Validation of monthly GRACE gravity field solutions against in situ ocean bottom pressure measurements

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Motivation

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Validation against independent measurements is required!

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gravity → mass

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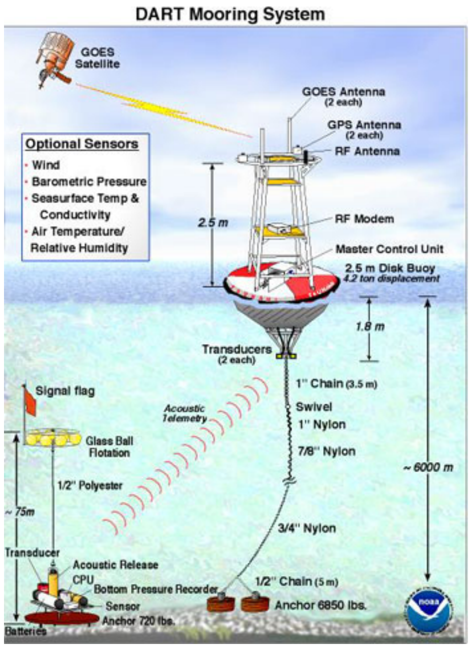
gravity → mass ← ocean bottom pressure



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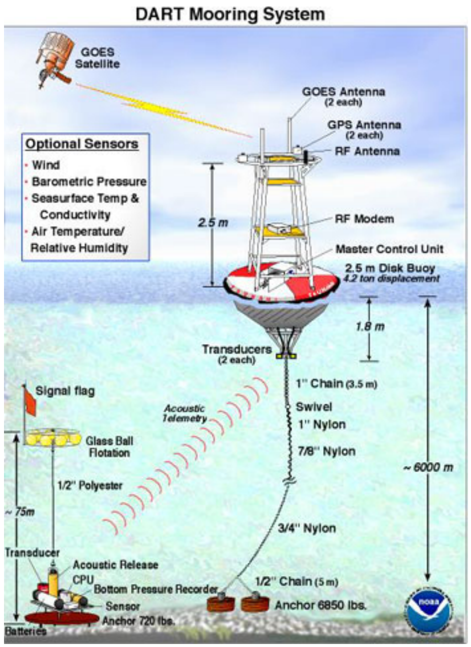
gravity → mass

validation

ocean bottom pressure



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- removing outliers, drifts, jumps and trends
- changing time step to 1 hour

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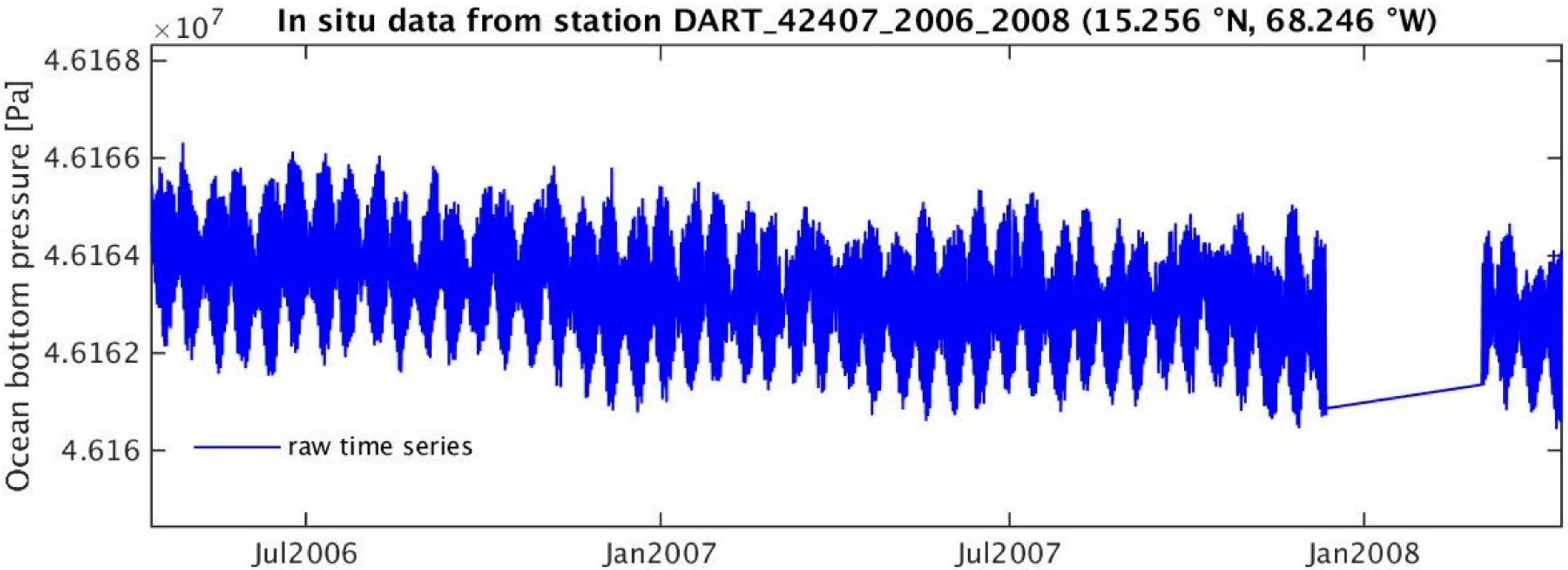

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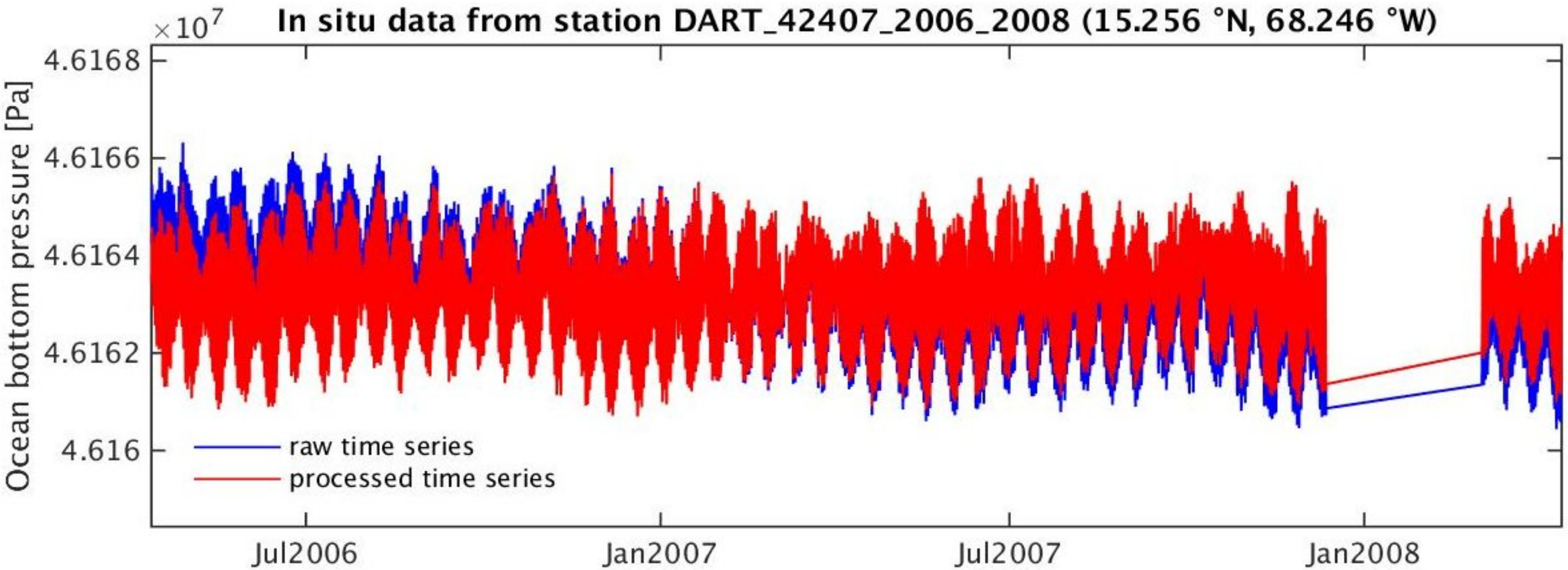

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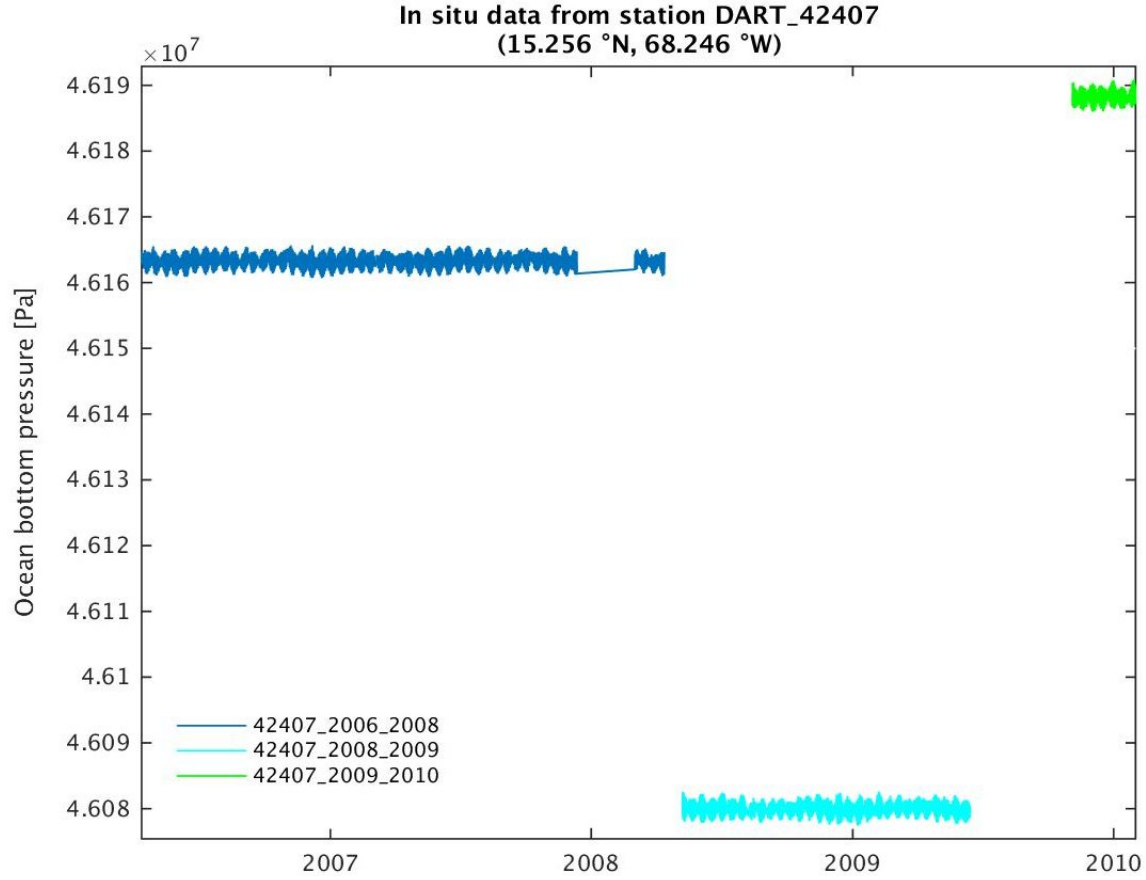

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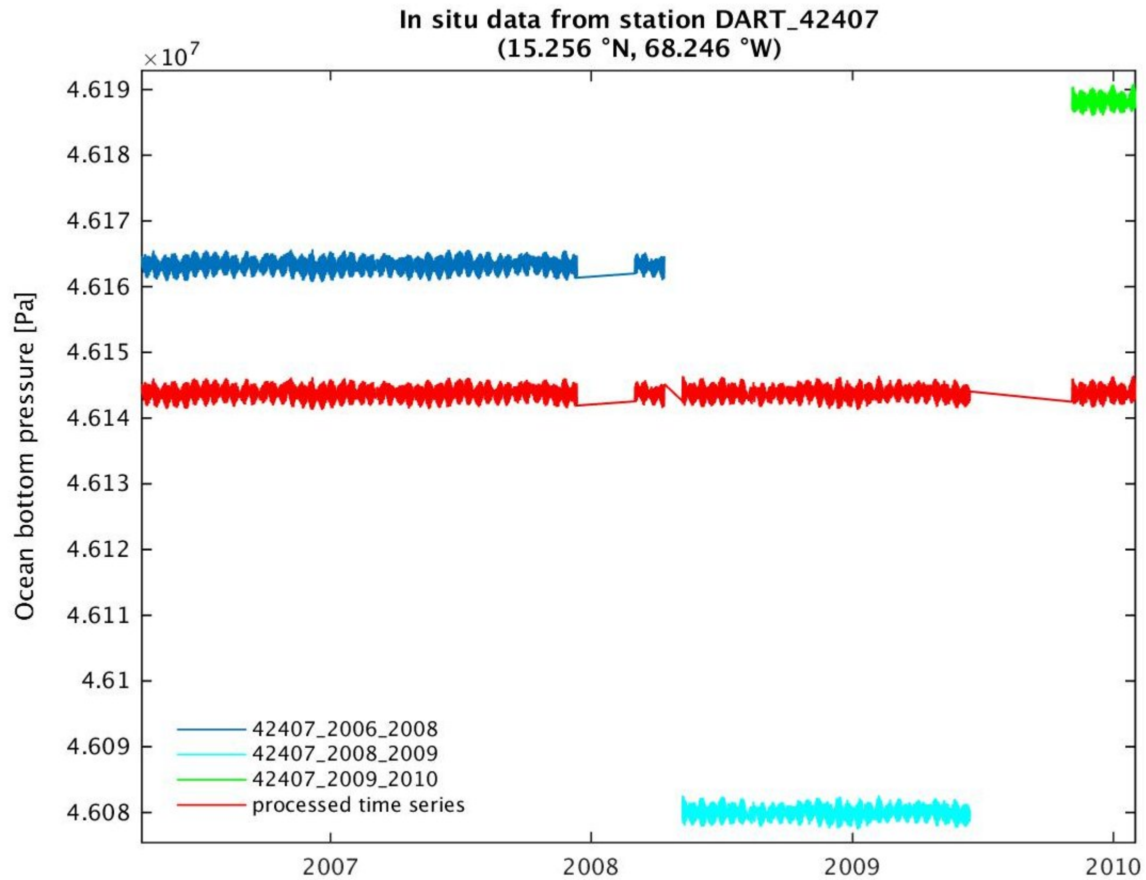

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T_TIDE MATLAB package for classical harmonic analysis [Pawlowicz et al., 2002]

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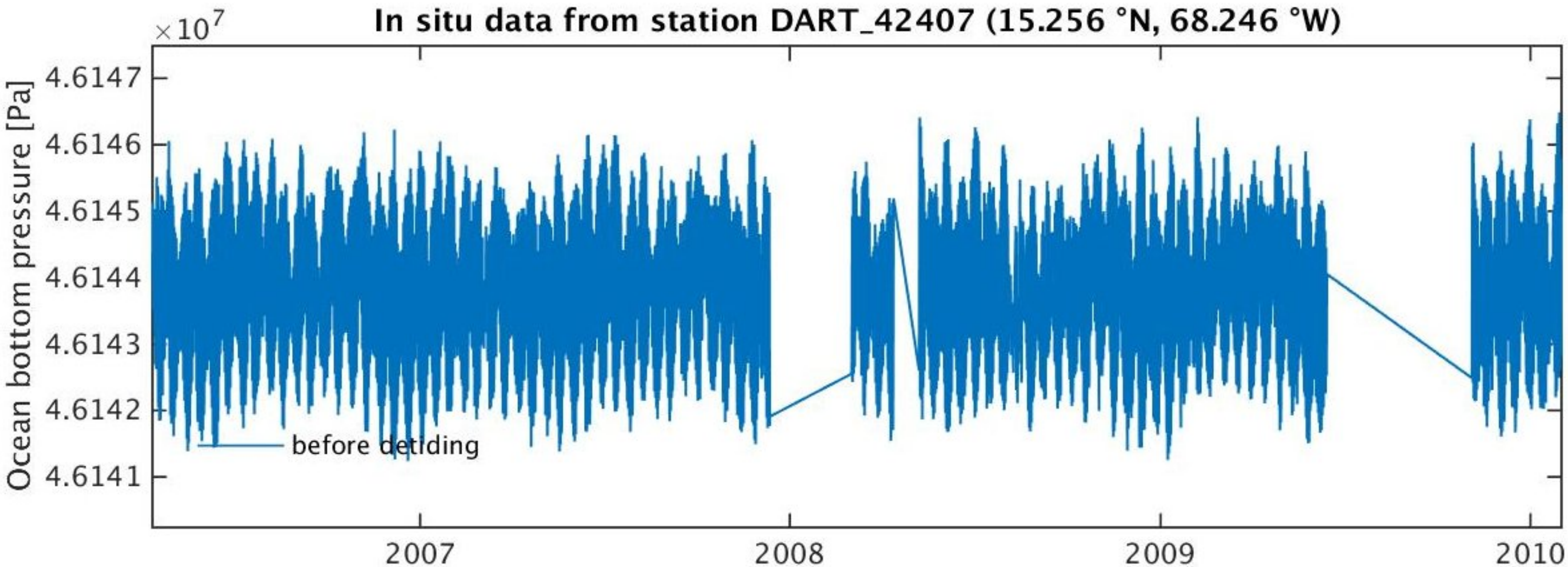

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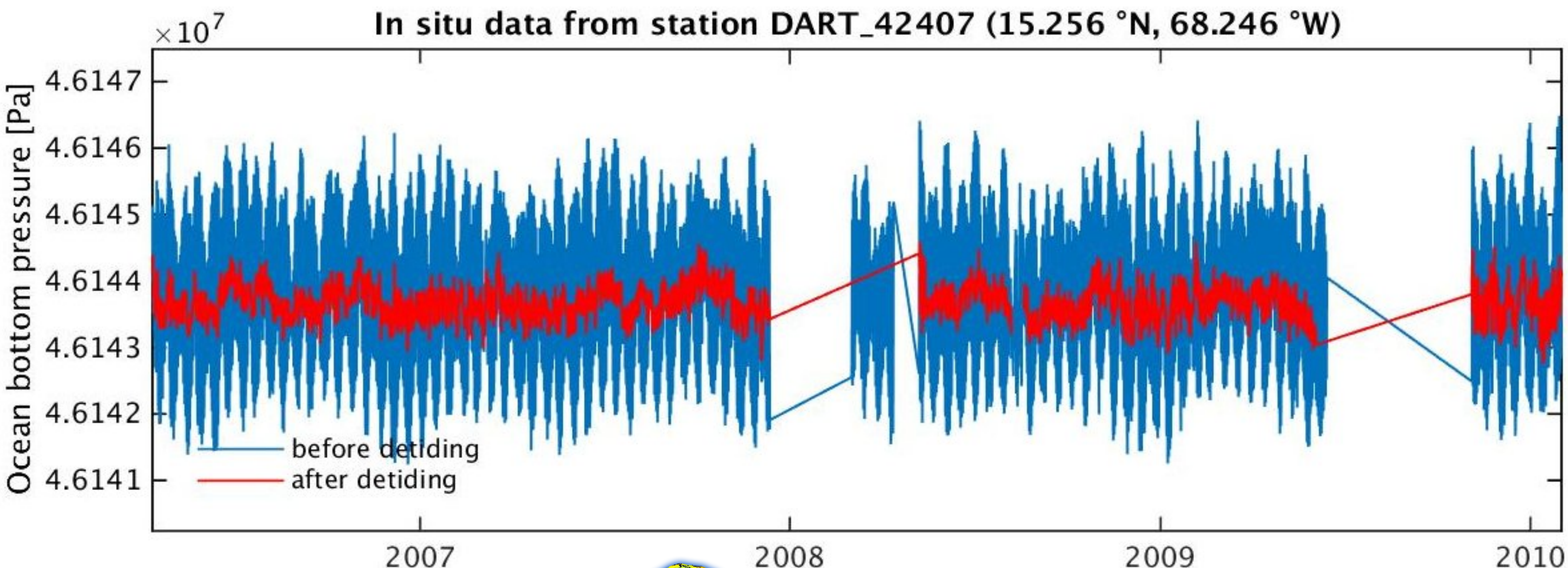

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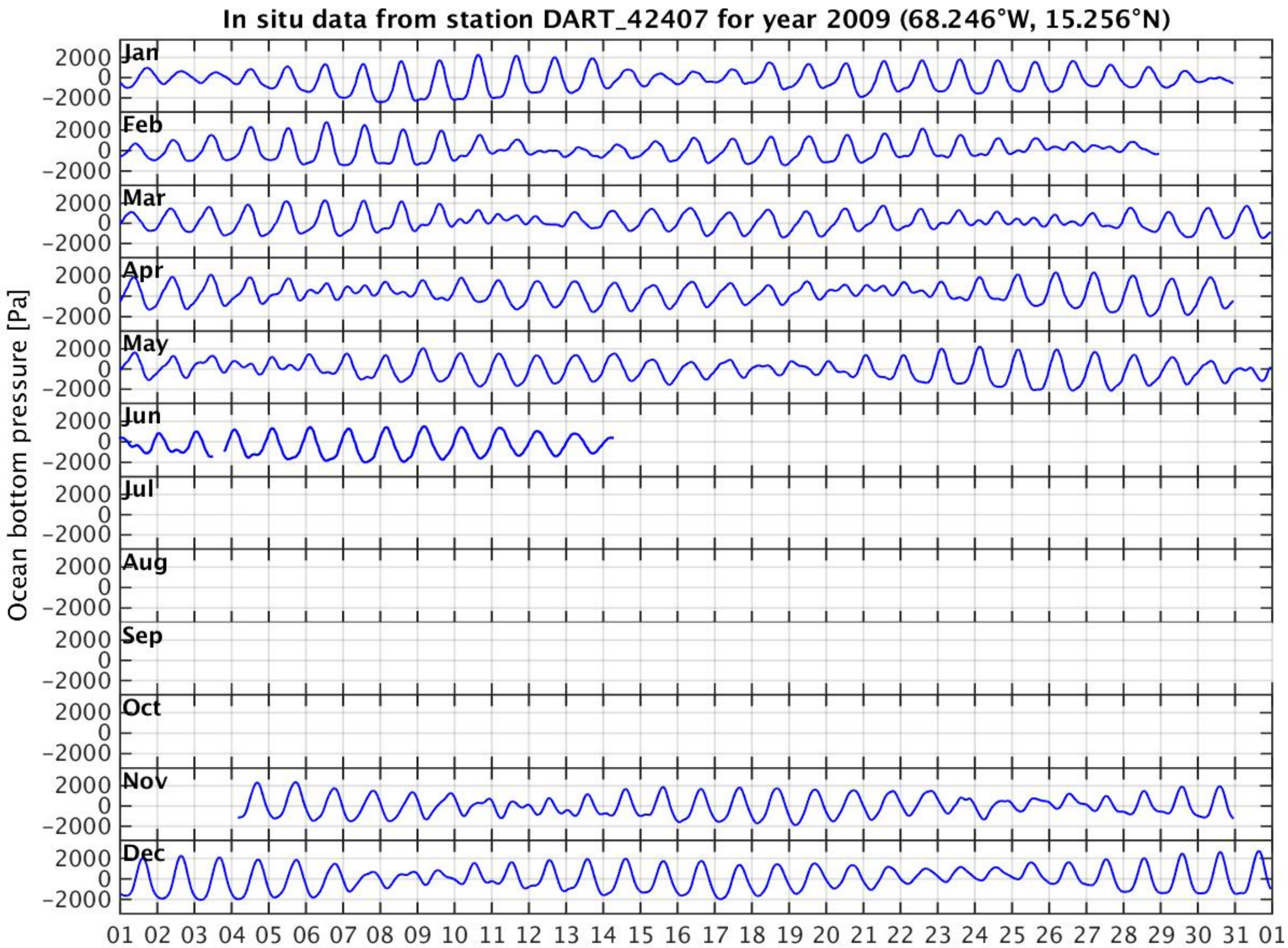

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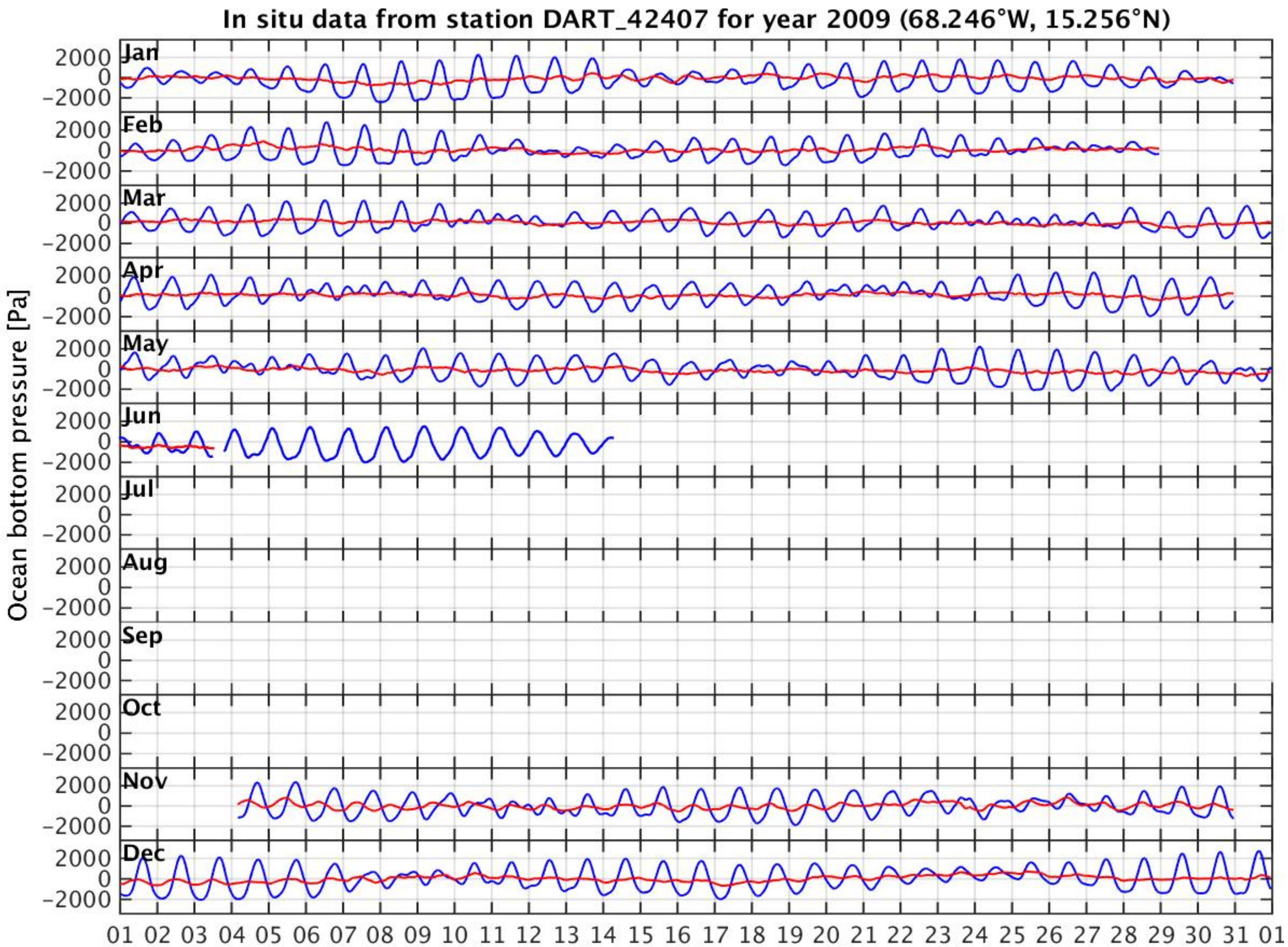

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3 frequency bands:

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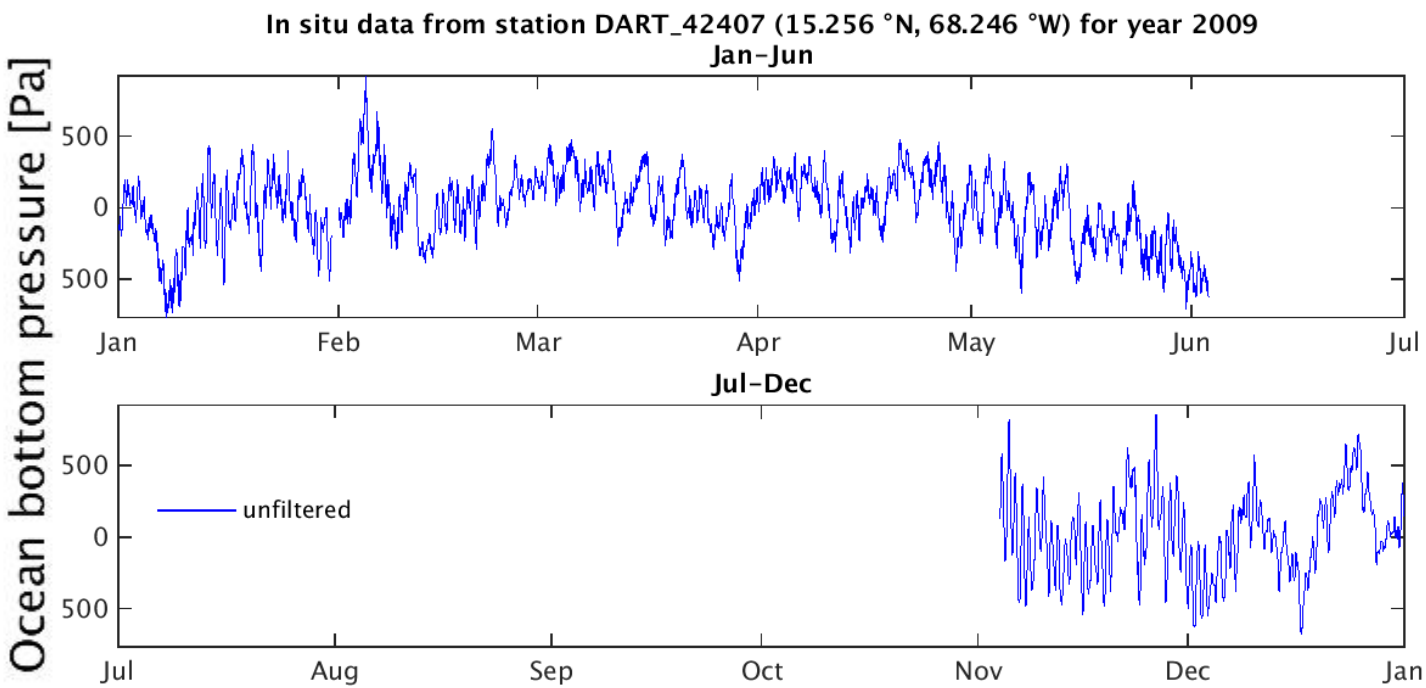

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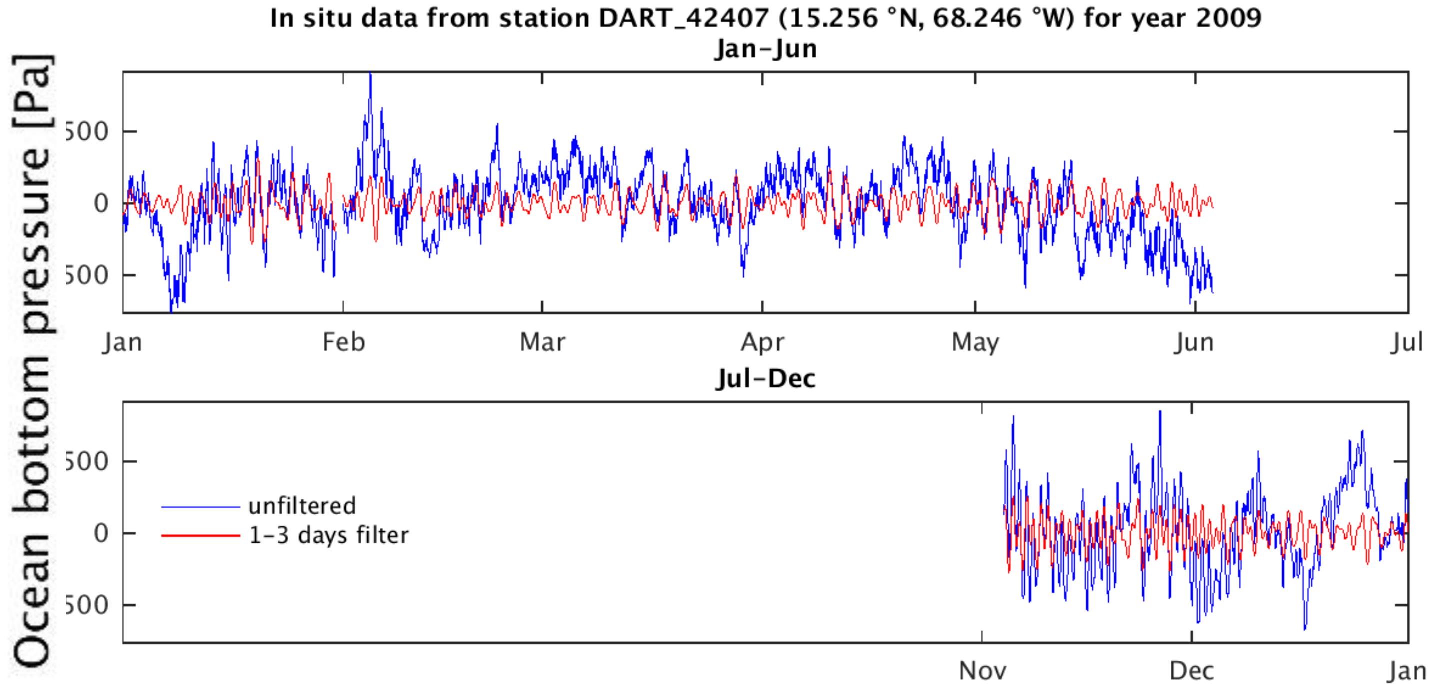
- removing tidal signal → T_TIDE MATLAB package for classical harmonic analysis [Pawlowicz et al., 2002]
- filtering data → Butterworth low pass filter



3 frequency bands:
- 1-3 days

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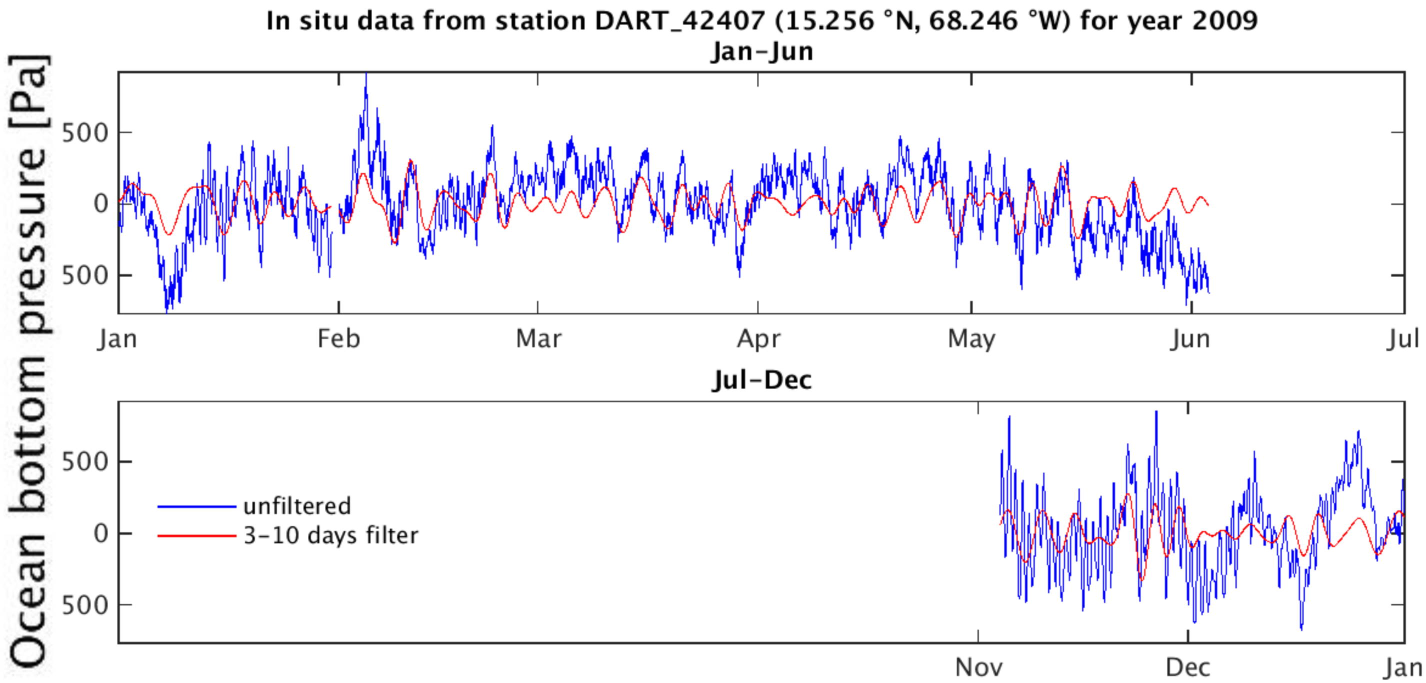

3 frequency bands:
- 1-3 days
- 3-10 days

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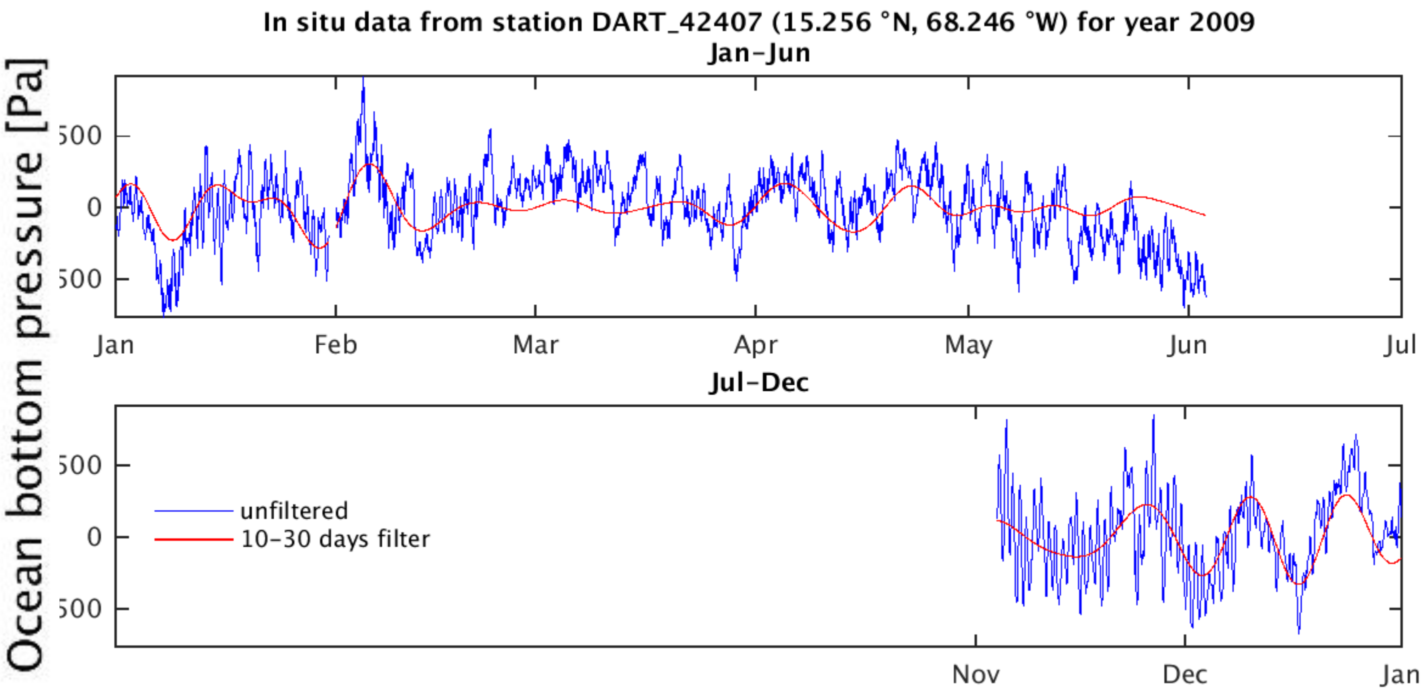

3 frequency bands:

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- 3-10 days
- 10-30 days

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or

- monthly mean

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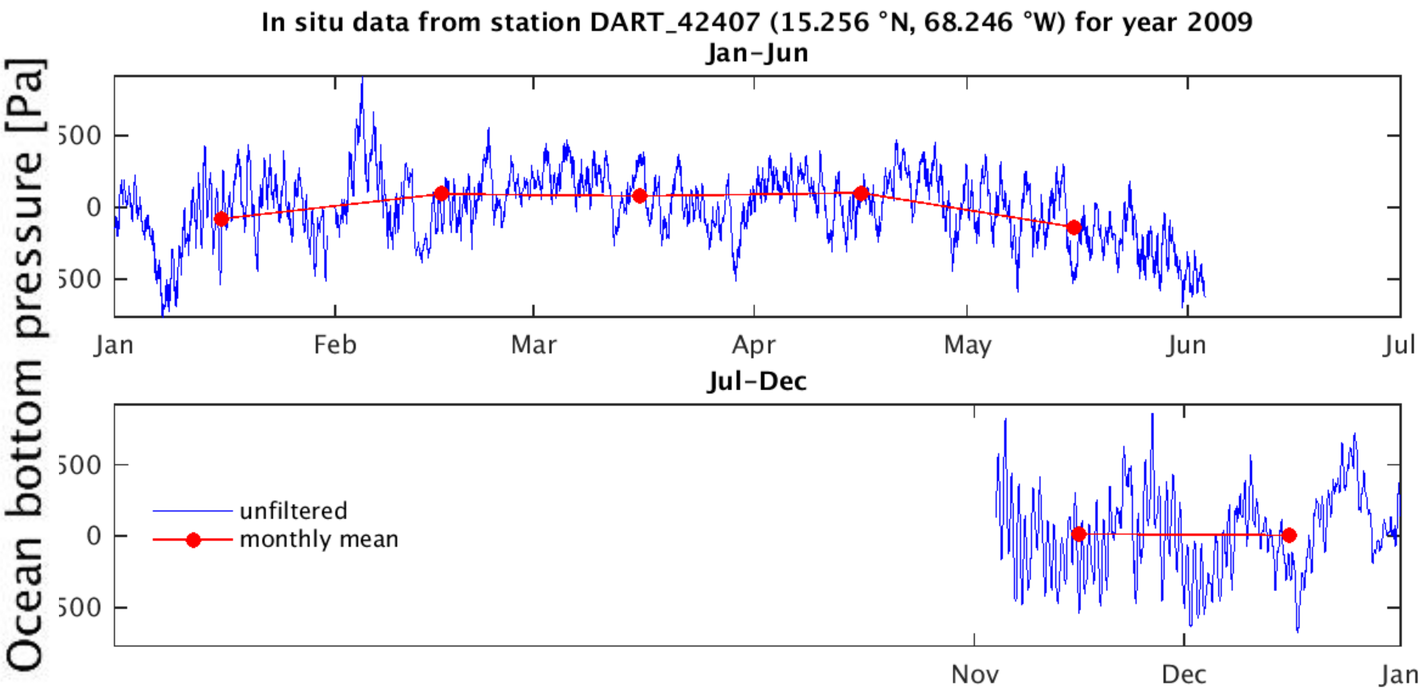
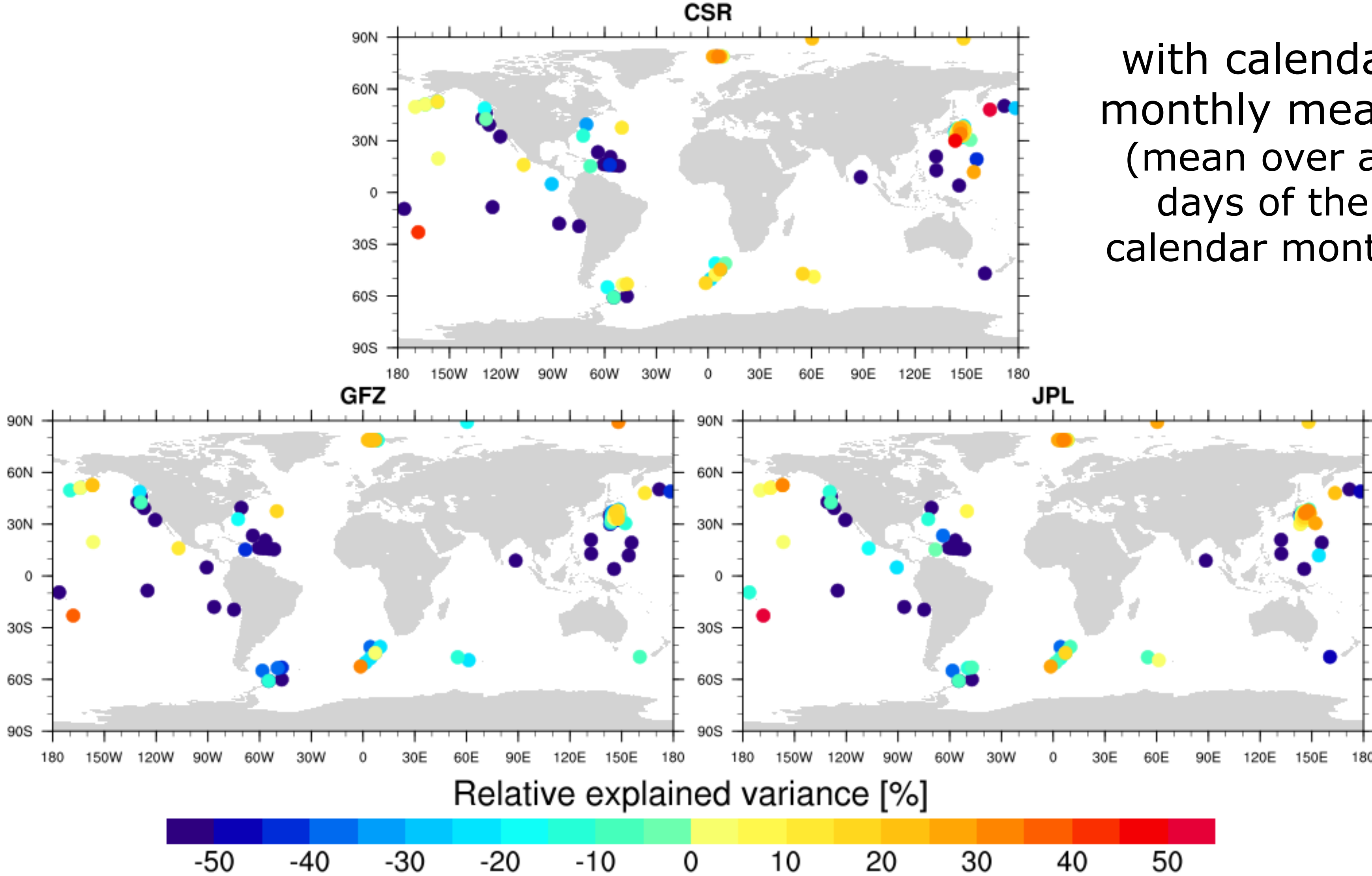


Validation of Tellus monthly solutions



with calendar monthly means (mean over all days of the calendar month)

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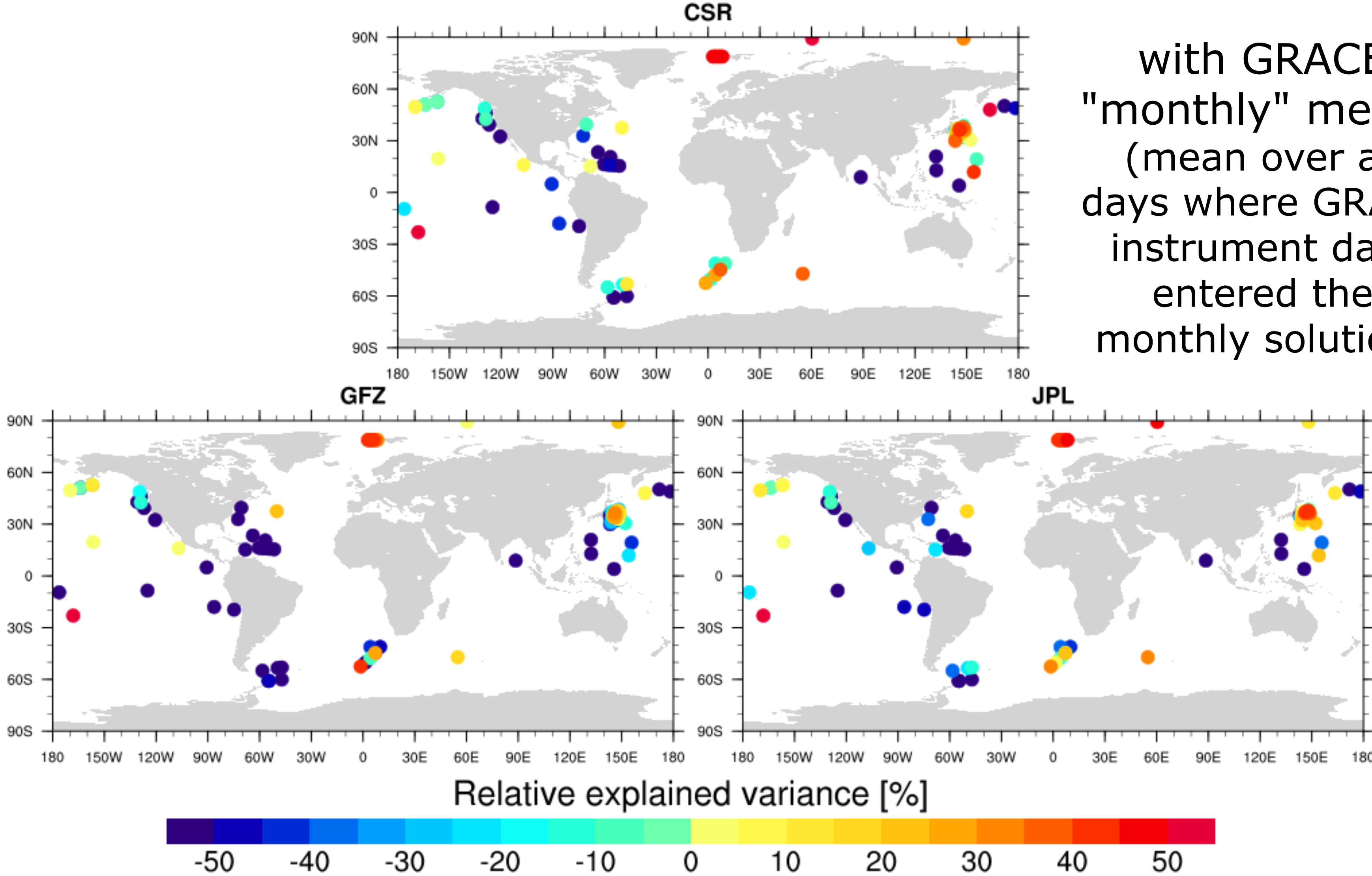
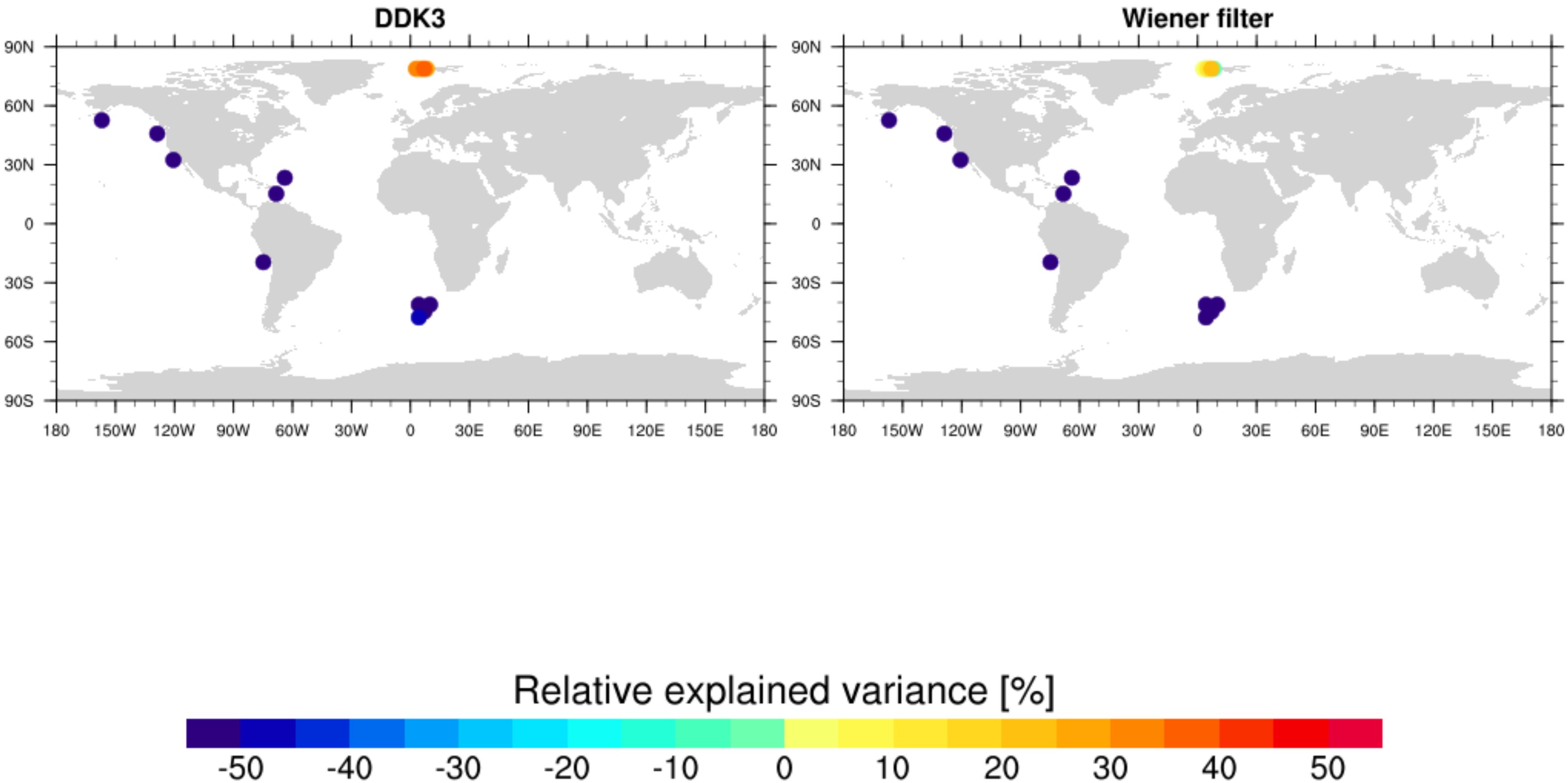


with GRACE "monthly" means (mean over all days where GRACE instrument data entered the monthly solution)

Validation of EGSIEM preliminary ocean grids

GRACE solution only for years 2006-2007 → only 16 stations provide sufficient data (12 monthly means) in that time span



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Thank you!

References

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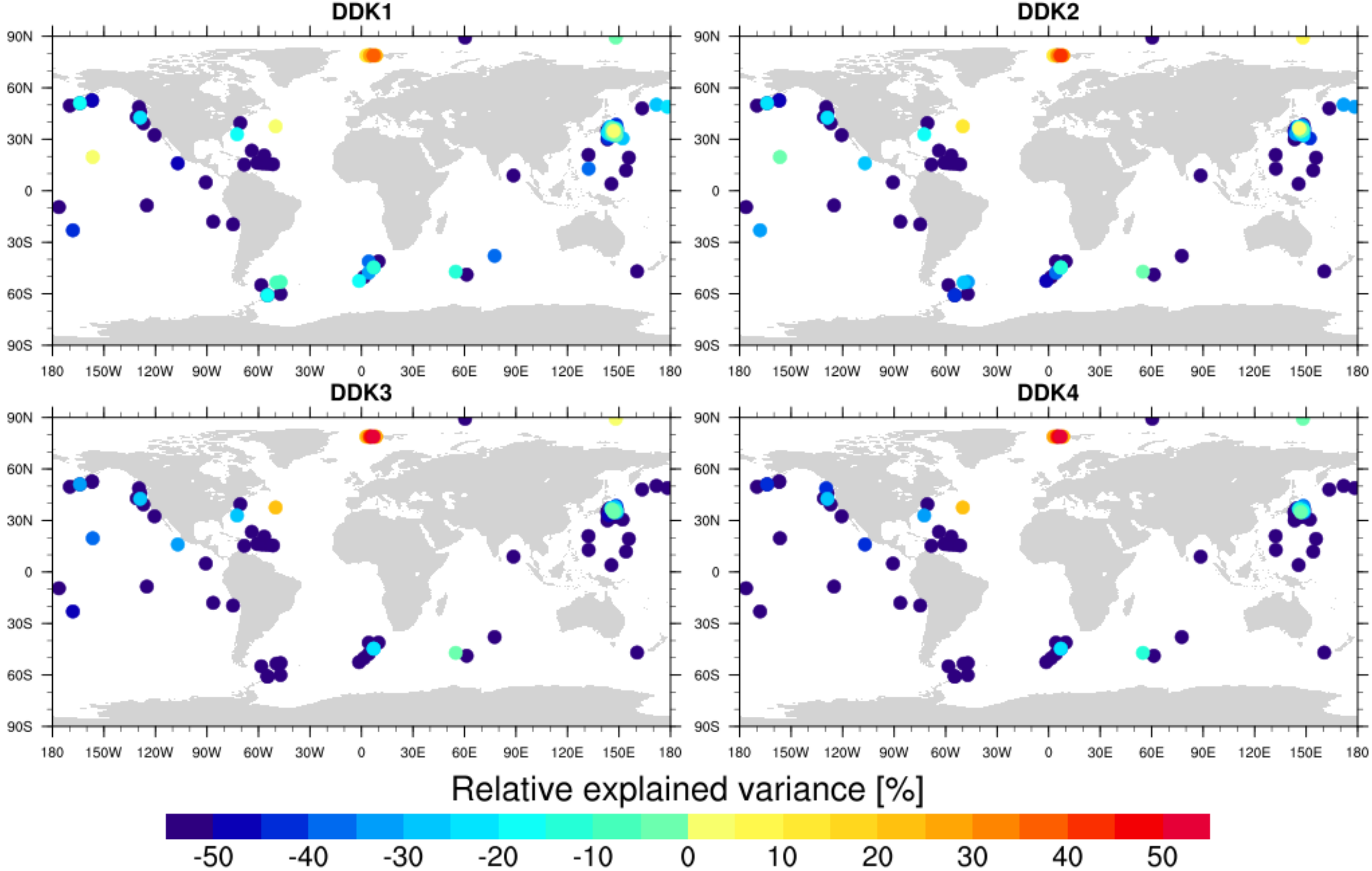
Relative explained variance

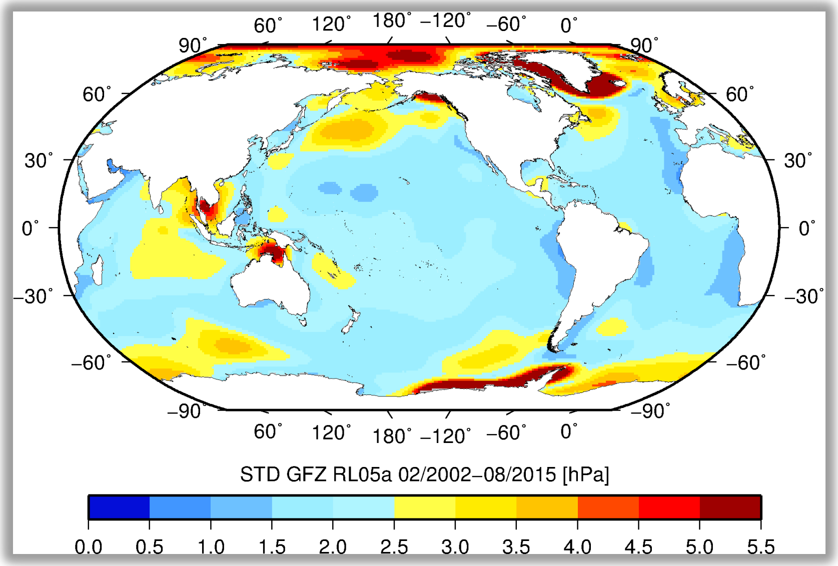
Explained variance – variance of in situ measurements explained by the model

$$V = \frac{\langle obs \rangle - \langle obs - \mathrm{mod} \rangle}{\langle obs \rangle}$$

Validation of ITSG 2016 monthly solutions



OBP fields from GRACE GFZ RL05a



Work in progress

- improve leakage correction
- remove Sumatra-Andaman earthquake signature
- reconsider GIA model
- residual tidal signal assessment: Gulf of Carpentaria
- reconsider level of smoothing (DDK2, DDK3)

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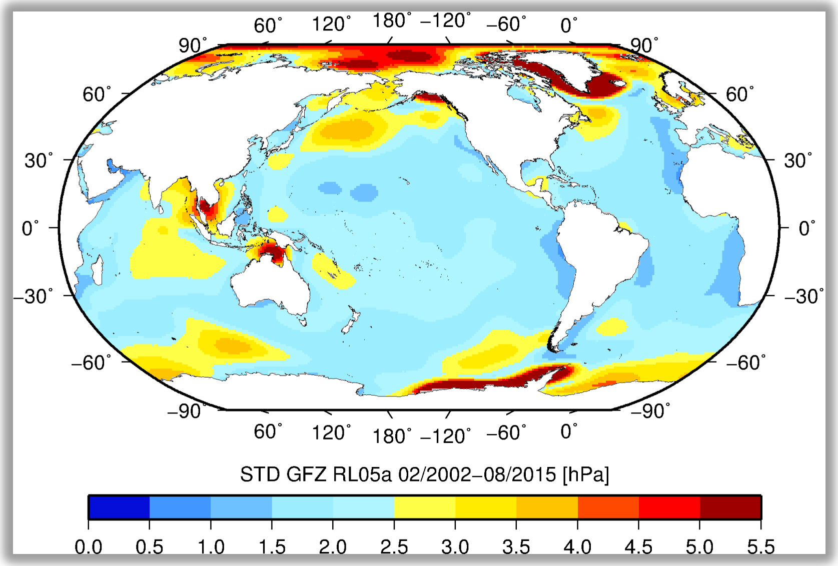

- 04/2002 – 08/2015
- up to d/o=90
- atmospheric jumps corrected with GAE & GAF
- C20 replaced (Cheng et al., 2011)
- GIA correction (Paulson et al., 2007)
- Geocenter variations included acc. to Bergmann-Wolf et al. (2014)
- land leakage reduction acc. to Wahr et al. (1998)
- GAD added back
- Filtering with DDK1 (Kusche, 2007)
- grid: 1° x 1°