Evaluating The Jason-2 Prime Mission Sea Level Climate Record

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Questions and outline

Jason-2 stability goal: The drift of the system (after calibration) shall not exceed 1 mm/year.

Has Jason-2 achieved its stability goal for measuring global mean sea level during the prime mission?

- Impact of the American Samoa earthquake on the Mitchum tide gauge calibration
- Evaluate the ESA/ESOC orbits on Jason-2 stability
- Evaluate application of consistent wet troposphere models

Can the cause of the different regional sea level trends from Envisat and the Jason series be found?

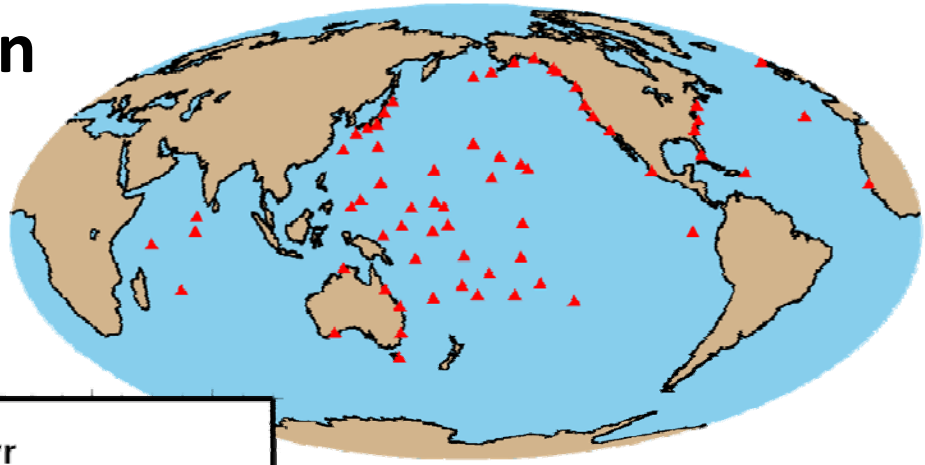
- Do the ESOC orbits eliminate the apparent geocenter drift?

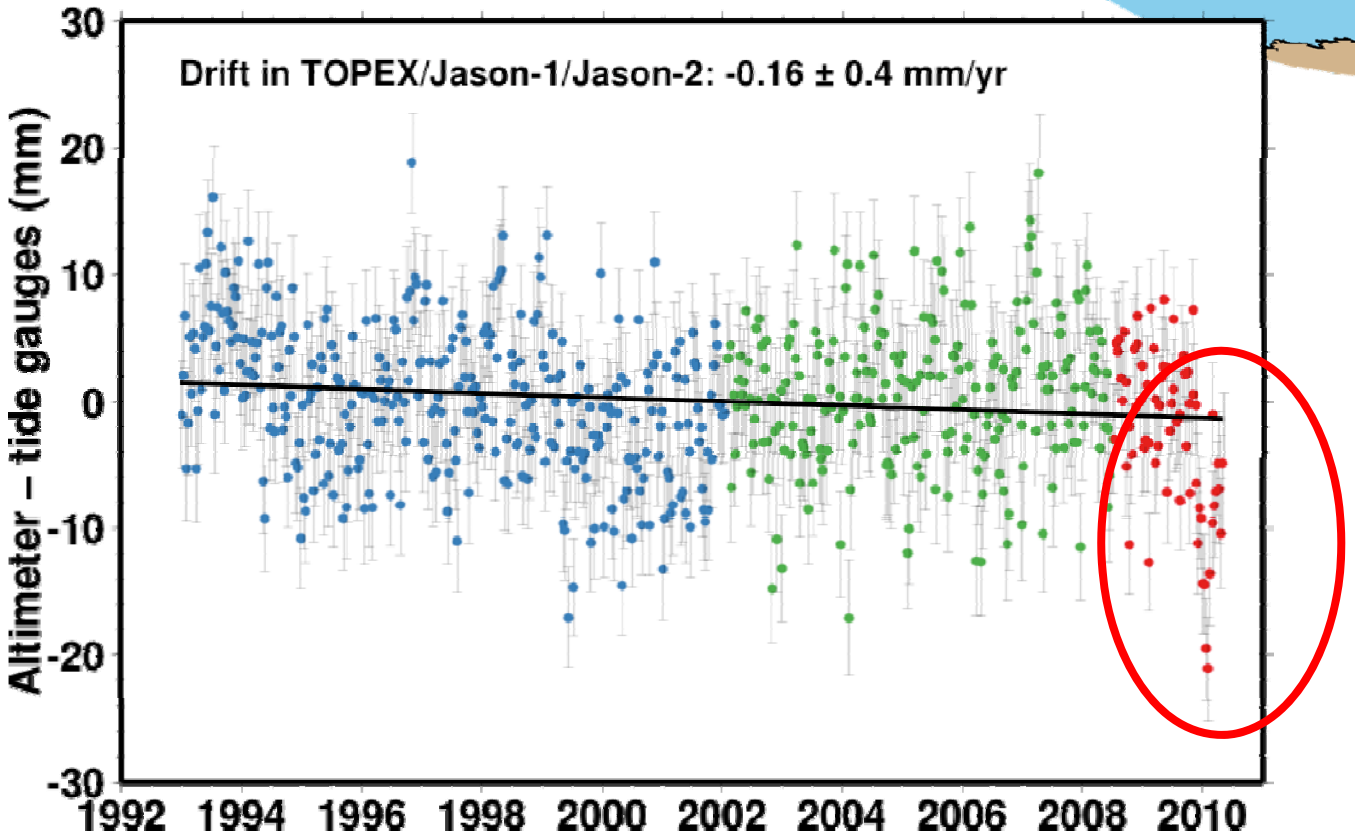
Can Cryosat-2 contribute to the sea level climate data record?

Tide gauge calibration

Mitchum tide gauge calibration

- 64 tide gauges
- "Single mission" TX/J1/J2 combination





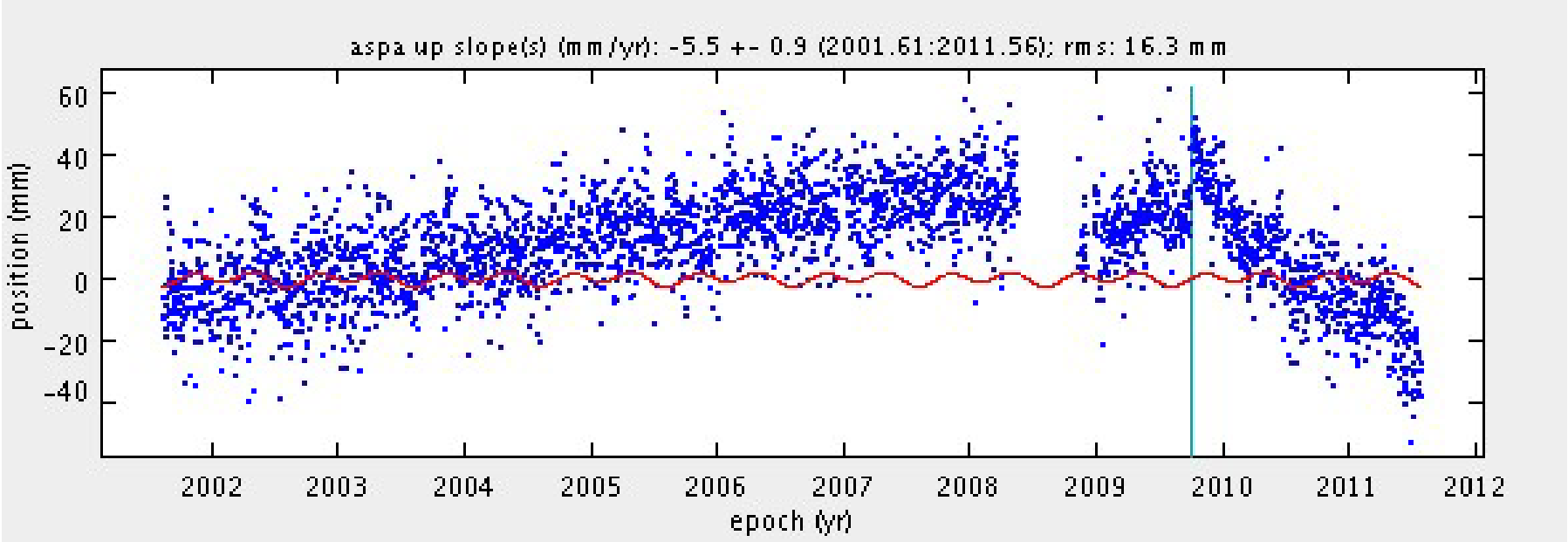
~1 cm offset in November 2009

Pago Pago post-seismic response

Two large earthquakes struck near gauges at roughly the time of the offset.

The post-seismic response continues to show a large negative trend.

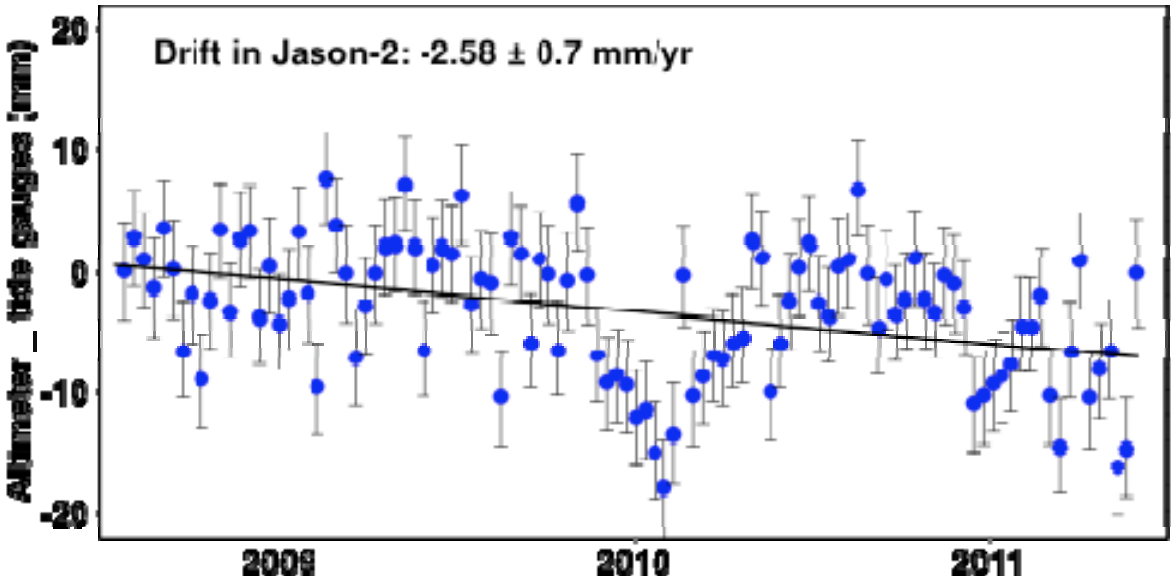
GPS vertical motion at Suva

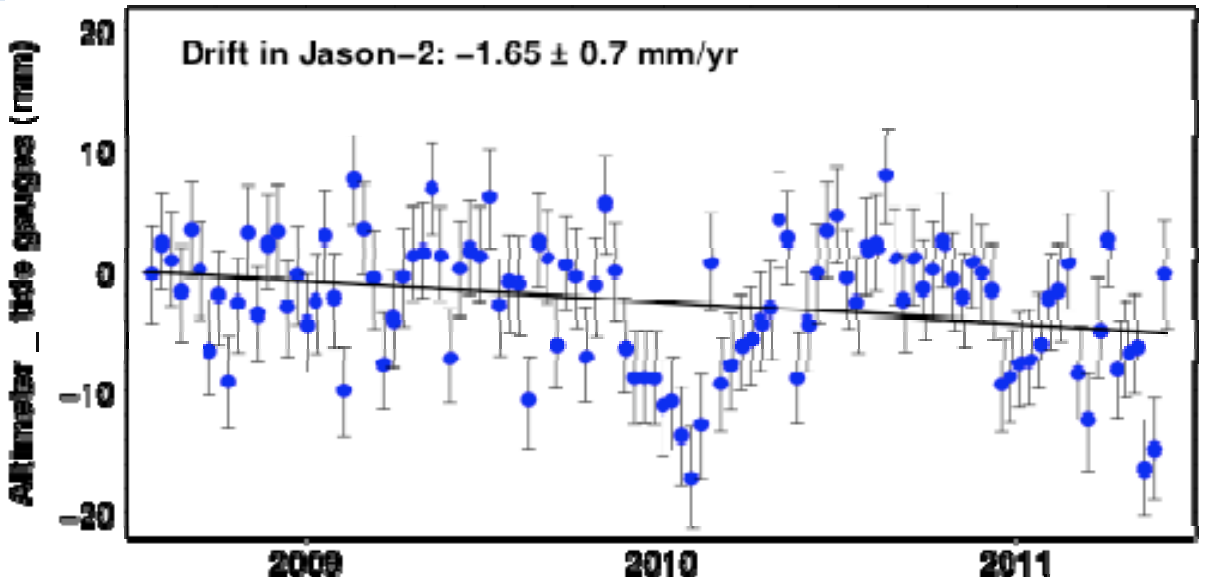


Jason-2 stability

Excluding Pago Pago from the tide gauge calibration decreases the drift

–2.58 to –1.65 ± 0.7 mm/year





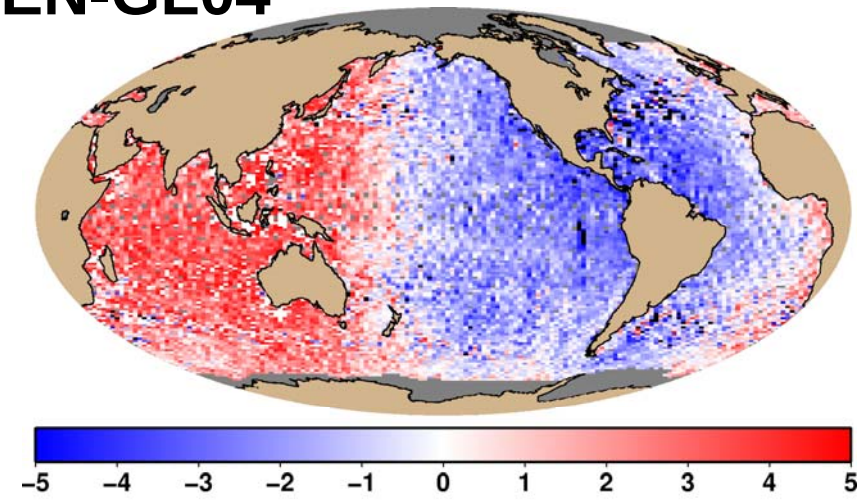
Jason and Envisat stability: ESOC orbits

With CNES EIGEN-GL04 orbits differences between Envisat and Jason-1 and Jason-2 (2002-2010) show trends ±5 mm/yr between the East/West Hemispheres.

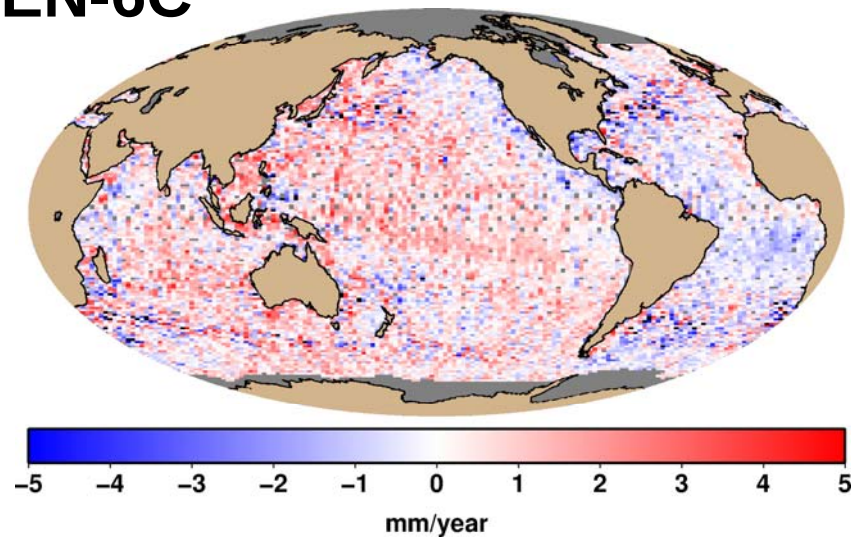
With ESOC EIGEN-6C orbits, the differences are more uniform. Jason – Envisat ~1 mm/year.

Jason minus Envisat trends

EIGEN-GL04

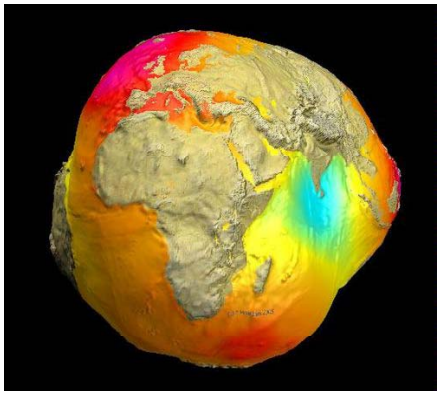


EIGEN-6C



Jason-2 and Envisat stability: ESOC orbits

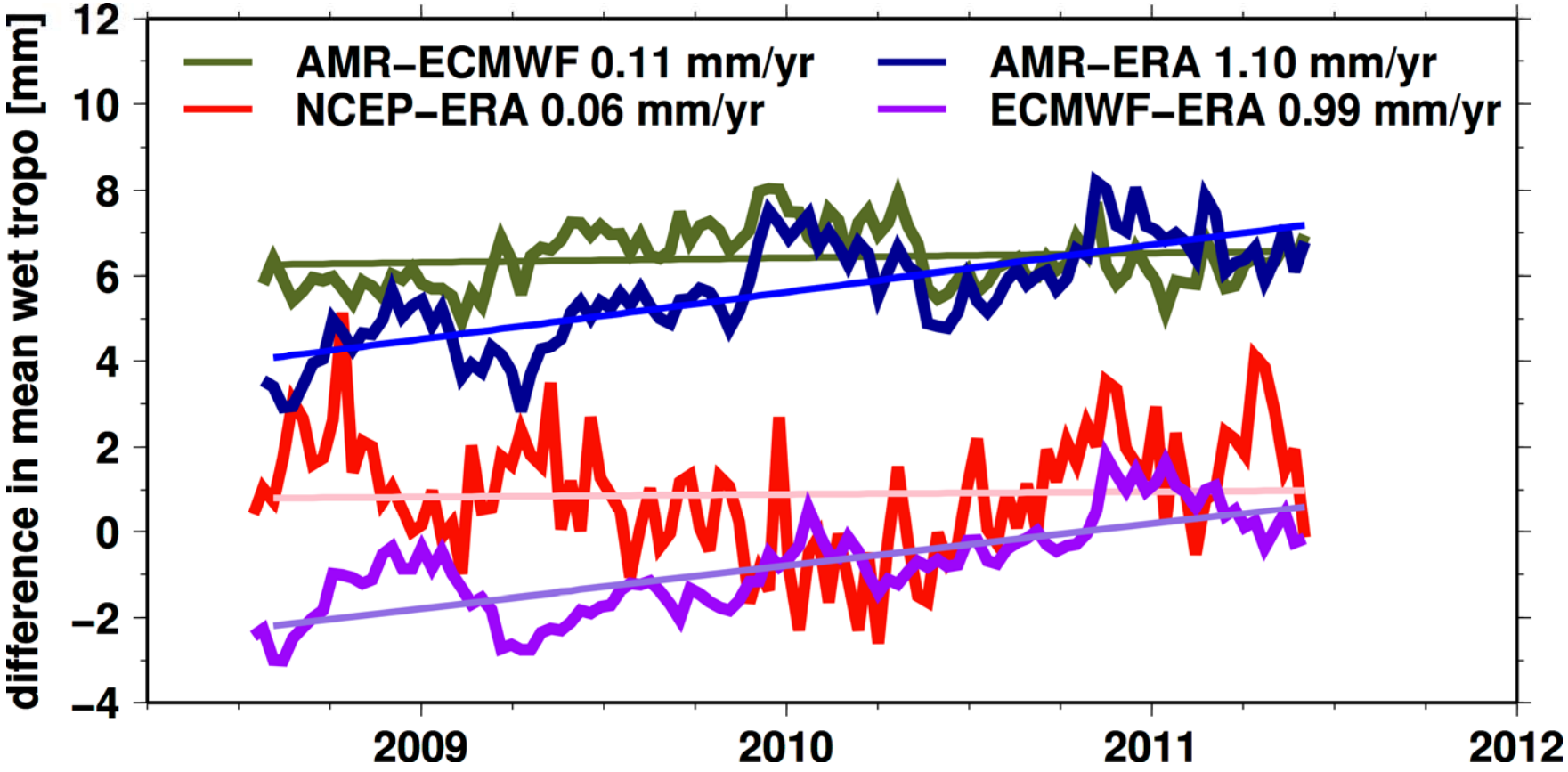
Tide gauge calibration results for the new European Space Operations Centre orbits that use the EIGEN-6C gravity field show slight improvements for Envisat and Jason-1, but degraded performance for Jason-2.



Mission	orbit	rms of residuals (mm)	mean error (mm)	drift (mm/year)
Envisat	GL04S	4.98	3.41	–1.10
	EIGEN-6C	4.67	3.40	–0.98
Jason-1	GL04S	7.03	4.06	+0.37
	EIGEN-6C	6.83	3.71	–0.07
Jason-2	GL04S	5.34	4.06	–1.65
	EIGEN-6C	5.62	4.02	–2.27

Jason-2 stability: wet tropo

Drifts in wet troposphere path delay differences from the GDR-T AMR and either NCEP and ERA-interim models are ~1 mm/year.



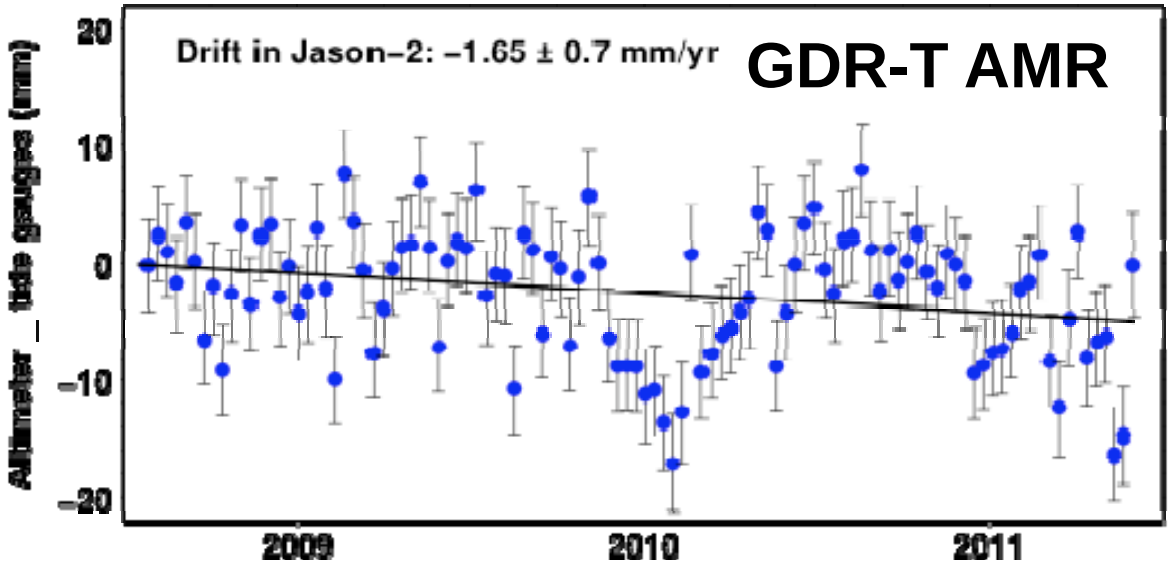
Jason-2 stability: wet tropo

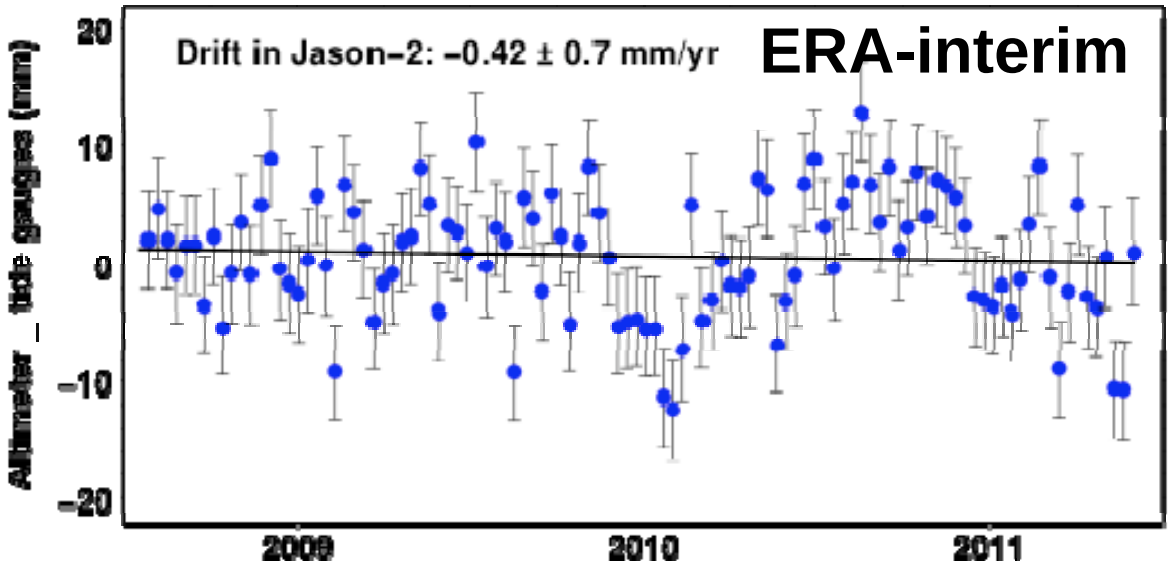
Drifts from calibration

GDR-T AMR: –1.65 mm/yr

ERA-interim: –0.42 mm/yr

Tide gauge calibration using the ERA-interim reanalysis atmosphere model is consistent with no drift.





CryoSat2 mean sea level

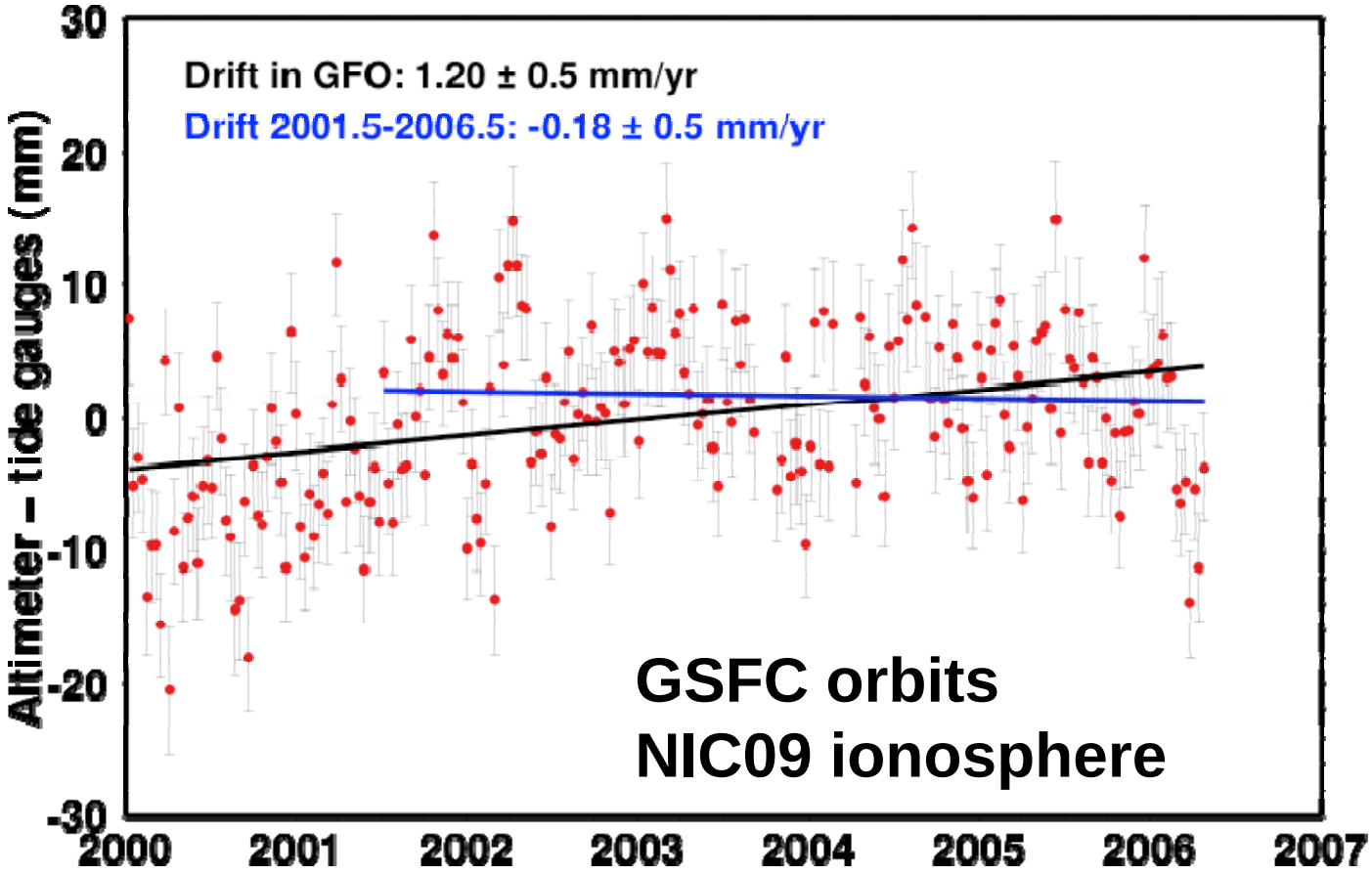
We're interested in evaluating CryoSat2's performance because the altimeter will be used on Jason-CS.

Range retracked (MLE3) and SSH corrected (see talks by Smith and Scharroo)

- ECMWF reanalysis wet troposphere
- JPL/GIM ionosphere
- Hybrid SSB model

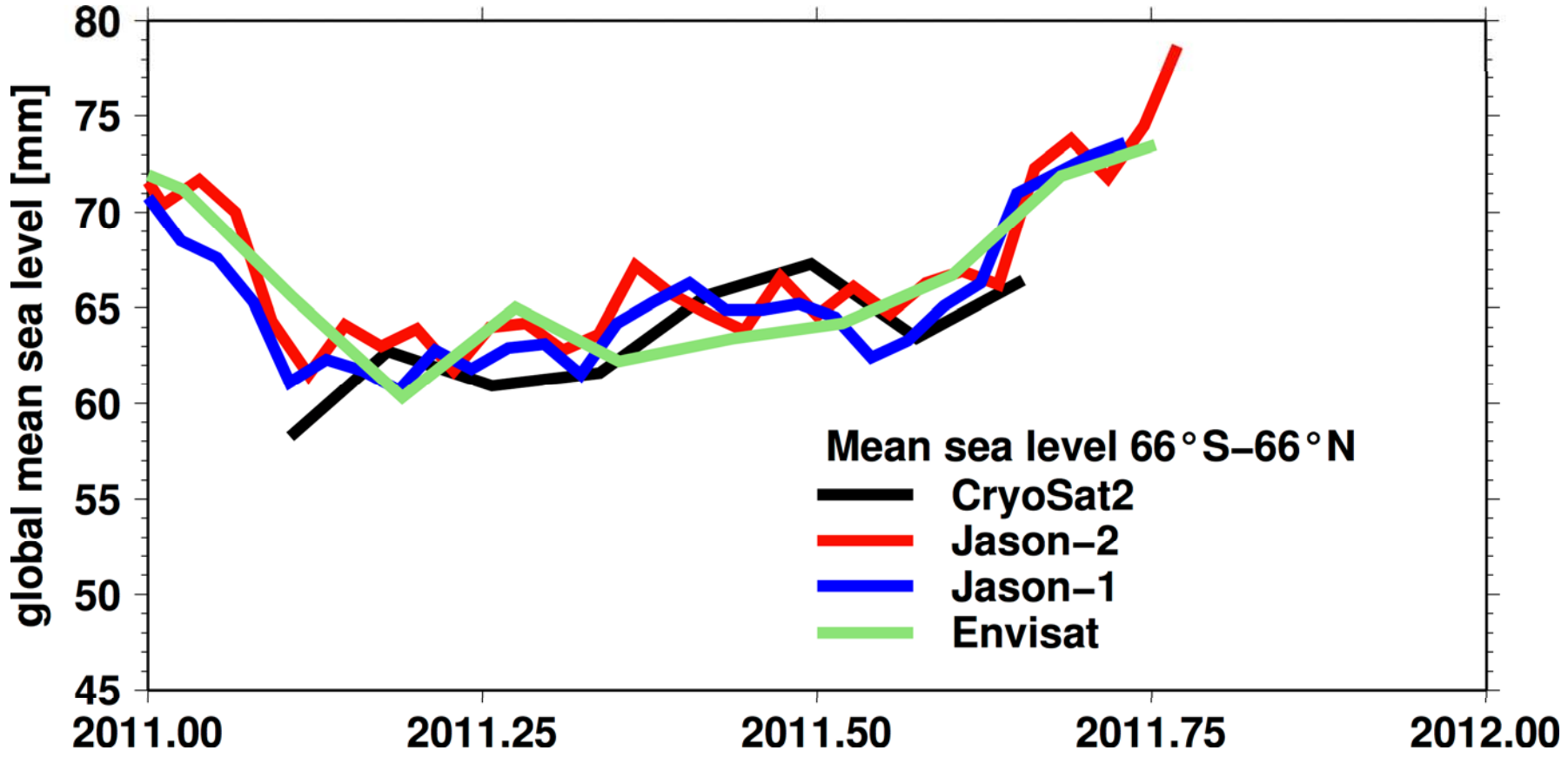
Tide gauge calibration: GFO

Even though GFO faced limitations similar to CryoSat2, the tide gauge calibration shows five years of stability.



CryoSat2 mean sea level

Seven months of mean sea level from CS show a significant drift (~40 mm/year) compared to J1, J2, and Envisat.



Conclusions

Has Jason-2 achieved its stability goal for measuring global mean sea level during the prime mission?

Yes, if Pago Pago is dropped from the tide gauge network and the ECMWF reanalysis (ERA-interim) wet troposphere correction used replaced.

Beckley et al. show stability with calibrated AMR and a hybrid orbit solution.

Can the cause of the different regional sea level trends from Envisat and the Jason series be found?

The EIGEN-6C ESOC orbits resolve most of the difference.

Can Cryosat-2 contribute to the sea level climate data record?

Possibly, if the large apparent secular drift can be corrected.

Backup slides