GGOS ATMOSPHERE (FWF P20902)

In modern geodesy and in particular in space geodetic techniques various effects of the atmosphere have to be considered. The atmosphere delays (or advances) radio signals emitted by satellites, e.g. of the GNSS (Global Navigation Satellite Systems), or by distant radio sources observed by VLBI (Very Long Baseline Interferometry), atmosphere pressure loading causes deformation of the Earth's surface up to more than one centimeter (see figure), Earth gravity observations from dedicated satellites have to be reduced for atmospheric influences, and a considerable part of the variations of Earth rotation (polar motion, length of day) is due to processes in the atmosphere. Thus, the atmosphere plays an important role for the Global Geodetic Observing System (GGOS) of the International Association of Geodesy (IAG) with its central theme 'Global deformation and mass exchange processes in the System Earth'.

In recent years, models for all these effects related to the atmosphere have been developed which are based on data from numerical weather models. However, the parameters describing each of these effects have been determined at various institutions, using different weather models with different resolutions, and applying different geophysical models and hypotheses. The overall goal of the project 'GGOS Atmosphere' is to determine consistent and homogenous models for

1. atmosphere angular momentum functions,
2. atmosphere delays,
3. gravity field coefficients for the atmosphere and
4. atmosphere loading corrections

based on a common data stream with predominantly the same underlying meteorological parameters like pressure, temperature, humidity, and wind velocity. Main tasks of the project are the download of high-resolution data sets from the European Centre for Medium-Range Weather Forecasts (ECMWF) extracting the best models with the highest spatial and temporal resolution available, and to consistently determine all four target quantities mentioned above. The influence of different ECMWF data classes and of the various geophysical models on these quantities will be investigated, and as soon as best-suited data classes and geophysical models are found the routines will be implemented at the supercomputing facilities of the ECMWF to save the download of the enormous data amounts. Pressure loading corrections, angular momentum functions and gravity field coefficients for the atmosphere will be consistently determined for the whole history of space geodetic observations and provided to the international science community. This will contribute to a better understanding of the System Earth that is based on a detailed knowledge of the interactions between geometry, rotation and gravity field of the Earth.