The DTU18 MSS Mean Sea Surface improvement from SAR altimetry

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Altimetric Mean sea surface.

Reference for deriving sea level anomalies (SLA).

DTU MSS are purely altimetric (no remove/restore vrt geoid (like CLS)

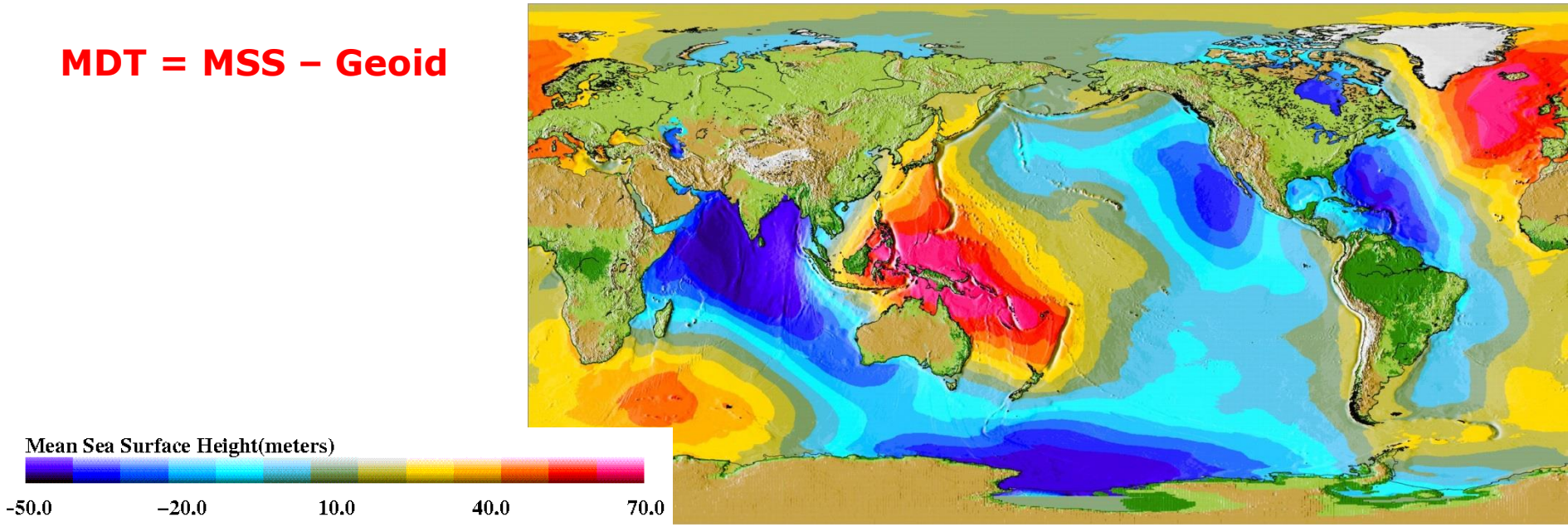
20 years mean profile of TOPEX/J1/J2 is fundament.

20 years mean profiles of E1/E2/N1/SA is fitted on this (remove d/o 10 diff)

Short frequenicies from geodetic mission altimetry C2+J1+SA.

Baseline for MDT (ocean current) estimation

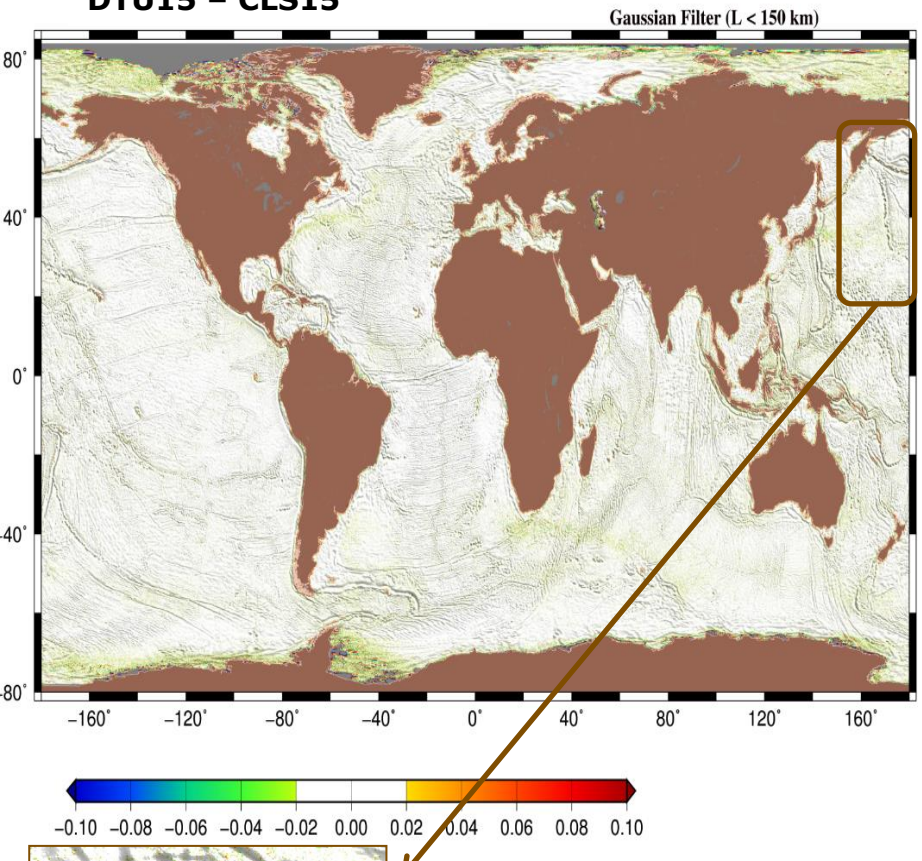
MDT = MSS – Geoid

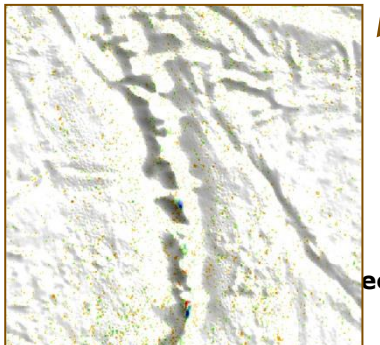


CLS 15 vs DTU15 at different wavelengths

Short wavelengths λ < 150 km

DTU15 – CLS15

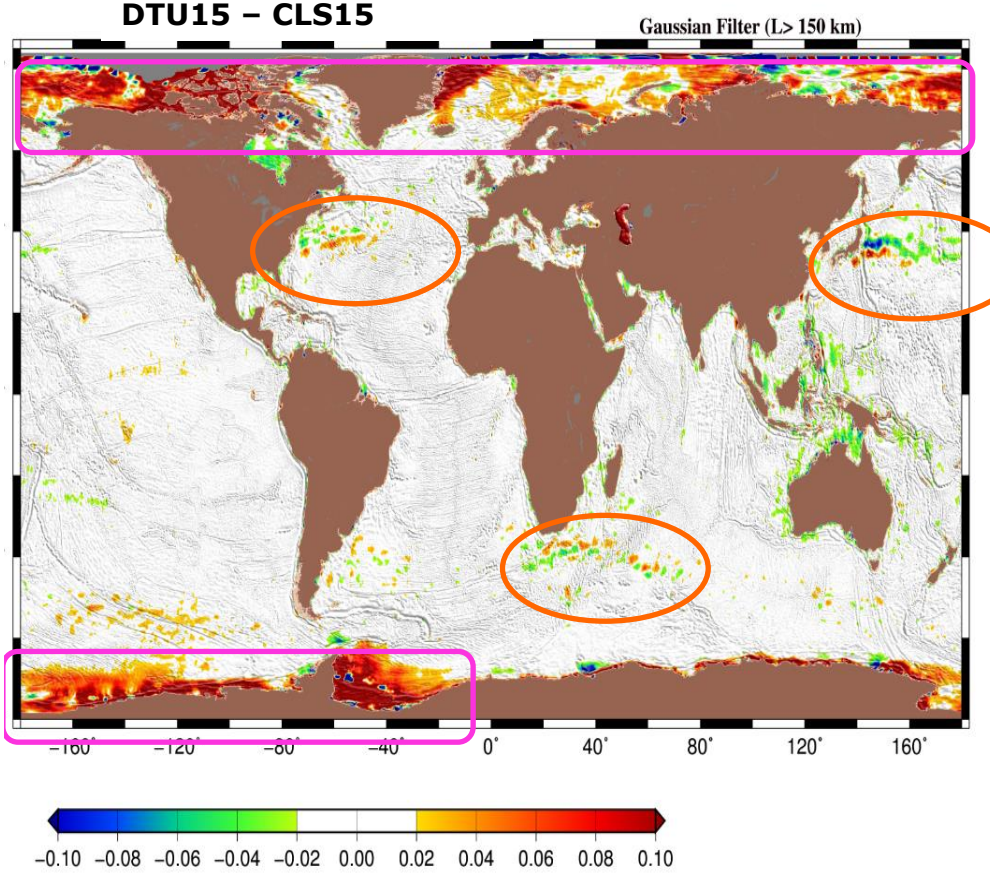




Zoom on the Hawaiian-Emperor seamount chain

Long wavelengths λ > 150 km

DTU15 – CLS15



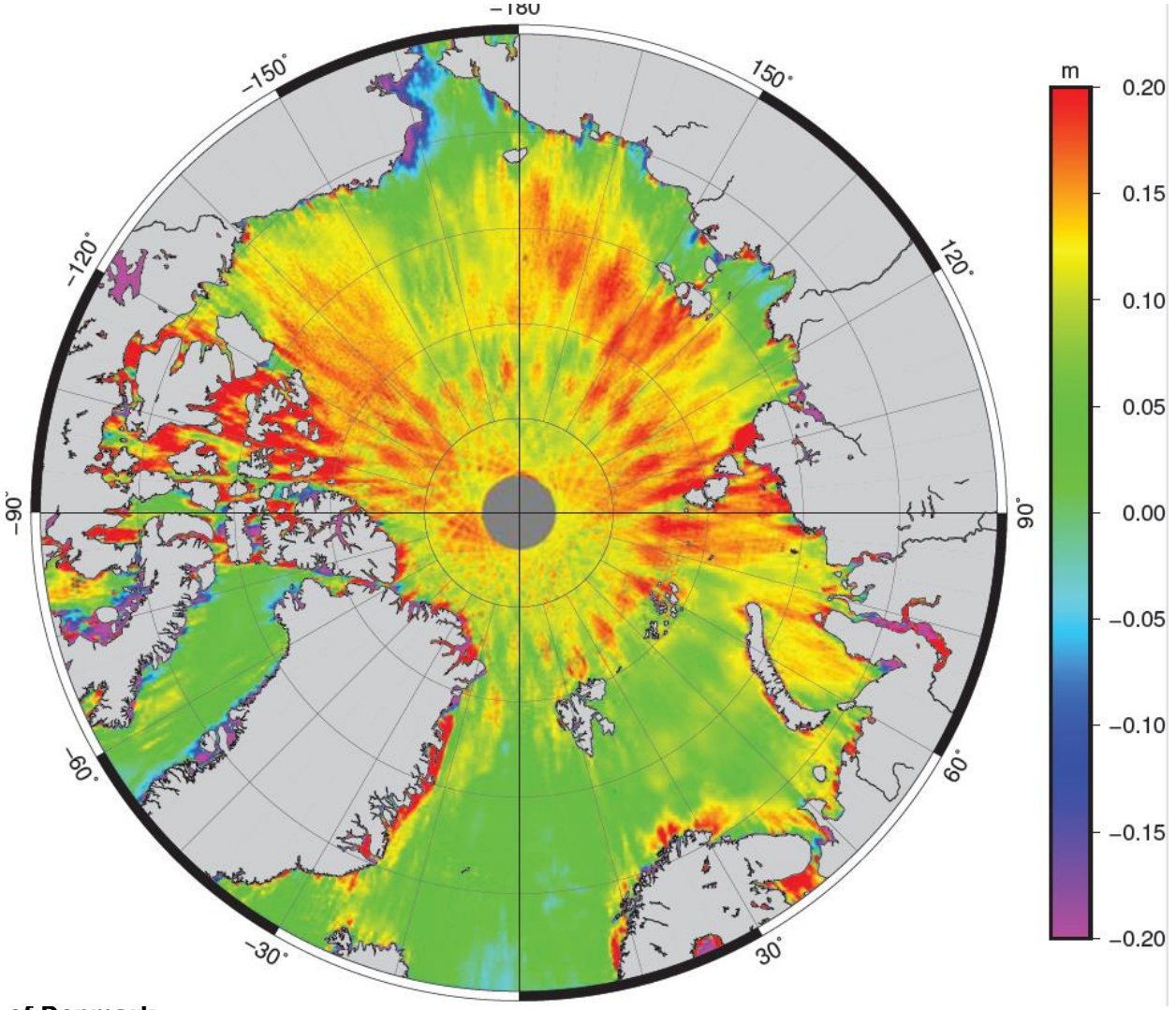
Average difference is less than 2 cm

- No significant difference at short wavelengths
- Some differences seen at wavelength > 150 km.

Courtesy of Shaeffer et al., 2017

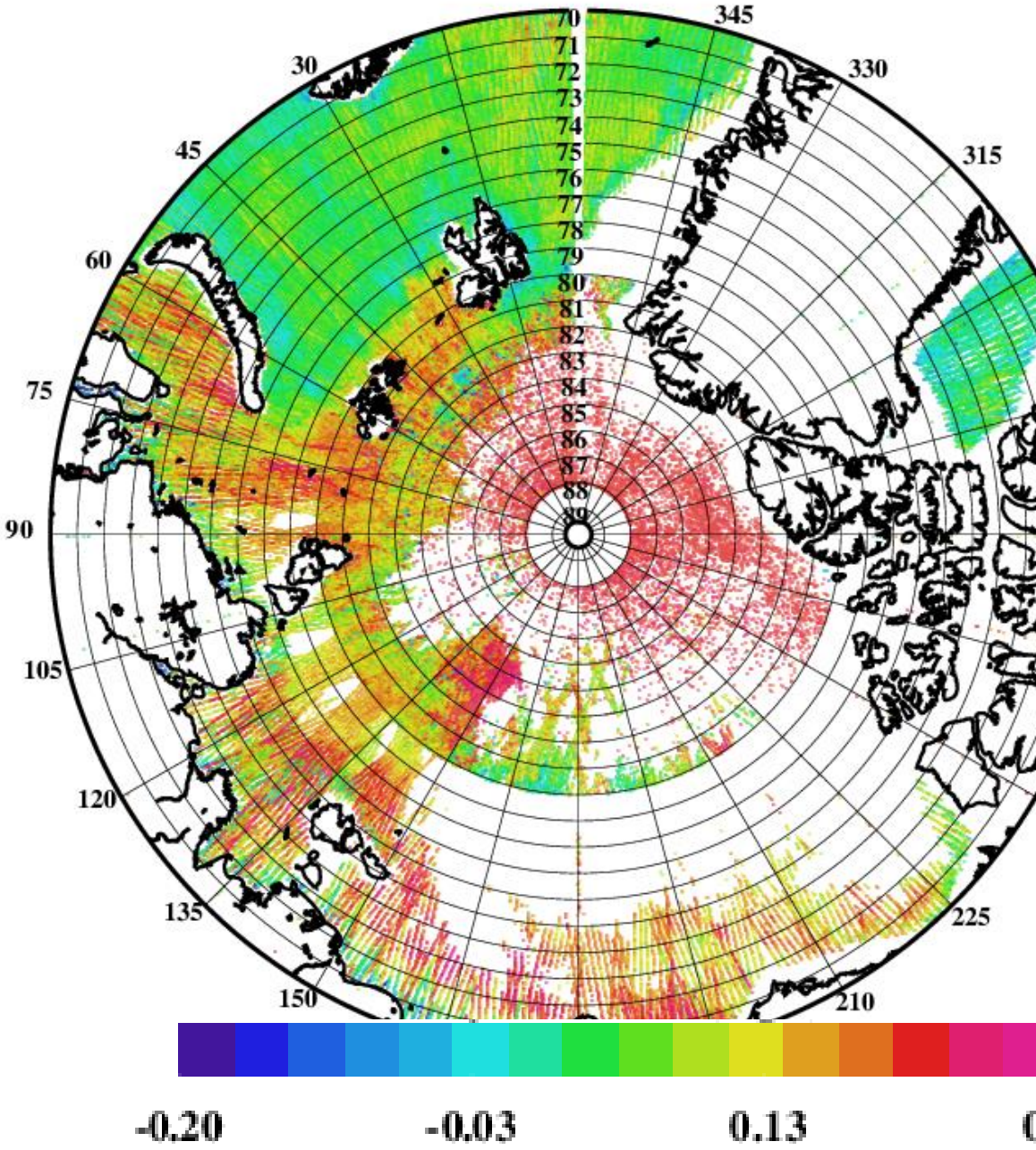
DTU15MSS-UCL13MSS (Regional)

- Confirms that DTU15 is
- Potential too high by
- 10 cm in the Arctic
- (ice covered regions
- So also around
- Antarctica….

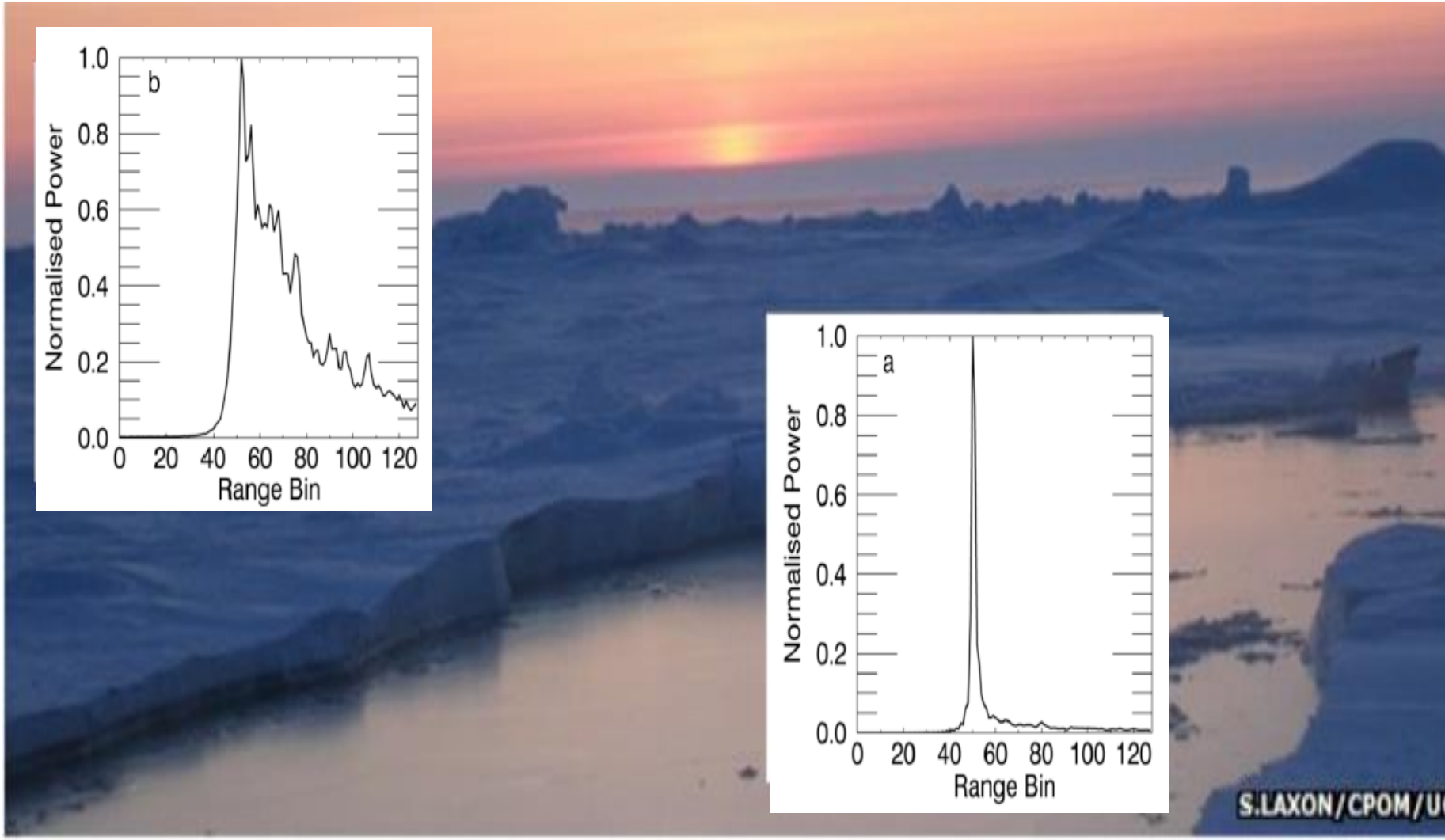


Problem:

- Cryosat 8 year Mean
- Relative to DTU15MSS.
- INDICATE THAT MSS
- SHOULD BE HIGHER
- **Whats wrong?**



RADS prefers "ocean like" waveforms in the Arctic this is sea-ice height

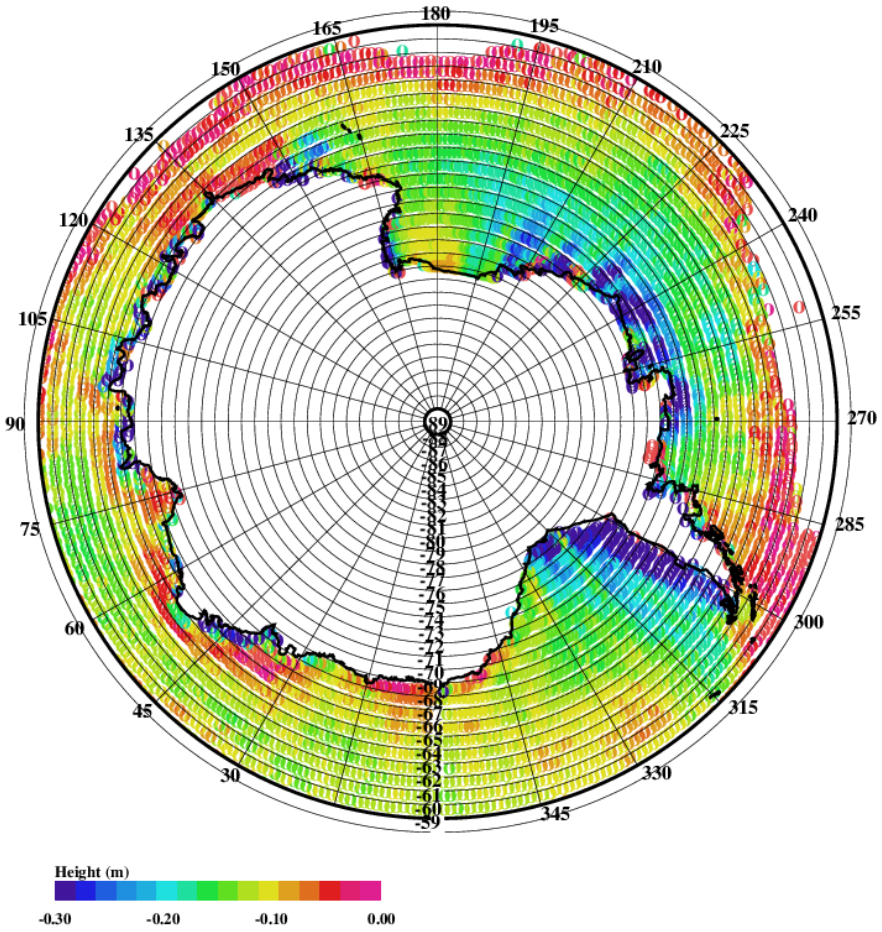


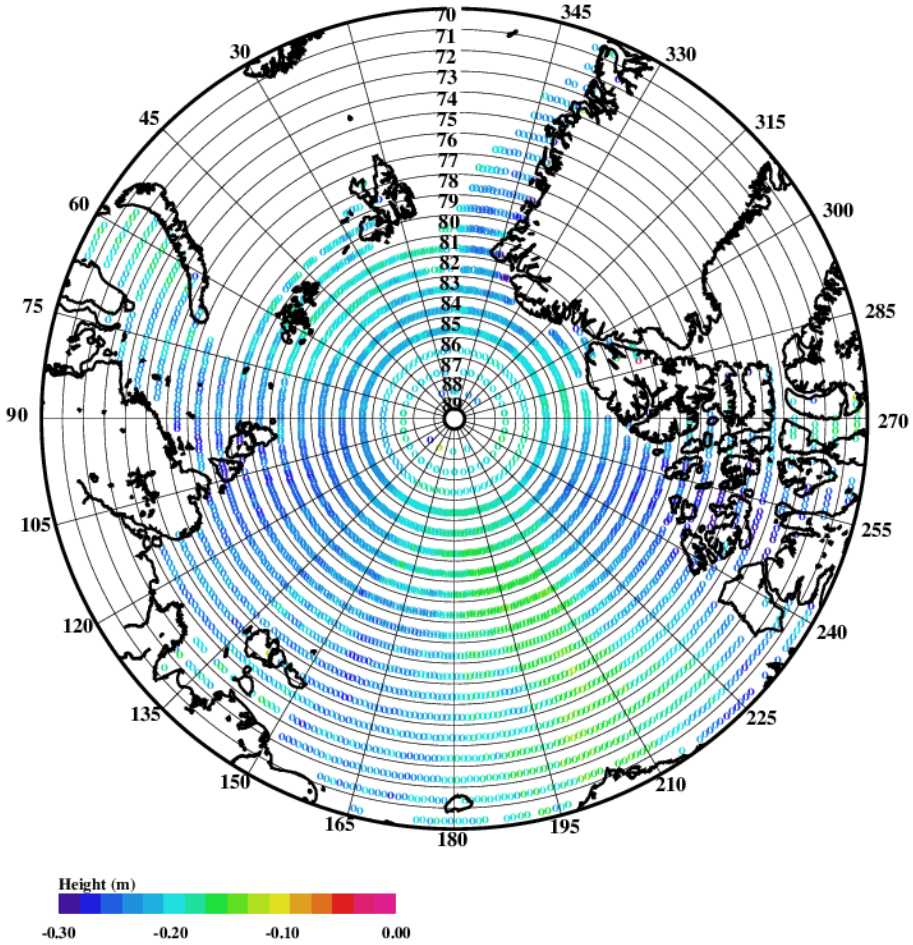
Four steps to update DTU15MSS to DTU18MSS.

- **New Arctic and Antarctic dataset -> Reprocessing/retracking of Cryosat-2 within leads……**
- **Long wavelength Correction TP/J1/J2 mean profiles**
- **Coastal zone update using S3A and TP/J1/J2 + TDM profiles**
- **Removing Geodetic Mission ocean variability in interplolation.**

C2 Lead (SAR+SARin) data

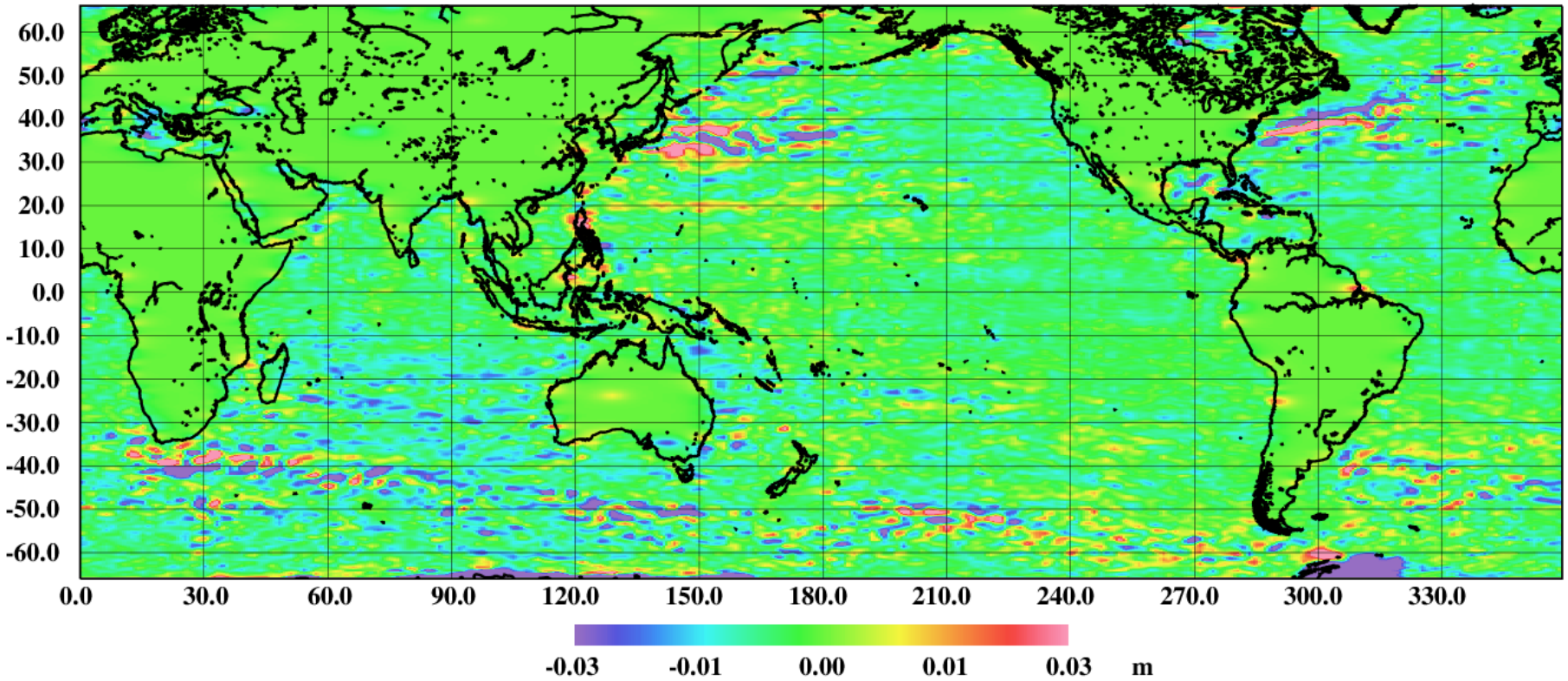
- 8 year mean estimated from > 4 million 20 Hz observations
- Retracker bias for Gauss Thresshold retracker found and corrected.





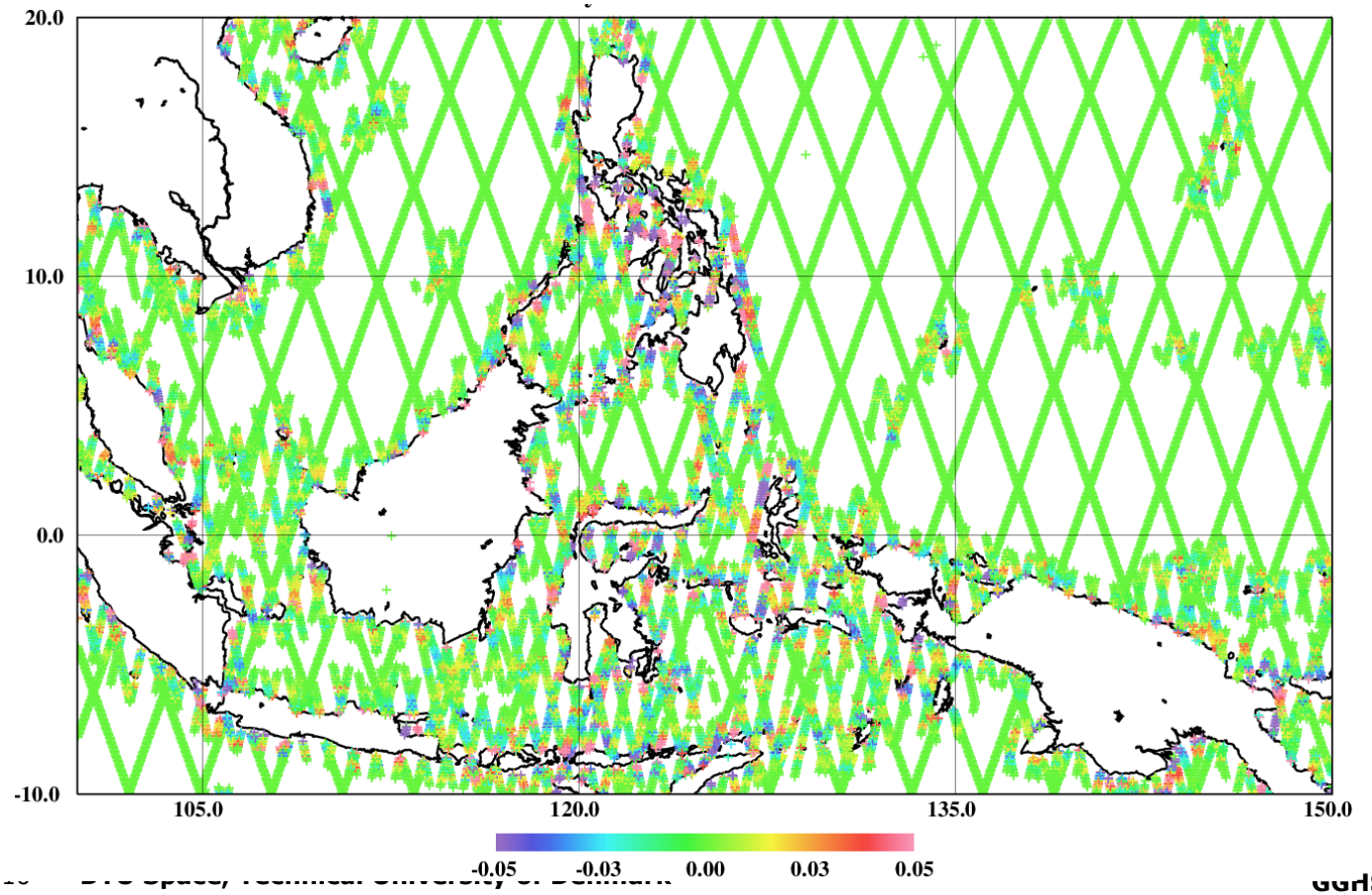
Long wavelength

- An-isotropic Gauss Markov covariance function
- Correlation length: 50 km NS & 150 km East west
- Stronger fit to mean tracks.



Coastal Zone (TP+TDM+ 2 years of S-3A)

- Within 70 km of coast (zeroed elsewhere).
- Long wavelength removed.



Dynamic Sea level Variability

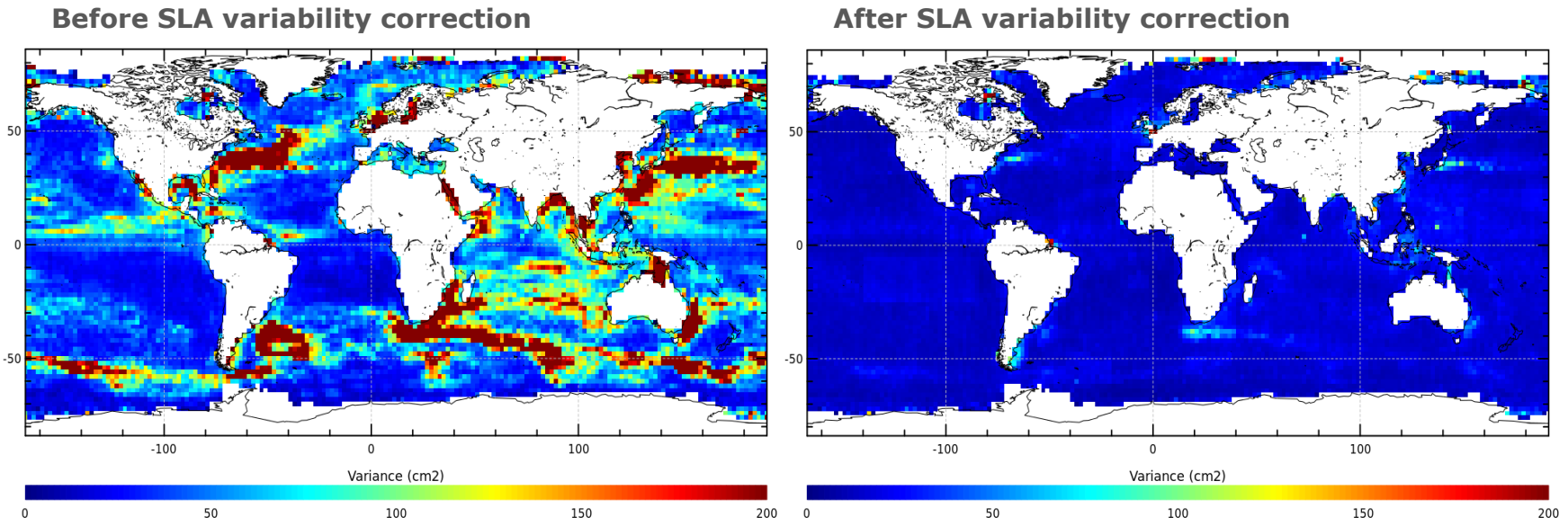
Interannual & seasonal oceanic variability corrected using 3D Optimal interpolation

From Daily AVISO SLA maps (Le Traon et al, 1998) >>>

$$SSH_{cor}(t,\lambda,\varphi) = SSH(t,\lambda,\varphi) - [SLA^{i}_{(t,\lambda,\varphi)}]$$

AVISO Daily SLA grids extimated from **All Altimeter missions**

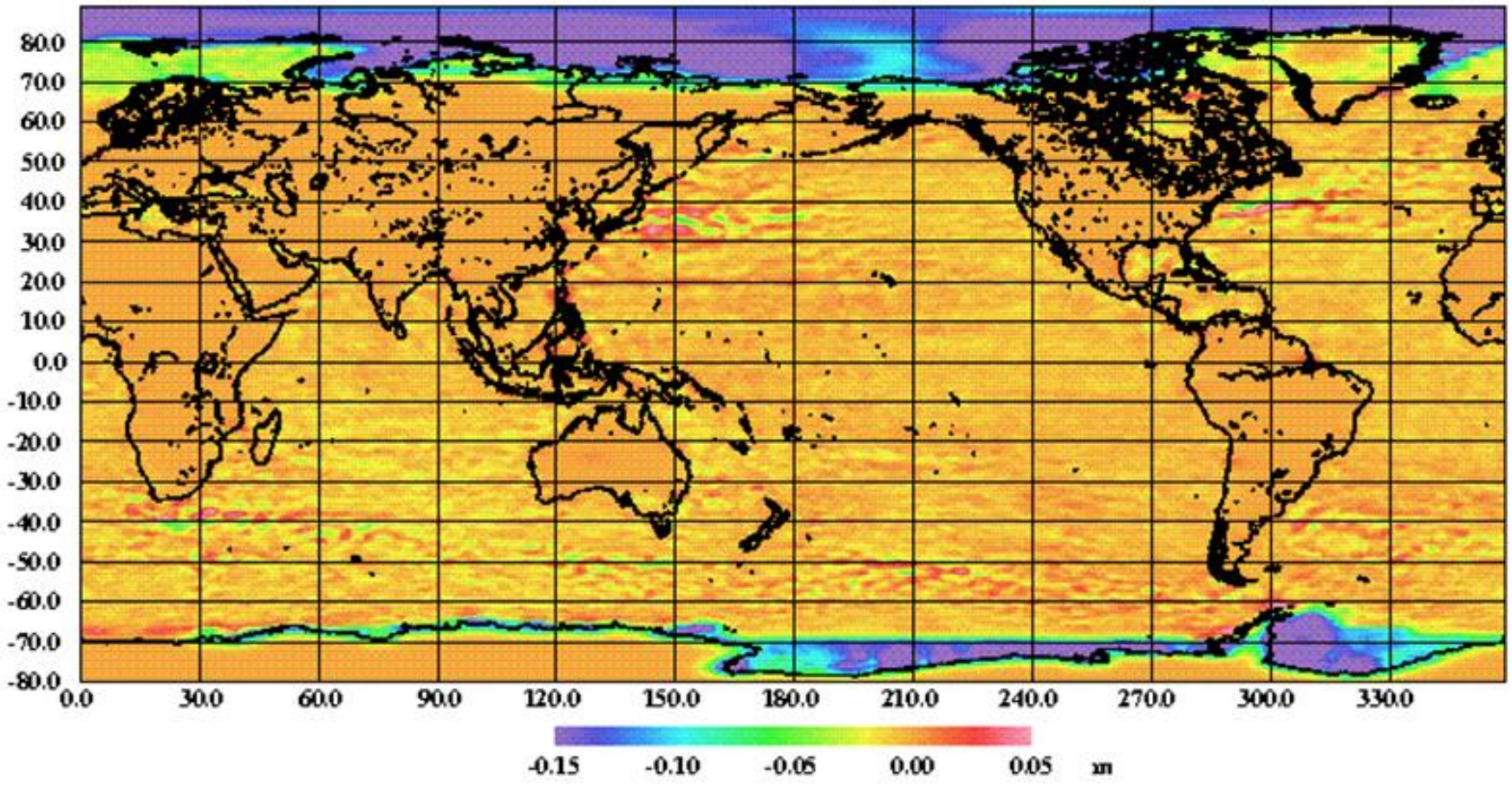
Variance of Cryosat-2 SLA before and after dynamical SLA variability

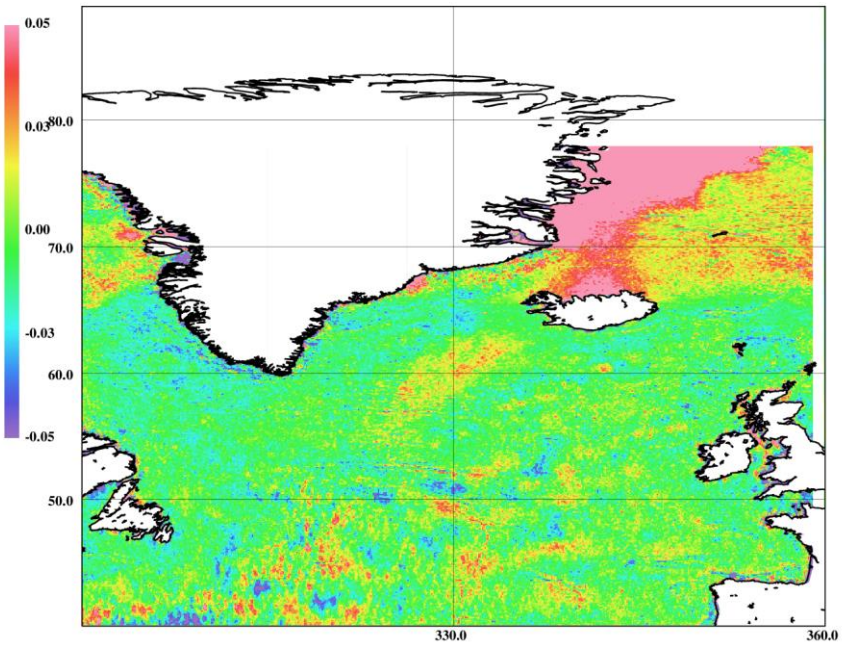


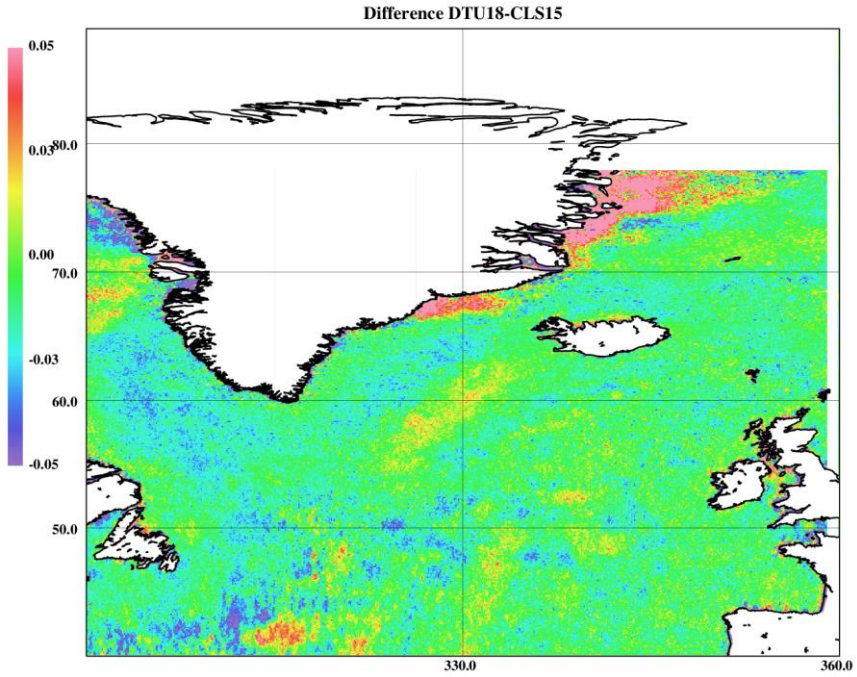
•Correction performed for Cryosat-2 (7y); SARAL GM (1y), Jason-1 GM (1y)

DTU18-DTU15

- Within +/- 66 bounds corrections up to 8 cm (std < 2 cm)
- Outside 66 bounds lowering with an average of 12-13 cm from C2 lead.







	DTU15	DTU18	CLS15
TP/J1/J2 mean	1.3 cm	0.8 cm	0.8 cm
TDM	2.81 cm	2.1 cm	2.2 cm
S3	4.1 cm	4.1 cm	4.1 cm

Summary.

- **DTU18MSS is ready to be released.**
- **Several smaller issues with DTU15MSS has been corrected.**
- **DTU15/18 are still only true global MSS available.**
- **220 km Cross Pole-hole extrapolation performed wrt geoid**
- **Final Testing around Arctic and Antarctic coasts are ongoing.**
- **Testing if appropiate to ”Direct Sea-ice Freeboard estimation”**