The number of continuous GNSS stations operating in the Euro-Mediterranean and African areas, and distributing RINEX data, has significantly increased in the last ten years (Fig. 1). Thanks also to the development of new networks realized for cadastral and topographic applications both at national and regional scales. The integration of geophysical and non-geophysical networks in the Euro-Mediterranean region provides an almost uniform coverage of continuous stations in southern Europe (Fig. 2). Table 1 lists the networks for which we routinely download, archive and analyze raw data. Initially, all the available non-geophysical networks integrate the INGV RIN (http://greg-2.ingv.it) continuous network, which is the only multi-constellation network realized for geophysical/tectonic studies in Europe.

Data from the RIN network are currently distributed through its web site. Within this e-mapping project, the RIN web portal will be the gateway for the dissemination of high quality data and geological products obtained from the analysis of all available networks in the Euro-Mediterranean area.

GPS/GNSS Networks

Several thousands GPS/GNSS permanent stations, managed by both scientific and cadastral institutions, are now available on the European plate and its boundaries. Data coming from those stations provide unprecedented spatial and temporal coverage of time-dependent deformation signals essential to understand the boundaries of plate tectonic deformation and faulting. The National Earthquake Center (Centro Nazionale Terremoti, CNT) of the National Institute of Geophysics and Volcanology (Istituto Nazionale di Geofisica e Vulcanologia, INGV) in Italy is the Italian leader institution for the collection, management, and scientific analysis of Global Positioning Systems (GPS) measurements. Distinct analysis centers independently and routinely process and analyze data using high-quality geodetic software (such as GAMIT, GIPSY, Clovis) to measure the movements of more than 1000 points spanning the Eurasian plate and its boundaries. The goal of this project is to offer high-quality geodetic products, increase their accessibility to the European scientific community and promote the inter-data exchange through a multi-level, user-friendly data gateway. These activities will be performed in strict contact with the GNSS Working Group of the EPOS project (http://www.epos-eu.org) that is preparing to integrate, archive and distribute data, metadata and products for available GNSS platforms on the European plate.

Introduction

Kave data from GPS sites shown in Fig. 2 are routinely analyzed by three different analysis centers, using different software and methods to estimate 3D velocities.

GSI Method

The PGS method is based on the linear combination of the solutions from different sources, which is the sum of the individual solutions weighted by a geometric factor related to the variance-covariance matrix of the solution. The resulting solution is thus the weighted average of the individual results.

Pros: The combination of the weighted solutions allows to handle different data sets, and to represent the variability of the results. The procedure is straightforward and computationally efficient.

Cons: The procedure is sensitive to the quality of the individual solutions, and the accuracy of the combination depends on the number of solutions available.

GIPSY Method

The GIPSY method is based on the least squares adjustment of the observations, which is the process of finding the best estimate of the unknown parameters that minimizes the sum of the squares of the residuals. The resulting solution is thus the set of parameters that best fit the observations.

Pros: The procedure is robust to the presence of outliers, and the accuracy of the solution depends on the number of observations available.

Cons: The procedure requires a large amount of computational resources, and the accuracy of the solution depends on the quality of the observations.

The GIPSY/GNSS Method

The GIPSY/GNSS method is based on the combination of the GSI and GIPSY methods, which is the process of combining the results from different methods to estimate the best estimate of the unknown parameters. The resulting solution is thus the weighted average of the individual solutions, where the weights are determined by the quality of the individual solutions.

Pros: The procedure is robust to the presence of outliers, and the accuracy of the solution depends on the number of observations available.

Cons: The procedure requires a large amount of computational resources, and the accuracy of the solution depends on the quality of the observations.

Figure 2 - Distribution of geophysical (blue symbols), geodetic (green symbols) and topographic (red symbols) GPS/GNSS networks in the Euro-Mediterranean area.