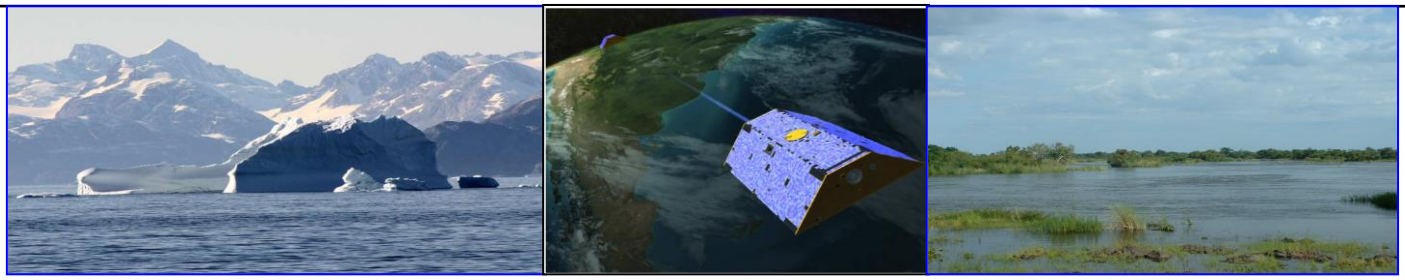
Master of Science Project

Department of Geoscience and Remote Sensing (GRS)

Theme: Mass transport

High-resolution modelling of mass transport in the Earth's system using the mascon approach



Research context

GRACE satellite mission launched in 2002 marked the beginning of monitoring mass transport in the Earth's system with satellite gravimetry. In this way, one can collect information about such processes as:

- Natural accumulation and discharge of water in river basins
- Large-scale extraction of groundwater
- Accumulation and melting of snow cover
- Shrinking of ice sheets in Greenland and Antarctica
- Melting of mountain glaciers
- Glacial isostatic adjustment
- Co-seismic and post-seismic mass-redistribution deformations triggered by megathrust earthquakes.

As such, observation of the mass re-distribution is of interest in many Earth sciences, including hydrology, climatology, and physics of the solid Earth. A number of research centers are engaged in modeling temporal variations of the Earth's gravity field from GRACE data. A good progress in GRACE data processing has been made since the launch of the GRACE mission. In particular, a novel techniques developed at the GRS Department of TU Delft allows long-term mass transport trends to be recovered with an unprecedented spatial resolution – of the order of 150–200 km. Nevertheless, there is still enough space for a further improvement of data processing techniques and of the quality of the resulting models.

Purpose of the research

The main objective of this project is to develop further the GRACE data processing technique based on the so-called "mascon approach", with a particular focus on long-term trends. This algorithms to be developed should result in a similar or higher spatial resolution of the resulting models, as compared to the models produced currently. At the same time, the new algorithms should be more flexible in exploiting available information about the likely locations of strong mass trends. In addition, they should require only modest computational resources. The results to be obtained will be validated agains independent measurements of large-scale mass variations, such as altimetric and in-situ measurements of water level in largest lakes. Finally, a successfully depeloped technique might be applied to quantify socially-relavant mass transport processes, such as a depletion of grounwater resources in the Middle East.

In the course of the project, the student will:

- Become more familiar with state-of-the-art techniques for mass transport modelling from satellite gravimetry data
- Improve his knowledge in data processing
- Further develop his/her programming skills
- Gain some experience in dealing with satellite and in-situ data suitable for monotoring various hydrological processes.

A successful completion of the project may result in the preparation of 1 or 2 scientific publications.

Further information and project supervisors:

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