# National report of France

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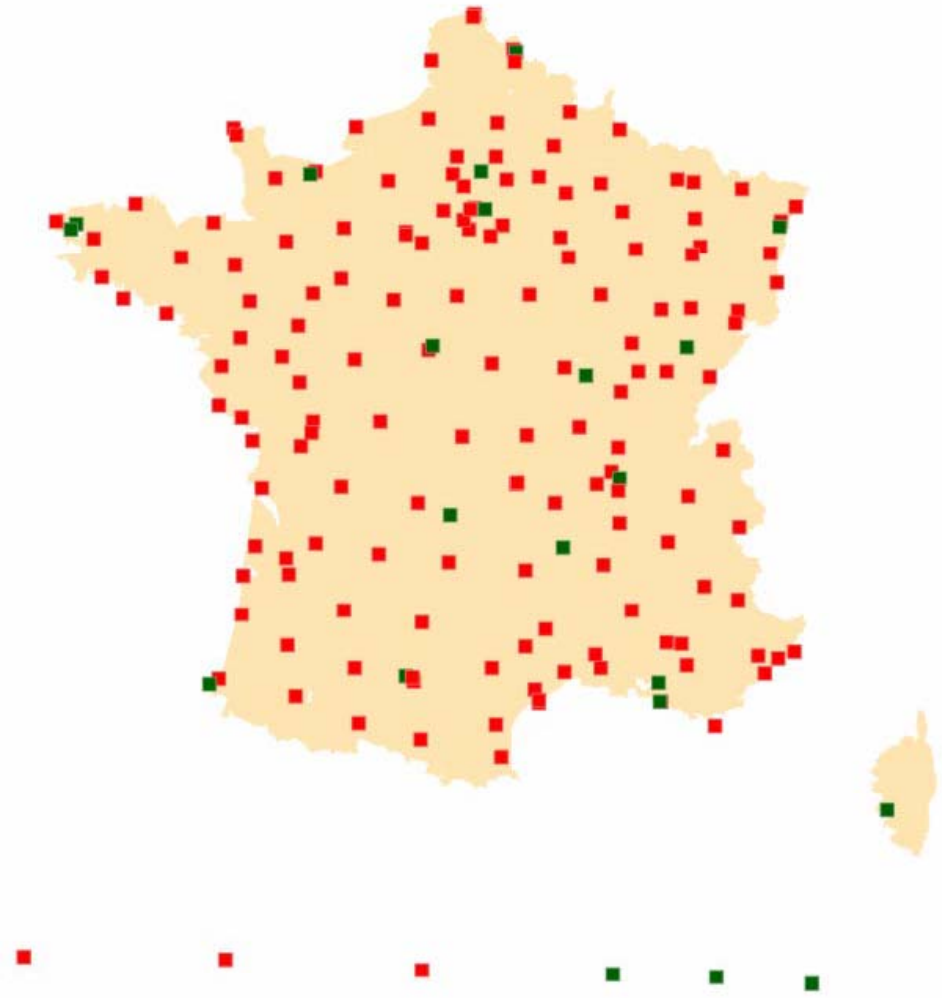
SGN: Service de Géodésie et Nivellement
IGN: Institut Géographique National

# RGP
# GNSS PERMANENT NETWORK



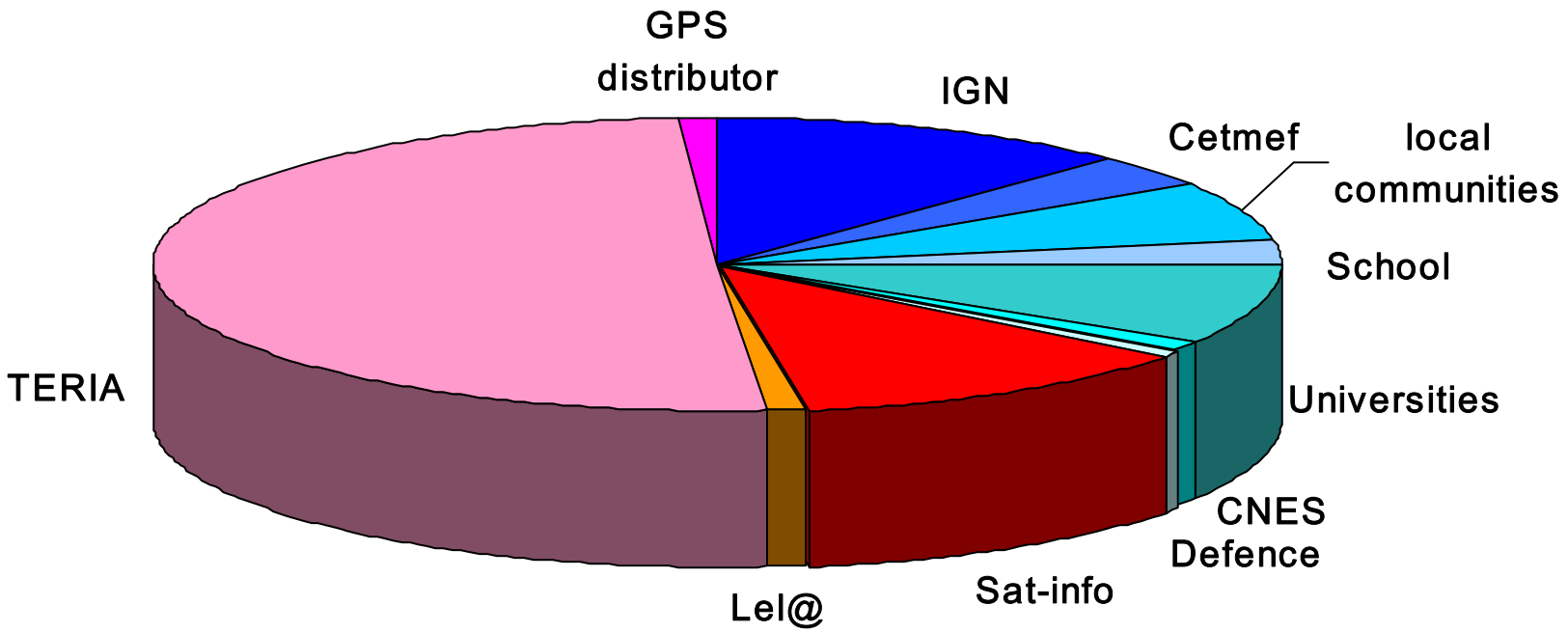
- 189 stations (33 new stations last year)
  - 23 IGN (green)
  - 44 public partners (red)
  - 122 private partners (red)

- RINEX files broadcasted on the Internet:
  - 1h/1s files: 174 stations
  - 24h/30s: all stations

- RINEX files are free of charge.

# RGP
# GNSS PERMANENT NETWORK

## A large Public Private Partnership




TERIA, Sat-info, Lel@: private real-time networks

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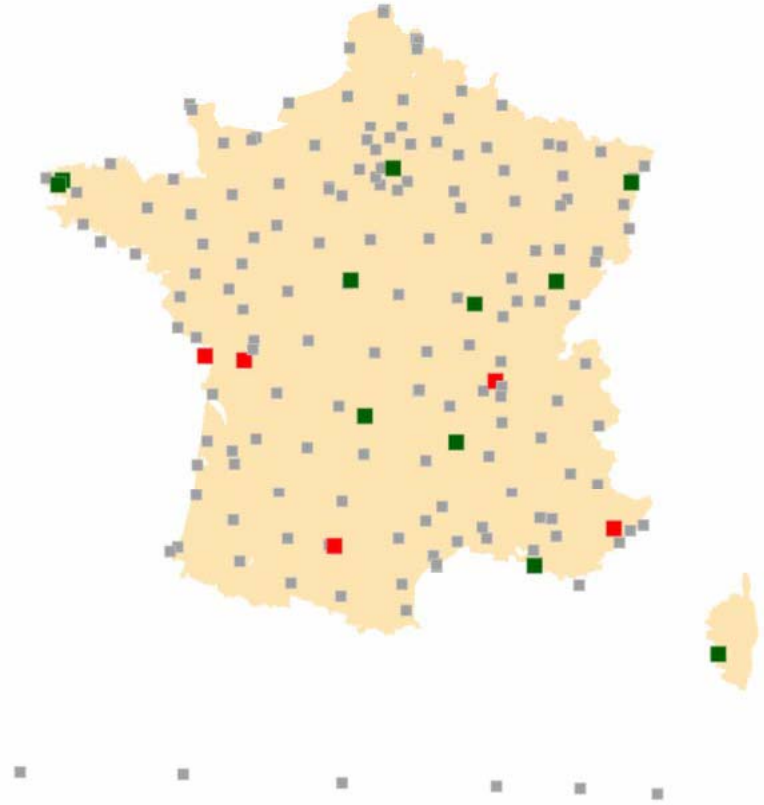
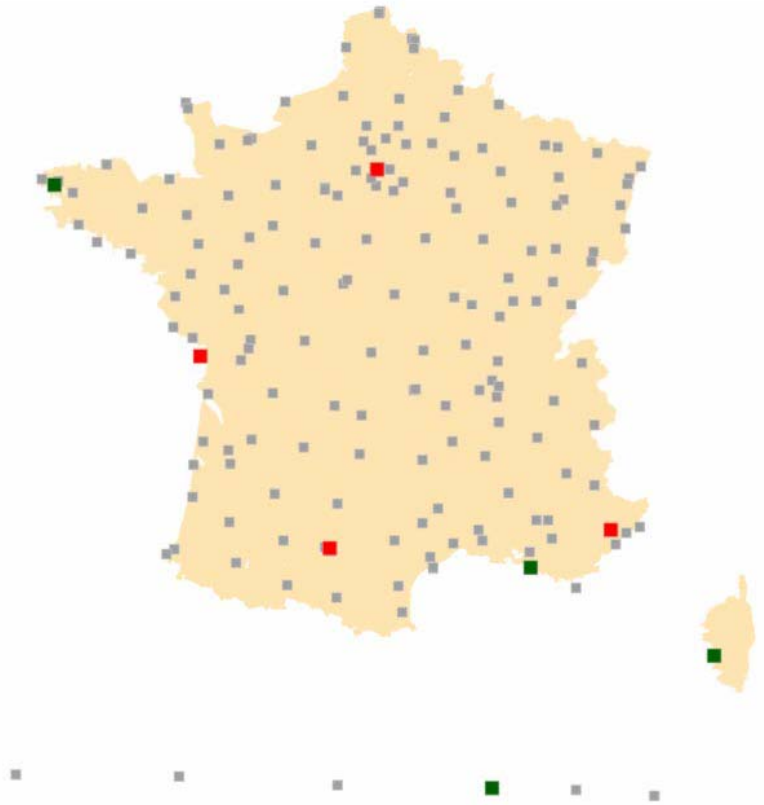
## EPN and IGS contributions



RGP_EPN: 11 IGN + 4 partner stations



RGP_IGS: 4 IGN + 4 partner stations

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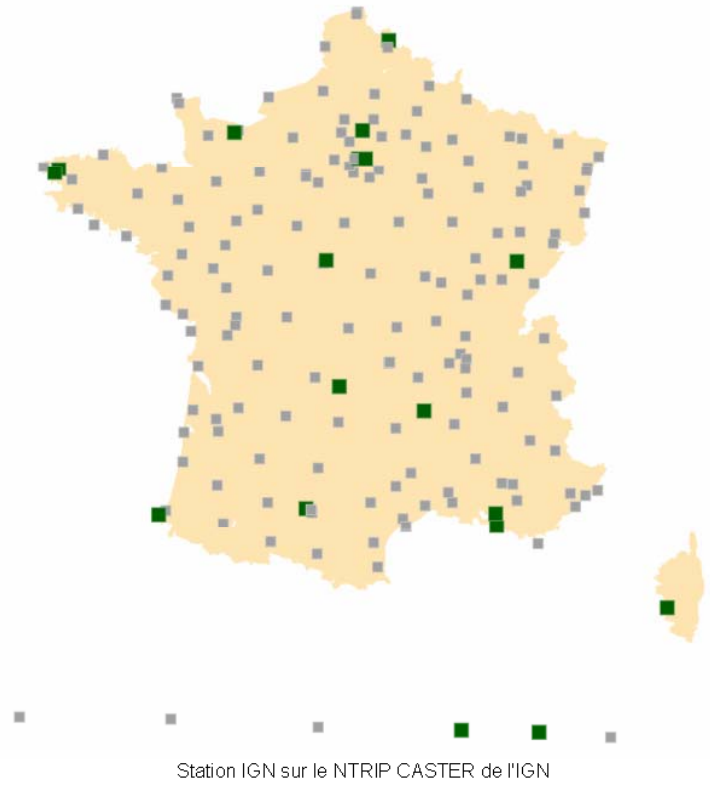
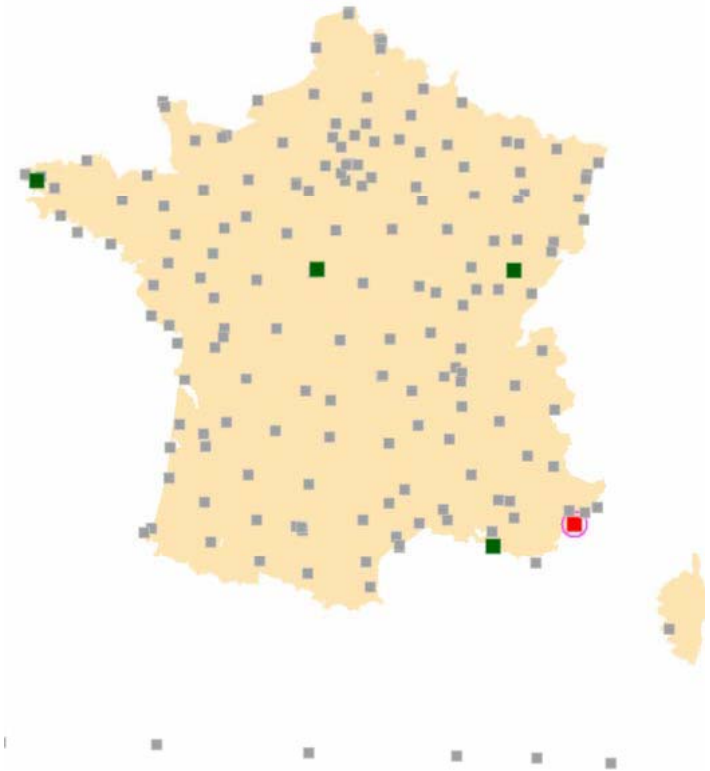
## Real Time : NTRIP



Station IGN sur le NTRIP CASTER de l'IGN

***IGN Caster:*** *18 NTRIP_IGN stations (23 at the end of 2009)*



***EUREF_IP****: 4 IGN + 1 partner stations*
*See « GNSS real time data flow: some economic aspects » E.R.Mathis, F.Duquenne (EUREF2009)*

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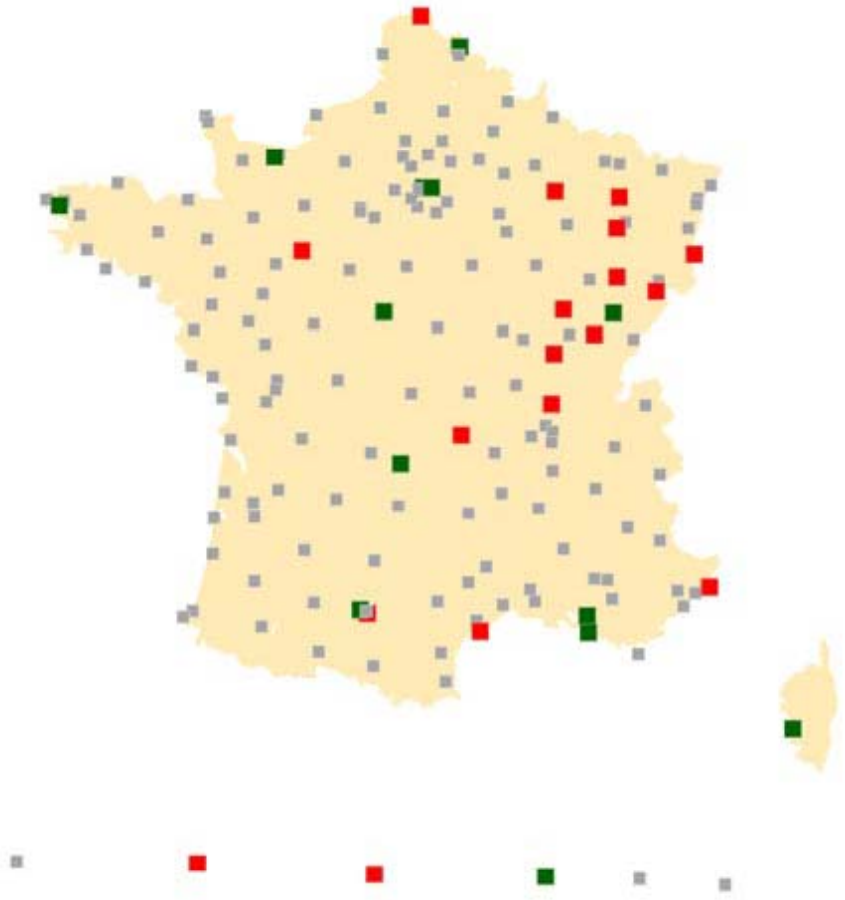
## GPS-GLONASS stations



- 14 IGN stations (green)
- 19 partner stations (red)

## ETRF coordinates – Present situation

The official (legal) geodetic reference frame in France is called RGF93.

It is an ETRS89 realization based on an ITRF93 epoch 93.0 solution coming from a 1993 GPS observation campaign analysis.

The official ETRF coordinates of the french GNSS permanent stations are expressed in the RGF93 reference frame. These coordinates result from the process of GPS observations campaign performed during the installation of the station to tie it to the nearest points of the reference/basic network whose coordinates are expressed in RGF93 realization.

## ETRF coordinates – New realization ETRF2000(R05)-F

Based on the reprocessing of the GPS observations of all the RGP network stations (including non french EPN/IGS stations) from 1998 (week 0938) to 2009 (week 1528) and the use of the CATREF software and the minimal constraint approach over a set of IGS05 reference stations, we propose

- A cumulative solution expressed in IGS05 at reference epoch for velocity and coordinates estimation
- A RGP IGS05 reference solution for a selected number of RGP "core" stations.
- Coordinates expressed in ETRF2000 for the stations of the RGP (called ETRF2000(R05)-F) derived from the IGS05 cumulative solution
- A monitoring process of the french GNSS permanent network (RGP) based on an updated cumulative solution and time series analysis

## ETRF coordinates – New realization ETRF2000(R05)-F

- The reference epoch of the IGS05 solution is 2009.0
- For « young » station with observation period *shorter than 2 years*, reference coordinates are estimated at *minimum variance epoch*, and velocity using the *ITRF2005 eurasian plate rotation model* is used to transfer position at the reference epoch.
- For « senior » station with observation period *longer than 2 years*, estimated velocities are used to transfer estimated position at the reference epoch
- Conversion to ETRS89 to compute a set of coordinates for the RGP stations defining a new french realization of the ETRS89 system.

## ETRF coordinates – Maintenance process

A cumulative solution is maintained for each new weekly solution, aligned with the RGP IGS05 reference solution at 2009.0 reference epoch

- Update ETRF coordinates of the RGP stations with regard to the reference solution
- Maintenance of the RGP IGS05 reference frame: stations with period of observations > 2 years are integrated into the reference solution and estimated velocities are applied

Frenquency: annually

- *For a new station, coordinates are published at reference epoch (minimum variance epoch, ITRF2005 eurasian plate rotation model).*
- *Update ETRF coordinates if a jump in the time series analysis is detected*

*Frequency: occasionnally*

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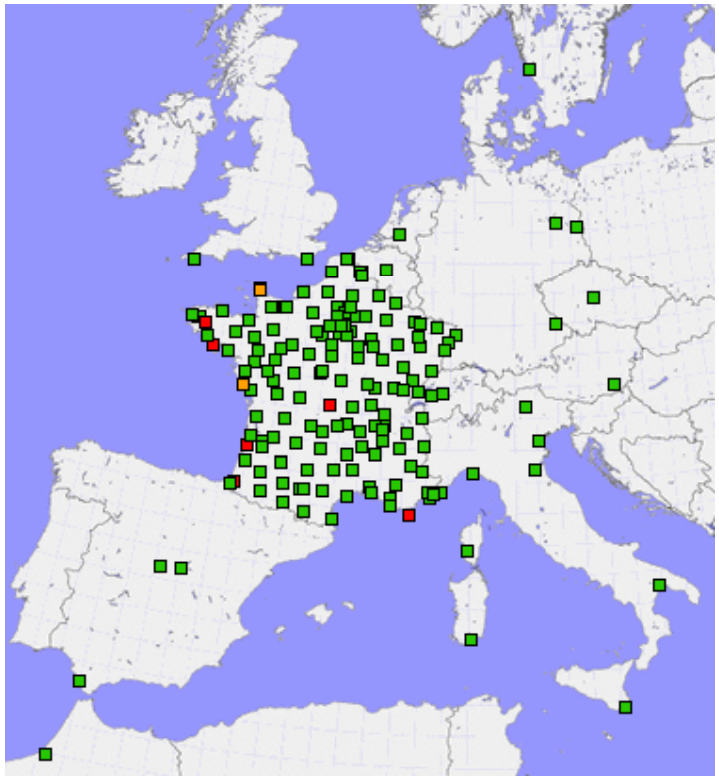
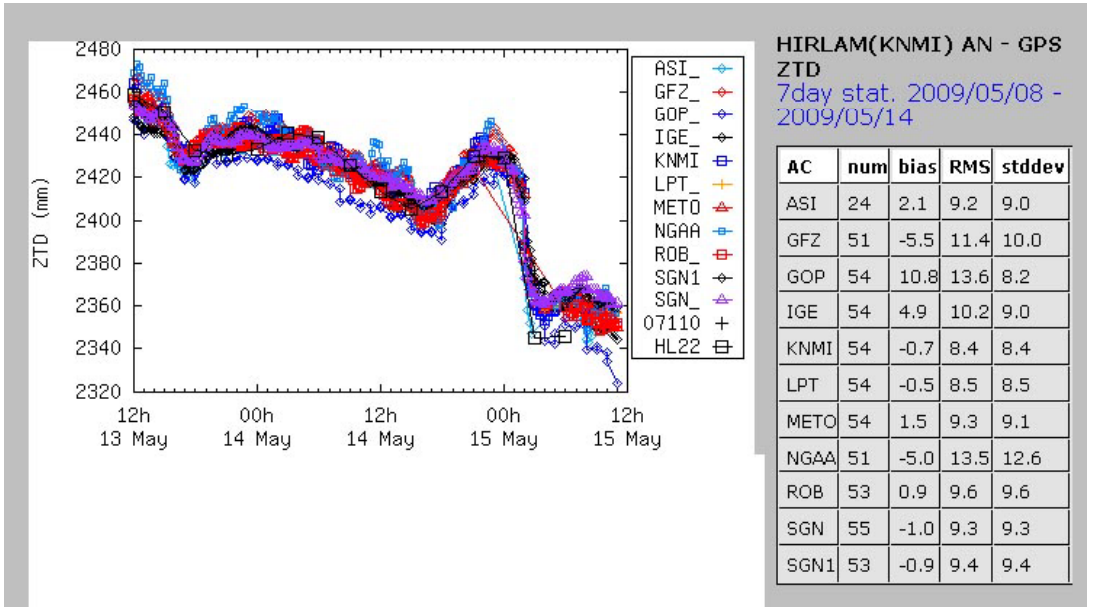
## Contribution to E-GVAP



- IGN is an E-GVAP processing center
- Two solutions SGN et SGN1




HIRLAM(KNMI) AN - GPS ZTD
7day stat. 2009/05/08 - 2009/05/14

| AC | num | bias | RMS | stddev |
|---|---|---|---|---|
| ASI | 24 | 2.1 | 9.2 | 9.0 |
| GFZ | 51 | -5.5 | 11.4 | 10.0 |
| GOP | 54 | 10.8 | 13.6 | 8.2 |
| IGE | 54 | 4.9 | 10.2 | 9.0 |
| KNMI | 54 | -0.7 | 8.4 | 8.4 |
| LPT | 54 | -0.5 | 8.5 | 8.5 |
| METO | 54 | 1.5 | 9.3 | 9.1 |
| NGAA | 51 | -5.0 | 13.5 | 12.6 |
| ROB | 53 | 0.9 | 9.6 | 9.6 |
| SGN | 55 | -1.0 | 9.3 | 9.3 |
| SGN1 | 53 | -0.9 | 9.4 | 9.4 |

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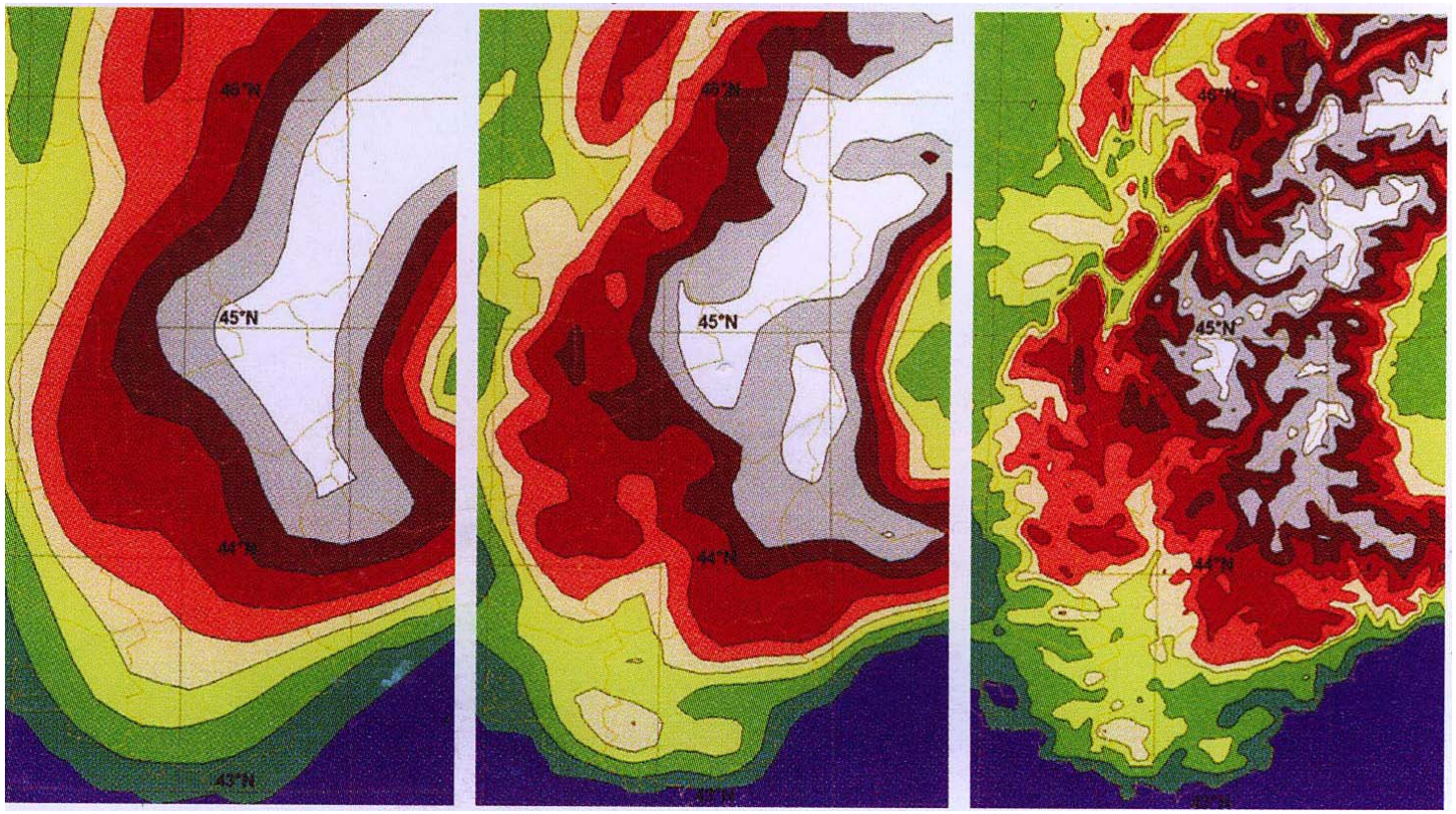
## ZTD assimilated in the Météo-France models




Arpège (25 km) Aladin (10 km) Arome (2,5 km)

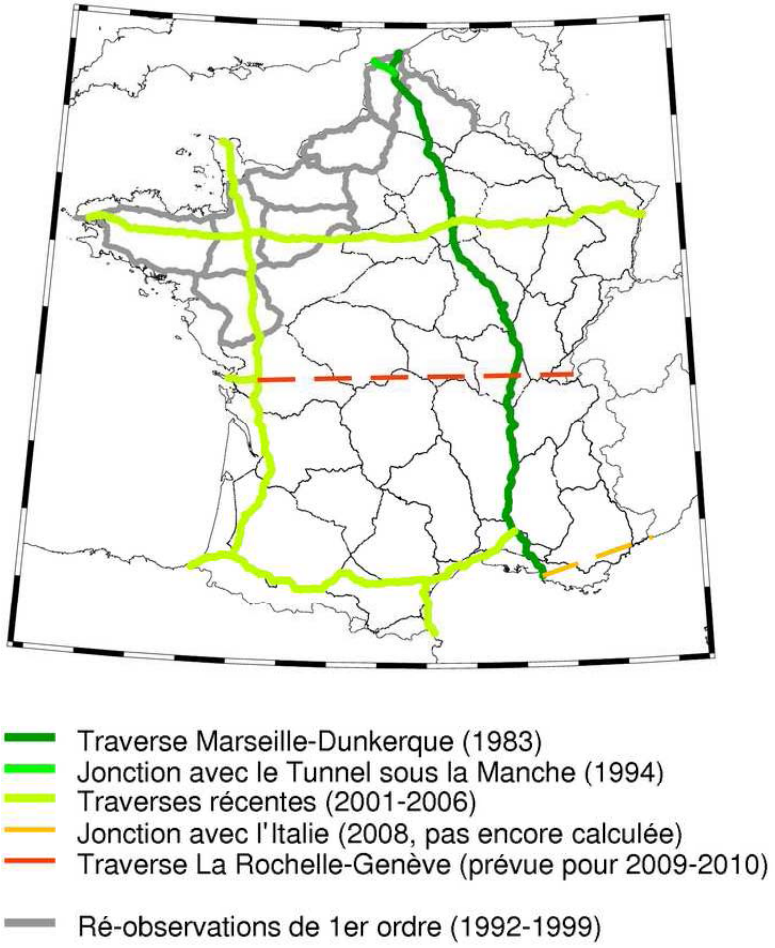
***Courtesy of Meteo France***

# NIREF: scientific levelling

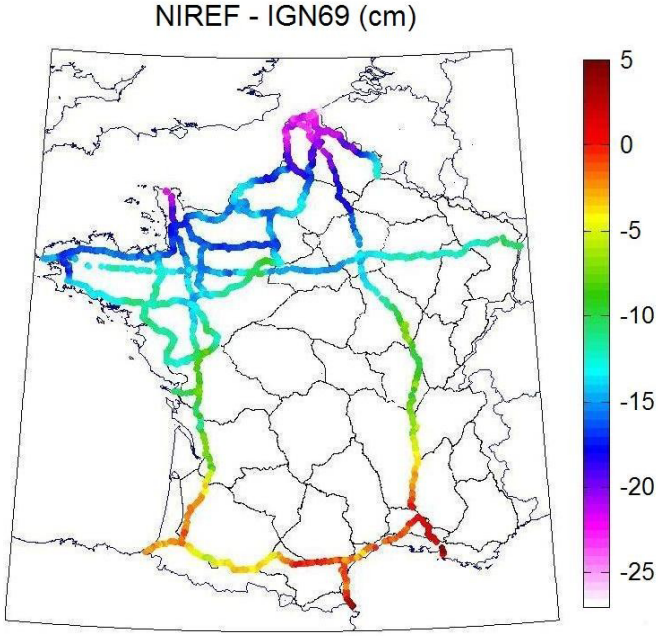
- 2008: Marseille TG to Italia (254 km)
- 2009-2010: Switzerland to La Rochelle TG

*NIREF: motorized levelling*

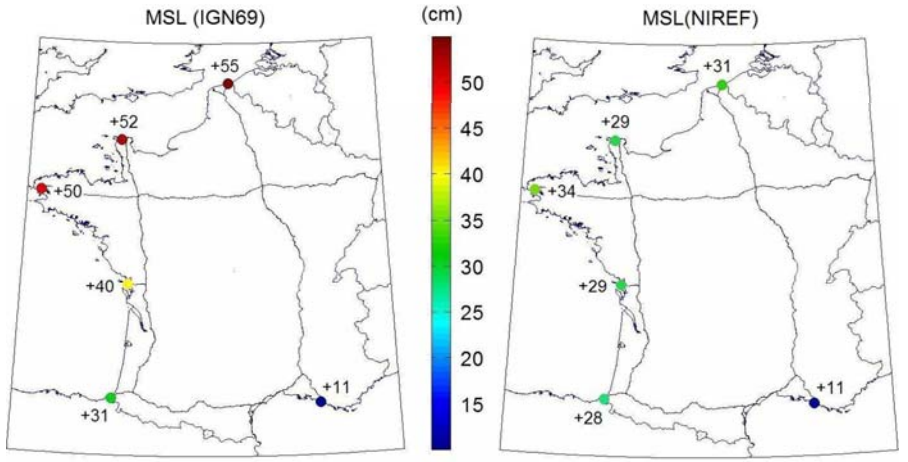
*NIREF: french Riviera*



# NIREF: scientific levelling

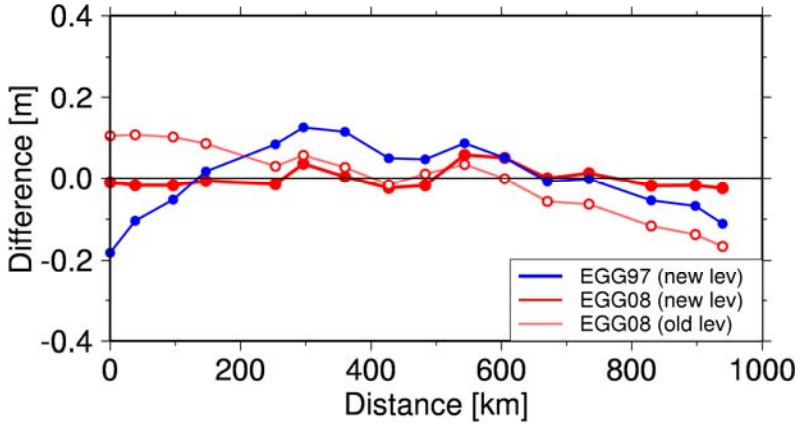



*P.Rebischung - 2008*




*Comparison with tide gauges (P.Rebischung - 2008)*

- Good agreement between NIREF, tide gauges and EGG08
- But not with the UELN data of the bordering countries…
- Integration process into UELN to be defined




*Comparison european geoids (H.Denker - 2008)*

# National levelling network maintenance

- ERNIT: Entretien du Réseau de NIvellement par les Triplets (Maintenance of the levelling network by triplets)

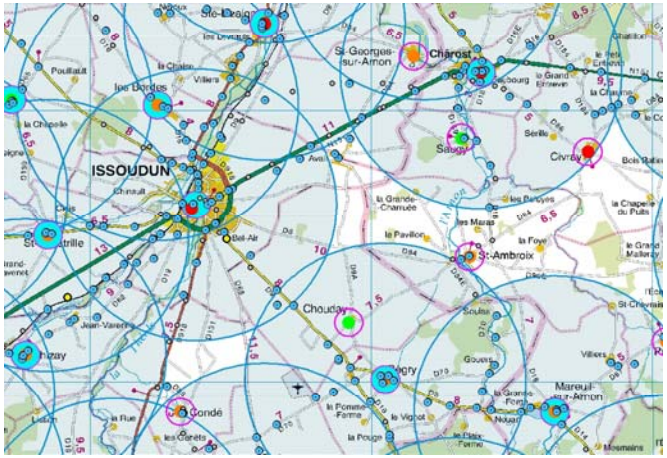
- Triplets : 3 benchmarks close together
  - Homogeneous distribution over the territory
  - Distance to the closest triplet : everywhere < 5km
  - 13200 triplets

- Maintenance periodicity: 12 years

- Mean age of triplets : 28 years presently
  6 years in 2020

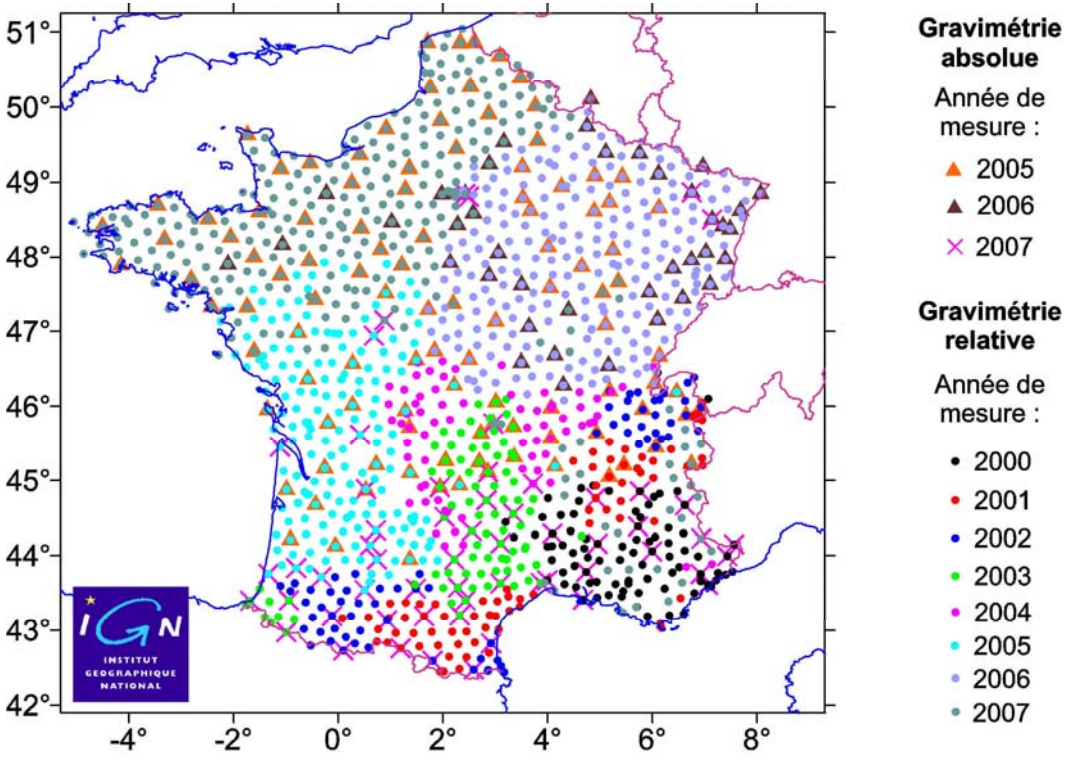
- Combination of GPS and spirit levelling techniques
  - GPS : absolute stability
  - levelling : relative stability

- 562 triplets measured in 2008 (1000/year from 2009)




# Gravimetry

- 236 relative gravity (Scintex CG5) measurements on the RBF Geodetic network
- 21 in Corsica



# Marseille tide-gauge

## A new instrument

- Fundamental point of the French Vertical Reference
- Contribution to the RONIM network
- GLOSS ECGN station

- 1884-today: analogic TG
  diagrams until 1985
  accumulator always on
- 1998-2009: acoustic digital TG
- 2009: digital radar TG : Krohne optiflex 1300C