National Report of France

E. CALAIS[1], H. DUQUENNE[2], H. FAGARD[3], B. GARAYT[3], TH. GATTACCECA[3], A. HARMEL[3], PH. NICOLON[4], J-M. NOCQUET[4]

Geodetic References

The RGF93 as it has been presented in a previous report, was adopted as the new legal geodetic reference system for surveying and mapping activities in France. It was fixed by law in 1999, and a decree is about to be settled for its enforcement.

A new map projection Lambert93 is also defined.

Access to the system can be achieved directly or by the mean of additional information through the following geodetic components:

- The Reference Network, RRF (« Réseau de Référence Français ») and the Basic Network, RBF (« Réseau de Base Français »), consisting of 1032 sites.
- The GPS Permanent network : RGP « Réseau GPS Permanent »
- The old network NTF « Nouvelle Triangulation de la France »

The Geodetic Network : RGF, « Réseau Géodésique Français »

The Réseau de Reference Français (RRF - French Geodetic Reference Network) is constituted of 23 (non-permanent) sites in France. It was observed in 1993 and 1996. The solution derived from the 1993 campaign leaded to the definition of the geodetic reference system RGF93, French realization of ETRS89. In order to study the stability of the RGF93 reference system, we re-processed the 1993 and 1996 campaigns using an homogenous strategy for all campaigns with the GAMIT/GLOBK software, including various IGS European stations. Moreover, about a quarter of the network was re-observed in 1999 in the east part of France where tectonic motions are expected. Some permanent GPS stations are now operating at 5 RRF sites with an accurate local tie available between permanent GPS stations and the RRF marker. The processing of these data show that (1) the stability of the network remains at a 2 cm level for planimetry and height (2) the consistency of RGF93 with ETRS89 realization derived from ITRF97 is about 3 cm (3) deformation at the order of 2-3 mm/yr might occur in this network. Further investigation and measurements should be undertaken to confirm detected motions.

The GPS Permanent Network: RGP, « Réseau GPS Permanent »

The GPS Permanent Network is developing to become fully operational in the next years following well established specifications.

A set of 5 new stations located in Ajaccio, Chizé, Lille, Lyon, Nantes and Strasbourg were established since 1999 or planed to be by the end of the year 2000 (see location map nearby).

This scheme will be completed by new stations during the next year so as to achieve a density of one permanent GPS station each 200-300 km.

Hourly file are available at a 1s and 30s data rate at the Brest and Marne-La-Vallée stations.

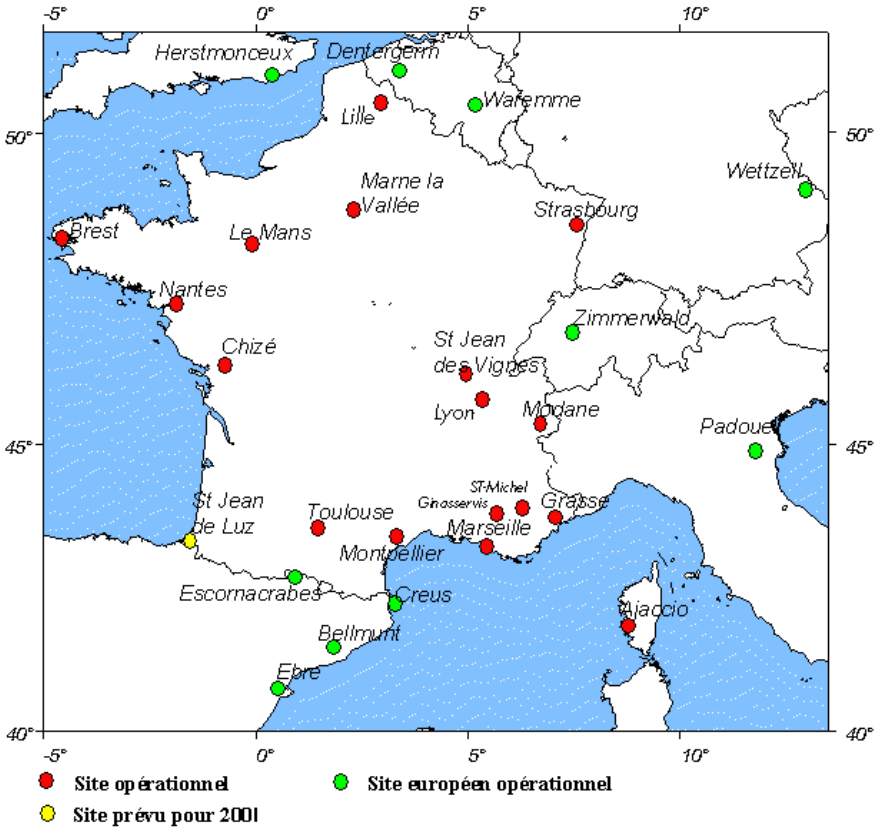
For each station, the local and regional stability of the monument is controlled through repeated observations of a local and regional control network of 3 points.

[1] Eric Calais: Centre National de la Recherche Scientifique, UMR Géosciences Azur 250, rue Albert Einstein, F 06560 Valbonne, France; Tel.: +33 - 4 93 - 95 43 28. E-mail: Calais@faille.unice.

[2] Henri Duquenne: Ecole Supérieure des Géomètres et Topographiques, 1, Bd Pythagore, Campus Universitaire du Mans, F - 72000 Le Mans, France; E-mail: henri.duquenne@esgt.cnam.fr.

[3] Hervé Fagard, B. Garayt, Th. Gattacceca, A. Harmel: Institut Géographique National, Service de Géodésie et Nivellement, F - 94165 Saint-Mandé Cedex, France; Fax : + 33 1 43 98 84 50

[4] Ph. Nicolon, J-M. Nocquet: Institut Géographique National, ENSG/LAREG, 6-8 Avenue Blaise Pascal, Champs-sur-Marne, France, F - 77455 Marne-La-Vallée, France; Fax : + 33 1 64 15 32 53.



Additional information can be found on the following web page: **http://schubert.ensg.ign.fr/RGP/**

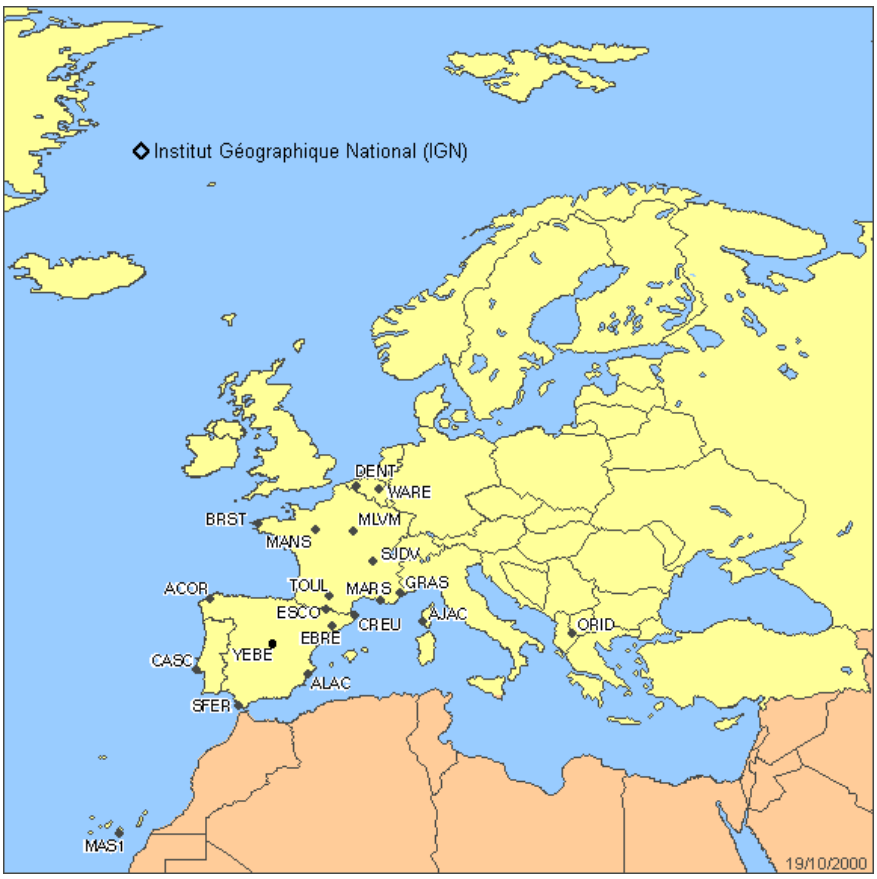
Contribution to EUREF

- RGP stations

AJAC Ajaccio
BRST Brest
GRAS Grasse
MANS Le Mans
MARS Marseille
MLVL Marne-La-Vallée
TOUL Toulouse
SJDV St-Jean-des-Vignes

- Other European stations

DENT, WARE : Belgium
CASC : Portugal
ORID : Macedonia
ACOR, ALAC, BELL, CASC, CREU, EBRE, ESCO, SFER, MAS1, YEBE : Spain



Based on these GPS permanent Stations and with other additional equipments for broadcasting and data links to a control centre, a new project to provide necessary data for a real-time positioning on the decimetre level was launched this year. The IGN, in cooperation with other governmental organisations will be responsible for the deployment and the exploitation of this network.

NTF "Nouvelle Triangulation de la France"

Transformation procedure based on a grid of transformation parameters (3 translations) was handled in order to take into account the distortions of the old geodetic Datum. This can be considered as an access to the RGF93 geodetic system within an accuracy level better than 5 to 10 cm. This model is based on the direct observations or connections to the nearest stations of the Reference or Basic Network of more than 1000 points of the NTF network over the whole country.

The old geodetic network is planed to be inspected during the next five years, together with the levelling network benchmarks. The purpose is to update the associated information contained in the database. Sites are selected according to access facilities.

DORIS ACTIVITIES

The DORIS station at Ny-Ålesund (Spitsbergen) was renovated in July 1999, and accurately tied to the IGS stations NYAL and NYA1.

Additional information about the DORIS activities in general can be found on the following web pages:

http://www.ign.fr/fr/PI/activites/geodesie/DORIS/

VERTICAL REFERENCES

Scientific levelling program

After the North-South traverse observed in 1983, it was decided to observe a East-West line using high precise levelling techniques, further to the computation of a East-West tilt of about 1m to fit the Zero-reference surface of the NGF (IGN69) levelling system.

Additional information can be found on the following web pages: **http://www.esgt.cnam.fr/fr** (an English version of this site is under construction)

paper: "QGF98, a new solution for the quasigeoid in France" H. Duquenne

Geoid

The height reference surface **RAF98** (apart from the Corsica Island) which was presented in the last EUREF national report (Prague, 1999) is officially operational and recommended since 1999, to be used as the reference altimetric surface for GPS altimetric applications in France, relatively to the RGF93 geodetic system.

Additional information can be found on the following web pages:

http://lareg.ensg.ign.fr/CNIG.PSD/alti.html

http://www.esgt.cnam.fr/fr/recherche/geoide.htm

Gravimetry

In August and September 2000, a campaign of gravimetric measurements was carried out in south east France over a hundred geodetic points from to the Base Geodetic Network, 10 nodal points from the levelling network, and six gravity points from the French Gravity Network RGF 83. Using two differential Scintrex CG3-M gravimeters, the existing "zero order network" (absolute gravity values determined at Montpellier, Mont Aigoual, Marseille and Grasse) was densified into a first and second order network consisting of the aforementioned points. The instruments were calibrated over the baseline between Montpellier and Mont Aigoual (310 milliGals change).

Calculations are under way, and the results will be published by the end of the year.

Their analysis should allow us to compute a better height conversion surface over the area, and to determine the time and methods needed to establish a new national gravity network with an accuracy of a few microGals for the zero and first order components.