4.3 Second GGOS Unified Analysis Workshop

After the GGOS Unified Analysis Workshop (UAW) in Monterey, California, USA, in December 2007 and a Follow-Up Meeting in Vienna in April 2008, the Second GGOS Unified Analysis Workshop was organized in San Francisco, California, USA, on December 11–12, 2009. As in the case of the first UAW, the participation in the UAW 2009 was based on invitation, i.e., the IAG Services decided on the persons to represent them during the workshop.

Workshop Scope and Goals

An important goal of GGOS is to advance the combination and integration of the various space and *in situ* geodetic techniques. This goal can only be achieved with the help of all the IAG Services, and especially the IERS and IGFS. Even if considerable progress has been made in the effort to rigorously combine the various space geodetic techniques (e.g. with the realization of ITRF2005, making use of a new approach based on time series of weekly/session SINEX files), there are still many deficiencies (missing parameters), inconsistencies and systematic effects to be addressed.

The workshop was intended to be a forum for the exchange of information and results concerning both,

- problems common to more than one service and
- problems specific to an individual service.

For a successful combination of the space geodetic techniques, experts of a certain technique have to be familiar with the critical issues of the other techniques. Therefore, the workshop was organized to increase the common understanding of the individual techniques as they contribute to GGOS.

Sessions

The workshop was organized in four sessions. Their titles, chairs, scopes and goals were the following:

Session 1: Products by the Services, GGOS Portal and Metadata

Chaired by R. Neilan, co-chaired by B. Richter B. and C. Noll

In this session each of the Services presented its present status of product generation, i.e., the products themselves, the standards, models, parameterizations, and processing strategies used. A list of the deficiencies and problems encountered by the various techniques was of special importance here and the Services described, how they are intending to improve these issues and what new strategies are considered to improve the technique and products in general. In addition, the metadata flow from the Services to the GGOS Portal (meta data format) was an important topic. Also an updated version of SINEX including necessary updates was considered.

Goals:

- Understand the processing details and problems of the individual techniques
- Information about the improvements planned by each of the techniques
- Discuss ways to improve the deficiencies and cure problems in the future
- Define formats, data structures and data flows for metadata for the GGOS Portal
- New version of SINEX

Session 2: Modelling Deficiencies and Modelling Based on External Data

Chaired by J. Böhm, co-chaired by T. van Dam

The geodetic/geophysical models used in data analyses still show significant deficiencies and are not really fully consistent among techniques and analysis centres. The various modelling problems (antenna effects, atmosphere, loading effects, etc.) were addressed and possible solutions/improvements were discussed. Of special importance is the fact, that in the future, the modelling of the observations will depend more and more on large amounts of external data (e.g., meteorological models for mapping functions and a priori delays, ocean models for non-tidal loading effects, hydrological models for hydrological loading, etc.). This can be considered a paradigm change in reference system definition and realization, because these external data sets will have to be available for all high-precision realizations of the frame, be it in post-processing or (near) real-time applications. The benefit from corrections based on external data and the implications thereof were addressed.

Goals:

- Improve the accuracy and consistency of the geodetic/geophysical models used
- Assess the benefits of correction models based on large external data sets
- Discuss the implications of the paradigm change (from corrections based on *simple* mathematical formulas to corrections based on large amounts of external data)

Session 3: Combination Strategies, Common Parameters and Combined Products

Chaired by H. Schuh H., co-chaired by R. Biancale R. and Z. Altamimi

One topic of this session were combination strategies to be used for various combined products of the IERS or GGOS (e.g., including troposphere parameters, quasar coordinates, gravity field

coefficients, clocks, …). Important issues were, among others, the weighting of the observations and variance component estimation, constraining of parameters, rank deficiencies, datum definition strategies, combination of UT1 and LOD, nutation offsets and rates (VLBI + satellite techniques), definition of the parameterization for parameters common to more than one technique, standards for a priori values/models to be used for these parameters as well as standards for the time resolution (weekly, daily, sub-daily, …) and reference epochs of parameters. Combination on the observation level was also considered.

Session 4: Network Simulations and Analyses

Chaired by M. Pearlman, co-chaired by J. Ries and E. Pavlis

One of the GGOS recommendations (see GGOS2020 book) is the establishment of a global, well-distributed network of core sites, where all the major observation techniques are co-located. Simulations and analyses are therefore important to assess the number of sites necessary, some reasonable locations and what results are to be expected if, e.g., new observation techniques are implemented (kHz-SLR, twin telescopes, combined GPS/GLONASS/GALILEO receivers).

Goals:

- Assess network characteristics required to fulfil demanding requirements (e.g., 1 mm reference frame, 0.1 mm/y stability)
- Identify improvements to be achieved with technological innovations (technique-specific and local ties)

The detailed programme, the position papers of the sessions, the presentations, and the Action Items are available at <http://www.iers.org/UAW2009>.

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