Validation of Daily GRACE Time-Series with in situ Ocean Bottom Pressure Observations

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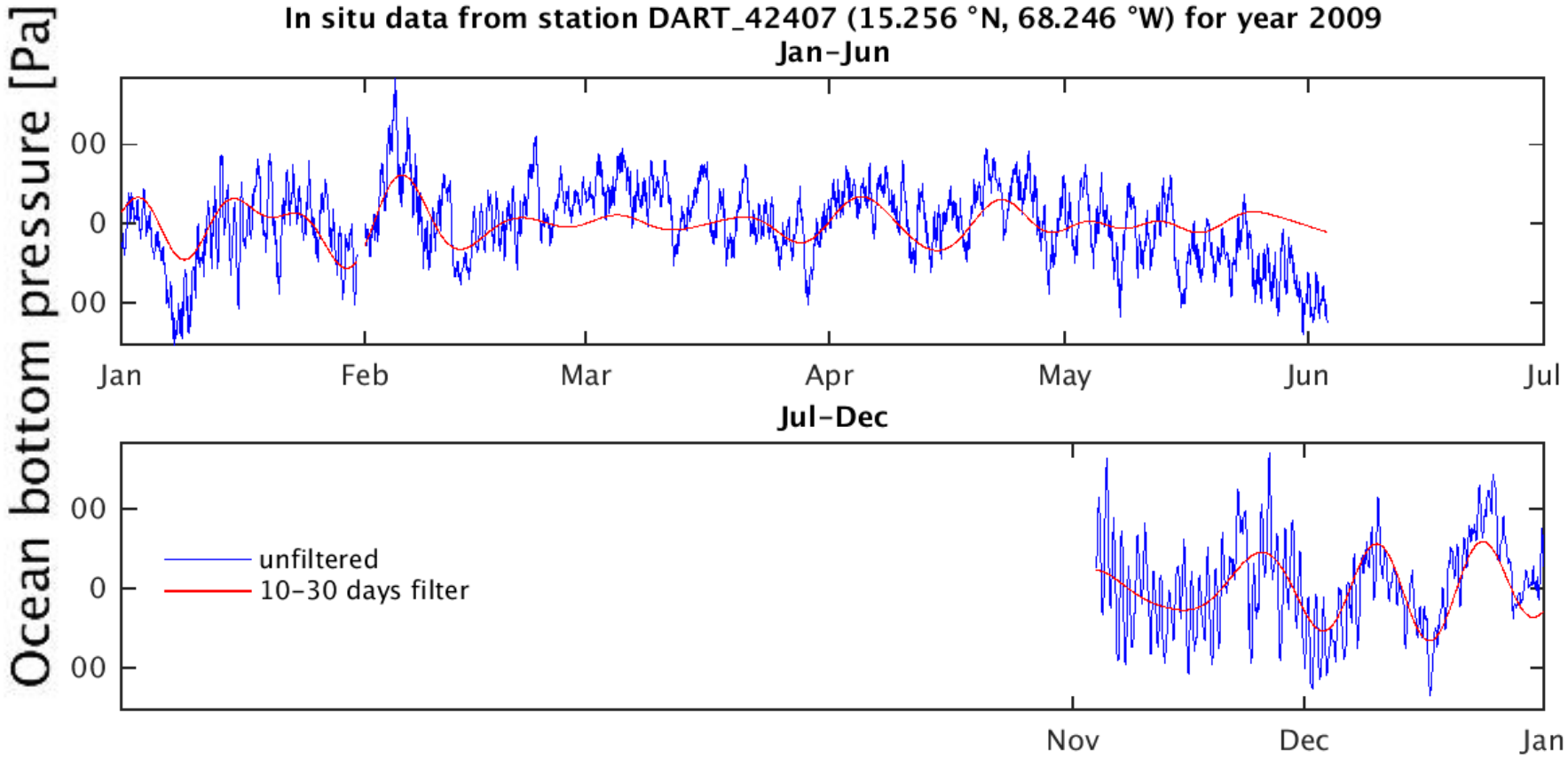
Introduction



1. **Validation of ocean model experiments for AOD1B**
2. **Validation of quasi-daily GRACE gravity field solutions:**
   - **ITSG-Grace2016_Kalman**
   - **GFZ daily RBF solutions v100 & v200**

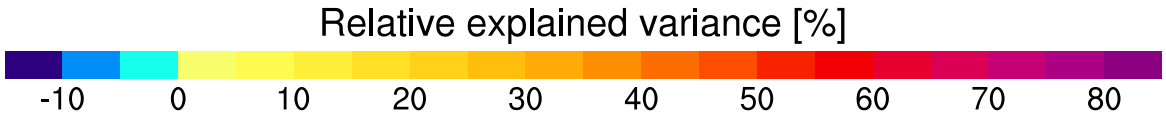
Validation Metric: Rel. Explained Variance

pressure (anomaly) observed by in situ OBP gauge

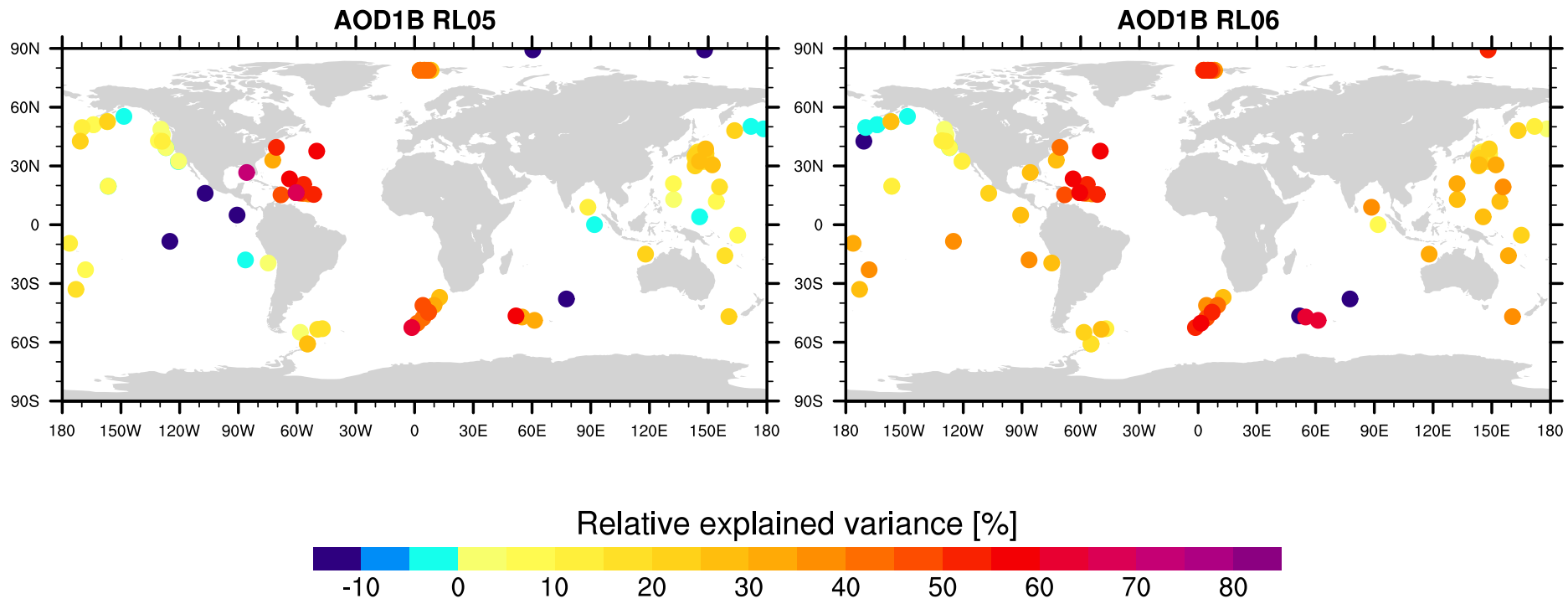
pressure (anomaly) predicted by a numerical model / gravity field model

$$\exp_p = \frac{< p_o^2 > - < (p_o - p_m)^2 >}{< p_o^2 >}$$

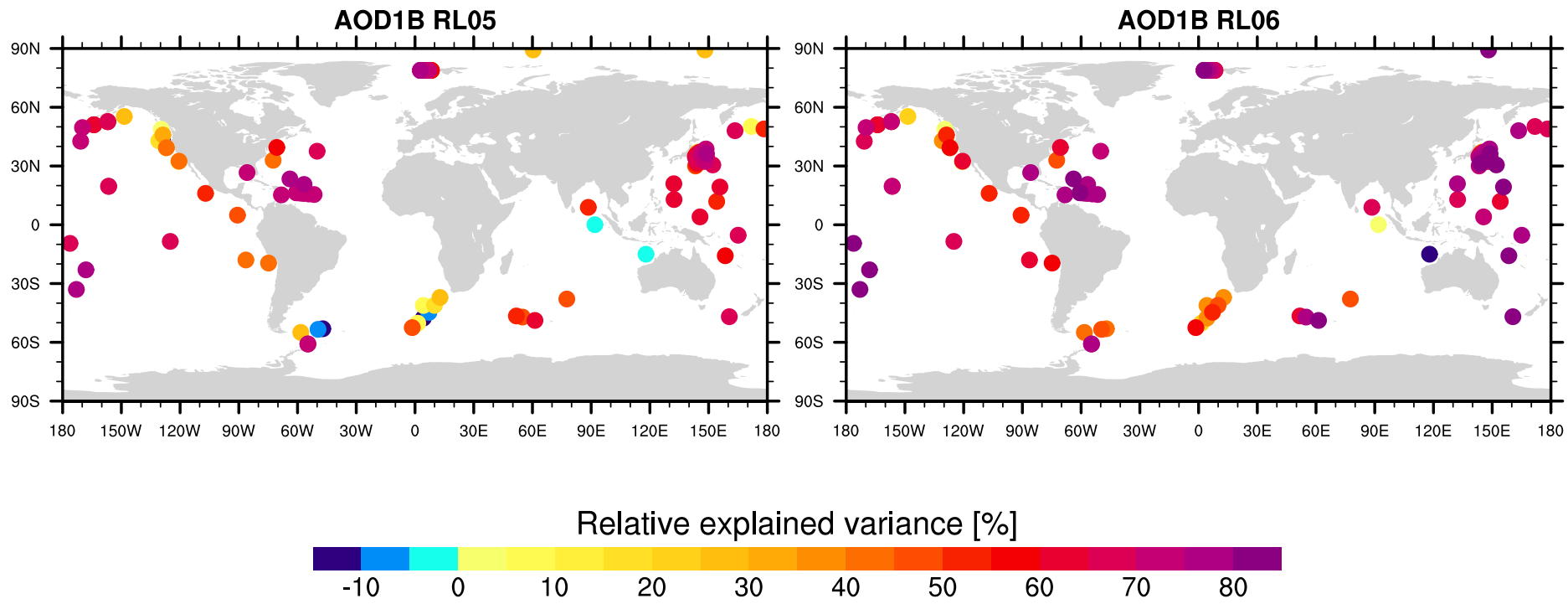
fraction of variance of the observation explained by the model



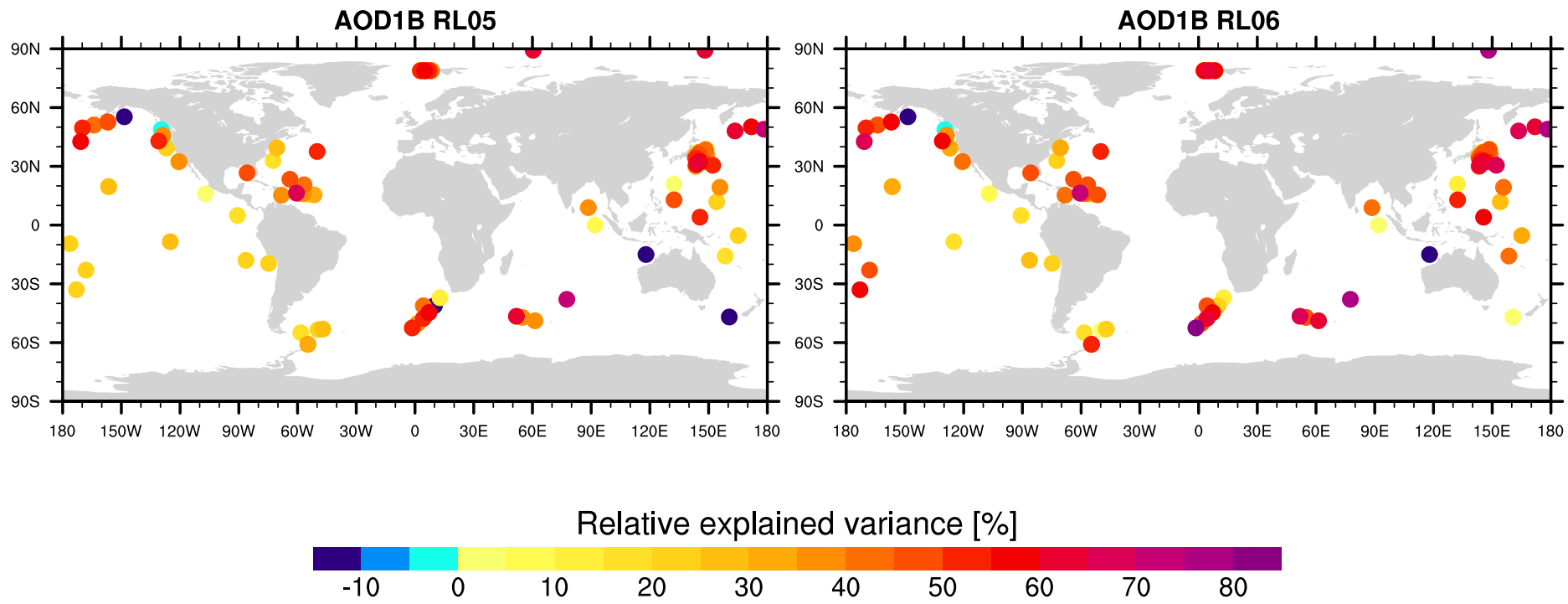
AOD1B: High-Frequency Signals (≤ 3 days)



AOD1B: Weekly Signals (3 – 10 days)



AOD1B: Sub-Monthly Signals (10 – 30 days)



Status of AOD1B RL06

- AOD1B RL06 processing is completed (1976 – 2017)
- 3h sampling; d/o=100 until 1999, d/o=180 since 2000
- improved long-term stability: no GAE/GAF products required
- tidal signals at 12 frequencies are provided in separate sets of coefficients (i.e. sin/cos terms per frequency)
- AOD1B RL06 Documentation already available at ISDC & PO.DAAC:

  ftp://isdcftp.gfz-potsdam.de/grace/DOCUMENTS/Level-1

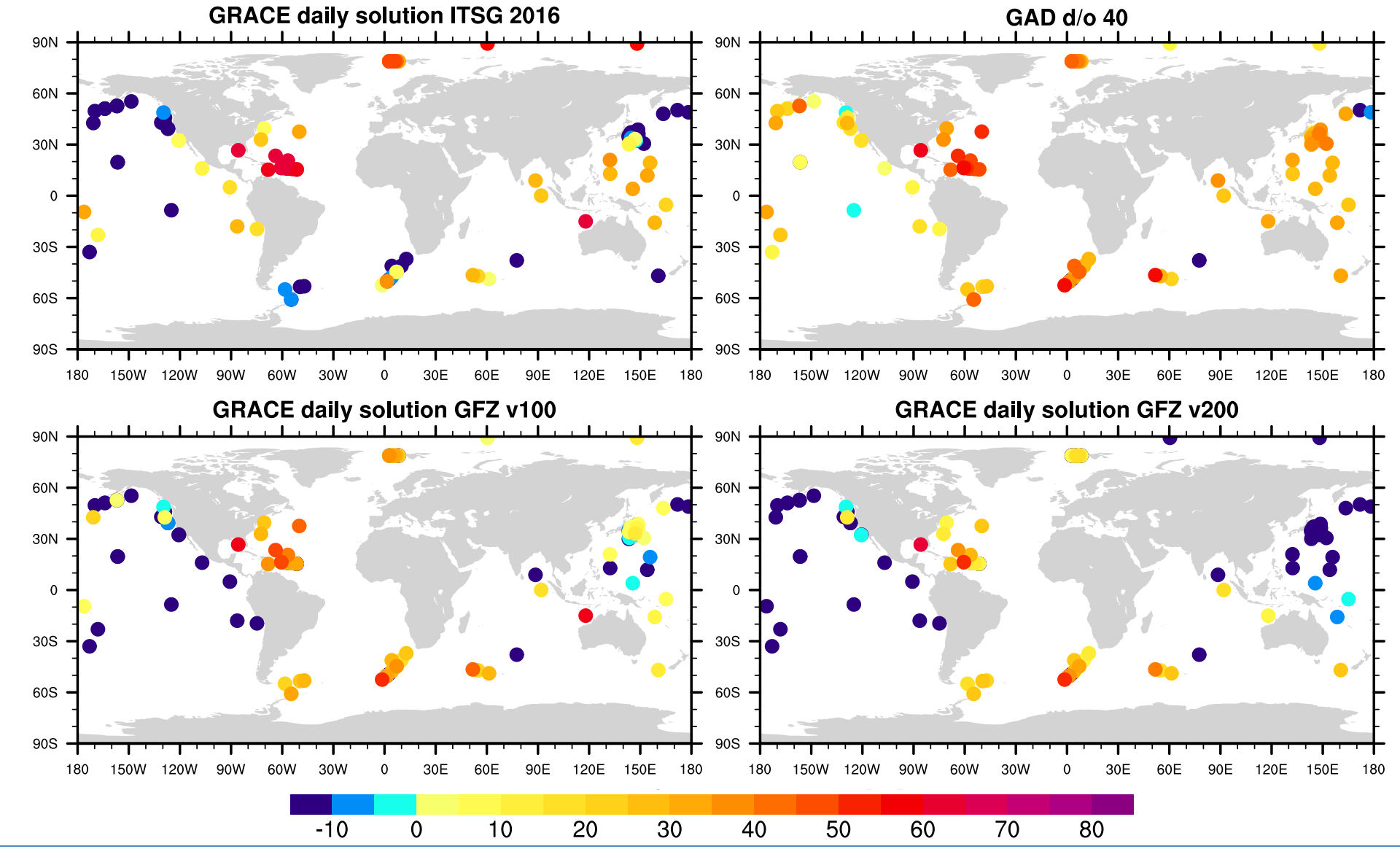
- Daily updates at about 11:00 UTC for the previous day
- AOD1B forecasts (3h; d/o=50; no upper-air signals) are processed daily for 6 days into the future

http://www.gfz-potsdam.de/en/esmdata/

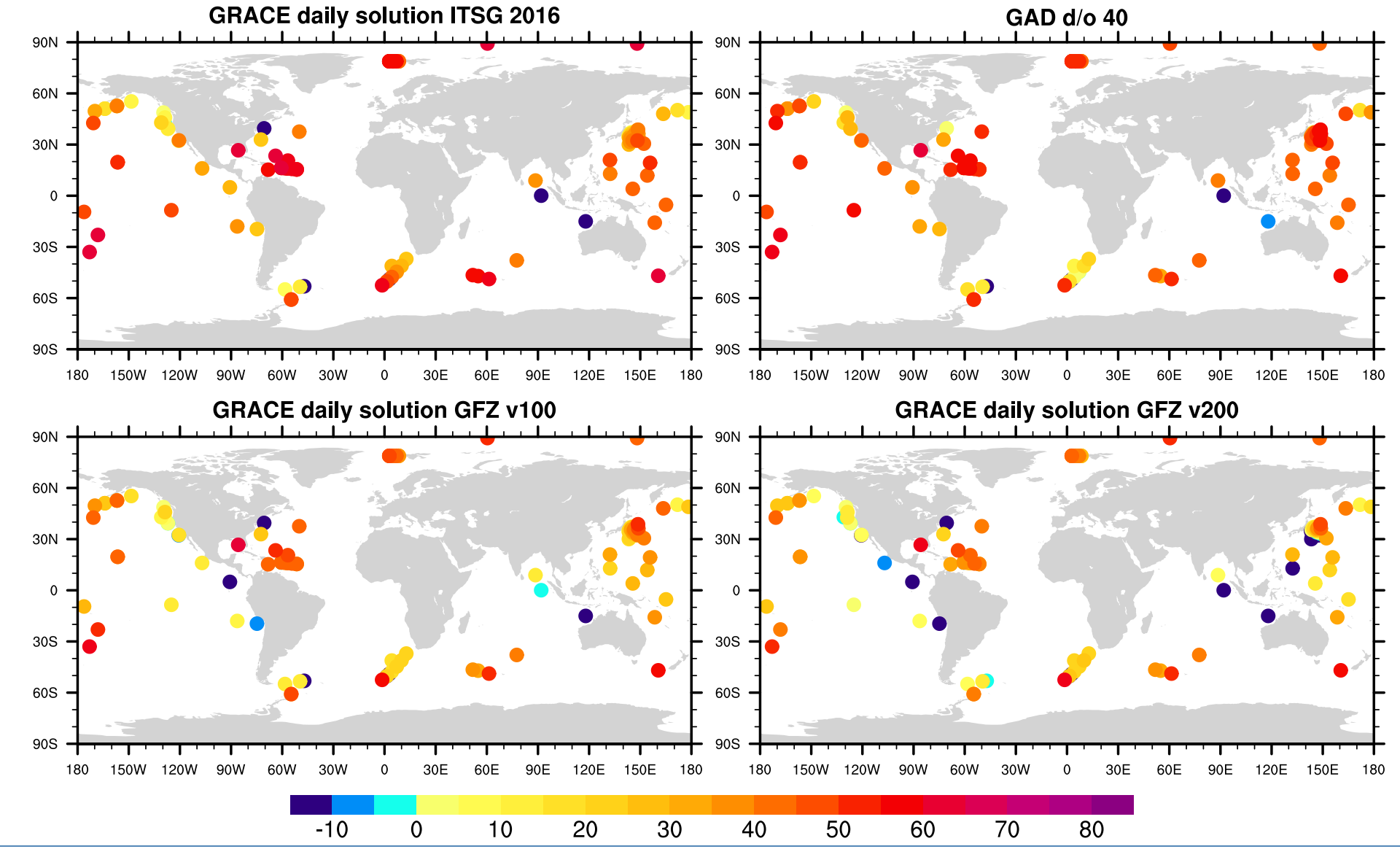
GRACE Level-2 Post-processing

	ITSG-Grace2016 Kalman n=40	GFZ daily RBF solutions v100 & v200
• replace C20 from SLR	-	-
• subtract a priori GIA model	X	-
• approximate degree-1 (Swenson et al., 2008)	X	-
• apply DDK-x filter (Kusche et al., 2009)	-	-
• reduce continental leakage (Wahr et al., 1998)	-	-
• add GAD product removed during De-Aliasing	X	(X)
• synthesize to grid	X	-
• fit & remove time-mean & trend	X	X

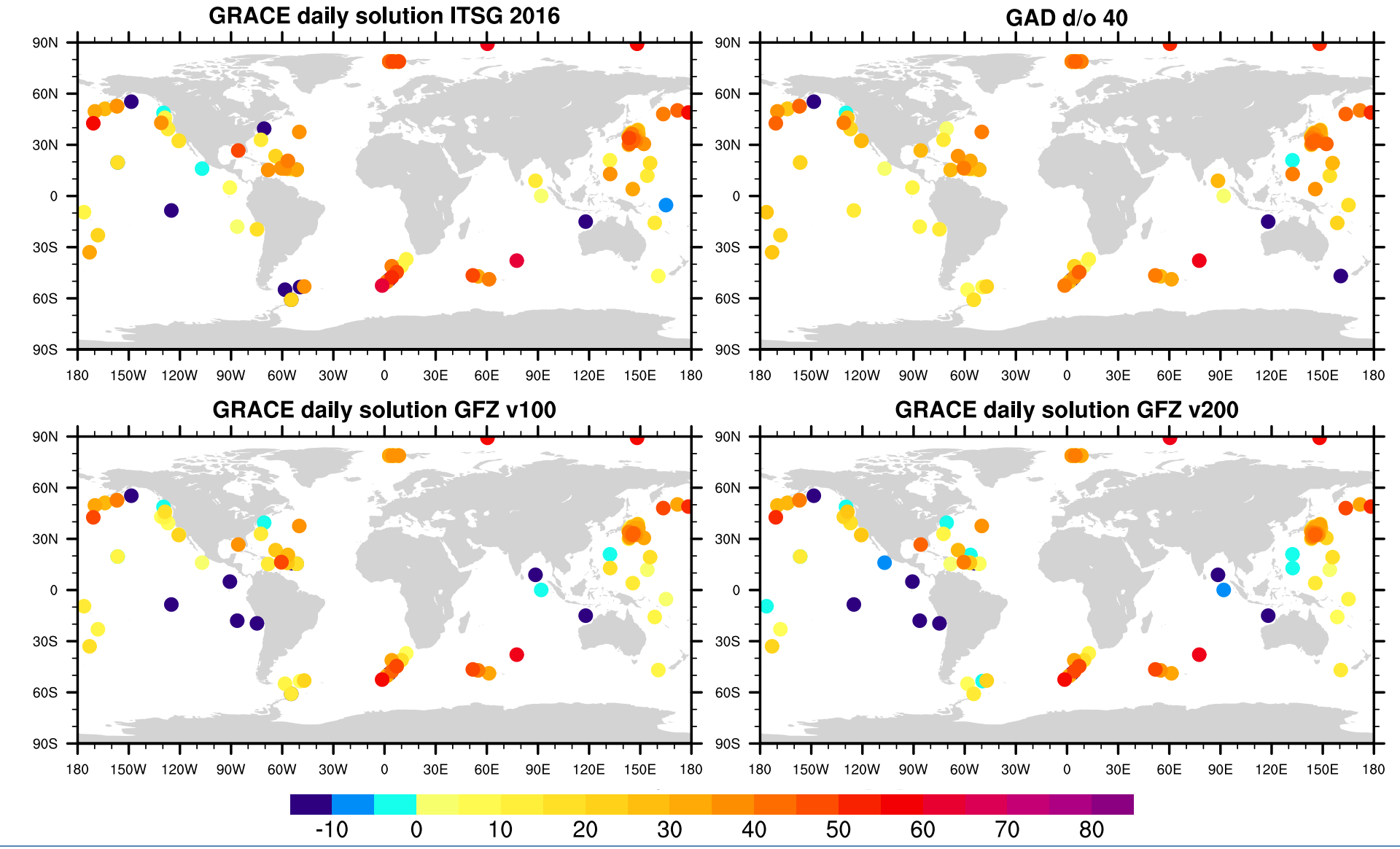
GRACE: High-Frequency Signals (1 – 3 days)



GRACE: Weekly Signals (3 – 10 days)



GRACE: Sub-Monthly Signals (10 – 30 days)



Summary

- in situ OBP database maintained at GFZ contributes to the validation of both AOD1B and GRACE gravity field time-series
- ITSG-Grace2016_Kalman has skill wrt. AOD1B_RL05/GAD in particular at higher latitudes and at weekly periods and longer
- GFZ daily RBF solutions are more noisy wrt. ITSG-Grace2016_Kalman, but might benefit from a specifically tailored post-processing not yet available
- GFZ daily RBF v100 performs better than v200 in terms of OBP in situ validation

ftp://isdcftp.gfz-potsdam.de/grace/DOCUMENTS/Level-1

http://www.gfz-potsdam.de/en/esmdata/

- Back Up -

Release 05 (2012)	Release 06 (2017)
1976 – 2016, 6 hourly, d/o = 100	1976 – 2016, 3 hourly, d/o = 180
ERA-40 (1976 – 1978); ERA-Interim (1979 – 2000); op. ECMWF (since 2001)	ERA-40 (1976 – 1978); ERA-Interim (1979 – 2006); op. ECMWF (since 2007)
tidal signals included and partly aliased (S2 standing wave pattern)	tidal signals estimated and removed for S1, S2, S3, M2 + annual modulations
no reference orography for surface pressure anomalies	surface pressure reduced to op. ECMWF orography from 2014
OMCT (Thomas et al. 2001), configuration R10L20; 6 hourly atmospheric forcing	MPIOM (Jungclaus et al. 2013), code revision #3932; configuration TP10L40; 3 hourly forcing; modifications to source code based on OMCT experience
ocean dynamics beneath Antarctic iceshelves with Padman et al. (2002) bathymetry	no ocean signals beneath iceshelves included