IERS Working Group on co-location and local ties

Jointly with IAG Sub-Commission 1.2

Charter

Introduction

Tie vectors are nowadays fundamental for the computation of global terrestrial reference frames: the combination of the individual techniques-specific reference frames relies on the accuracy of tie vectors as well as the number and distribution of co-location sites. In order to be useful, tie vectors must be provided with full variance covariance information and must be accurate to the 1 mm level. Variance covariance computation strictly attains to the data processing phase of the tie vector; it can be rather simply achieved and should be regarded as a mandatory task of any local tie. An accurate estimation of the tie vector is more difficult to obtain and many efforts must be taken during the whole local tie process. The accuracy of a tie vector is usually (and indirectly) assessed through a comparison with the space geodetic solutions in the combination phase: the residuals of the combination are analyzed and used to identify discrepancies between space geodetic and terrestrial measurements. If, on one hand, these discrepancies simply highlight a disagreement for a specific co-location site, on the other hand, they are the starting point for a rigorous investigation on the wide variety of causes that might originate from technique specific problems. It should be noticed that the whole process is characterized by the unavoidable complication of reliably coupling measurements of different nature (space geodetic and terrestrial) related to different reference points (electrical and conventional points, respectively).

Local tie surveys are usually performed combining terrestrial measurements of angles, distances and height differences and aim at computing differential coordinates (local ties) between space geodetic instruments expressed in a topocentric frame. In order to do so, terrestrial measurements are performed and combined according to a geometric model (whose complexity and flexibility can vary considerably) apt at realizing the *conventional* definition of the instrument's reference point. Regardless of the way the observations are acquired, processed and conditioned (all these aspects obviously impact the tie vector estimation) it should be noticed that it is impossible to directly observe the instrument's electrical reference point with terrestrial techniques (i.e. the antenna's phase centre for GPS, VLBI and DORIS and the photodetector for SLR). Furthermore, the tie vector is naturally expressed with respect to a topocentric frame and, in order to be useful, it must be accurately transformed into a global frame.

Space geodetic observations are acquired at the electrical reference point and are commonly referred to the conventional reference point by means of specific corrections and models that are assumed to properly realize the connection. Many factors may influence the stability of the electrical point and any inconsistency related to this very delicate connection phase obviously reflects on the combination's residuals. Addressing, investigating and understanding electrical point instabilities has been a major concern for the whole geodetic community and it is a mandatory task when tie vectors and space geodetic measurements are combined.

The WG on site surveys and co-locations aims at enhancing the cooperation between the groups involved in local tie surveys and their adjustment, the combination centres, the

users of tie vectors and the space geodetic techniques services (i.e. IGS, ILRS, IVS and IDS), with the purpose of bringing together all necessary capabilities apt to improve present day situation.
Cooperation with GGOS activities and its branches should be sought and established.

Goals and Objectives

The WG should spread the knowledge related to local surveys and their adjustment among the national agencies in charge of co-location sites maintenance.

1. Site surveys standards:
    a. Revise the local tie surveying activity developed so far. Identify open issues and promote research and discussion.
    b. Set guidelines related to in field operations.
    c. Spread the know how among the community and the national agencies in charge of co-located sites maintenance.
2. Tie vector estimation:
    a. Set guidelines on tie vectors computational standards and their transformation into global frame.
    b. Provide local tie vectors with full variance-covariance information in SINEX format.
    c. Develop a concrete action plan to improve local ties for future ITRF realizations.
3. Site surveys activities:
    a. Promote local tie surveying wherever needed.
    b. Remotely assist site surveying activities.
    c. Provide computational support.
4. Coordination and research:
    a. Liaise with technique combination centres.
    b. Liaise with technique services.
    c. Promote a joint effort aimed at focussing on the most recent combination residuals of the global frame for investigating local inconsistencies at co-location sites and identify actions to be taken to improve the performances of tie vectors within ITRF like combinations.

Schedule

June 2009:	Update the WG's web page on the IERS and on the IAG IC-WG1.4 site.
September 2009:	Members representing technique's Services appointed
September 2009:	End collection and revision of previous activity on local tie surveying and tie vectors estimation: database on scientific literature created on the IAG IC-WG1.4 page and linked to IERS WG web page. Promote discussion on scientific production among working groups members.
September 2009:	IGN database on local tie vectors linked with Google Earth application (in cooperation with GGOS Bureau for Networks and Communications).
October 2009:	Promote data and software exchange between members; start processing and re-processing of existing datasets.

November 2009:	Gather information about the performances of the local ties from most recent global TRF combinations produced by different combination centres. Start investigation on site-dependent discrepancies.
December 2009:	Start a research project on local ties and global frame combination (see goal 4.c).
April 2010:	Organize a session dedicated to site surveying and local ties at EGU. Organize a Working Group meeting at EGU. Review the template of the “Analysis strategy summary” file for terrestrial ties and the draft of the document on guidelines for tie surveying.
December 2010:	Release guidelines on local tie surveying and computation. Release documentation.

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