SLR, GRACE and SWARM gravity field determination and combination

Ulrich Meyer¹, Krzysztof Sosnica², Florian Andritsch¹, Rolf Dach¹, Adrian Jäggi¹, Daniel König³ and Daniela Thaller³

¹Astronomical Institute, University of Bern, Switzerland ²Institute of Geodesy and Geoinformatics, Wroclaw University of Environmental and Life Sciences, Poland ³Bundesamt für Kartographie und Geodäsie, Frankfurt, Germany

EGU General Assembly 2019 Vienna April 08-12, 2019



Contents

- Monthly gravity field solutions from:
 - SLR
 - GRACE
 - SWARM
- Localization of mass change signal
- Quantification and temporal variation
- Combination of normal equations:
 - SWARM + SLR
- Summary and Outlook

Monthly SLR gravity fields (d/o 6)



- LAGEOS 1+2: 30 d solutions based on 10 d arcs.
- SLR-LEOS (Beacon-C, Ajisai, Starlete, Stella, Larets, Lares): 30 d solutions based on 1 d arcs.
- Gravity field: $5 \times 5 + C_{61}$ and S_{61} ; C_{50} constrained.
- A priori gravity: static 7 y GRACE (AIUB-APR).
- A priori orbits: LAGEOS own predictions, LEOS CPF

Monthly GRACE gravity fields (d/o 90->6)



- GRACE GPS+K-band: monthly 90 x 90 gravity field solutions, truncated at degree / order 6.
- Degree 2 excluded.
- Degree 1 fixed to 0.
- No filter applied.

Monthly SWARM gravity fields (d/o 70->6)



- SWARM GPS: monthly 70 x 70 gravity field solutions, truncated at degree / order 6.
- Degree 2 excluded.
- Degree 1 fixed to 0.
- No filter applied.

















Quantification of mass change



Quantification of mass change





Ice mass change: Greenland Coast



SLR and GRACE provide consistent mass trends when truncated at the same degree/order.

Ice mass change: Greenland Inland



Details at small spatial scales are lost. A separation between Greenland coast and inland is not possible with SLR.

Ice mass change: Antarctica



Combination of NEQs: SWARM + 0.01 * SLR



Combination of NEQs: SWARM + 0.1 * SLR



Combination of NEQs: SWARM + 0.4 * SLR



Combination of NEQs: SWARM + SLR



Summary and Outlook

- Truncated to the same spherical harmonic resolution the three space geodetic techniques SLR, high-low-SST (GPS) and low-low-SST (K-band) provide comparable estimates of largescale mass change.
- Temporal evolution of Greenland and West Antarctic ice mass change is well observed by SLR at d/o 10.
- Best SLR + SWARM combination results are achieved with equal weighting.