

USING 'MASCONS' TO ANALYSE SLR BIASES

J. Moyard, A. Couhert, F. Mercier, E. Jalabert, S. Houry⁽¹⁾

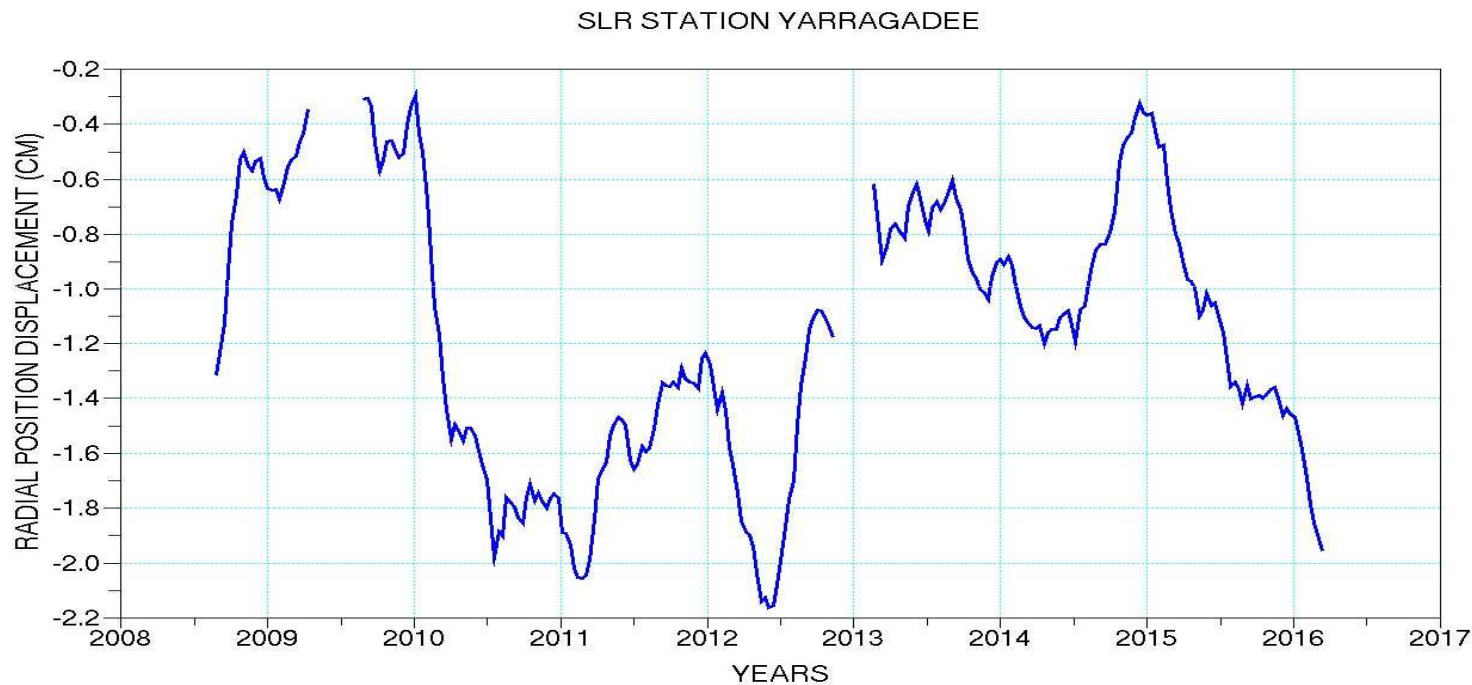
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La Rochelle,
FRANCE

(1) CNES POD Team, Toulouse, France

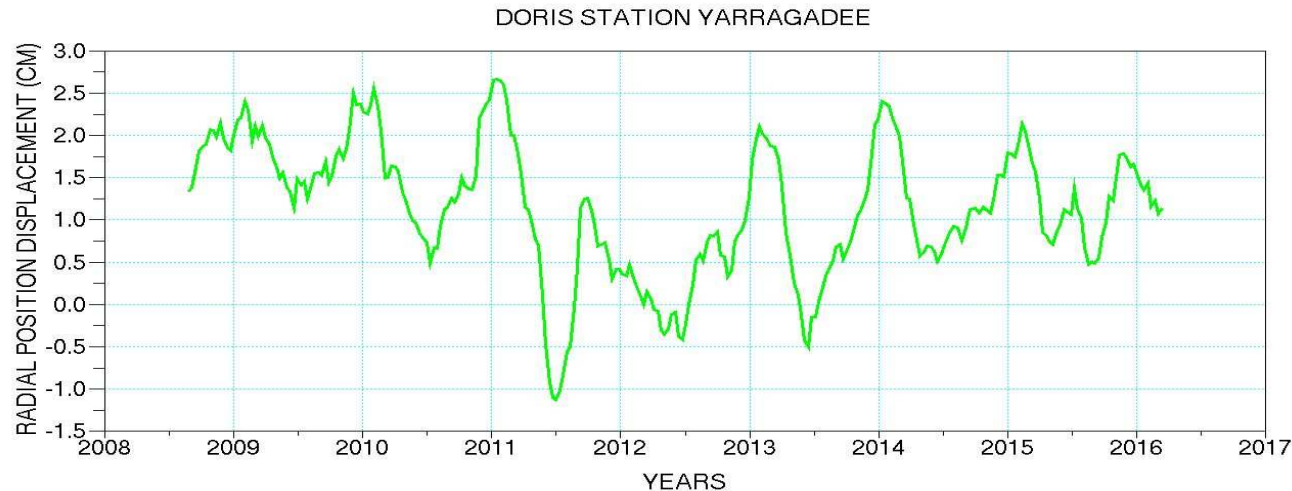
CONTEXT OF STUDY

Observed anomalies in the SLR post-fit residuals for Yarragadee Jason-2.
Adjusting the station coordinates shows an important vertical bias in period 2010-2013 :



Nothing has been found in the GPS stations position times series from IGS Network, Nevada Geodetic Laboratory, but ...

CONTEXT OF STUDY



A vertical bias seems to appear in DORIS YARRAGADEE station too when adjusting on Jason-2 data.

Mail exchanged with Yarragadee Geodetic Observatory « *No changes occurred in 2010 that should have had any effect on station position metrics. [...] It is hard to explain the effect.* »

If we suppose a local mass variation → investigation using 'mascons' to check this hypothesis

No significant mass variation on GRGS GSFC JPL solutions (GRACE PLOTTER)

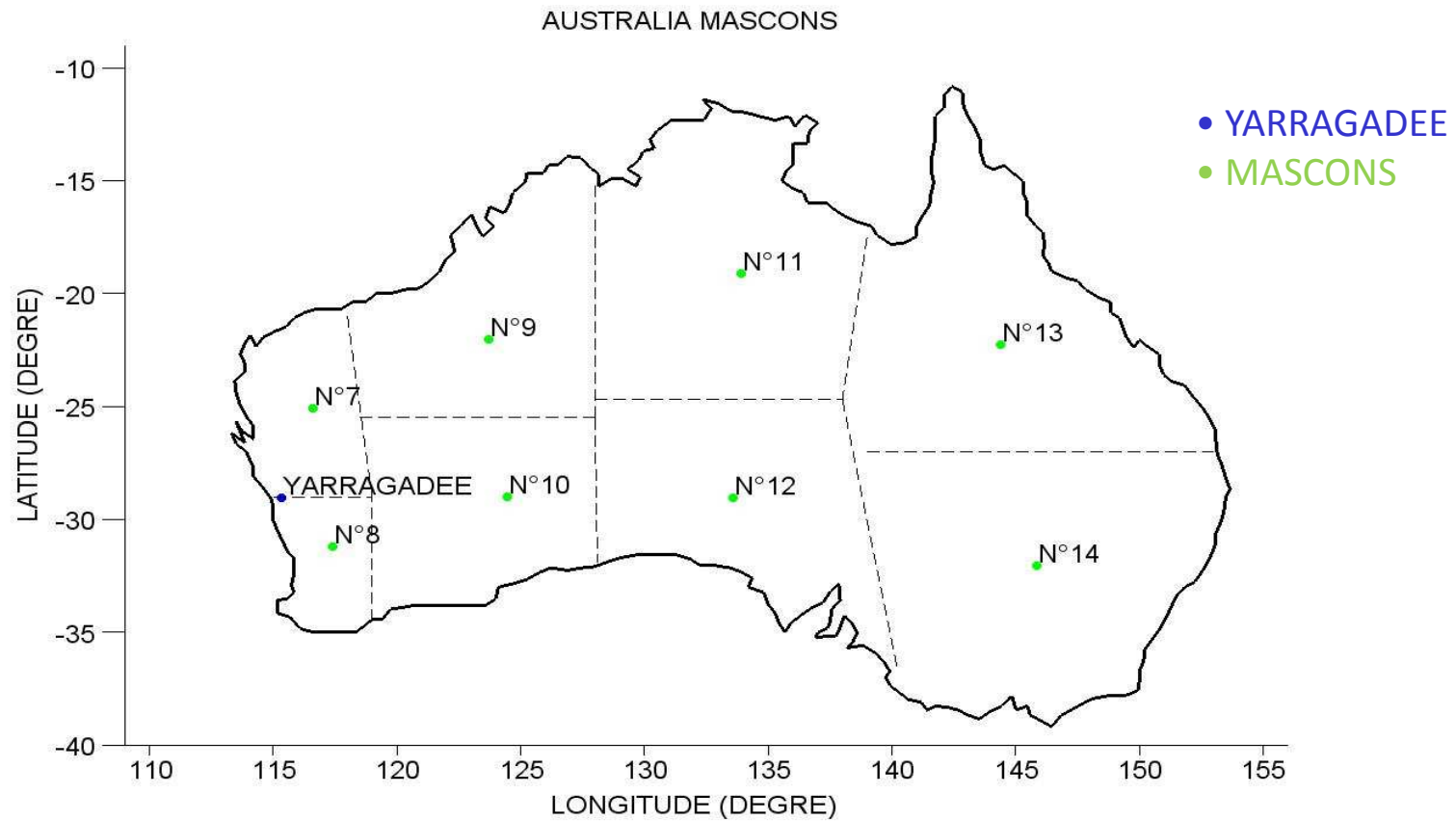
METHODOLOGY

Stacking normal equations of all DORIS missions (standard GDR-E DORIS dynamic orbits with GRGS static potential Release 02) on 6 months intervals.

Cerri et al. (2012) : 6 high latitude mascons (Greenland, East and West Antarctica, North Canada, Fennoscandia) responsible for long term Time Varying Gravity variations.

For this study, same 6 mascons and 8 added mascons on Australia

AUSTRALIA MASCONS DEFINITION



Definition of 8 surfaces, each associated with a mascon

MISSIONS

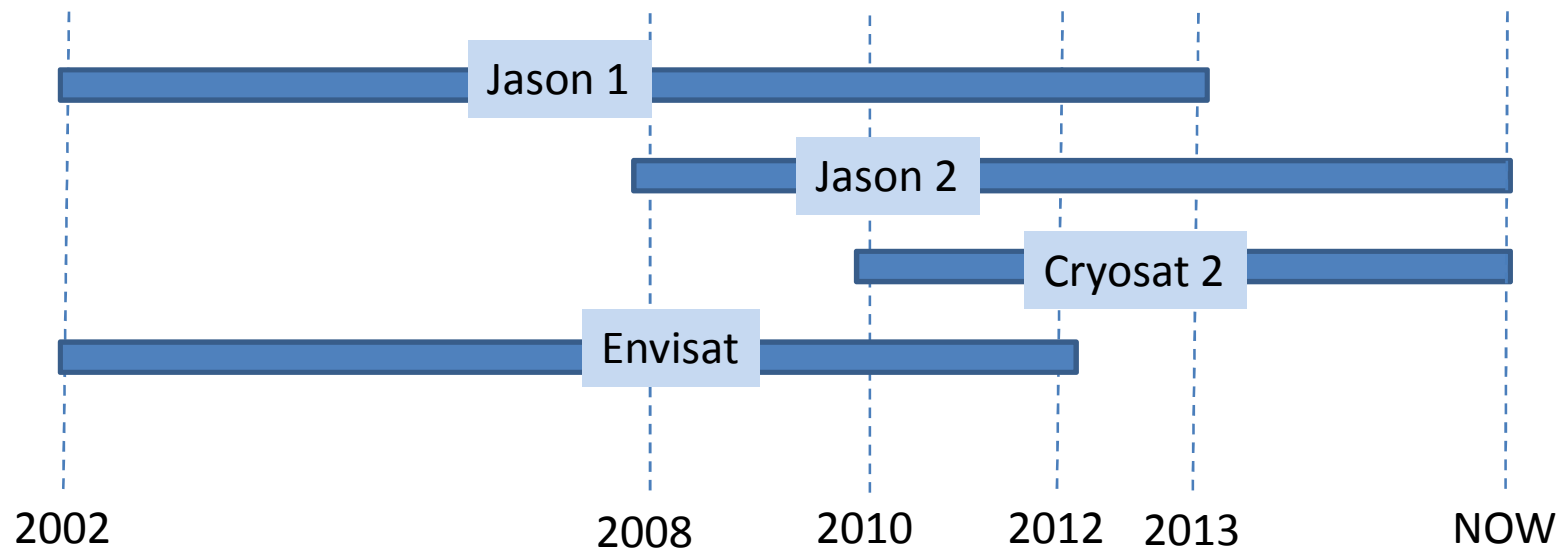
Use of new DORIS preprocessing and weighting function to take benefits from low elevation measurement ($5^\circ < \dots < 10^\circ$), c.f. oral presentation IDS WORKSHOP 2016

Use of altimetry missions to cover period 2010 → 2013 :

	JASON-1	OSTM JASON-2	CRYOSAT-2	ENVISAT-1
Inclination (°)	66.04	66.04	92	98.6
Altitude (km)	1 337	1 337	717	800
cover period (years)	2002→2013	2008→now	2010→now	2002→2012
Repeat period (days)	9.9156	9.9156	369	35
Number of revolutions within a cycle	127	127	5344	501

GRACE mission, polar orbit – inclination 90° - altitude 500km

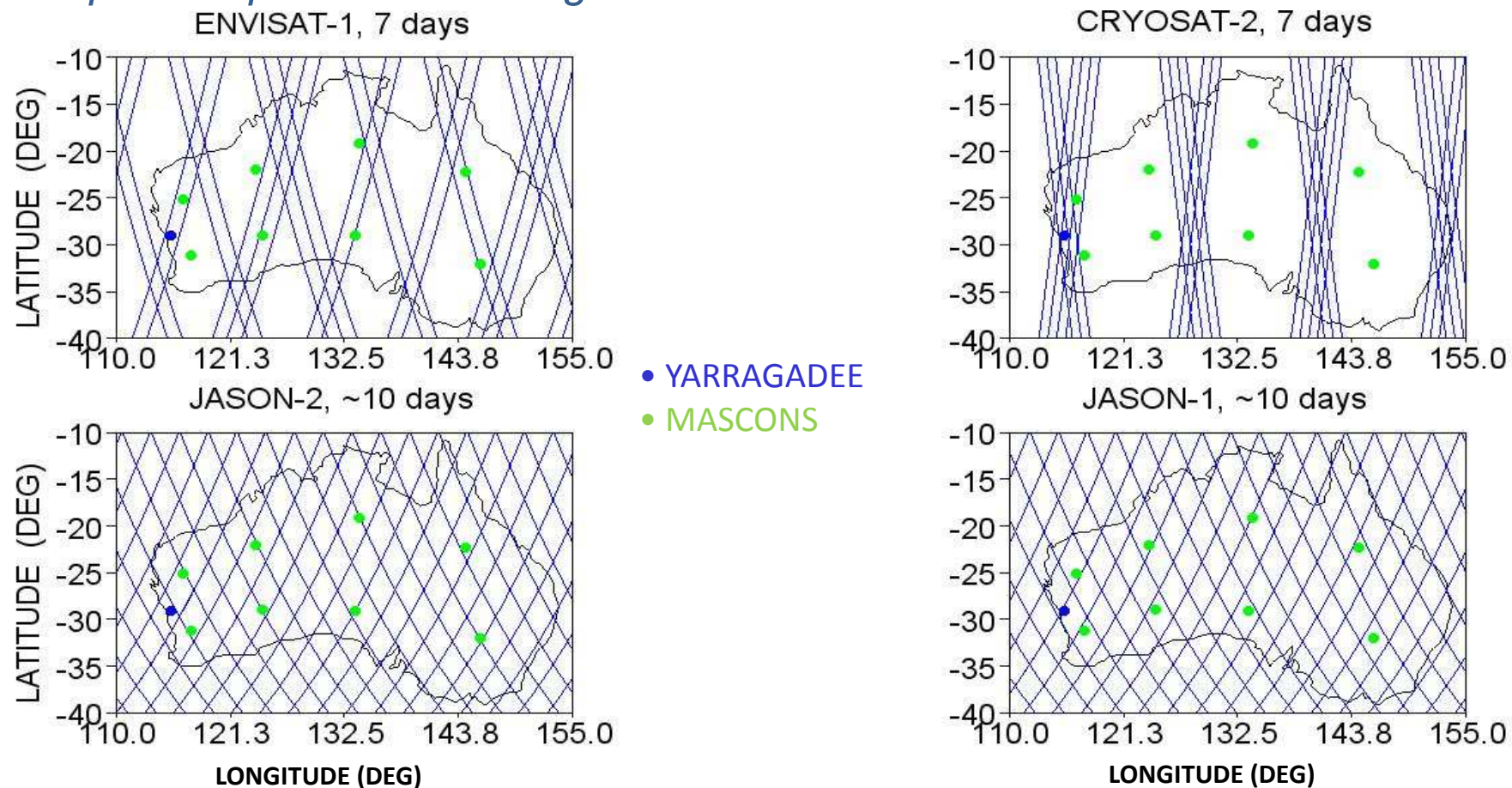
FOCUS ON MISSIONS DURATION



At beginning of 2008, stacking process on 3 missions starts

FOCUS ON MISSIONS GROUND TRACKS

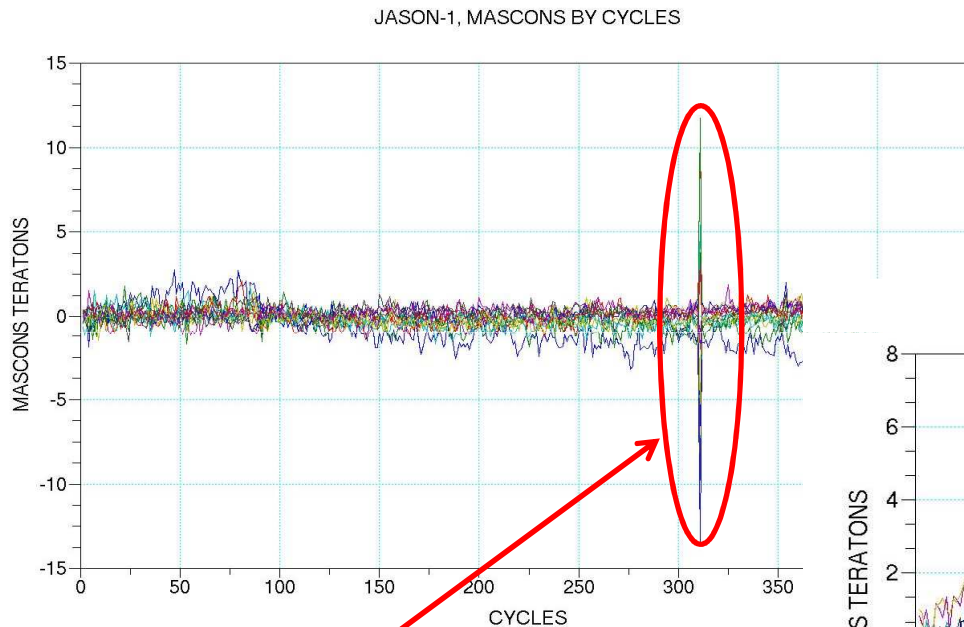
Graphics representation of ground tracks :



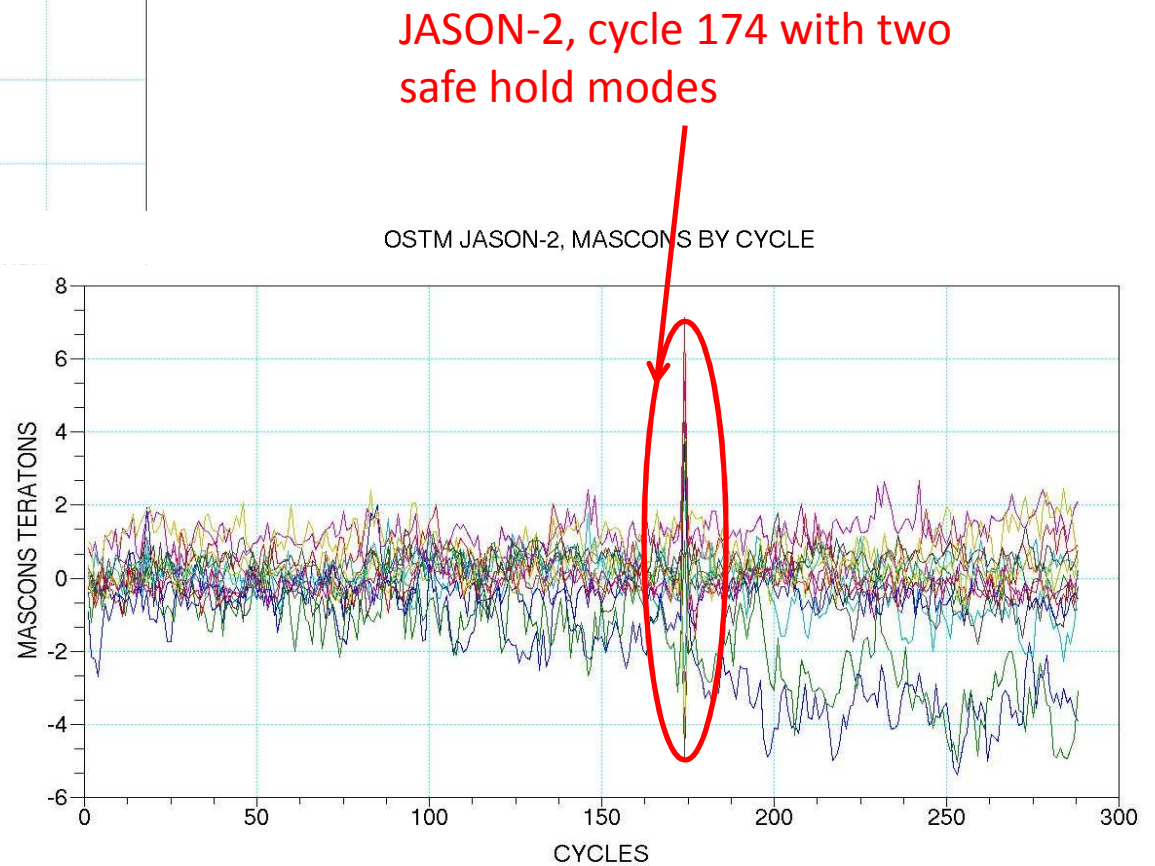
Simultaneous use of these 4 missions should improve the observability in the East – West direction over polar orbits.

FOCUS ON UNITARY SOLUTIONS

Check of the elementary solutions (by arcs) to eliminate outliers



JASON-1, cycle 315 with
severals maneuvers



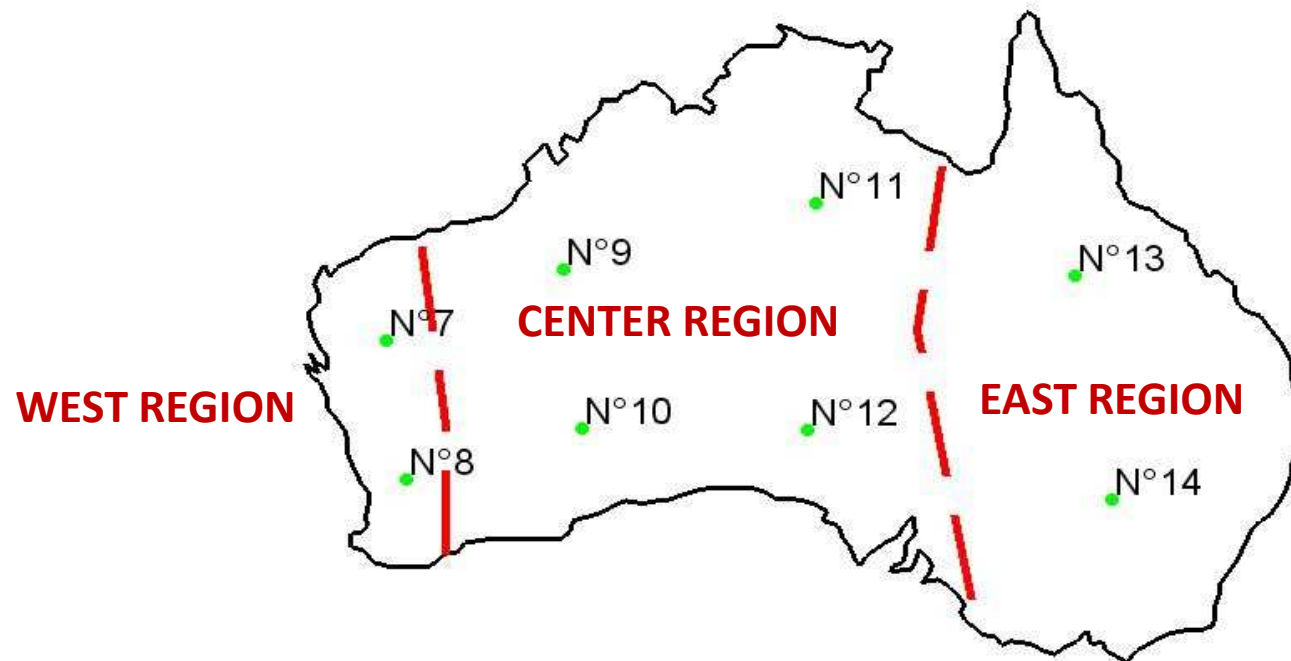
AUSTRALIA REGIONS

Improve the problem observability, 3 regions using constraints on the defined mascons :

West region (Yarragadee), mascons 7 & 8

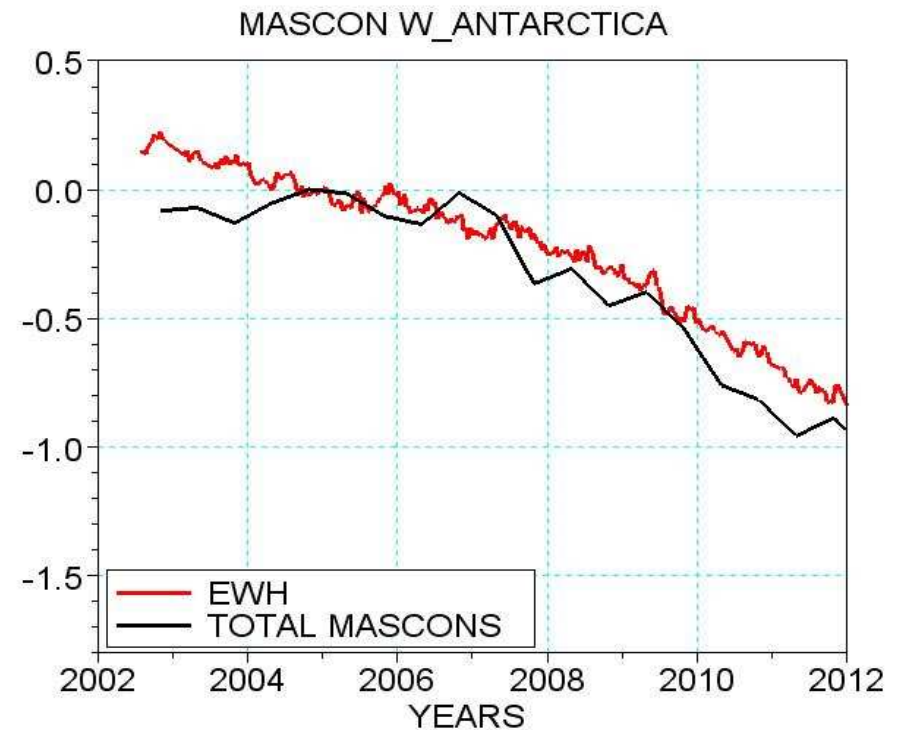
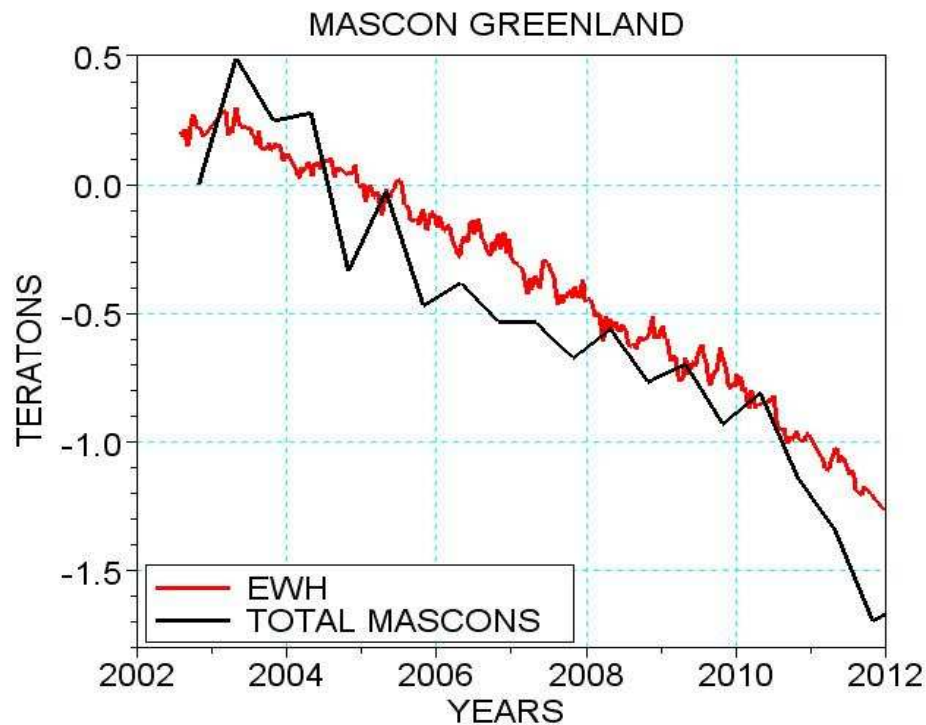
Central region, mascons 9 & 10 & 11 & 12

East region , mascons 13 & 14



RESULTS (1/4)

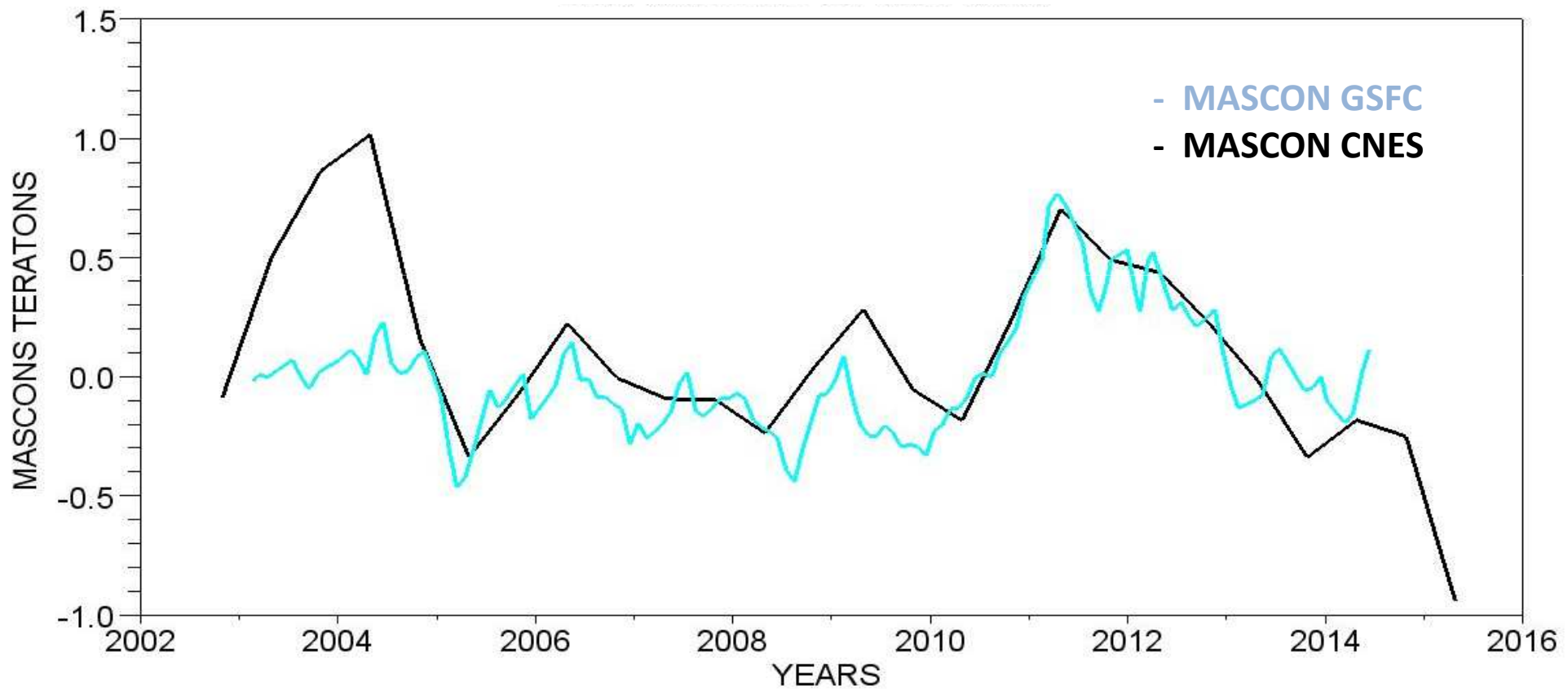
Stacking process on 6 months intervals :



Results are quite equivalent to GRACE Equivalent Water Height on this type of mascon : validation of the process

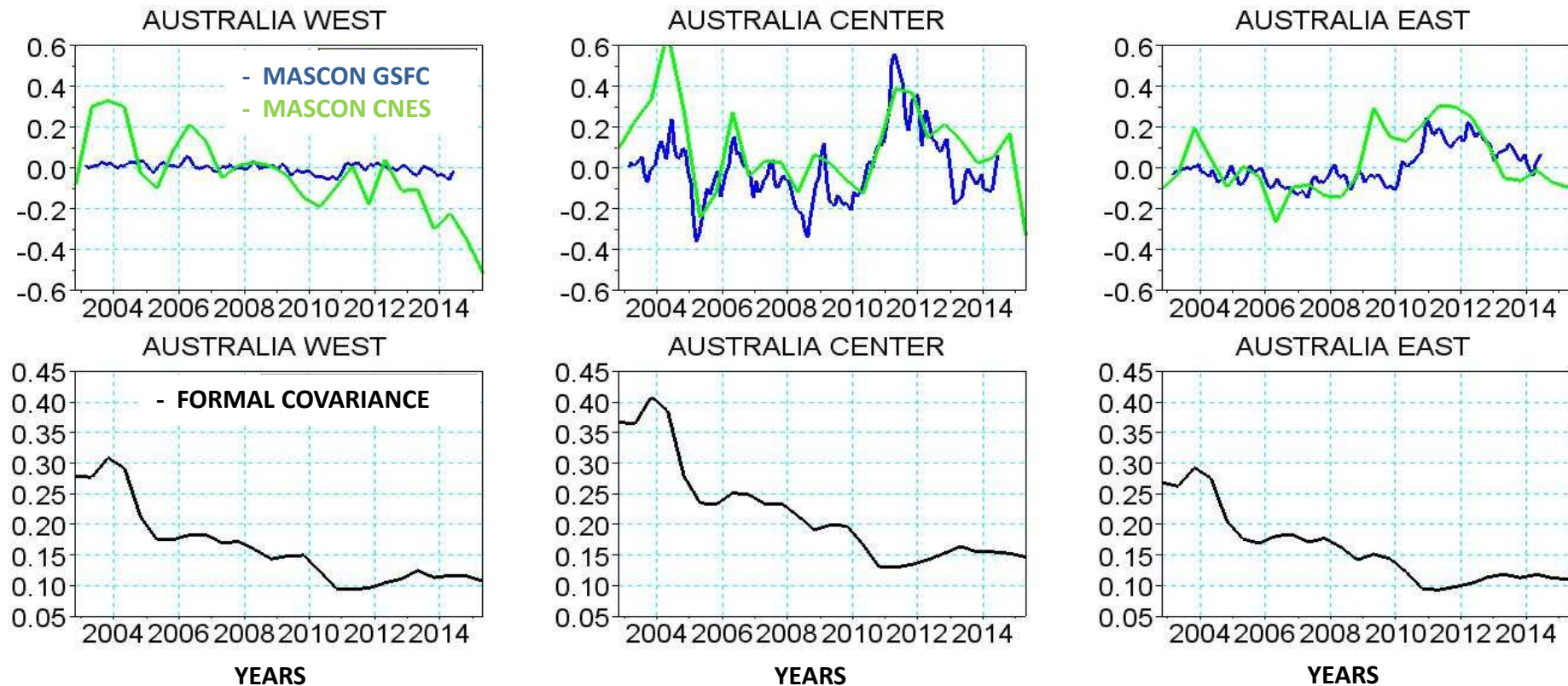
RESULTS (2/4)

Sum of the Australian mascons :



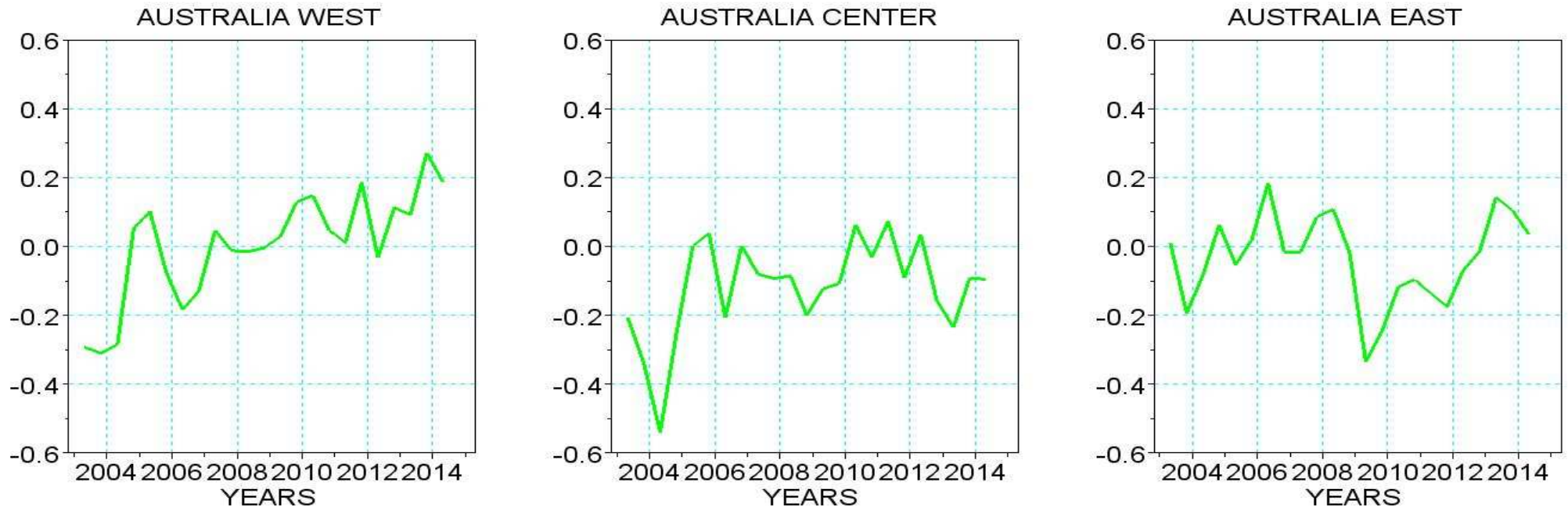
RESULTS (3/4)

Regional comparison with accumulated GSFC Australia bassins solutions



GSFC and CNES mascons at Australia Center / East quite equivalent, formal covariances are similar but.... GSFC mascons at Australia West and CNES mascons have different behaviour

RESULTS (4/4)



Differences between CNES and GSFC mascons have similar characteristics (observed mascons solution noise)

No evident signature in the west region for 2010-2013, could be in the noise.

CONCLUSION

Point mass mascons method implemented in CNES orbit determination process is validated on some long terme variation like the ones located at GREENLAND and ANTARCTICA

Possible improvement could be done including GPS measurements for JASON-2 mission , under investigation. The present results are not consistent with corresponding DORIS results.

CNES mascons on Australia are noisy but comparable with GSFC GRACE results.

GRACE results (GFSC bassins solutions) do not show important mass variation on the West region.

Due to the noise we are not yet able to explain Yarragadee SLR observed vertical bias by local mass loading anomalies based on this study.

BACKUP

JASON-2 MASCONS SOLUTIONS BY CYCLE

Combine DORIS and GPS :

OSTM JASON-2, MASCONS BY CYCLE

