

EUREF Contribution of Italy

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Support of the University of Padova to the European Permanent GPS network

The University of Padova supports EUREF by means of the permanent GPS station PADO (formerly UPAD), a Local Analysis Center UPA, and contributing to Special projects. Prof. A. CAPORALI serves as member of the Technical Working Group.

The technical information concerning the Permanent stations UPAD and (beginning November 2001) PADO can be found at the EUREF CB Web site. The move of UPAD to PADO (some 1000 m apart) was justified by the inadequacy of the old astrogeodetic dome hosting UPAD and the availability of some limited but sufficient space in the new Institute for Space Research. The subnetwork and analysis method enforced at the LAC UPA are also available at the same Web site. We concentrate here on additional information.

We support two EUREF projects: one is the Special Project on Geokinematics, which aims at validating the time series of coordinates of each permanent station. The project will enable a rigorous estimate of the velocity in 3 dimensions of each station, and hence to map the ITRFxx coordinates of that station from some reference epoch to different epochs with the highest possible accuracy. The output of this SP is relevant to the understanding in a rigorous manner of the accumulation of large scale strains in particular areas, such as for example Turkey (North Anatolian Fault), the Alps and the Apennines. Therefore, a fruitful and active interface is maintained with the local community of the Structural Geologists and Seismologists, who closely investigate the relationship to Quaternary tectonics of the velocity field in the area covered by the EUREF network, and attempt some interpretative scenario. The SP on Geokinematics is coordinated by dr. AMBRUS KENYERES. The second project regards the dissemination of RTCM/RTK differential corrections using the WWW. The real time corrections generated by the receiver of the PADO station are accessed via a terminal server by the BKG in Frankfurt, which makes them available at its Web site to any user equipped with a client software. A Web server application developed at BKG under the direction of dr. GEORG WEBER is, in parallel, being tested at a local computer connected to the PADO station. This research points to future developments, where the GPS data plus the validated (in the sense of being compatible with ETRXXX) coordinates of the broadcasting station are accessible by any user in a efficient and inexpensive way. This represents a dissemination of the EUREF coordinates of permanent stations to local survey points, which is

expected to result, in a hopefully near future, in an improvement of the basis for local cartography. An active interface is maintained with the local community of the surveyors and field geologists, to disseminate the use of this technology to professional applications.

We finally attempt to densify the EUREF network by analysing, on the same standards as for the weekly EUREF routine processing, all the Italian GPS permanent stations for which we have access to the data, and publish a weekly bulletin which reports on the repeatability of the coordinates of each station during the week. At this time we process 26 permanent Italian GPS sites operated by private and public Institutions, and the number is growing. In closing, it is a very important collateral output of EUREF related activities the opportunity they give to establish close bilateral relationships with research groups of other Countries, particularly of Central and Eastern Europe. The University of Padova has sponsored a bilateral exchange with the Academy of Sciences of Ukraine, which is proceeding very successfully. Bilateral Geodetic Meetings with Poland take place every three years, and the one for 2003 is planned in Italy, possibly in the summer campus of the University of Padova located in Brixen (South Tyrol).

Geodetic Activities at Istituto Geografico Militare (IGM)

The geodetic activities at IGM in the years 2001 and 2002 concerned mainly, as in the past years, the maintenance and the densification of the existing basic networks: IGM95 GPS network and the fundamental high precision leveling net.

IGM95 network maintenance and densification

The main activities concerning the GPS IGM95 network, like in the past years, is (a) some minor densifications (mostly devoted to restore damaged or missing monumentations) and, above all, (b) a systematic densification of the GEOTRAV points. The latter activity aims to increase the number of IGM95 points altimetrically connected with the benchmarks of the leveling lines, in order to determine a reliable link between ellipsoidal and orthometric heights.

High precision leveling net maintenance and densification

The project of revision and densification of the fundamental leveling net (started few years ago) aims both to provide the national surveyors with a more reliable and effective reference for their professional purposes and to make

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available a denser and controlled frame for scientific purposes (DTM's and/or geoid checks).

The total length of the densification lines, as already noted in the past reports, is about 5500 km (which are going to increase the 13000 km of the fundamental leveling network).

During the years 2001 and 2002, over 1500 km have been measured (including old and new lines).

The project will be completed hopefully within 4-5 years.

Support of the Italian Space Agency to EUREF

The main activity of interest for EUREF, supported by the Italian Space Agency (ASI) concerns its role of Local Analysis Center. So ASI provides to EUREF weekly solutions of the coordinates of a subset of GPS permanent stations mainly placed in the Mediterranean area.

Another task covered by ASI is the use of geodetic solutions – GPS, SLR and VLBI – performed at Matera Space Geodesy Centre “G.Colombo” for obtaining strain rate fields of the central Mediterranean sites mainly distributed along the Italian Peninsula. In particular GPS and SLR horizontal velocities have been combined in a least mean square fashion, into a common reference frame (ITRF2000) and residuals values with respect to a common Eulerian pole have been calculated and analysed. The Eulerian pole has been obtained on the base of a selected number of ITRF2000 sites, properly representing the stable Eurasian plate. Results show that a large residual motion w.r.t. Eurasian rigid plate is present in the Italian region, according to an active tectonic, an ongoing deformation and a large compression near the northern African margin which is fully compatible with an ongoing compression between African and Eurasian plate. Furthermore a main extensional regime is present between Cagliari

and Matera and between Matera and Noto, according to geological evidences of active extensional tectonics in the Calabrian arc and in the Adriatic region. Finally a compression regime seems to be confirmed by the strain rate calculated in the triangle Aquila-Matera-Sarajevo. These are first preliminary results obtained combining GPS and SLR geodetic solutions. The perspective is to include in the analysis the VLBI solutions as well and enlarge the GPS network in this area.

Another field of activities concern the use of ground GPS network for Meteorology and Climate Applications. Since May 2001 routine GPS data processing for Zenith Total Delay (ZTD) estimation in near real time mode is performed at ASI within the COST-716 near real time demonstration campaign. In addition post-processing ZTD estimates are available since January 1999. The GPS network included in the processing procedures consists of 55 stations (namely the EUREF stations) and covers the central and southern Europe; having Italy as primary region. All stations are analysed in post-processing mode and a subset of 36 also in near real time.

Finally an Absolute Gravimetry in Matera has been installed and is going to be operational.

At Matera Space Geodesy centre “G.Colombo” activities of combining geodetic solutions

In this work, we present the combined GPS and SRL. The two independent solutions are combined. An Eulerian rotation pole of stable Eurasian plate has been computed using a selected number of ITRF2000 sites. Results in terms of residuals with respect the Eurasian pole have been discussed, using only the most reliable and stable station velocities.