

## Joint Working Groups of Sub-Commission 2.6

### JWG 2.6.1: Geodetic observations for climate model evaluation

(joint with Comm. 1)

Chair: Annette Eicker (Germany)

#### Terms of Reference

Spatio-temporal variations of gravity are related to the dynamics of the Earth's interior, land surface and hydrosphere, oceans, cryosphere, and atmosphere. Due to its large signal, in particular the variations of continental water storage have been observed and analyzed in recent years from space gravimetry. In addition, the temporal change of gravity has been successfully related to net flux at the land-atmosphere interface, the sum of precipitation, evapotranspiration and runoff/discharge. Another powerful geodetic technique is microwave remote sensing of the atmosphere; in particular global and regional water vapor trends can be determined from GNSS measurements and other space-geodetic data and, e.g. radiosonde information.

Global and regional climate models simulate the coupled atmosphere-land surface- ocean system on decadal to century-long time scales. Since the water cycle is coupled to the energy and carbon cycles and critically controls biomass evolution, their ability of correctly simulating variability, frequency and trends of climate variables like land and sea surface temperature and precipitation and their response to anthropogenic forcing depend critically on their skills in representing the water cycle. As a result, the representation of the water cycle, including groundwater and human modifications like pumping and irrigation, has gained much attention in recent years. This holds also for climate monitoring activities that rather focus on assessing the current state of the Earth's climate than on the future. Initialization of climate model runs, detection and attribution of the anthropogenic fingerprint, or reanalysis of atmospheric/land surface modelling all depend on accurate observations of the current water cycle.

The gravity field, derived from GRACE and in the near future from GRACE-FO and other missions with unprecedented accuracy and resolution, provides a unique opportunity to validation of global and regional climate models. Different from 'GRACE-Hydrology', the focus of this WG would be on the observation, analysis and validation of fluxes across the land-atmosphere interface, and not on water resources. We would also aim at developing synergies between gravimetric, microwave-based, and other geodetic climate model validation efforts.

#### Objectives:

- To further the understanding of the potential of gravity and other geodetic measurements for the observation, analysis and validation of fluxes across the land-atmosphere continuum.
- To promote the cross-disciplinary study of these fluxes through comparison and possibly integration of gravimetric and hydro-meteorological measurements such as soil moisture, precipitation, water vapor, or evapotranspiration (e.g. latent and sensible heat flux)
- To advance the improvement of climate models (including land surface models), climate monitoring systems and analyses/reanalyses through space-based measurements of gravity
- To stimulate discussion between the gravity community and the land surface modelling, atmospheric modelling and climate communities

#### Program of Activities

- The WG will create opportunities for communication and discussion through suggesting/organizing sessions at international meetings and conferences
- The WG will develop reference (best-practice) methods for evaluating/improving climate models from geodetic data and publish these methods (e.g. in a 'white paper')
- The WG will seek to organize a special issue on its topic in an appropriate international journal

#### Members (TBC)

Annette Eicker (Chair, Germany)