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A Unique Reference Frame: Basis of the geodetic observing system for geodynamics and global change

Abstract

The elements of the System Earth, i.e., the atmosphere, the hydrosphere and the solid Earth are transmitting signals detectable by modern geodetic observation techniques. The signals affect the measurements, e.g. by refraction of optical rays or microwaves, and the geodetic parameters to be determined (geometry and gravity), e.g. by loading and gravitational forces. For geodetic use, these signals are seen as disturbances and reduced from the observations. For geodynamics and global change research they provide useful information with respect to the ongoing processes in the System Earth. From the repeated evaluation of the time-dependent signals, geodesy is capable of detecting variations of the parameters of the atmosphere, sea-surface, continental water and ice covers, and deformation of the solid Earth.

The geodetic parameters are always related to a conventionally defined reference system. For instance, coordinates of points of the Earth surface are not directly measurable, but they are transformed by constraints to a reference system. As the signals of global change are very small (in general below the single measurement's precision) it's essential for their detection that all related parameters be estimated by a common adjustment considering the complete set of geometric and gravimetric observations referring to the same reference system, which has to be realized by a unique reference frame. The principal problem is to combine the geometric (point positions, orientation, translational and rotational velocities) and the physical parameters (mass distribution, gravity) into one consistent frame. Non-modeled variations of the coordinates of tracking stations in satellite orbit determination affect the gravity field determination, and non-modeled gravity field variations affect the estimated geometric deformations of the Earth surface. Only the adequate modeling provides reliable results for global change and geodynamics which are presented here.

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Short biographical notes

Education

1970	Dipl.-Ing. (Geodesy), Tech. University Hannover
1975	Graduation Dr.-Ing., Tech. University Hannover

Professional Activities

1970 – 1977	Junior / Chief scientist, Tech. Univ. Hannover
1977 – 1979	Professor, Univ. del Zulia Maracaibo, Venezuela
1979 – 1994	Scientist, DGFI Munich
1985 – pres.	Lectureship "Geodynamics", Tech. Univ. Munich
1994 – pres.	Director DGFI, Munich
1994 – pres.	Honorary Professor, Tech. University Munich

Major International Positions

Since 1994	IAG Representative, American SIRGAS project
Since 1999	Member of the ILRS Governing Board
Since 2001	Bureau Member of the Int. Lithosphere Project
Since 2003	President IAG Comm. 1 "Reference Frames"
Since 2003	IUGG Representative to the Pan-American Institute for Geography and History, PAIGH
Since 2003	IUGG Repres. to the UN Cartographic Bureau
Since 2005	Member of the GGOS Steering Committee