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The ILRS contributions to the GRACE mission and its success

König, R., Schreiner, P., Vei, M.

Abstract

GRACE has proven to be a very successful mission, SLR contributed considerably to its success. In a subjective and brief manner we list the advances in science and in particular the achievements through SLR. We also take a look into the future and the challenges resulting for the ILRS community.

Mission Objectives

- Recovery of the gravity field and its variations
- Atmospheric and ionospheric sounding

Requirements on SLR

- Complementary tracking system to on-board GPS
- Validation and quality control of microwave based Precise Orbit Determination (POD)

Success of the GRACE Mission

- GRACE monitors the hydrological and cryological cycle
  - Basin monitoring (Amazon, Mississippi)
  - Groundwater lowering (California, China)
  - Ice mass loss (Greenland)
  - etc.
- GRACE is a pillar of occultation measurements over 14 years now
- The first GRACE-only static gravity fields were better than any others before
  - Measurement of the Lense-Thirring effect with 10% accuracy (Ciufolini & Pavlis in Nature, 2004)

SLR Tracking Record

- SLR tracking record is sufficient to fulfill the basic requirements for validaton and quality control
- Accuracy at centimeter level or better is sufficient for this purpose as well
- SLR data yield is small in spatial and temporal coverage compared to space-borne GPS
- Data latency has improved over the course of the mission

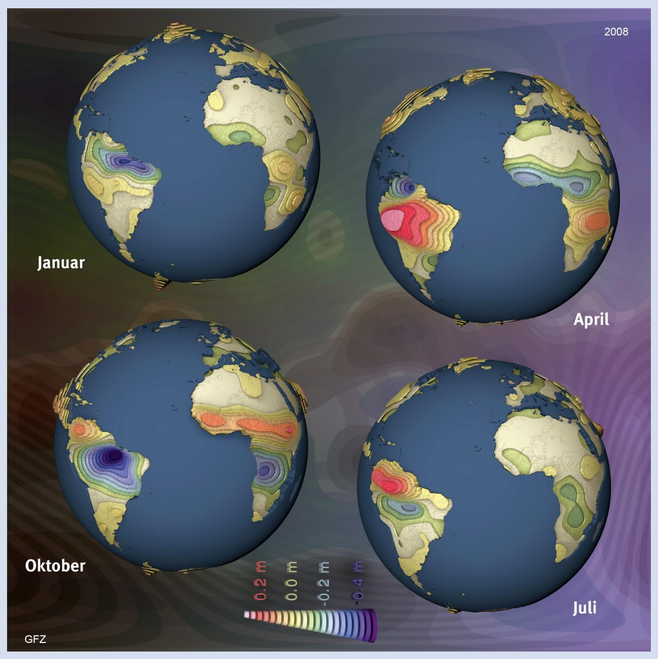
Future Needs

- Continued support needed for
  - Quality control of POD
  - Usage of space ties in a GGOS reference frame
  - Gravity field monitoring with or without GPS but together with SLR data from the geodetic satellites
  - Orbit decay monitoring (space debris mode)

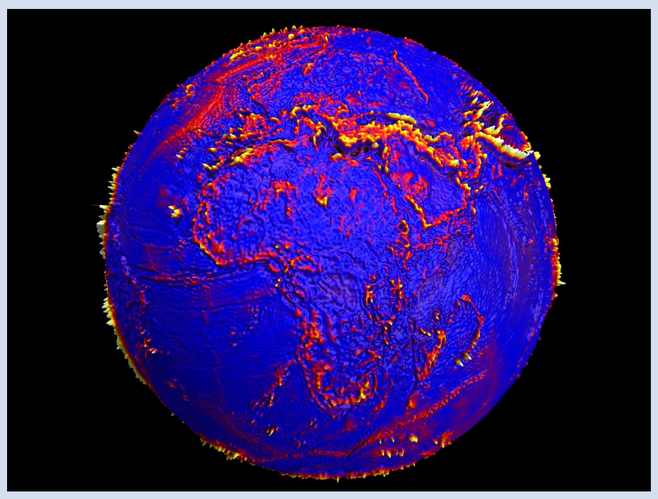
Issues

- No full science mode around longest shadow phase due to aging of batteries
- Final decay expected for beginning of 2018

The GRACE satellites



GRACE water seasons



GRACE gravity anomalies

Summary

SLR contributed considerably to the success of the GRACE mission. Even indirectly, SLR got its success by relying on GRACE products, i.e. the measurement of the Lense-Thirring effect with 10% accuracy. All in all, ILRS is doing a great job despite running on a voluntary basis and the ongoing financial discussions.