



Variance component estimation for co-estimated noise parameters in GRACE Follow-On gravity field recovery

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Introduction





basic parametrisation:

- initial conditions 2x(6)
- accelerometer bias 2x(3)
- accelermeter scaling 2x(3)

parameters per arc 24

Introduction





Perturbation theory [Kim, 2000]: Errors in background models will (mostly) sum up in 1/rev

→ frequently used in the Celestial Mechanics Approach [Beutler et al., 2010]

basic parametrisation: 2x(6) initial conditions accelerometer bias 2x(3) 2x(3) accelermeter scaling parameters per arc 24 additional parameters: • 15 min PCA per satellite in → radial 2x(96) 2x(96) → along-track → cross-track 2x(96) parameters per arc 576

in daily arcs (30 days):

- 18000 parameters,
- 17280 for the noise model
- + gravity field

Introduction





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How to constrain their impact to the correct magnitude?

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Impact of different constraints



 $1 \times 10^{-8} \text{ ms}^{-2}$ «loose» constraint (gravity field signal absorbed in PCAs)

Impact of different constraints



 $1 \times 10^{-12} \text{ ms}^{-2}$ «tight» constraint (not enough to absorb mis-modellings)

Impact of different constraints



 $3 \times 10^{-10} \, \text{ms}^{-2}$ «reasonable» balance (applied in the operational solutions)

Constraining

 $\mathbf{N} = (\mathbf{A}^T \mathbf{P} \mathbf{A}) \qquad \text{and} \qquad \mathbf{b} = \mathbf{A}^T \mathbf{P} \mathbf{l} \qquad \mathbf{b}$

Constraining







VCE: Each group of observations gets a weight based on its contribution to the final solution





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M. Lasser, U. Meyer, D. Arnold, A. Jäggi: Variance component estimation for co-estimated noise parameter: in GRACE Follow-On gravity field recovery, EGU General Assembly 2022, 26 May, 2022



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Conclusion

- observation-based approach
- computed together with the solution
- provides a good solution (if PCAs sample correctly)
- improvement...



- computational efficiency?
- observation-based outliers
- improvement...



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