

Progress of IAG SC1.3 Working Group in Providing a Dense Global Velocity Field Based on GNSS Observations

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1. Introduction

Because of accuracy, ability to provide results in a global reference frame, and low cost of receivers and versatility, Global Navigation Satellite Systems (GNSS) are presently the main sensor of the Earth's surface deformations. Consequently, GNSS networks have been installed all over the world and repeated GNSS campaigns are conducted to monitor ground deformations. In addition, a large number of Continuous Operating GNSS Reference Stations (CORS) are operating today for multi-disciplinary applications ranging from surveying to numerical weather prediction.

The regional sub-commissions within IAG sub-commission 1 "Regional Reference Frames" have already made a first step in coordinating these activities in order maintain their regional reference systems. This IAG Working Group on "Regional Dense Velocity Fields" aims at joining the efforts of the regional sub-commissions together with the groups processing local/regional CORS or repeated GNSS campaigns in order to compute a dense velocity field referenced in a unique global frame. For that purpose the WG has set up the following goals:

- define specifications and quality standards for the regional SINEX solutions and relevant meta-data;
- collect SINEX solutions and their meta-data ;
- study in-depth the individual strengths and shortcomings of local/regional and continuous/epoch GNSS solutions to determine site velocities;
- define optimal strategies for the combination of regional and global SINEX solutions;
- provide dense regional velocity fields;
- provide the densification of the ITRF2005 (or its successor);
- encourage participation in related symposia;
- implement a web site in order to provide information on the activities and access to the products of the WG
- and prepare recommendations and a comprehensive final report on the WG activities.

The Working Group brings together representatives of the regional sub-commissions and experts in the combination of SINEX files. Working Group members are Altamimi Z. (France), Becker M. (Germany), Bruyninx C. (Belgium), Craymer M. (Canada), Combrink A. (South Africa), Combrinck L. (South Africa), Dawson J. (Australia), Fernandes R. (Portugal), Dietrich R. (Germany), Govind R. (Australia), Herring T. (US), Kenyeres A. (Hungary), King B. (USA), Kreemer C. (USA), Lavallée D. (the Netherlands), Legrand J. (Belgium), Sánchez L. (Germany), Sella G. (US), and Woppelmann G. (France).

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2. Activities

The goal of the WG is to provide regional dense GNSS-based velocity information in a common reference frame. The working group is linking its activities with the regional sub-commissions within IAG sub-commission 1 “Regional Reference Frames” (AFREF, Asia&Pacific, Antarctica, NAREF, SIRGAS, and EUREF). Their expertise, coordination role for their region, and their capability to generate a unique cumulative solution for their region including velocity solutions from third parties (even campaigns) is essential for the WG. The WG thus divided the world in different regions corresponding to the regions of the different sub-commissions and appointed for each region a region coordinator. The region coordinators are gathering velocity solutions for their region (in accordance with the WG requirements) and combine the submitted velocity solutions with GNSS solutions from the regional sub-commissions to produce one regional combined velocity solution. In addition to the individual regions, cumulative SINEX solutions from global networks as TIGA are also used. A first set of preliminary regional combined solutions is prepared for June 2009. Two working group members have agreed to combine the preliminary regional SINEX solutions with long-term solutions from global networks such as the IGS and tie the result to the ITRS anticipating a preliminary WG solution in time for the IAG 2009 meeting in Buenos Aires. This main goal of this preliminary solution will be to identify the problems that will arise and help to set strategic choices and guidelines for the future. These guidelines will be used to issue a new solution in 2010-2011.

The WG issued a call for participation at the end of 2008 (see <http://www.epncb.oma.be/IAG/call.php>) as well as submission guidelines (http://www.epncb.oma.be/IAG/documents/Submission_guidelines.pdf). Figure 1 shows the solutions that have been proposed to the Working Group until now. Not all of them have been received at this moment and it is expected that some of them will only be available end of 2009.

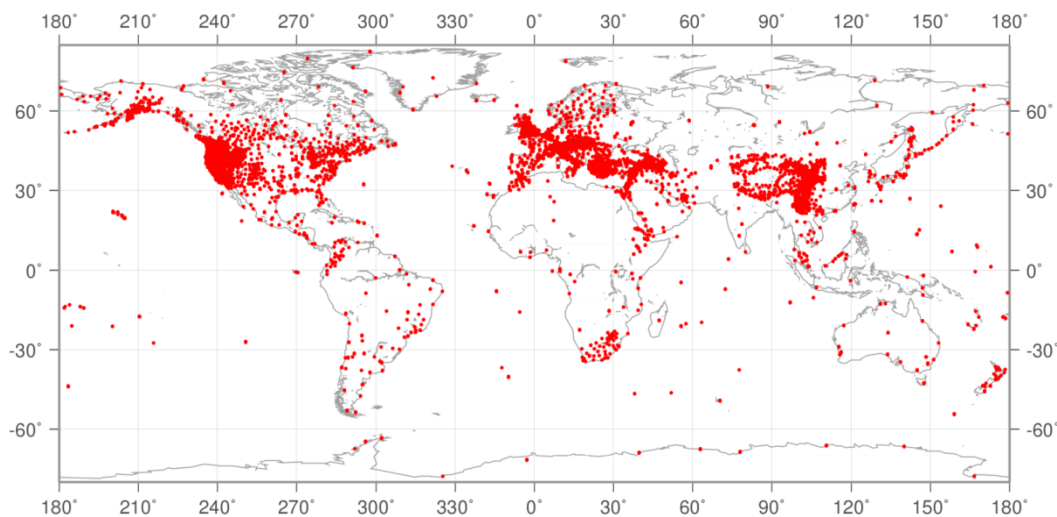


Figure 1 - Map of the velocity solutions proposed to the Working Group to date. In total about 6000 sites are included.

The following problems have been encountered up to now:

- *Domes numbers & station names*: Not all sites included in the contributing solutions have official domes numbers attributed by the IERS and this can make SINEX combination software fail. A coordinated approach for attributing virtual domes numbers will therefore be necessary. In the case of duplicates station names, a new station 4 char-ID and virtual DOMES number will also have to be assigned in a coordinated way avoiding overlaps and inconsistencies between the different regions.

- *Solutions with only precise velocity estimates and no precise coordinates:* The implication is that inter-site correlations (not always negligible) are neglected which cause failure of some combination software.
- *Inconsistent solution numbers:* The WG recommended in the guidelines that: "For IGS sites the timing of offsets should be identical to those in use by the IGS". However, this does not help when solutions have already been produced. A dedicated approach for this problem will have to be investigated.

3. Outreach

A web site has been set up providing a gateway to the WG activities, including the submission guidelines, call for participation, list of contributors, etc... It is available from <http://www.epncb.oma.be/IAG/>.