The Geoid,Mean sea surface and mean dynamic topography

Splinter summary & recommendations

Y. Faugere and O. Andersen

The Session.

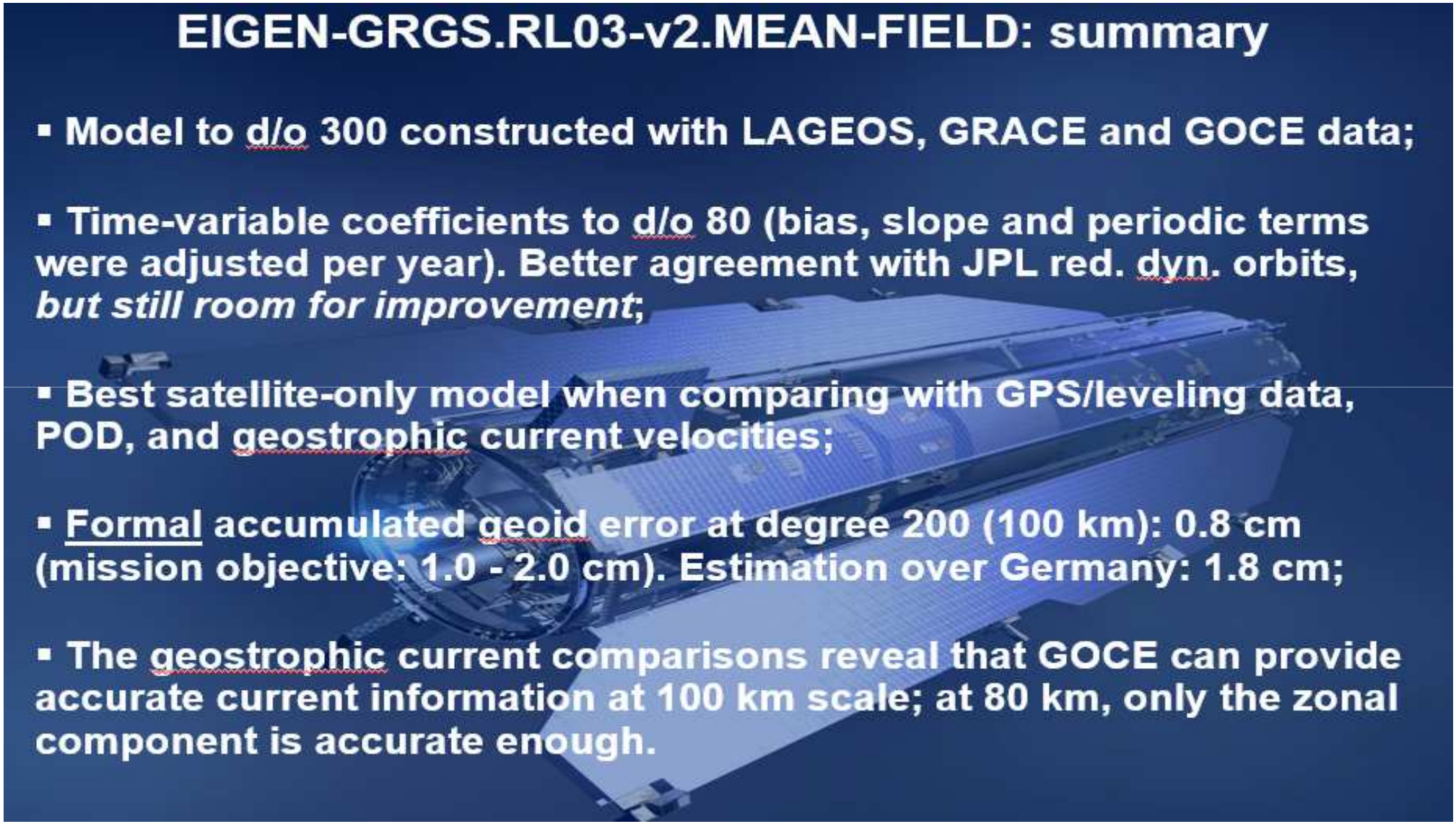
- **6 oral presentations (geoid/MSS/MDT)**
- **2 Posters (on MDT)**
- GEO_001 – Müller, Dettmering and Bosch

  Pointwise comparison of geostrophic currents of altimetry-derived instantaneous Ocean Dynamic Topography with in-situ measurements

  GEO_002 – Knudsen,

  The updated geodetic mean dynamic topography model – DTU15MDT.

S. Bruinsma et al: The POD gravity field model for GDR-E: EIGEN-GRGS.RL03-v2.MEAN-FIELD

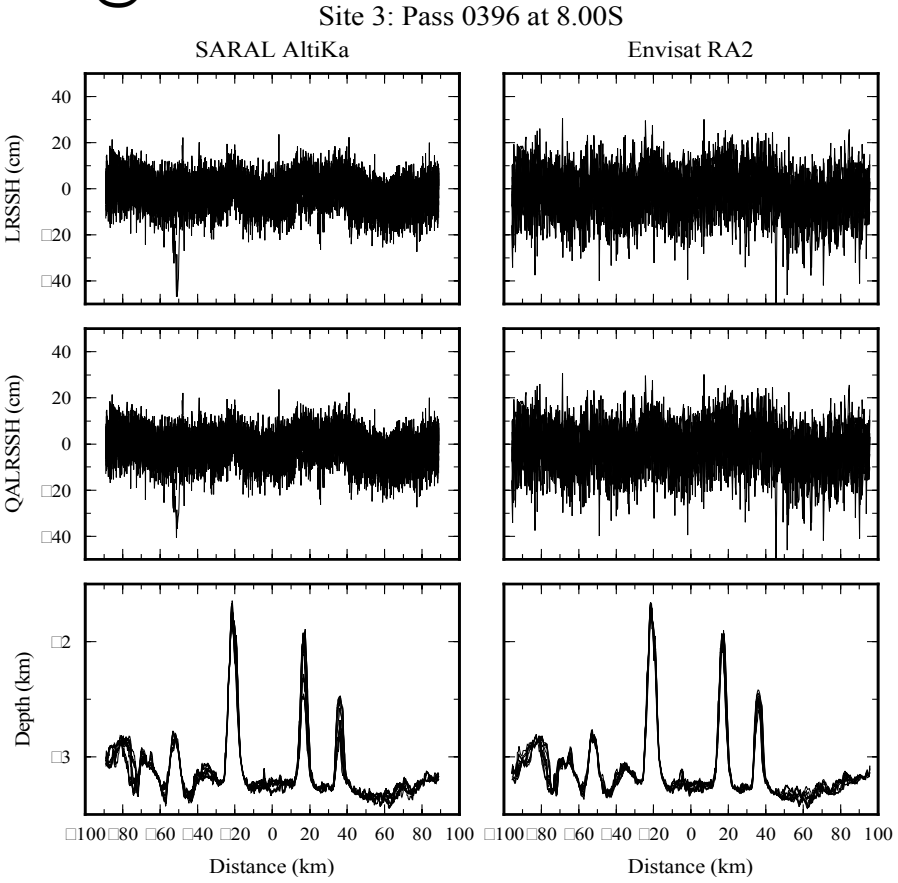


Smith and Marks: Stacking repeat cycles of 40-Hz AltiKa data resolves the geoid anomalies of very small seamounts Walter Smith

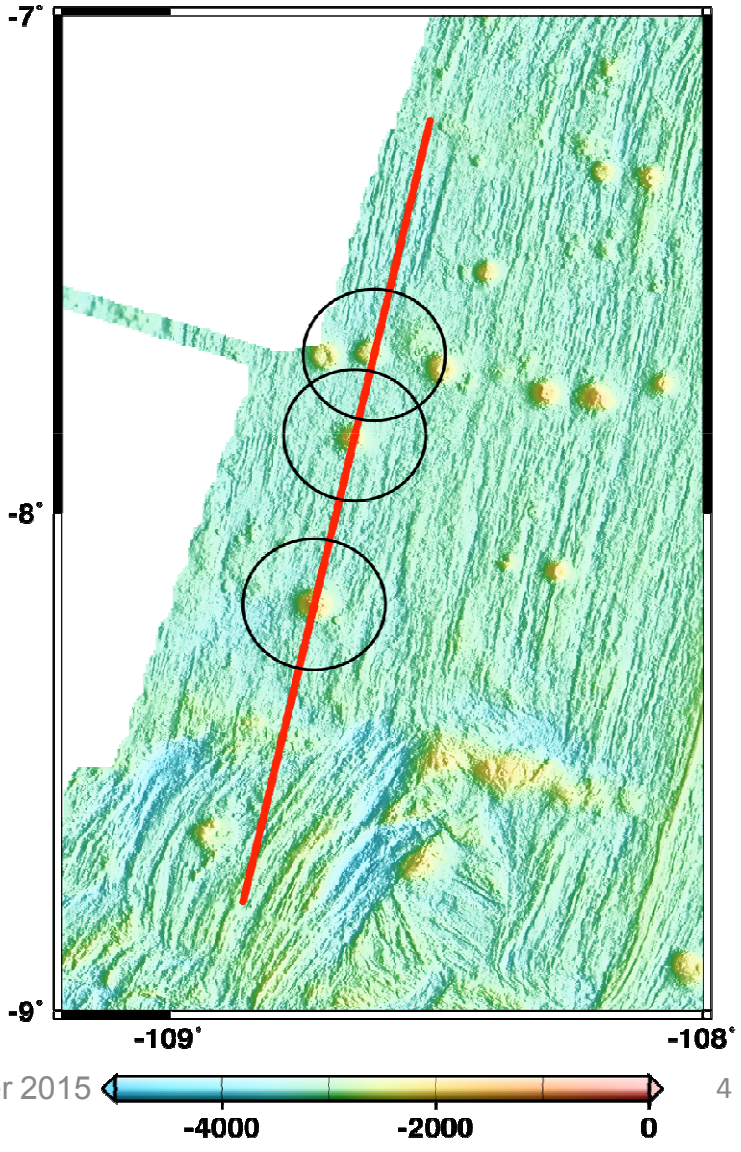
Sea level (geoid) anomaly over Seamounts. 12 repeat tracks.

AltiKa samples @ 40 Hz rate

Ku samples @ 18 Hz rate



Left: Figure from Smith, doi:10.1080/01490419.2015.1014950. Right: bathymetric survey by Cochran et al., image by Karen Marks.



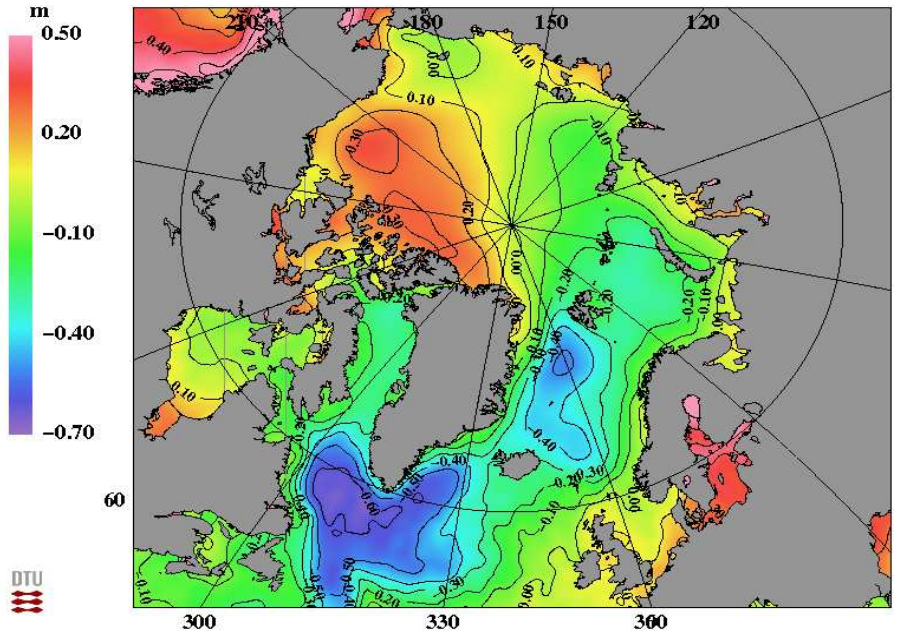
Andersen et al. DTU15 MSS and MDT

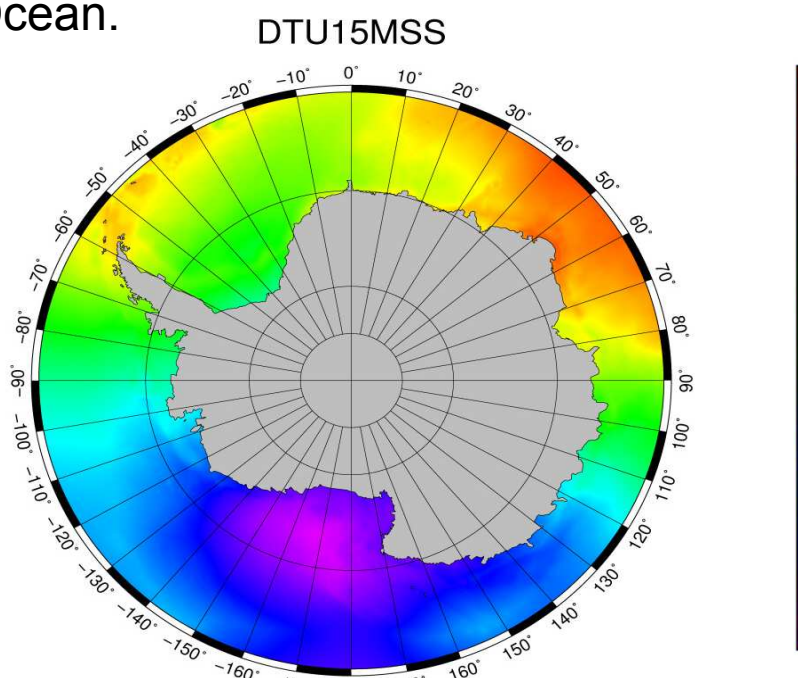
What is NOT NEW….

- **MSS is STILL based on 20 year Mean T/X-J1+J2 profiles (1992-2012)**
- **Identical reference time period to DTU13.**
- **Corrections consistent to RADS V.3**

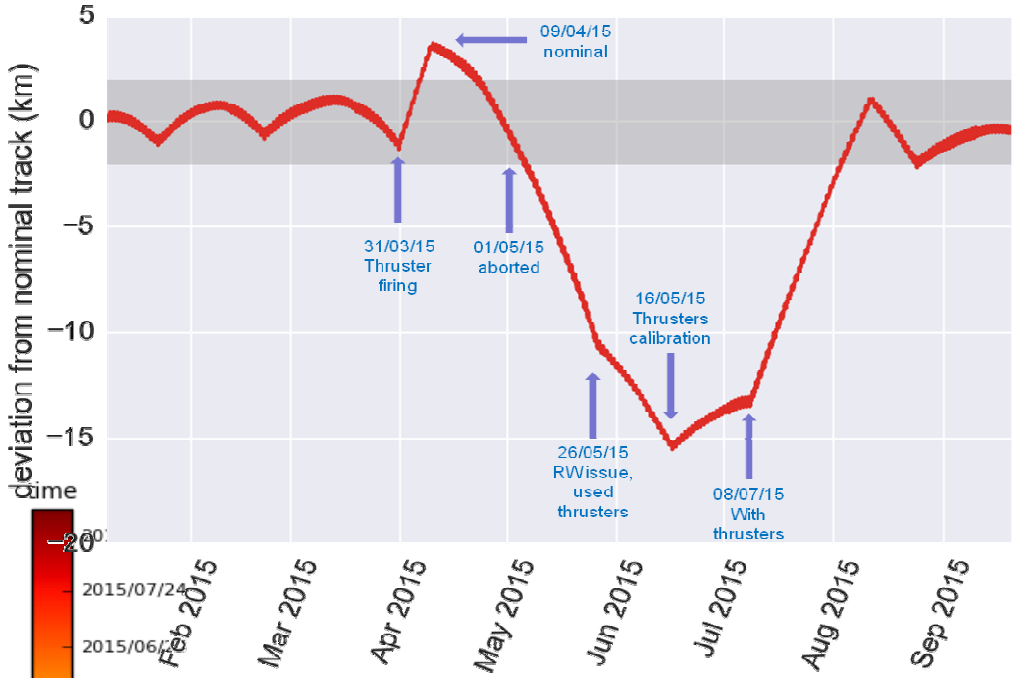
Whats new:

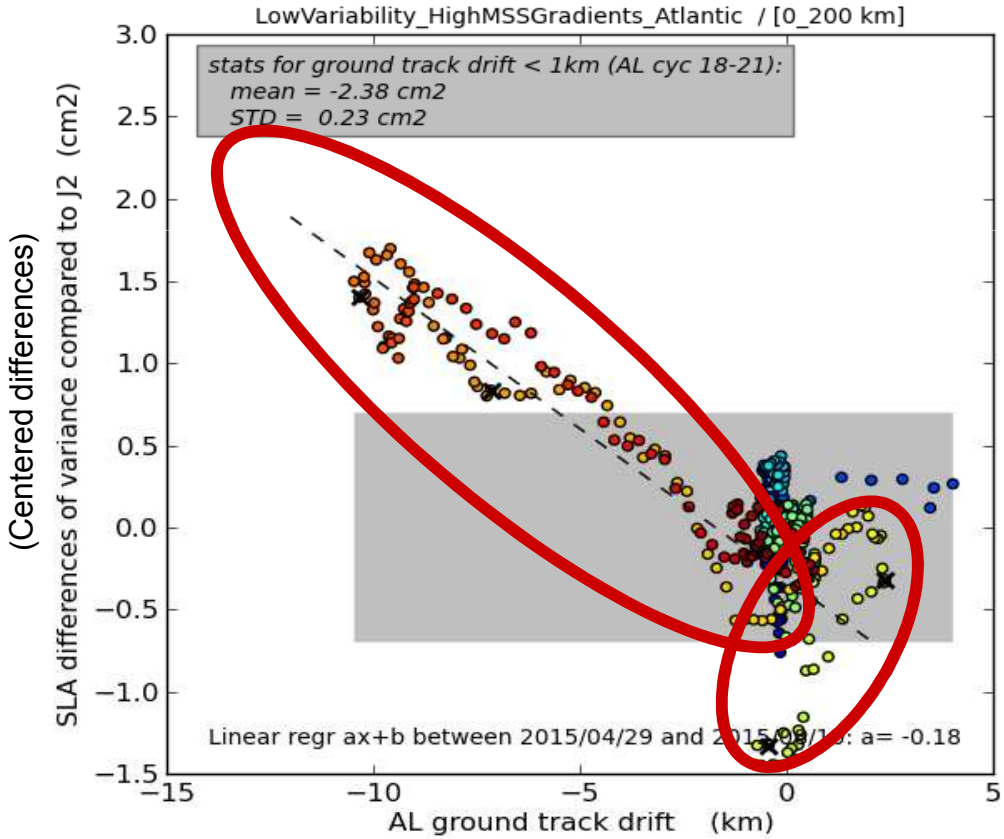
- **Old Geodetic mission of ERS-1 and GEOSAT have too low range precision**
- **Compared to C2 and J-1. Hence they are not used at mid/low latitudes.**
- **SARAL/AltiKA and ENVISAT(phase C) drifting orbits incorporated.**
- **Update of short wavelength in** Arctic and Antarctic Ocean.

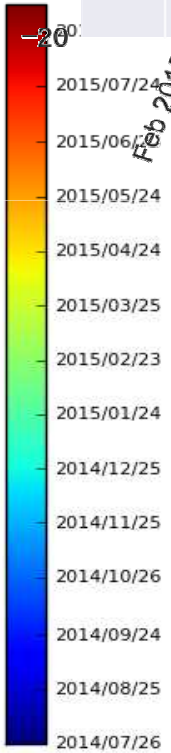




Pujol et al.: The recent drift of SARAL: an unexpected MSS experiment







MSS error evolution with AL ground-track position:

→**Err = 4.2 mm rms / km**

→ Mixed with ocean variability between 0-4 km

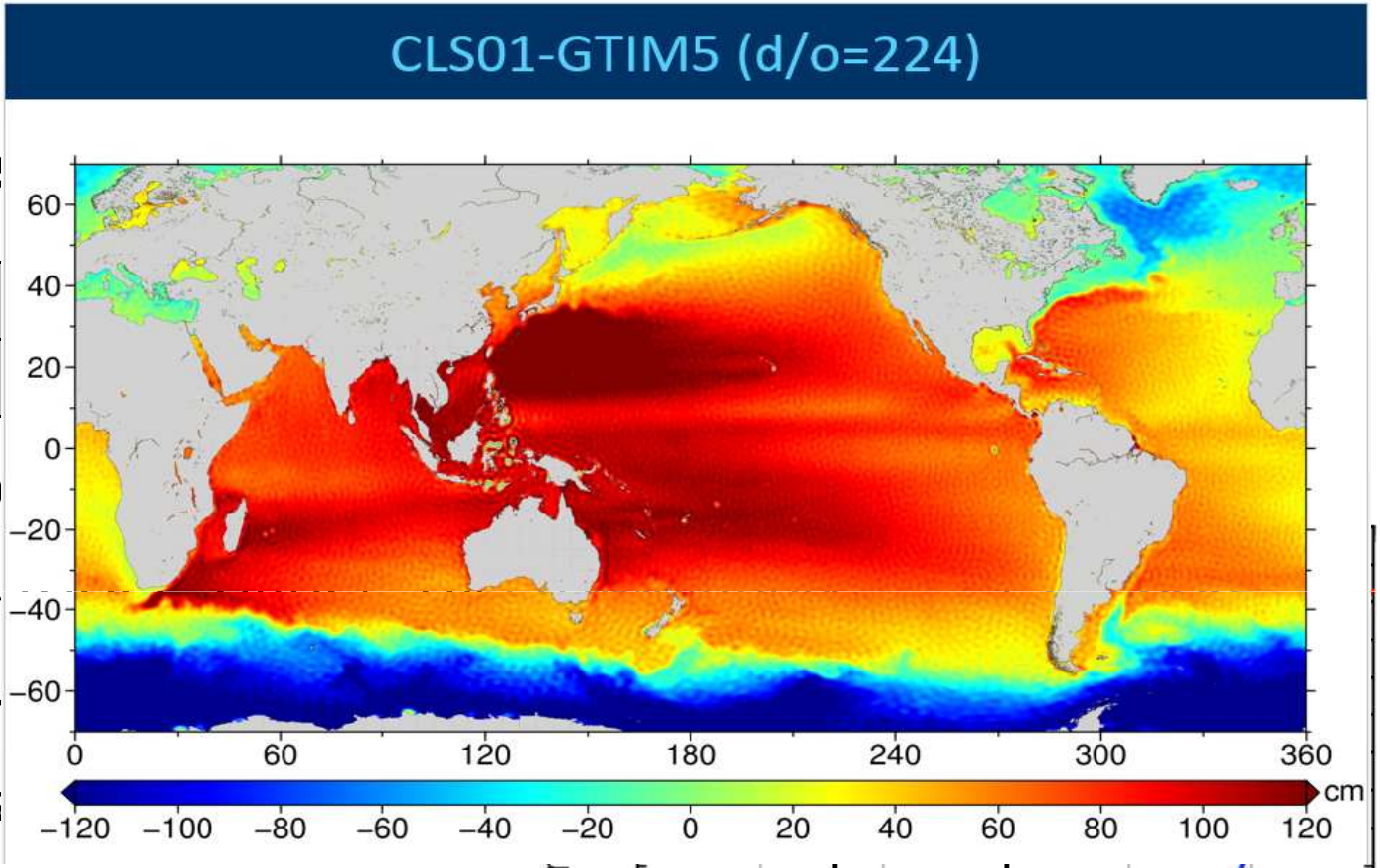
→ **Err significant for ground-track distance > 5km** (low variability & high MSS gradients area)

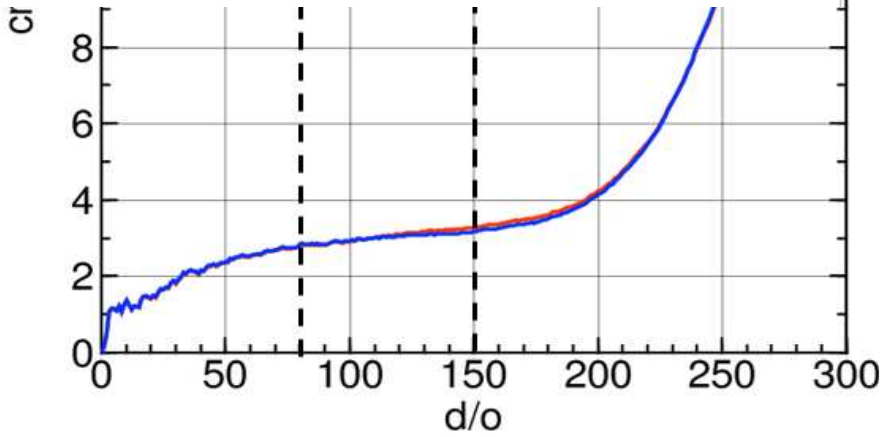
Bingham: Assessing the contribution of GOCE and altimetry to improvements in geodet determination Rory Bingham

- **How well can we**

resolution (km)	
error (cm)	

- Little difference betv
- TIM (GOCE) and DIR
- Compared to DIR, th
- have shown the grea
- in the LW and MW components
- Different MSS (CLS/DTU) products
- have little overall impact:
  - Swamped at LW by residual geoid omission error
  - Swamped at SW by geoid commission error



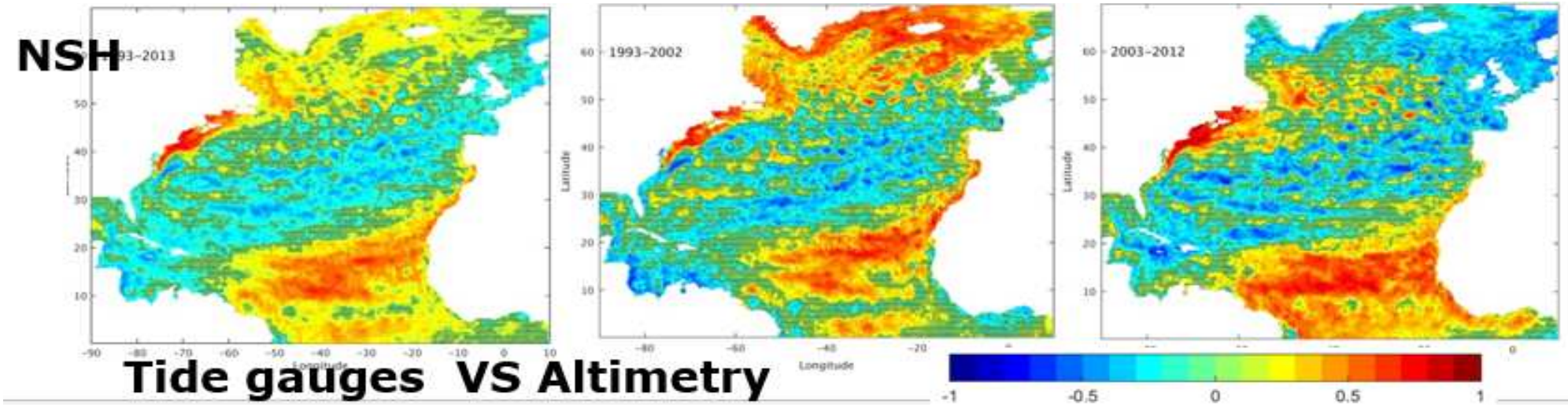


Cheng et al. Variations of observed correlations between satellite altimetry and tide gauge data along the U.S. east coast

Significant correlations and the correlation variations between tide gauge data north of Cape Hatteras and altimeter data in the subpolar and tropical North Atlantic Ocean in the last two decades.

Sea level variations in the Labrador Sea are highly correlated to local sea level variations north of Cape Hatteras with phase leading of about 3 years over 1993-2002 time period.

Spatial distribution characteristics of the correlation variations are linked to the slowing down of AMOC and the variations of NAO winter, atmospheric forcing and Ocean Heat Content in the North Atlantic Ocean.



Tide gauges VS Altimetry

Recommendations: Jason-2 EoL

RECOGNISE that it's a great achievement that J-2 is IN VERY GOOD SHAPE(full redundancy), and RECOMMEND early investion of possible/various EoL scenarios

RECOMMENDATION is linked to the expected altimeter constellation in upcoming years.

Assuming we have two operational repeat satellite (J-3 & S-3A) +

2 additional satellites (Altika and/or C2 and/or HY2A and/or S-3B) flying.

RECOMMEND to move J-2 to a GM mission as soon as possible in preparation for SWOT

RECOMMEND to plan for TWO interlaced GM cycles to reduce cross track sampling to 4 km in order to Improve resolution and generate next GENERATION MSS/Gravity/Bathymetry.

RECOMMEND THAT TIMING IS CONSIDERED: Two interlaced GM cycles will take 800 days or3 years. If SWOT will launch in Dec 2020 a J-2 EoL GM should be initiated no later than Dec 2017

RECOMMEND two Interlaced GM because we can not use interleaved orbit with J-1 GM

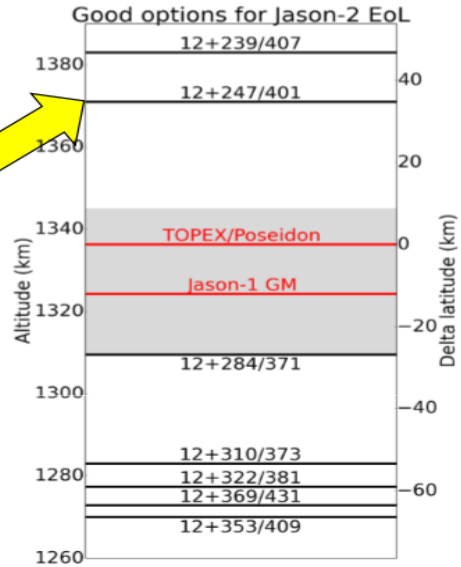
RECOMMEND study if first GM can be phased to maximize info with J-1GM in case of J-2 failure (near interleaved but at other altitude)

Recommendation: J-2 EoL orbit choice.

Following presentation by Dibarbure

- Best contender: codename 12+247/401
  - 35km above Jason-3
  - Minimizes mesoscale sampling duplication
  - Good geodetic grid
- Gains (geodesy) and losses (mesoscale) of geodetic phase will be the same as for Jason-1

Priority	Revs per day	Sub-cycles
1	12+247/401	3, -5, 13, 138, 401
2	12+369/431	-7, -146, 431
3	12+353/409	-7, 22, -73, 168, 409
4	12+310/373	-6, -77, -148, 373
5	12+284/371	-4, 17, 81, 145, 371
6	12+322/381	-6, 13, -71, 155, 381
7	12+239/407	-2, 5, -17, -63, -172, 407



RECOMMEND to investigate the orbits (higher RECOMMEND THAT orbit with highter altitude than nominal orbit - codename 12+247/401 (1) and 12+239/407(2) is further investigated as it seems optimal withrespect to optimal sea state and oceangoraphic use.

RECOMMEND a study of orbit wrt sampling of oceangraphic signals.

RECOMMEND choice of with intermediate sub-Cycle in case of failure of the satellite

SARAL/Altika “Extension of Life”

- Due to technical problems two future orbit choices were outlined (35 or drift)

- RECOMMEND the not-maintained (drifting) orbit for MSS/Grav/Bath.

- RECOMMEND this phase to start as soon as possible (awaiting 3 years project meeting in early 2016)

- RECOMMEND to start investigating possible scenarios of drifting orbit (decrease) and investigate consequence for oceanographic signal (tides, mesoscale)

- RECOMMEND TO perform (i.e. 1 year) orbit simulation for 2 scenarios (low and high solar activity) for AltiKa drifting orbit

- RECOMMEND to consider timing and investigate consequence of several simultaneous geodetic missions

Other topics

- Discussed having a dedicated MSS meeting in 2016
- (accuracy/future needs/ processing/ assesment/
- impact of various future Geodetic missions)
  - possible outside/adjacent to OSTST
  - Possible phased with SWOT meeting.