EOT10a – a new results of empirical ocean tide modelling

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Introduction

- EOT10a is the latest version of a global ocean tide model, developed by empirical analysis of nearly 18 years of multi-mission satellite altimeter data.
- Compared to EOT08a the processing strategy was changed:
  - neither ERS-1 nor GFO data used (disputable orbit quality)
  - no multi-mission cross-calibration applied (tidal signals may be absorbed in radial correction)
  - instead mission-specific offsets estimated at each grid node
 - more careful data editing

Altimetry mission data:

Mission	Cycles	Period	Source
TOPEX/Poseidon	001 - 481	1992/09/23 - 2005/10/08	MGDR-B (NASA)
Jason-1	001 - 291	2002/01/15 - 2009/12/04	GDR-C (NASA,CNES)
Jason-2	000 - 064	2008/07/04 - 2010/04/07	GDR (CNES)
ERS-2	000 - 085	1995/04/29 - 2003/07/02	OPR-V6 CERSAT
ENVISAT	009 - 064	2002/09/24 - 2008/01/07	GDR-A,GDR-B ESA/CNES

Development and Validation of EOT10a

1. Preprocessing of multi-mission-altimeter data
   - Homogenize (ellipsoid, time scale, FES2004, new DAC corr.)
   - updates (e.g. satellite orbits, radiometer correction)
2. Least squares harmonic analysis (w.r.t. FES2004) on a 15´×15´ grid
   - mean, trend, annual and semi-annual variations
   - diurnal tides: O1, K1, P1 und K1
   - semi-diurnal tides: M2, S2, N2, K2 und 2N2
   - non-linear and long-period tides: M4, Mm, Mf and S1
3. Interpolation to FES2004 grid (7.5´×7.5´) and addition of the reference model FES2004
   - at high latitudes (|φ| > 62°) transition from EOT10a to FES2004
4. Validation by
   - time series of bottom pressure gages
   - time series of sea surface heights at crossover points
   - tidal constants from external sources

M2 and S2 residual amplitudes (cm) in open ocean
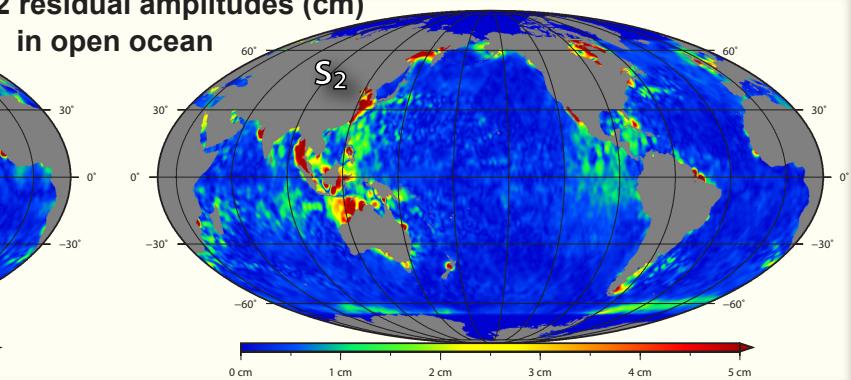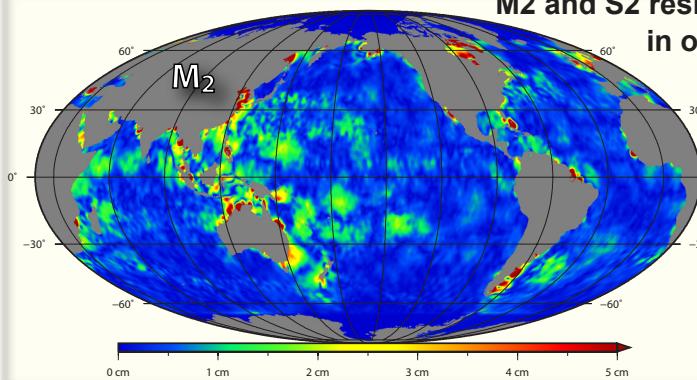

Shallow water residuals (cm) in the Yellow Sea
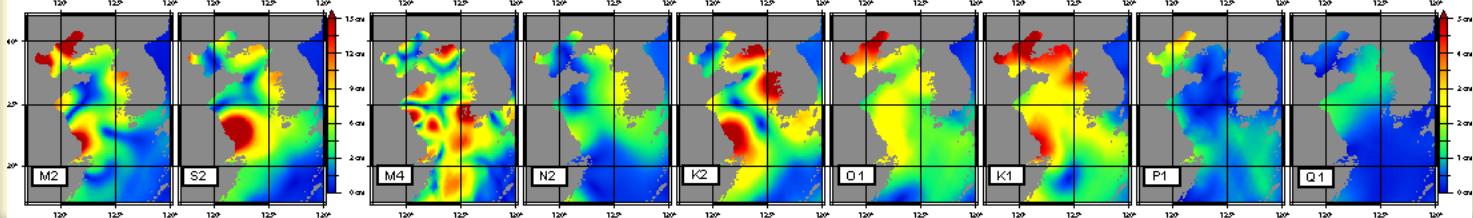

Comparison with external tidal constants
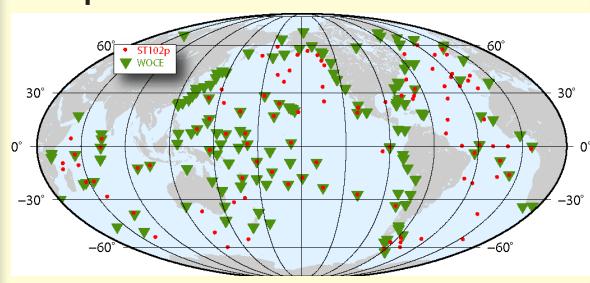
	ST102 (96-102 TGs)				WOCE (158 TG)		
	EOT10a	EOT08a	FES2004	GOT4.7	EOT10a	EOT08a	FES2004
M2	1.41	1.44	1.45	1.46	11.85	12.06	10.7
S2	0.84	0.96	0.86	0.93	4.20	4.36	4.34
N2	0.64	0.65	0.67	0.64	2.53	2.66	2.52
K2	0.42	0.45	0.47	0.40	1.51	1.52	1.63
O1	0.73	0.74	0.75	0.76	2.98	2.97	3.02
K1	0.96	0.98	1.00	1.01	4.02	4.02	4.20
P1	0.37	0.42	0.40	0.37	1.30	1.32	1.37
Q1	0.28	0.30	0.30	0.27	0.68	0.62	0.68
M4					1.23	1.34	1.47

RMS differences [cm] of tidal constants at TGs of the ST102p and the WOCE data sets. Smallest RMS are indicated by red boxes.

Validation @ BPG
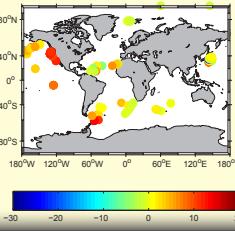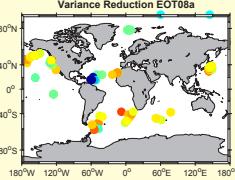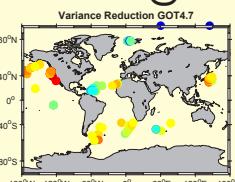
Reduction of variances
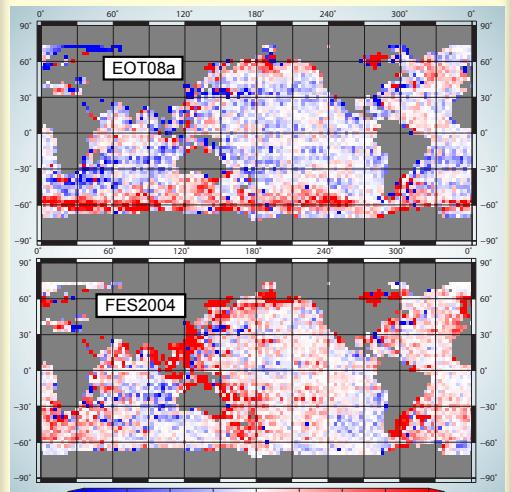
Reduction of variances (cm²) for GFO crossover differences due to EOT10a

Reduction of variances (cm²) at BPG wrt reference model FES2004 (courtesy of Madlen Gebler, AWI Bremerhaven) ▶

The tide model EOT10a is available for download at ftp://ftp.dgfi.badw.de/pub/EOT10a