Geophysical Research Abstracts
Vol. 13, EGU2011-9942, 2011
EGU General Assembly 2011

Using relativistic frequency shift in multi-satellite gravity field missions

Reinhard Mayrhofer and Torsten Mayer-Gurr
Institute of Theoretical and Satellite Geodesy, TU-Graz, Graz, Austria (reinhard.mayrhofer@tugraz.at)

Einstein's general theory of relativity can be used to introduce the relativistic frequency shift as a new observation for gravity field reconstruction. It states that mass alters the geometrical shape of space-time. Thus, the general relativistic effects caused by earth's mass on electromagnetic wave propagation produces a frequency shift of a microwave-link between a transmitter and a receiver, which is further expressed as time dilatation. By placing the microwave transmitter in an earth orbiting satellite and the receiver on earth's surface a simple satellite gravity field mission configuration is found.
As the effects are quite small the requirements on satellite state vector determination and atomic clock precision are high. In this study it is investigated how multi-satellite mission configurations can be set up for delivering best quality static and time variable gravity fields. Furthermore, the mathematic principles and the requirements on atomic clocks for designing and computing such a mission are explained. This is done by setting up an appropriate simulation requirement where various atomic clock noises and position and velocity uncertainties can be simulated.