Quality Assessment of Sub-cycle vs. Full Repeat Period Solutions of Future Gravity Field Missions

S. Iran Pour, N. Sneeuw, T. Reubelt

Introduction

Challenges

- Orbital sampling problem and the aliasing effect of the high frequency geophysical phenomena
- Separation of the time-variable gravitational signal into its individual geophysical sources
- Which satellite mission scenario is better for retrieving the gravitational signals of the geophysical sources?

Strategies to mitigate the aliasing problem

- Satellite configuration design: GRACE, Pendulum, Cartwheel, ...
- Alternative recovery strategies: Full repeat period solution, Sub-cycle solution, ...
- Post processing: Filtering, Regularization

Solutions

Data


- GRACE Formations

The Approach

Background models (brown): 90% of the true world

Solution by 10% + Difference of two tidal models + White noise

Solutions

GRACE and Multi-GRACE Formations

Raw Solutions

Post-processed Solutions (based on EOF+KS-test filter)

Conclusion

- Cleaner maps for full repeat period solutions compared to sub-cycle solutions (as expected)
- Possibility of using sub-cycle solutions (by post-processing), exp. for Pendulum and two pairs formations
- Eliminating much of the white noises by EOF + KS-test filter
- Need of much tougher significance level for sub-cycle solution
- Trade-off between eliminating noise and removing geophysical signals, exp. for sub-cycle solution
- Large improvement by Pendulum formation, compared to one of GRACE
- Some improvements by two pairs of satellites (exp. the polar Cartwheel + Pendulum) in comparison with one pair Pendulum
- The choice of one fast repeat period polar GRACE and one inclined long repeat period polar GRACE by technical concerns

Acknowledgment

- BMBF/DFG Forschungs- und Entwicklungsprogramm Geotechnologie „Zukunftskonzepte für Schwerkraftsatellitenmissionen“, Projekt Nr. 03G0175A.

References