Contribution to EUREF of the ASI (Agenzia Spaziale Italiana) Matera Space Geodesy Centre "G.Colombo" (CGS).

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1. Introduction.

Within the space geodesy analysis activities performed at ASI/CGS (Agenzia Spaziale Italiana/Centro di Geodesia Spaziale), a predominant role is played by the geodetic research and products devoted to the Terrestrial Reference Frame realisation: global and regional geodetic products (Devoti et al., 2002a; Devoti et al., 2002b), based on the three space geodesy techniques hosted by CGS (SLR, VLBI, GPS) are regularly submitted to the geodetic international organisations (IERS, ILRS, IVS, IGS). In particular, ASI/CGS has been contributing to EUREF since 1996, starting with weekly coordinate solutions of a network of seven permanent GPS receivers, distributed in Italy, Spain and Germany. Since then, the contribution has been growing in the years both in terms of number of analysed sites (twenty-two up to now) and of data products; moreover, following the evolution of the EUREF objectives, at present ASI-CGS submits regularly not only coordinates but also tropospheric zenith delays. ASI-CGS is actively participating to two EUREF special projects: "EUREF Permanent Network Time series monitoring" and "Troposphere Parameter Estimation".

2. The starting and the evolution of the ASI/CGS contribution to EUREF.

In January 1996, in response to a call for participation, the ASI/CGS joined the "IGS pilot project for densification of ITRF through a regional GPS analysis network", providing weekly solutions of a small (Fig. 1) south European network of GPS permanent stations, since the start of the IGS commitment (June 30, 1996-GPS week 0860).
Later on, in the August of the same year, the ASI-CGS contribution to that project was integrated in the EUREF activities, becoming officially one of the Euref Local Analysis Centre according to the IGS recommendations; actually, since 1996, EUREF acts in the European region as IGS Regional Associate Analysis Centre, delivering weekly free-network solutions to IGS, obtained combining the weekly solutions from the Local Analysis Centres and the EUREF network of permanent receivers has to be considered as a true densification of IGS network.
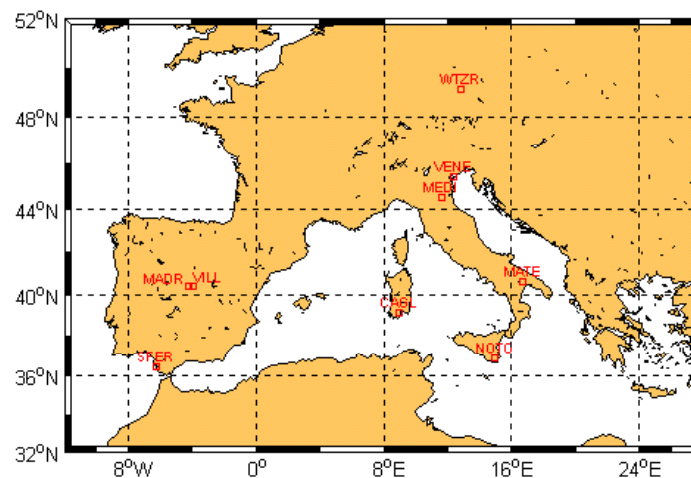

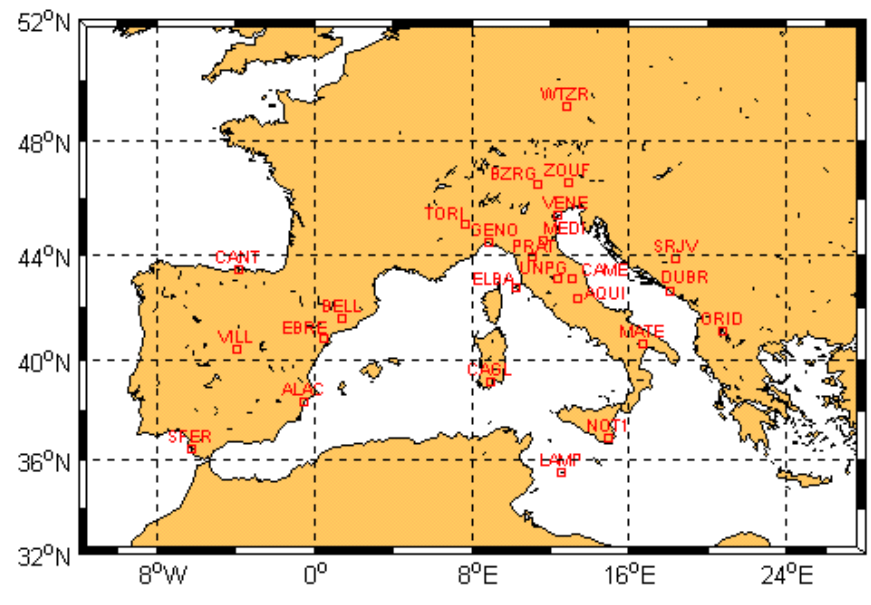Fig.1 Network analysed at the beginning of the ASI contribution to EUREF

Fig. 2 Present network analysed as ASI contribution to EUREF (Febraury, 2004)
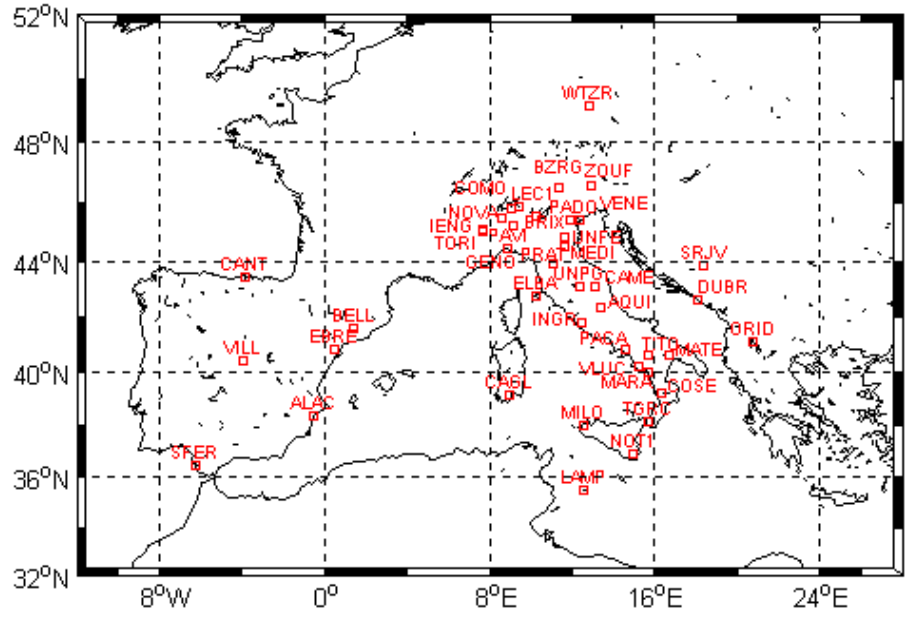

Fig. 3 Extended network daily processed al ASI-CGS (Feb.,2004)

At present, network analysed in EUREF contribution of ASI/CGS (Fig.2) has been enlarged to twenty-five stations; moreover, at CGS is regularly analysed each new Italian permanent station, which make available its own data on GeoDAF (Geodetic Data Archive Facility), the Matera geodetic data bank, which works since 1995 (http://geodaf.mt.asi.it). The present GPS analysed network has forty-one stations (Fig.3).

3. Daily and weekly analysis features.

ASI/CGS is the only Local Analysis Centre of EUREF using the software MicroCosm vs. 2001.0 (T.Van Martin, 2001); the processing approach is "fiducial": one station (generally Wettzell) is linked to ITRF (at present, ITRF2000), while a priori sigmas of the other stations are quite large (one meter) (Ferraro C. and Vespe F., 2001).
The processing for obtaining weekly coordinates and tropospheric path delays has been based on three main steps:

 a) data pre-processing
 b) orbit determination
 c) parameter estimation

3a. Data pre-processing

This is the first step of coordinates estimation and is mainly devoted to double-differences observable, with respect to an opportune hub station. Before forming double-differences, the receiver clock time-tags correction has been performed, using pseudo-range observable, together with outliers editing and cycle-slip detection and fixing. MicroCosm, at the end of this phase, produces a binary file which works as input in the estimation step.

3b. Orbit determination

IGS final orbit and related Earth rotation parameters are used for the daily data processing. A bayesian least squares fit of this orbit values is performing, in order to estimate initial state vectors of satellites and model parameters at a reference epoch.

3c. Parameters estimation.

Double differences binary file and estimated orbit at a reference epoch are the inputs for the parameters estimation step. The process is based on a bayesian least squares estimation of stations coordinates, double differences ambiguity as real number and total zenith path delays by station, each two hours. The total zenith path delay deriving from this run is not the tropospheric contribution of ASI/CGS to EUREF; "ad hoc" runs, fixing the coordinates before estimated for that week, produce zenith total path delays, according to the last EUREF recommendations, in order to reduce eventual biases among different EUREF LACs (Local Analyses Centres).

4. ASI/CGS contribution to EUREF special projects.

ASI/CGS joined the EUREF special project for the troposphere parameter estimation already during its experimental phase; this project deals with the opportunity of contributing to the investigation of climate monitoring and research and weather prediction, taking advantage of a so dense and large network of permanent GPS receivers in Europe.
The EUREF special project "Time Series for geokinematiks" started in order to ensure the long

term reliability of the EPN (EUREF permanent network) stations; to do it, a monitoring of these stations is necessary, following closely the events at the stations, monitoring the time series and identifying local events which usually are related to jumps or biases in the coordinate time series. ASI/CGS, with UPAD (University of Padova, Italy) LAC, has the responsibility of the sites in the Alps/Mediterranean and Dinarides area.

5. Conclusions.

ASI/CGS is acting in EUREF since August, 1996; its contribution has been growing during the years, particularly enlarging the network of GPS permanent stations analysed, providing weekly coordinates; since April, 2001 ASI/CGS is regularly producing and delivering to EUREF also zenith total path delays at each analysed station, within the EUREF special project "Troposphere parameter estimation". ASI/CGS is also active in the EUREF special project of "Time Series for geokinematiks" strictly monitoring stations of its competence, contributing to ensure the reliability of EPN stations.

References.

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