3.6.1.3 Natural Resources, Canada (NRCan)

Preliminary solutions between the GPS component of the IGN, DGFI and EMR solutions were compared. The first comparisons were made during the summer of 2005 with the files available. A few stations with significant coordinate and velocity differences were identified and reported. These coordinate and velocity differences could be attributed for the most part to minor variations in the time series used, the discontinuities used, the stations included, conditions imposed, etc. In those preliminary solutions the IGN, DGFI and EMR solutions had respectively 497, 317 and 501 station coordinate and velocity segments. The validity of the matrices was also checked. The number of common segments was about 300 for all comparison pairs. After alignment using a 14-parameters Helmert transformation at a common epoch, the most reliable stations had position and velocity agreement approaching the mm and mm/y level, respectively. The original combination of the weekly solutions included the following information:

GPS weeks 837 – 998 (96/01/21 – 99/02/27): in most cases the AC solutions only included station coordinates. The daily ERP's (pole position, pole rate and calibrated LOD) were only included by a few ACs and only toward the end. A requirement to extract weekly implicit geocenter information from the ACs solutions was only agreed at the beginning of the pilot project and thus not available for this period.

GPS weeks 999 – 1012 (99/02/28 – 99/06/05): the apparent geocenter was included, but the ERP's were not available from all the ACs and thus not included in the combined product.

GPS weeks 1013 – 1308 (99/06/06 – 05/02/05): the apparent geocenter and the ERP's were included in the weekly solutions. The contribution eventually included up to the end of 2005 (GPS week 1355 (05/12/31)).

Two updates were added for ITRF2005, they are:

GPS weeks 1309 – 1333 (05/02/06 – 05/07/30) and

GPS weeks 1334 – 1355 (05/07/31 – 05/12/31).

Along with the added data since ITRF2000, the combination with the discontinuity table is probably the more significant change. Exchanges with IGN and DGFI also helped improve the list of station discontinuities. During the review of the time series, segments with questionable station coordinates time series were identified for removal and summarized using the discontinuity table format. The format could/should also be used to list stations with significant periodicity or exponential decay in the case of large earthquakes. For more refined analysis, modeling can be limited to one coordinate component at a time (e.g.: vertical). Coordination of the discontinuity list for common stations with the EUREF and NAREF regional analysis centers will also ensure the consistency of the

global and regional solutions. This will facilitate the integration of the regional solutions in the new ITRF2005. Some velocity discontinuities were also included and could be correlated to large earthquakes. Only a subset (~200) of the discontinuities identified (~600) are relevant for this ITRF2005 realization. Many of the discontinuities could be correlated to events such as earthquakes or equipment changes, while several still have an unknown cause. For events before GPS week 837 (1996/01/21), the JPL and SIO station coordinates time series were the main sources of information.

The provided discontinuity table has also been subdivided in two subsets, one where the events are fairly certain, and the other where there is significant uncertainty. In general, in the first group, discontinuities could be observed from multiple time series and/or could be correlated with known events and/or had a large offset. Several individuals and organizations (e.g. TUM) also provided valuable information to improve the list of discontinuities.

These discontinuities may potentially cause some difficulties at collocated sites especially where no local markers relative motion is involved (e.g.: equipment change). The issue has to do with properly connecting the GPS measurements to the marker which may not necessarily be best for the epoch of the measurement tie.

The IGS weekly solutions are characterized by a gradual increase of the number of stations which was also accompanied with an improvement of the accuracy of the solutions since 1996. The time evolution of statistics for the North, East and Up components for the weekly station coordinates residuals show an improvement of a factor of about 4–5 between 1996 and 2005. The precision is currently at 3mm horizontally and 6mm vertically. Several factors are contributing to this significant improvement namely: 1) improving station hardware, 2) processing software and 3) increase in the number of stations processed.

A subset of the ITRF2005P solutions was compared to the IGS weekly combined “official” solutions for GPS weeks 1356–1370 (06/01/01 – 06/04/15) which were not included in ITRF2005. This subset was composed of the 139 stations in the IGS proposed realization of ITRF2005. The ITRF2005P subset was propagated to the epoch at the middle of the week corresponding to each weekly solution. The weekly solutions were aligned by estimating translations, rotations and scale to the proposed realization of the corresponding epoch before computing the residuals. The standard deviation of those residuals (N, E, and H) is 2.0 mm, 1.9 mm and 5.9 mm. These statistics are consistent with the expected noise level. The estimated noise level is consistent with past IGS realizations of ITRF. As in the previous realizations, the sample used includes of the best stations. In this case, the sample has over 40% of the GPS stations in ITRF2005P.

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