3.6.2 Combination Research Centres
3.6.2.1 Agenzia Spaziale Italiana (ASI) – Centro di Geodesia Spaziale

Introduction

The Italian Space Agency's (ASI) Space Geodesy Center (CGS), located near Matera, Italy, is a Fundamental Geodetic Station, hosting three permanent Space Geodetic systems (SLR since 1983, VLBI since 1990, GPS since 1995) providing raw observational data, acquired, screened and archived continuously and then forwarded to the IERS Technique Centres (ILRS, IVS, IGS). Since several years, in addition to the single-technique data analysis products provided to ILRS, IVS, IGS, IERS, ASI-CGS consolidated its role as a Combination Center (IERS CRC, ILRS CC).

Combination research activity and products

In 2008, the ASI-CGS combination activities, within the ILRS frame, have been focussed on the continuous production of the ILRS official combined weekly solution and its further analysis to prepare the new long term contribution to the ITRF, as well as on the preparation of the experimental combined ILRS orbital products. Moreover, other combination products and value-added geophysical products based on combined geodetic products have been realized, such as the Mediterranean area combined solution and the derivation of excitation functions from the estimated EOPs.

1. ILRS combined SSC/EOP weekly solution

Every Wednesday ASI-CGS issues the weekly ILRS official solution (ILRSA) derived from the combination of individual contributing SLR solutions based on the observations to Lageos 1-2 and Etalon 1-2 satellites, providing them to the users via the CDDIS and EDC archives, and hereto IERS. The combination methodology relies on the direct combination of loose constrained solutions, described in previous IERS reports. The ILRSA solutions, based on the individual solutions from 8 ACs, contain:

1. Weekly coordinates of the worldwide SLR tracking network
2. Daily EOPs (xpole, ypole, LOD), ITRF2005-framed for IERS Bulletin B

The latency of the combined weekly product goes from a minimum of 4 days to a maximum of 10 days for the EOP parameters: to provide IERS with a faster, constant-latency SLR product, with comparable accuracy level to the weekly one, a daily product has been set up. The ILRS ACs have been requested to generate a 7-day arc solution every day, with a one day latency with respect to the data acquisition; one day after, ILRS CCs generate the combined solutions, along the same strategies implemented in the weekly product. Since February 2008, 5 ILRS ACs (ASI, BKG, GFZ, JCET, NSGF) have been concurring to the generation of this new product, in a pre-operational phase (i.e. not public, just sent

Fig. 1: ILRSA Daily EOPs residuals and latency

to USNO). Several analyses, performed during 2008 have verified that ILRS is able to provide routinely a daily EOP product with high quality level, with constant latency lower than the minimum latency of the ILRS weekly solution.

Grouping the EOP residuals for the period February-September 2008 according to their latency, the following behavior is visible in any component:

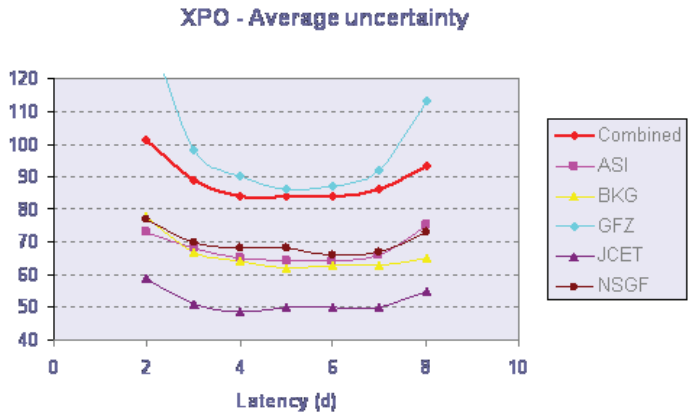

Fig. 2: ILRSA Daily EOPs and latency

The 'edge' effect is visible, the lowest latency estimates (2 day) show a lower accuracy, due to a lack of data for the last analysed day, as well as possible different analysis strategies (e.g. constraints) for the terminal days. For these reasons, at the present state-of-the-art, the best trade-off between accuracy and latency seems to be represented by the 3-day latency EOP estimates.

2. The ASIMed solution

Twice a year, ASI-CGS produces a combined velocity solution for the Mediterranean area using its original single-technique velocity solutions (SLR, VLBI and GPS) covering the whole data span acquired by the three co-located systems from the beginning of acquisitions in Matera. The ASIMed solution (<http://geodaf.mt.asi.it/html_old/ASImed/ASImed_06.html>) gives a detailed picture of the residual velocity field in the area, profiting of the dense permanent GPS coverage. The semiannual updating profits of the improvements in the velocity field information as geodetic sites become stable in terms of their data acquisition history.

In 2008, a special version of the velocity combined solution (presented at the WEGENER 2008 Meeting) included also an independent CGS GPS solution based on the Precise Point Positioning analysis approach.

The cross-check of the two independent GPS solutions allows to detect discrepant behavior for sites processed by both solutions or compared to geographically correlated sites and to apply a recovery processing to anomalous sites, eventually edited from the solution.

The following sites are assumed as colocated and the velocity is merged among techniques: Matera (SLR, VLBI, GPS), Medicina (VLBI, GPS), Noto (VLBI, GPS), San Fernando (SLR, GPS), Athens (SLR, GPS).

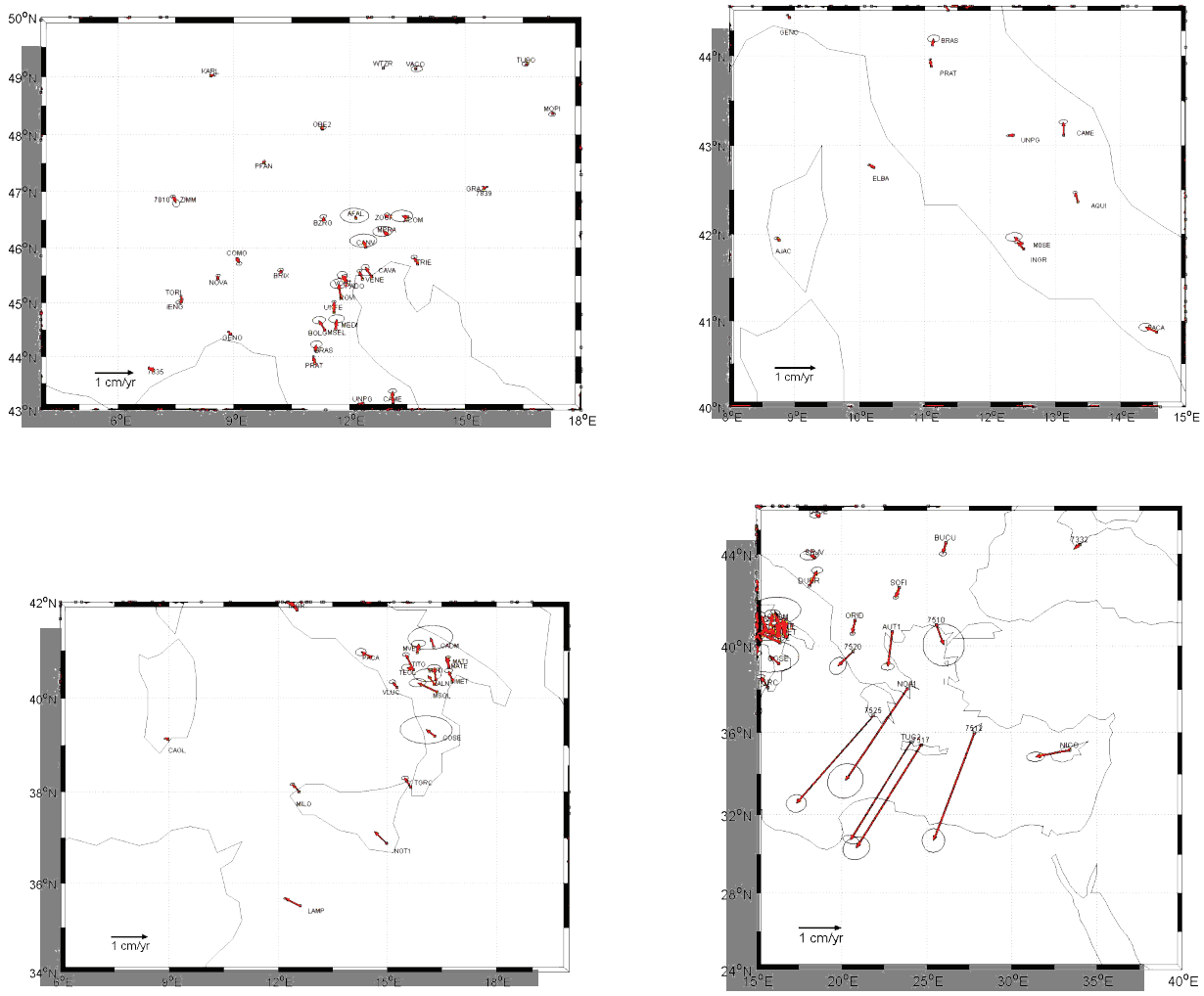

Fig. 3: Italian and Aegean residual velocity field from ASIMed2008

The obtained velocity field seems to be in agreement with the main expected tectonic behavior for this area.

The Aegean spreading can be confirmed as far as the substantial stable behavior of the Iberian peninsula, apart from its southern part.

Italy shows small, but significant residual motions; this evidences that, more or less, the whole Italian territory acts as a complex plate boundary, where African and Eurasian plates are converging, and the presence of the Adriatic micro plate (or African promontory?) complicates the overall scenario.

3. The EOP excitation functions

ASI-CGS continued the pre-operational production and the testing/validation phase for the geodetic excitation functions from its own estimation of EOP values (at present SLR only; the current use of CGS VLBI and GPS EOP is also under testing) to make them available on the ASI geodetic web site (<http://geodaf.mt.asi.it>): the daily geodetic excitation functions are produced every Wednesday along with the operational weekly SLR solution, stacked and compared whenever possible with the atmospheric excitation functions from the IERS SBA, under the IB and non-IB assumption, including the “wind” term.

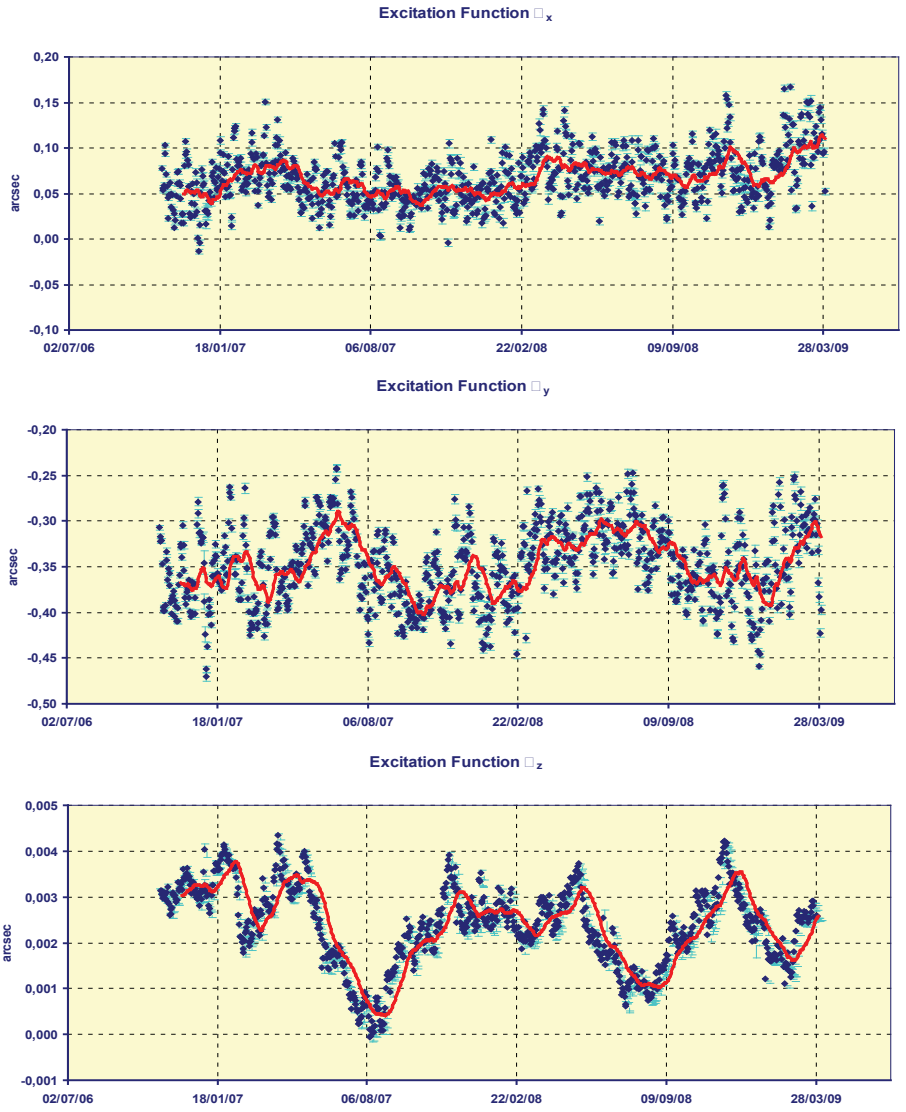

Fig. 4: ASI EOP Geodetic Excitation Functions 2007-2008 from SLR solutions

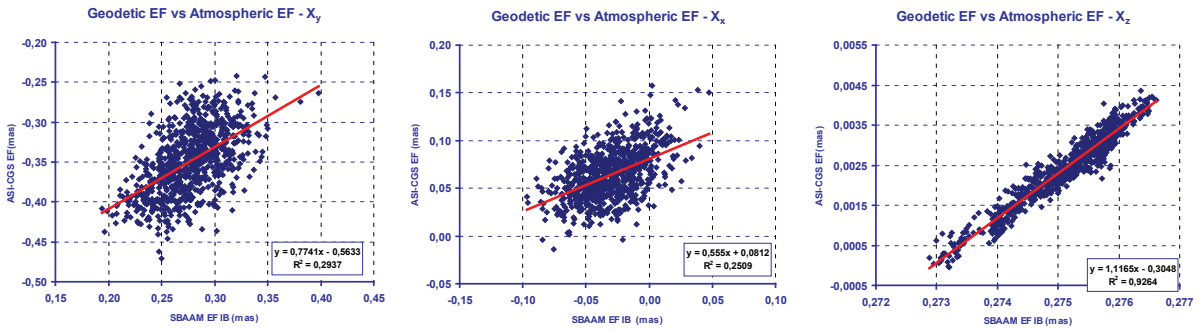

Fig. 5: Linear regression of Excitation Functions 2007-2008 from ASI SLR and SBA values

The atmospheric and geodetic excitation functions show clear similarities, not considering the expected systematic differences, especially in the z component, as it is shown in the following plots (a systematic bias has been removed from the atmospheric values).

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