FFI Technology Development Center - Software Development

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Abstract

This report discusses the current status of the FFI Technical Development Center as well as upcoming changes.

1. Status and Future Changes

FFI is currently an Associate Analysis Center for IVS and ILRS, and a Technology Development Center for IVS. The Norwegian Mapping Authority (NMA) and FFI have a close cooperation in the analysis of space geodetic data using the GEOSAT software. NMA has recently been given the status of an Associate Analysis Center of IVS (28 October 2010). The plan is that NMA will apply to become a Technology Development Center for IVS and that FFI will end this formal role in 2012. The GEOSAT TD and AC activities at both institutions will be coordinated by NMA. This also implies that FFI will stop being an IVS Associate Analysis Center in 2012.

2. The GEOSAT Software and Activities in 2011

FFI's contribution to the IVS as a Technology Development Center focuses primarily on the development and validation of the GEOSAT software for a combined analysis at the observation level of data from VLBI, GPS (ground-based and LEO), SLR, DORIS, altimetry, accelerometry, and GRACE KBR. The advantages of the combination of independent and complementary space geodetic data at the observation level is discussed in Andersen [1].

Space borne accelerometry has been implemented, and a small set of data has been tested (GOCE and GRACE). Software to convert space-based gravity models and accelerometry / gradiometry data to geoid information is being implemented right now. A complete production line for altimetry (Topex, ENVISAT, JASON 1 and 2) has been implemented and tested. Map animations of sea level rise have been developed, so far based on GDR-orbits. Software for the analysis of cross-over data is being developed right now. In the near future the altimeter analyses will be based on orbits determined with GEOSAT instead of the GDR-orbits, to be more consistent with the TRF realized with GEOSAT. The cross-over software can be used for quality evaluation of the GDR and GEOSAT orbits.

The GEOSAT orbit model has been validated against external LEO orbits. The RMS difference between JPL GRACE orbits and internal GEOSAT orbits is typically 4 mm in each Cartesian direction. The corresponding RMS difference between external GOCE orbits (ESA official, approximately 250 km altitude) and internal GEOSAT orbits is typically 11 mm. This work will continue in 2012.

A lot of work has been done to improve the consistency between VLBI results from GEOSAT and results from the other IVS Analysis Centers.

- The VMF1 model for tropospheric refraction has been implemented.
- A LSQ-module quite similar to GSFC SOLVE, including continuous linear spline parameter representations, has been implemented and tested. The plan is however to use the UD-filter

estimator available in GEOSAT for the production of SINEX files. The LSQ estimator was implemented for the purpose of data editing and as an external check of the filter solutions.

- A misinterpretation of the NGS-format has been corrected, giving more consistent estimates of UT1-UTC.
- A number of options have been implemented for the detection and correction of clock breaks, for the suppression of one or more individual stations, for manual detection and rejection of individual outlier observations, and for validating the results.

NMA has now taken over a version of VLBI/GEOSAT with these improvements, and a production line for the routine generation of normal equations for IVS combination will be established in the near future. There are now options in GEOSAT so that the VLBI model is in compliance with the other VLBI analysis software packages.

3. Staff

Dr. Per Helge Andersen - Research Professor of Forsvarets forskningsinstitutt (FFI and NMA). Dr. Eirik Mysen - Research geodesist at the Norwegian Mapping Authority (NMA). Dr. Kristian Breili - Research geodesist at the Norwegian Mapping Authority (NMA). Dr. Halfdan Kierulf - Research geodesist at the Norwegian Mapping Authority (NMA). Dr. Oddgeir Kristiansen - Section Manager at the Norwegian Mapping Authority (NMA).

References

[1] Andersen, P. H. Multi-level arc combination with stochastic parameters. Journal of Geodesy (2000) 74: 531-551.