

CONCEPT FOR REFERENCE FRAMES IN GEODESY AND GEODYNAMICS:  
THE REFERENCE DIRECTIONS

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ABSTRACT

Modern high accuracy measurements of the non-rigid Earth are to be referred to four-dimensional, i.e., time and space-dependent reference frames. Geodynamics phenomena derived from these measurements are to be described in a terrestrial reference frame in which both space and time-like variations can be monitored. Existing conventional terrestrial reference frames (e.g., CIO, BIH) are no longer suitable for such purposes.

The ultimate goal of this study is the establishment of a reference frame, moving with the Earth in some average sense, in which the geometric and dynamic behavior of the Earth can be monitored, and whose motion with respect to inertial space can also be determined.

The study is conducted in two parts. In the first part problems related to reference directions are investigated, while the second part deals with positions, i.e., with reference origins. Only the first part is treated in this paper.

The approach is based on the fact that reference directions at an observation point on the Earth's surface are defined by four fundamental vectors (gravity, Earth rotation, etc.), both space and time variant. These reference directions are interrelated by angular parameters, also derived from the fundamental vectors. The interrelationships between these space and time-variant angular parameters are illustrated in a commutative diagram--tower of triads, which makes the derivation of the various relationships convenient.

In order to determine the above parameters from observations (e.g., laser ranging, VLBI) using least squares adjustment techniques, a model tower of triads is also presented to allow the formation of linear observation equations. Although the model tower is also space and time variant, these variations are described by adopted parameters representing our current knowledge of the Earth. For details, see Bulletin Géodésique, end of 1978.