# GPS network

## in South of France for better understanding and prediction of

# Heavy Rains

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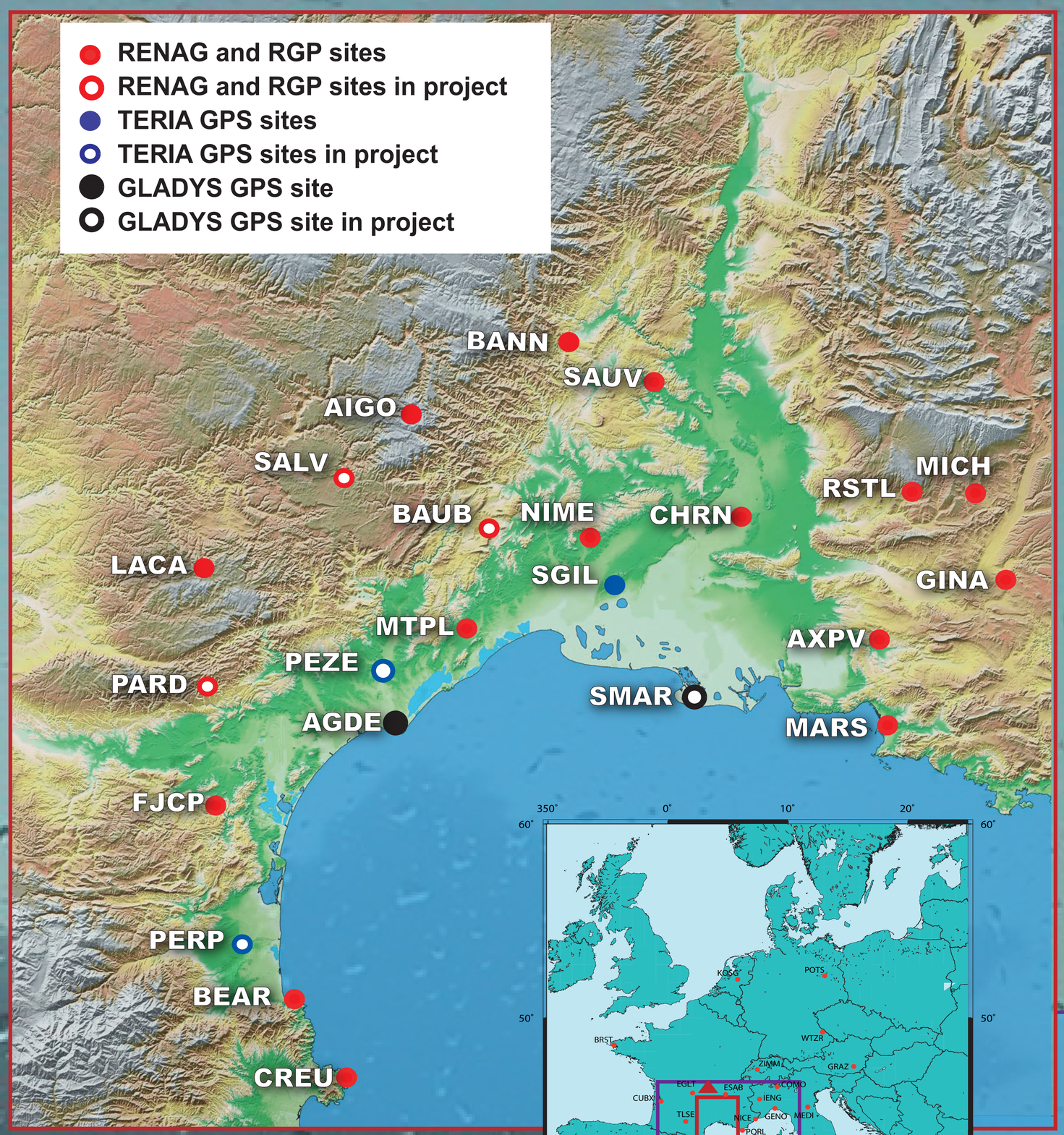


*Figure 2 : Local GPS sites in South of France*

South of France and particularly the Mediterranean coast are characterized by frequent catastrophic heavy rains.
As part of the CYPRIM project (CYclogenèses et Précipitations Intenses en Méditerranée) and OHM-CV observatory (Observatoire HydroMétéorologique Cévennes-Vivarais), GPS measurements are carried out to study these strong events.
GPS is well known as a positioning system instrumentation. Since a decade it is also used to estimate tropospheric water vapor.
Usual meteorological tools (radiosoundings) provide sparse and discontinuous tropospheric water vapor measurements. By contrast, GPS measurements allow dense and continuous measurements.
In order to accurately sample the troposhere and to perform a real-time data recording, ten new GPS sites are to be installed in South of France.
This study will contribute to a better understanding of the cyclogenesis of precipitations and also to an improvement of heavy rains forecasting.

The regional network has a 30 km resolution to get a tightened network, it combines :

- Permanent GPS sites from RGP and RENAG network
- Semi-permanent GPS sites that will be upgraded in permanent sites
- New academic sites
- Few stations from commercial networks.

The network combines far field stations (European permanent stations, figure 1) and local stations (figure 2) in order to constrain the computation of both station position and Precipitable Water (PW) in the area studied.
The GAMIT 10.3 software developed by MIT is used for the analysis of GPS data.




*Figure 1: Far field permanent stations*

## Installation characteristics for real time network

A GPS site includes a GPS receiver, an antenna and a meteorological screen. Trimble NetRS receivers allow Ethernet connectivity. Real time communication will be established every one hour thanks to GSM, GPRS or ADSL system.

The antenna is fixed on a concrete pillar (figure 4), on a wall (figure 5) or on a roof according to available facilities. Antenna is located in an open view area in order to pick up a maximum of satellites.

A meteorological screen (figure 6) is useful to protect materials and for a good ventilation.

Combined barometric pressure and temperature transmitters Vaisala PTU 200 are used.

Power supply is provided by 220V or by solar panels.

*Figure 4: Antenna on concrete pillar (Aigoual, AIGL)*

*Figure 5 : Antenna on a wall (Baubiac, BAUB)*


*Figure 6 : Meteorological screen*

The existing stations in South of France and Catalunya show the maximum humidity field shifting from West to East (figure 3). Peak of 40 mm of precipitable water visible on day 265 in FJCP is moving to MARS until day 267.

These results show that a tightened network is useful to better understand and predict heavy rains. A set up of real time connection would be helpful to perform meteorological warnings in Cévennes mountains.

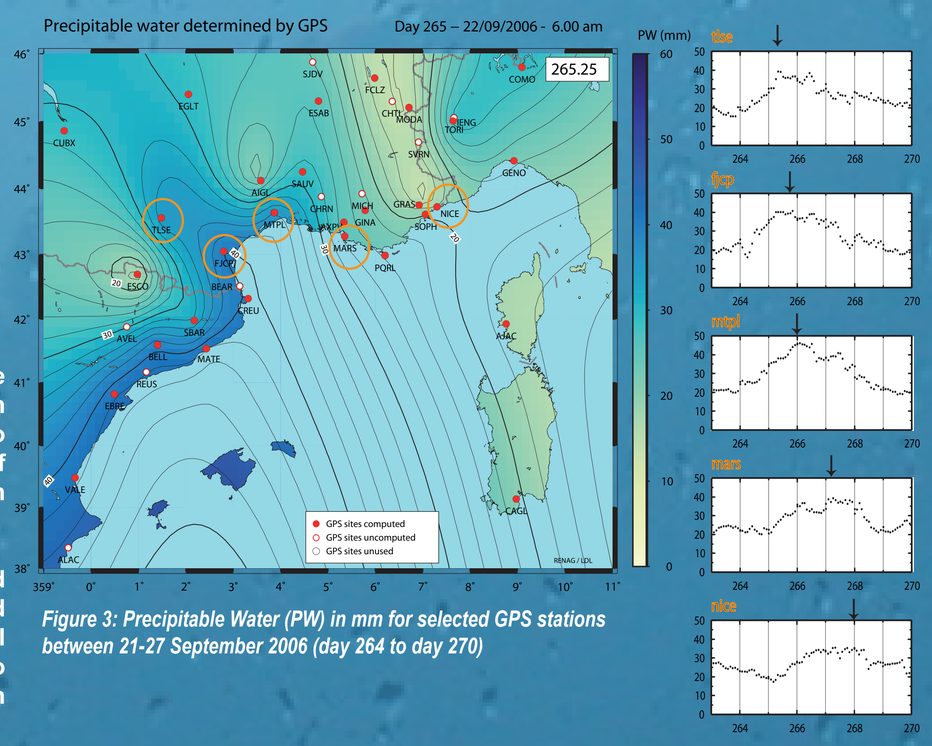


*Figure 3: Precipitable Water (PW) in mm for selected GPS stations between 21-27 September 2006 (day 264 to day 270)*

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## Perspectives

A real time GPS network of about 15 stations will be established in South of France before summer 2007.

In a first approach the network will provide data for the Zenital Tropospheric Delay and the Precipitable Water Vapor. Precipitable water retrieved from GPS data will be assimilated in the Aladin Meteo France model. A systematic comparison between Aladin Meteo France model forecasting with or without GPS data will be performed. Thus, it will be possible to determine in which circumstances GPS data improve model forecasting.

Also, the Slant Integrated Water Vapor will be used to perform tomography data processing of the whole region. The LOFFT_K tropospheric tomography software developed by Géosciences Montpellier laboratory will be used to