

Realization of ITRF and Problems in Plate Boundary Zone

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In the modern geodesy, the shape and its time variations of the earth are presented by the International Terrestrial Reference Frame (ITRF), which gives the accurate coordinates of the observation sites of the space geodetic techniques.

The observations by GNSS also contribute to establish the ITRF models through the permanent GNSS sites (for instance, International GNSS Service (IGS) network sites), but the most important contribution of GNSS for the modern geodesy is the realization of ITRF. At any place on the earth we can observe easily the GNSS satellites using less expensive GNSS receivers and determine the accurate ITRF coordinates of the site by the analysis with the GNSS fiducial sites which coordinates are given by ITRF accurately. This is the realization of ITRF in the states of art.

Thus both the determinations of the ITRF model applying space geodetic techniques and the realization of the ITRF applying the GNSS receivers to determine the present accurate coordinates of any place on the earth are just two halves of the whole in the modern geodesy.

In this presentation we also discuss the most important problem that prevent the realization of ITRF, that is, the co-seismic and post-seismic motions of huge earthquakes (M8 or larger) that make it difficult to give the accurate coordinates of the GNSS fiducial sites in the moment after the earthquake especially for the sites in the plate boundary zones.

For instance, after the 2011 Great East Japan Earthquake the IGS reference frame stations in and around Japan, TSKB, MTKA, YSSK, DAEJ, and SUWN sites, move considerably both in co-seismic and post-seismic period, and change the site coordinates very largely and rapidly. Especially TSKB site is one of the very important core site of the IGS network for long time and the coordinates of the site change near one meter. Thus there arises very wide blank area of the ITRF reference frame sites in Eastern Asia after the earthquake.

Another case is the 2004 Great Sumatra-Andaman Earthquake. The earthquake makes it impossible to use NTUS IGS site in Singapore which was the only one reference frame site in Indochina area at that time for very large co-seismic and post-seismic movements. Because of the considerable post-seismic motion, there still exists very wide blank area of the reference frame sites in this area.

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