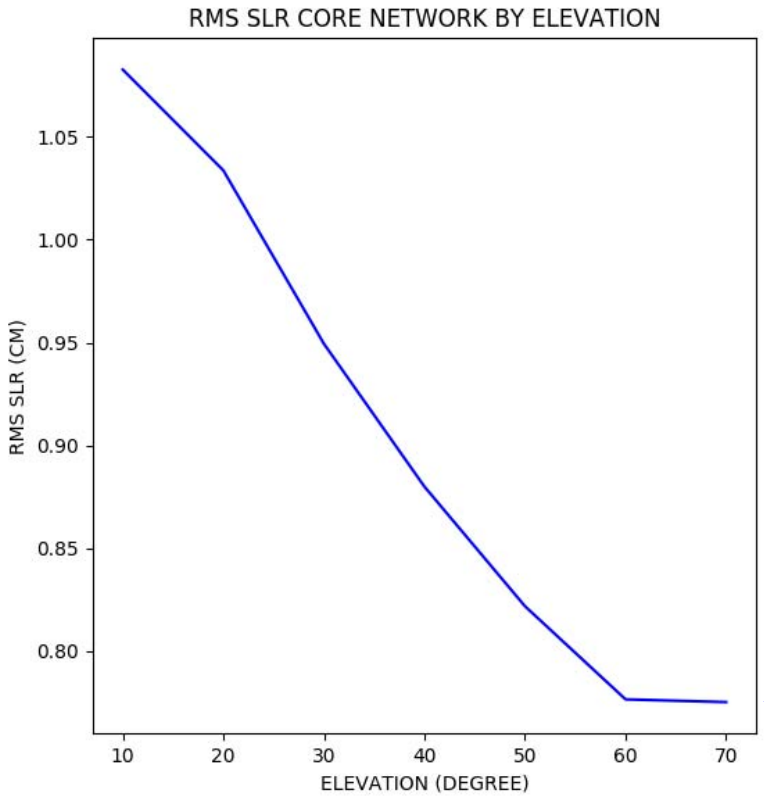


BIAS -1.8CM
SIGMA 0.8 CM

HY-2B CNES POE-F GPS-ONLY ORBITS

CNES POE-F GPS orbit SLR RMS (integer ambiguities)





← 0.78 CM

Stable SLR RMS residuals or these first arcs

Orbit accuracy comparable to Sentinel-3 mission

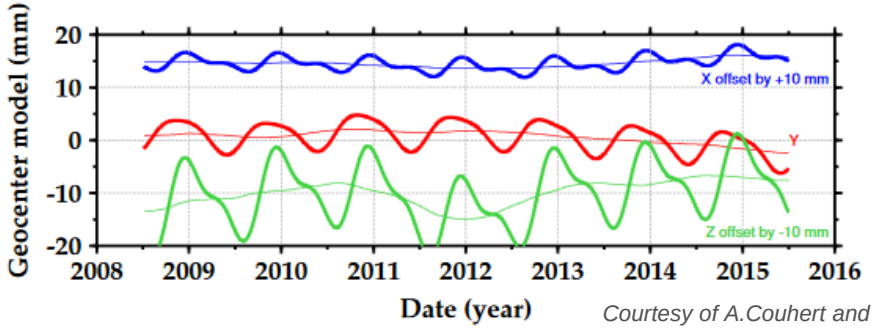
ON GOING AND FUTURE WORK

DORIS processing improvement (exploitation of full phase information)

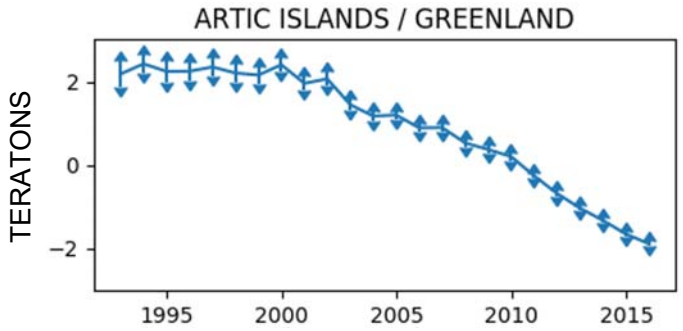
Multi-constellation GNSS (GPS, GLONASS, GALILEO, …) processing for future satellites

Combined solution with LEO satellites + MEO constellations

Improve knowledge of the geocenter motion → for satellite altimetry (and other applications)



Courtesy of A.Couhert and al



← Improving TOPEX orbits (mascon approach based on DORIS satellites)

Improvement of SLR processing for orbit validation

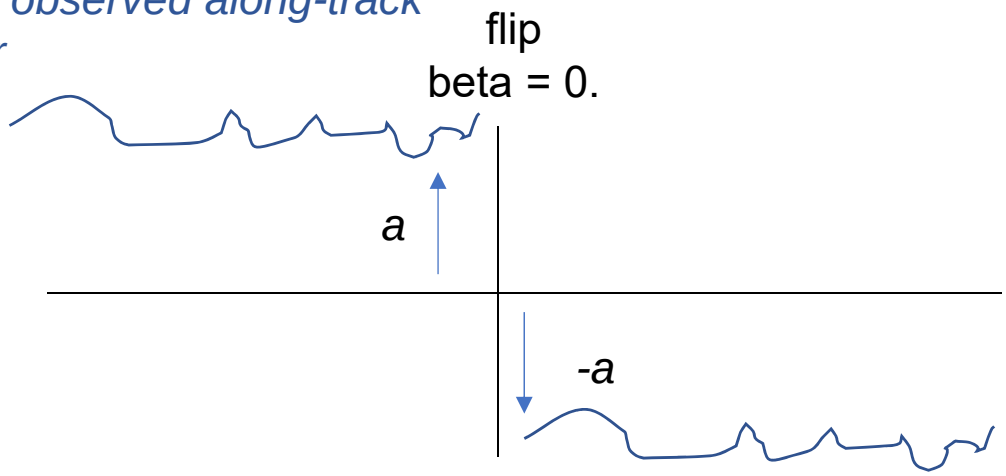
EXAMPLE OF ON GOING WORK

SLR validation of along-track biases during fixed yaw periods

Effect of an error '*a*' in the distance between SLR and GPS along the X satellite axis (± along-track)

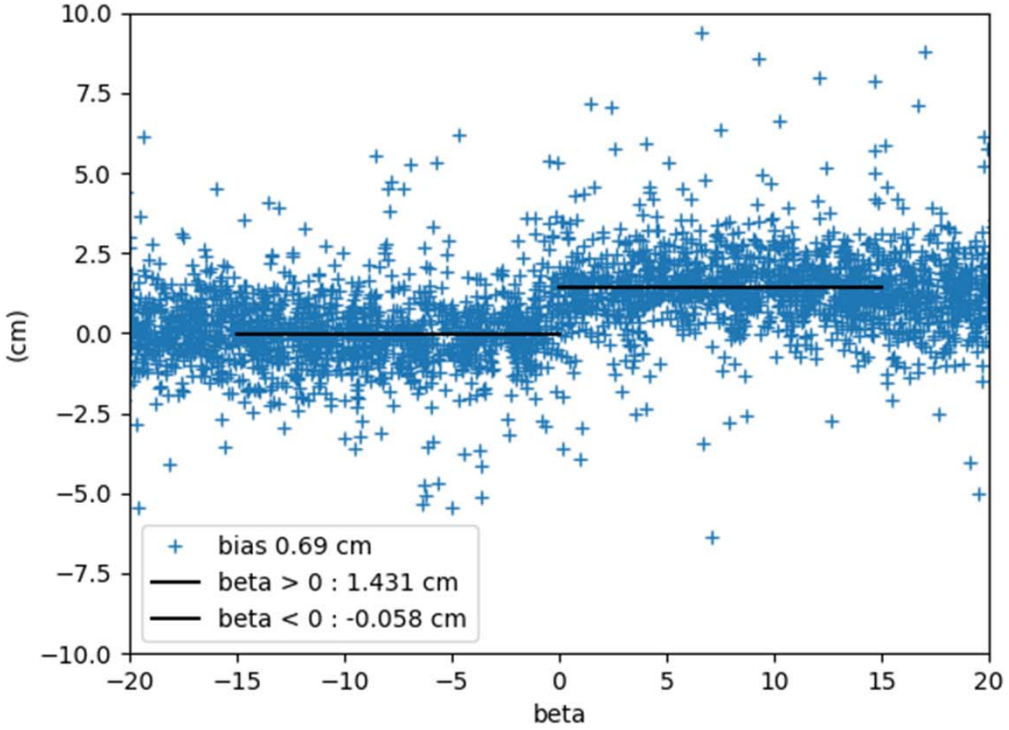
Courtesy of NOAA

SLR observed along-track error

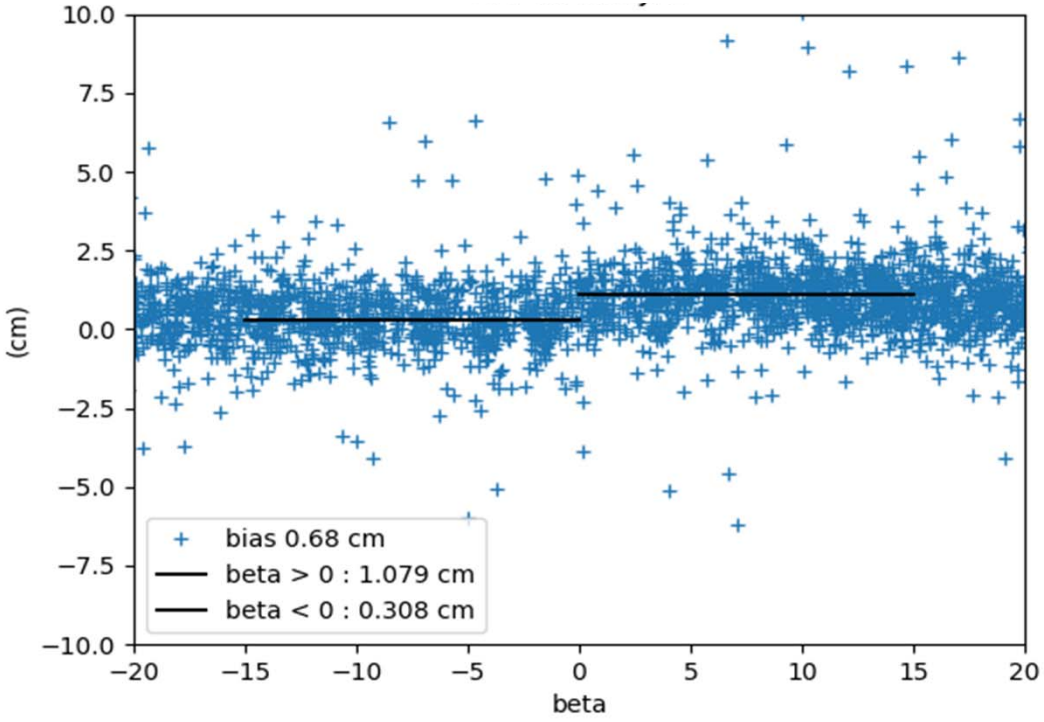


EXAMPLE OF ON GOING WORK

CNES



JPL



a: CNES=7mm, JPL=3.5mm

Yet identical global along-track bias of ~7mm

to be investigated further

CONCLUSION

JASON-3, SENTINEL-3A/B, HY2-B reduced dynamic DORIS+GPS orbit performances, SLR RMS, around 7mm in radial and 1cm in 3D

Reduced Dynamic DORIS-only orbits radial performance (CRYOSAT-2 / SARAL) now approach GPS-only one's

7 altimetry missions currently processed, many upcoming new missions in the next years with strong international cooperations (NASA, ESA, ISRO, NSOAS, …)

Several ways for improvement are identified, nice jobs in perspective !

THANK FOR YOUR ATTENTION!