

CHAPTER 3 CONVENTIONAL TERRESTRIAL REFERENCE FRAME

The IERS Terrestrial Reference Frame (ITRF) adopted for either the analysis of individual data sets by techniques (VLBI, SLR, LLR) or the combination of individual solutions into a unified set of data (station coordinates, Earth orientation parameters, etc.) follows these characteristics (Boucher, 1987):

- a) It is geocentric, the center of mass being defined for the whole Earth, including oceans and atmosphere.
- b) Its scale is that of a local Earth frame, in the meaning of a relativistic theory of gravitation.
- c) Its orientation is given by the BIH orientation at 1984.0.
- d) Its time evolution follows a no-global-net-rotation-or-translation condition.

The unit of length is the meter (SI). The IERS Reference Pole (IRP) and Reference Meridian (IRM) are consistent with the corresponding directions in the BIH Terrestrial System (BTS) within $\pm 0''005$. The BIH reference pole was adjusted to the Conventional International Origin (CIO) in 1967; it was then kept stable independently until 1987. The uncertainty of the tie of the IRP with the CIO is $\pm 0''03$.

When one wants to realize such a conventional terrestrial reference system through a reference frame; i.e. a network of station's coordinates, it will:

- a) Include the permanent solid Earth tidal deformation so that the adopted coordinates will differ from the instantaneous coordinates by only periodic terms (see Chapter 6).
- b) Be specified by Cartesian equatorial coordinates X, Y, and Z, by preference. If geographical coordinates are needed, the GRS ellipsoid is recommended ($a_e = 6378136$ m, $f^{-1} = 298.257$; see IERS recommended values).

The way followed by various analysis centers depends on their own views on modelling, but also on the techniques themselves. For the origin, only data which can be modelled by dynamical techniques (presently SLR and LLR for IERS) can determine the center of mass. The VLBI system can be referred to a geocentric system by adopting for a station its geocentric position at a reference epoch as provided from external information. It is recommended to use a value coming from the initial IERS Terrestrial Reference frame

(ITRF-0) - see below.

The scale is obtained by appropriate relativistic modelling. This is particularly true for VLBI and LLR which are usually modelled in a barycentric frame.

The orientation is defined by adopting IERS (or BIH) Earth orientation parameters at a reference epoch. In the case of SLR, an additional constraint in longitude is necessary. The use of ITRF-0 values is recommended for this purpose.

The time evolution of the orientation will be ensured by using a no-net-rotation condition either directly, or by adopting a plate motion model which fulfills this condition (for information on AMO-2, see Chapter 9).

Coordinates of sites may be found in the most recent Annual Report of the IERS.

REFERENCES

Boucher, C., 1989, "Definition and realization of terrestrial reference systems for monitoring Earth rotation," Variations in Earth Rotation.