

Portuguese Activities related with ES1206 GNSS4SWEC

overview of the GNSS-meteorology status in Portugal

GNSS - Meteorology status

- Areas of Research:

- a) GPS data processing for tropospheric products using GIPSY-OASIS; Improvement on the solutions via testing different parameterizations;
- b) Improvement of a software for water vapor tropospheric tomography;
- c) Analysis of the influence of a-priori values on the derived ZTD solutions;
- d) Correlation between (ocean and atmospheric) loading and PWV.

Ongoing Projects

NUVEM

New methods to Use GNSS Vapor Estimates for Meteorology of Portugal



[NUVEM \(EXPL/GEO-MET/0413/2013\)](#) is funded by the Portuguese National Science Foundation (FCT);

[Started in March 2014 - September 2015.](#)

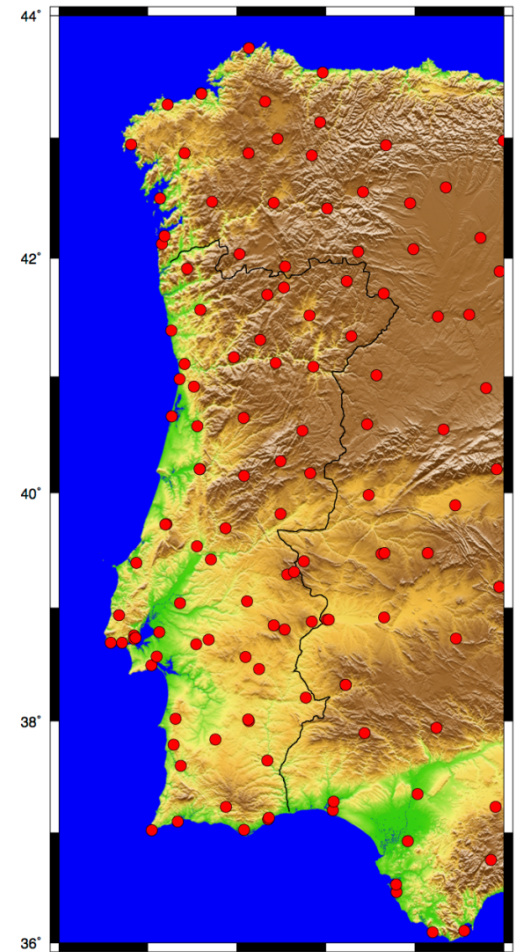
Nuvem Project

Objective: Include GNSS-PWV estimates in Portugal's Weather Forecasting Centre, especially in the decision process for warning of extreme weather situations.

To achieve such objective, NUVEM is divided in two major components:

a) development and implementation of methods to compute accurate estimates of ZTD (Zenith Total Delay) and derived PWV (Precipitable Water Vapor) in near real time.

b) integration of these estimations in the nowcasting operations done at IPMA (Portuguese Meteorological Service).



Portugal:

RENAP [http://www.dgterritorio.pt/cartografia_e_geodesia/geodesia/redes_geodesica/renap/].

SERVIR [<http://www.igeoe.pt/servir/servir.asp>];

and neighboring networks in Spain:

IGN [<http://www.fomento.es/>].

Galicia [<http://www.cartogalicia.com/>].

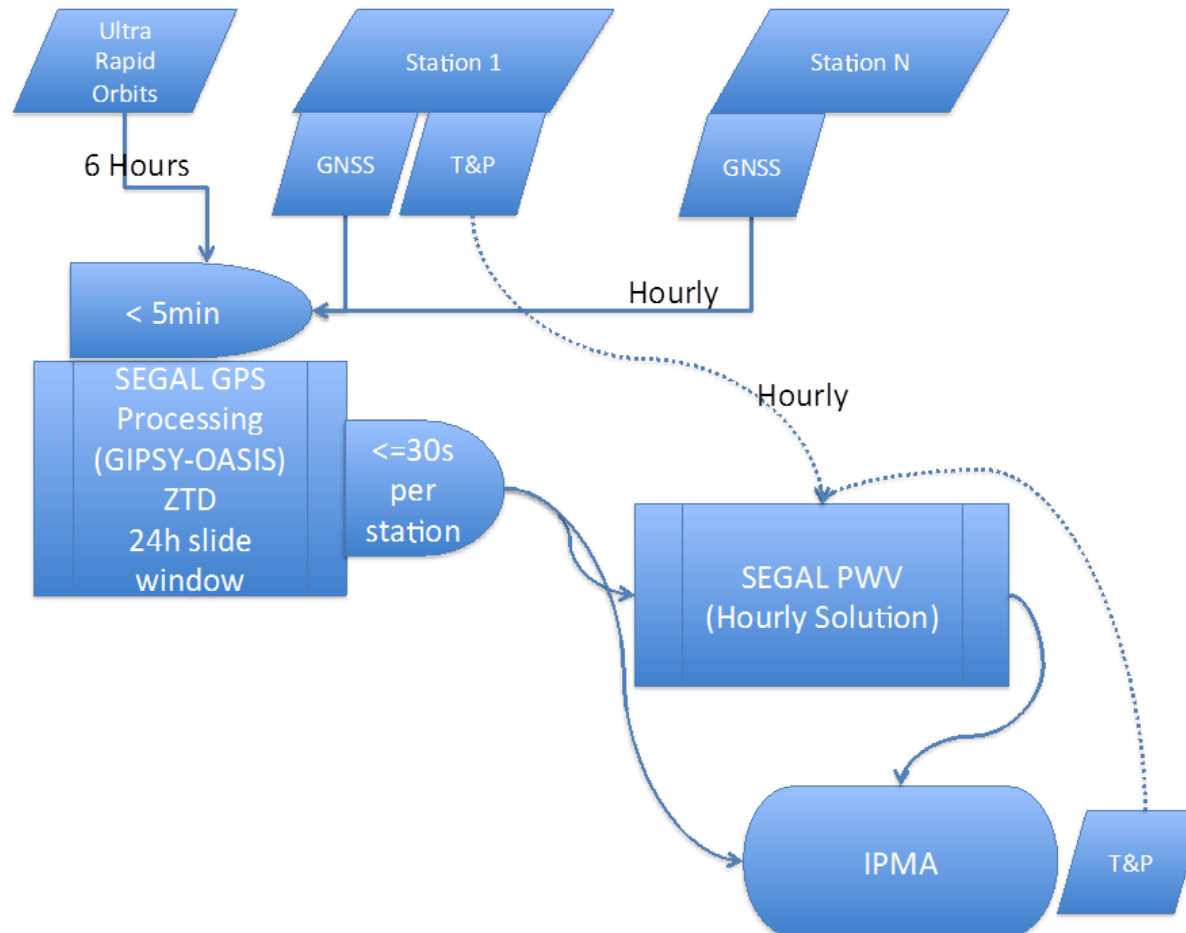
Castilla and Leon [<http://gnss.itacyl.es/>].

Extremadura [<http://194.224.247.162:8080/WebExtremadura/>].

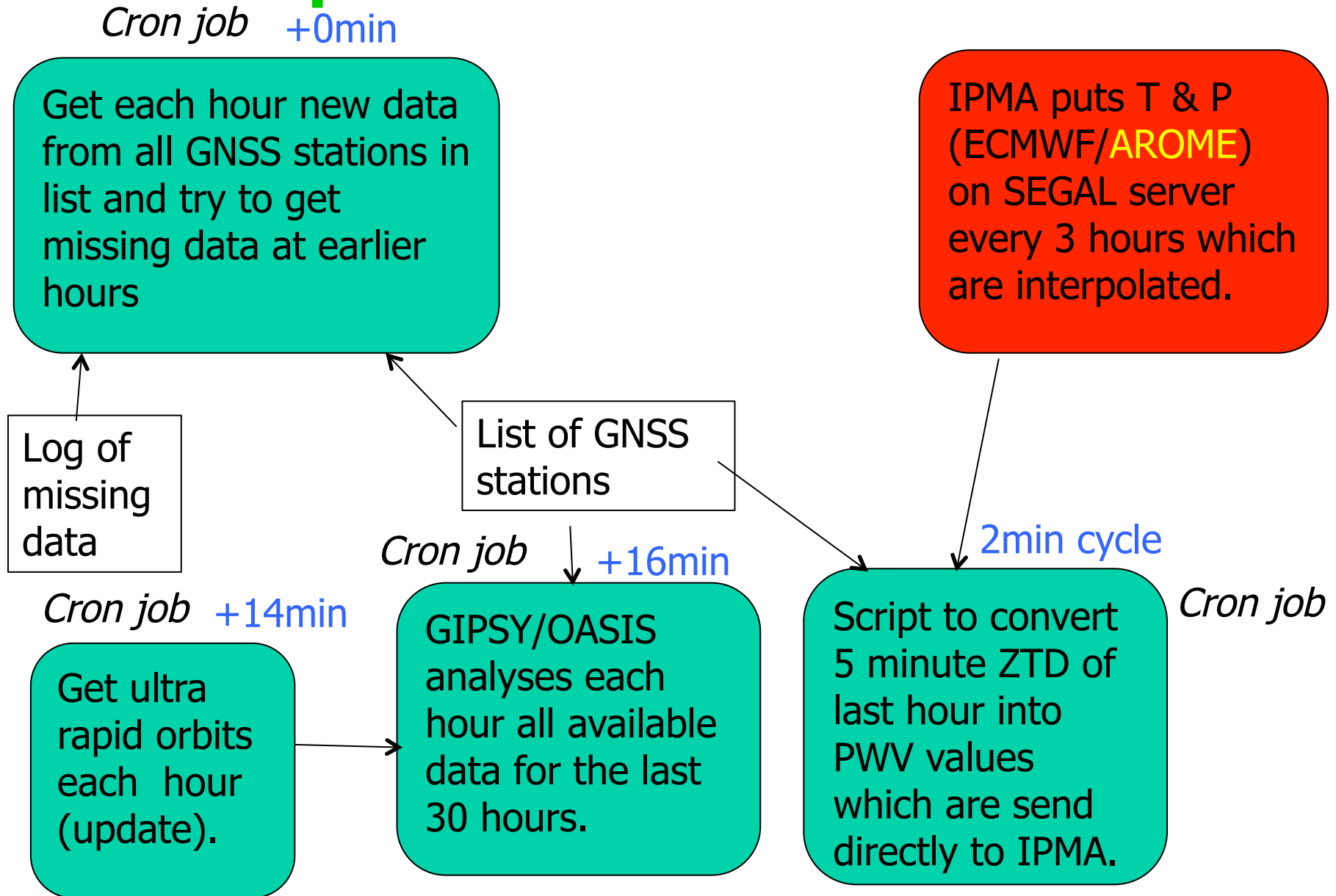
Andalucia [<http://www.juntadeandalucia.es/obraspublicasytransportes/redandaluzadeposicionamiento/rap/>].

NUVEM Project

The flowchart of the processing system



Implemented structure 2015



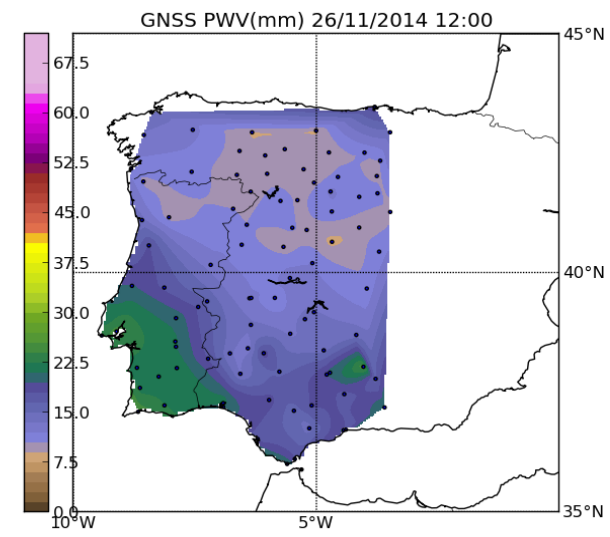
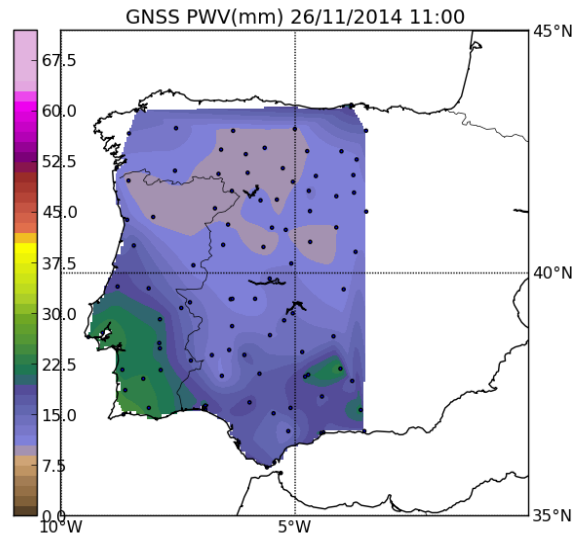
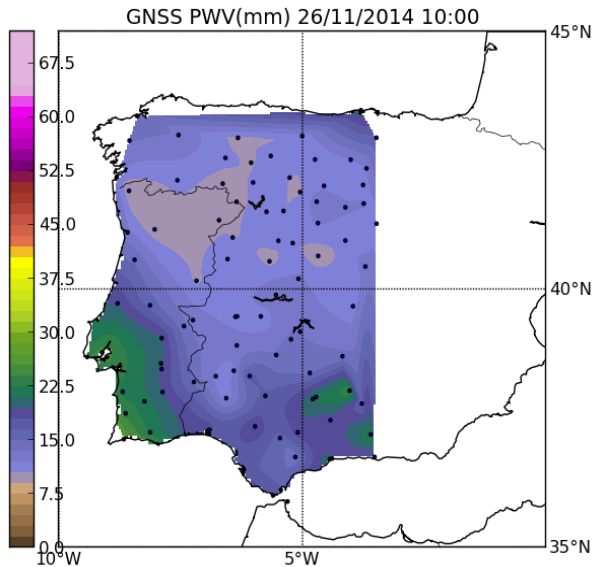
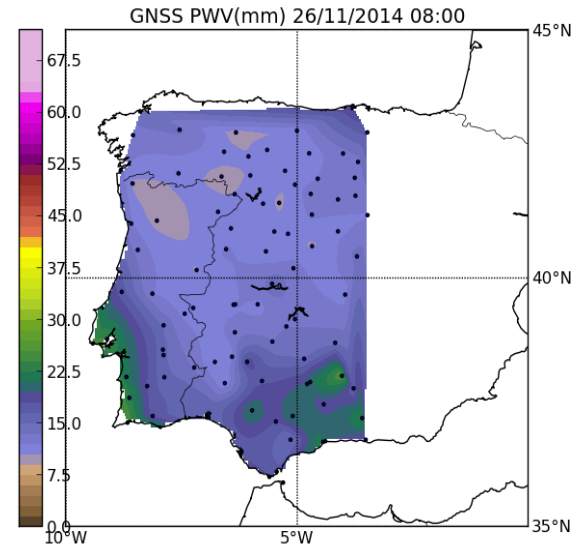
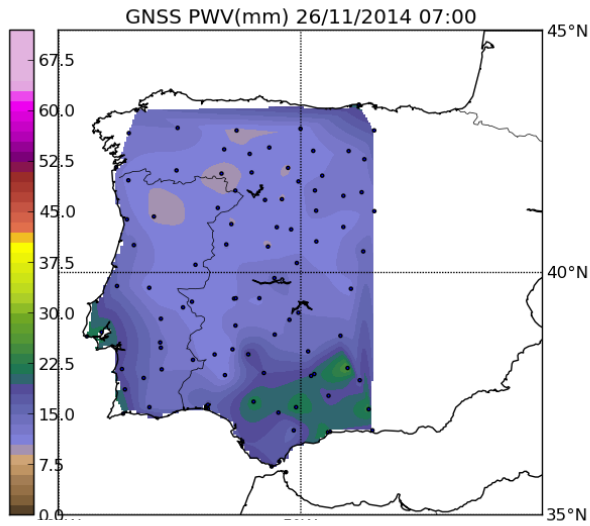
Nuvem project

Heavy rain – 26 November 2014, Lisbon

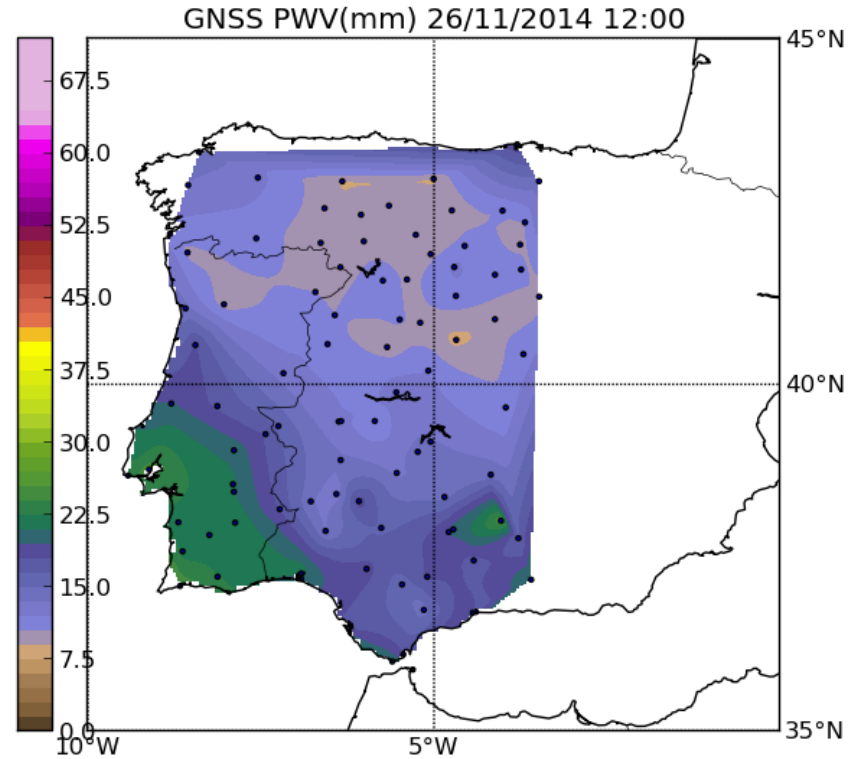
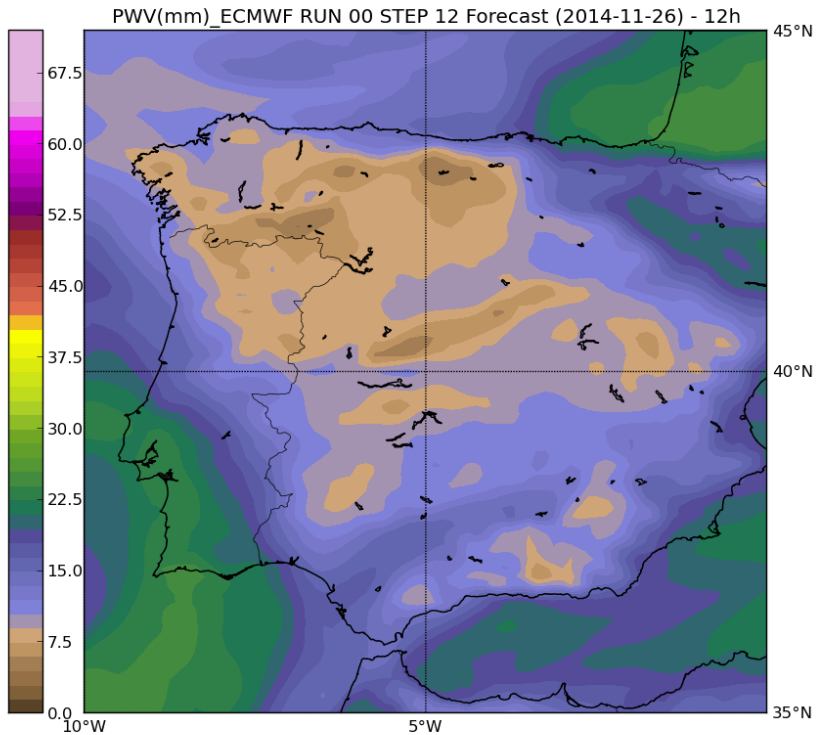
Precipitation began around 12 pm, the GNSS-PWV began to detect few hours before, that had not been predicted by the models used by IPMA.



Nuvem project



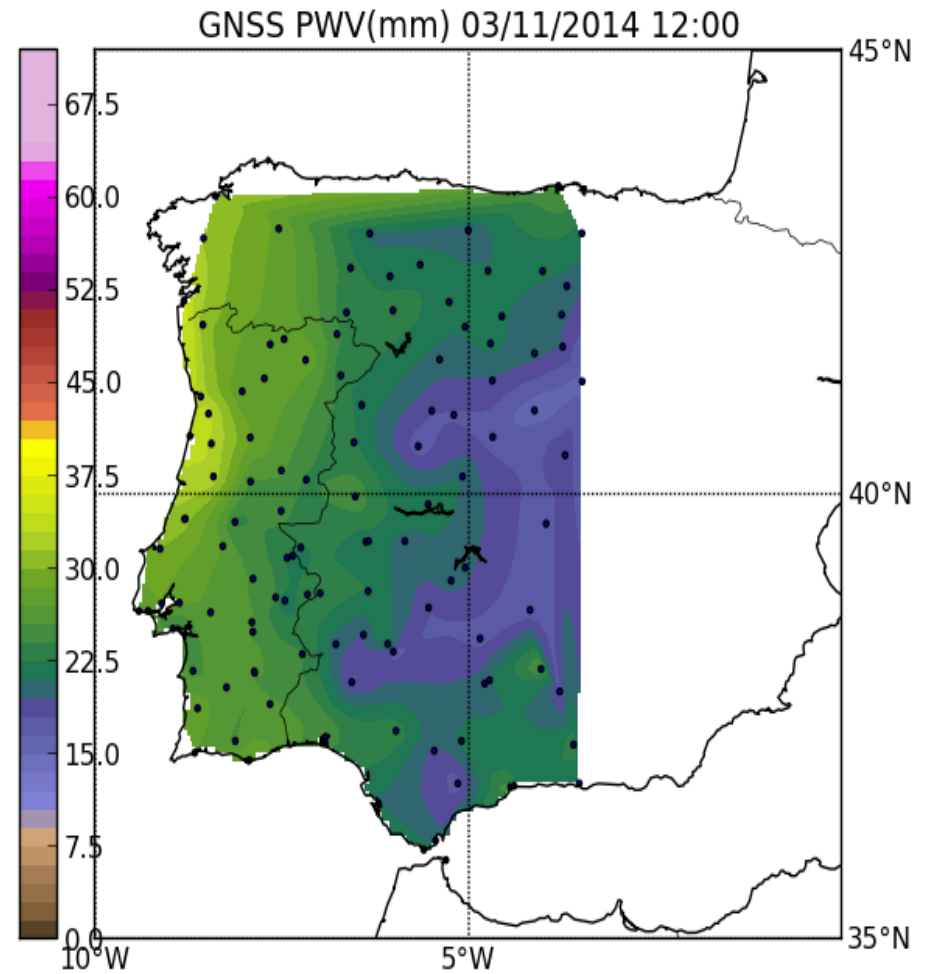
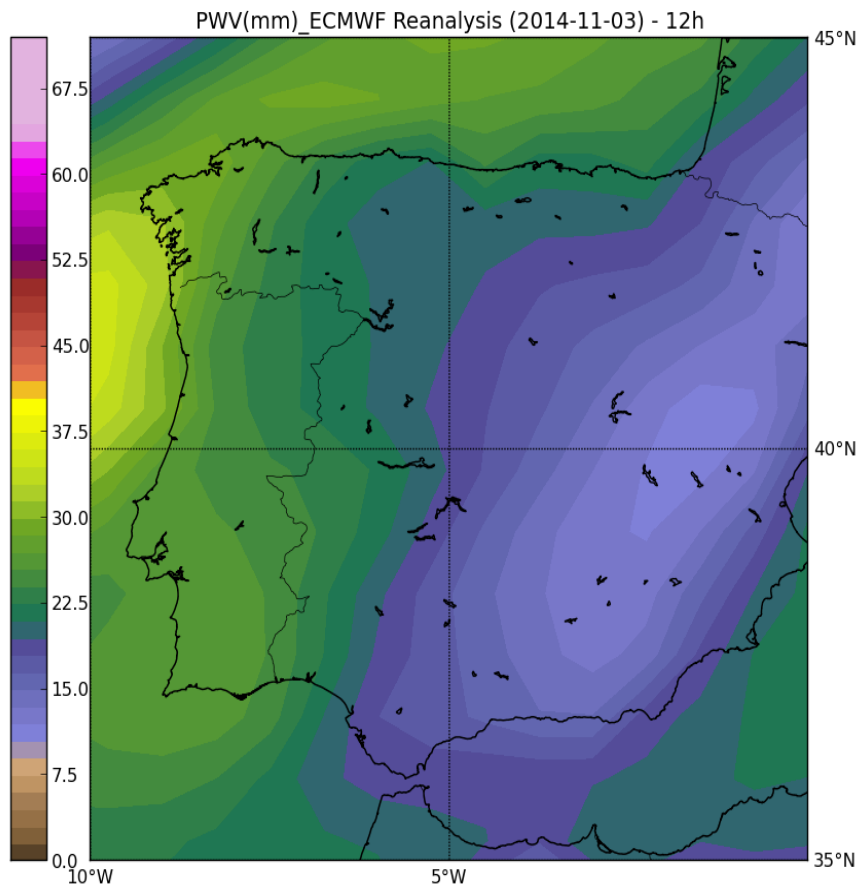
Nuvem project

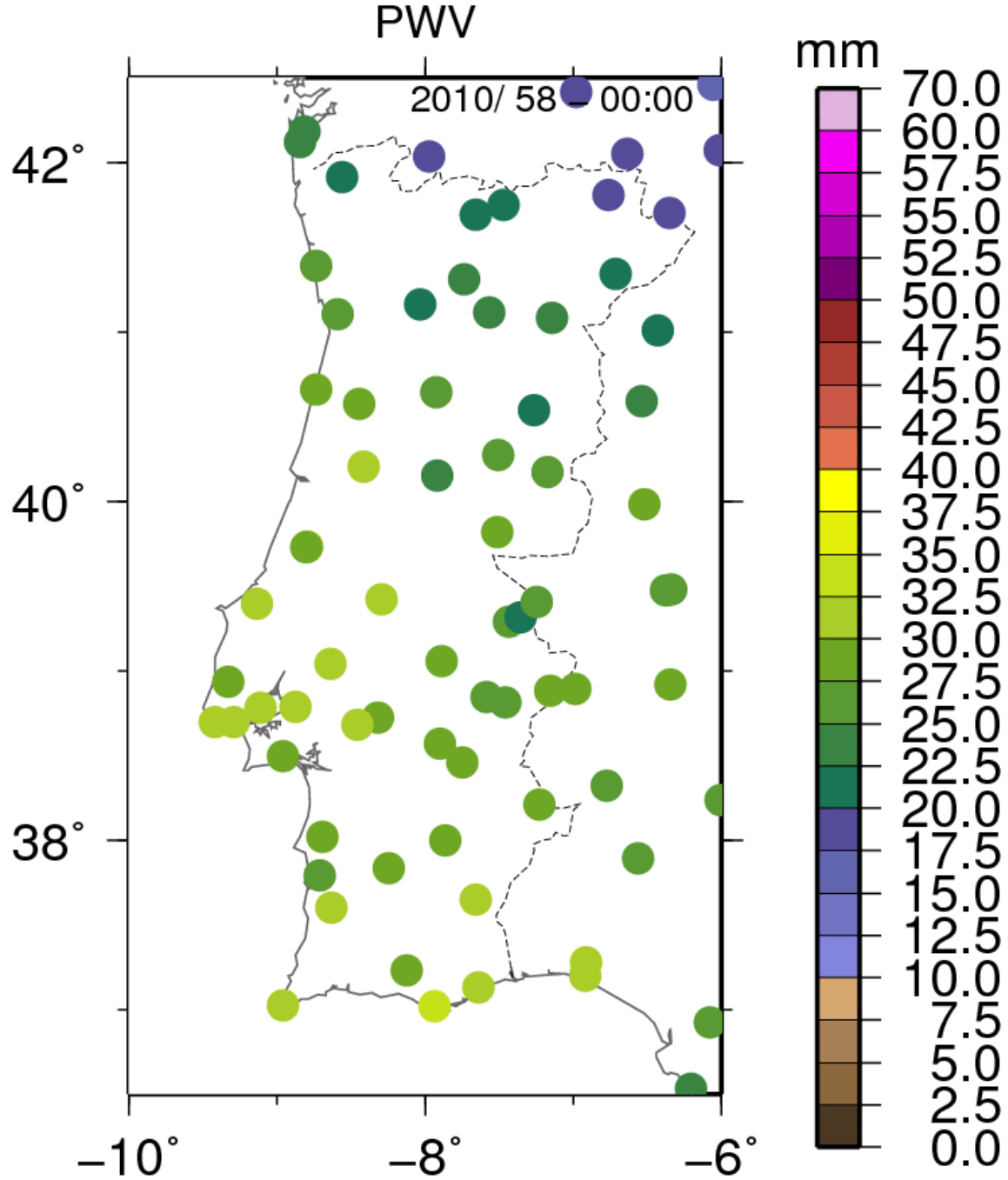


Heavy Rain – 26 November 2014, Lisbon

Nuvem project

Weather front – 03/11/2014





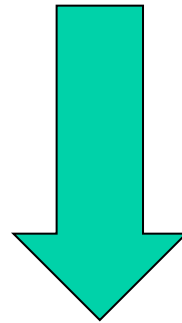
Statistics of received data from 25-27 September 2015 (72 hours)

Network	Nr. Stations	Delay (min)	Missing (%)
Extremadura	11	0	0
IGN	20	0-11	3.5
SERVIR	28	0-2	13.2
RENEP	45	0	2.2

Obtained Results

- Setup of a dedicated SERVER
- Data retrieval from GNSS Networks
- Orbits retrieval
- PWV computation
- Delivery to IPMA

Automated



- Increase of relevant information for weather predictions
- Improvement of the weather nowcasting in Portugal



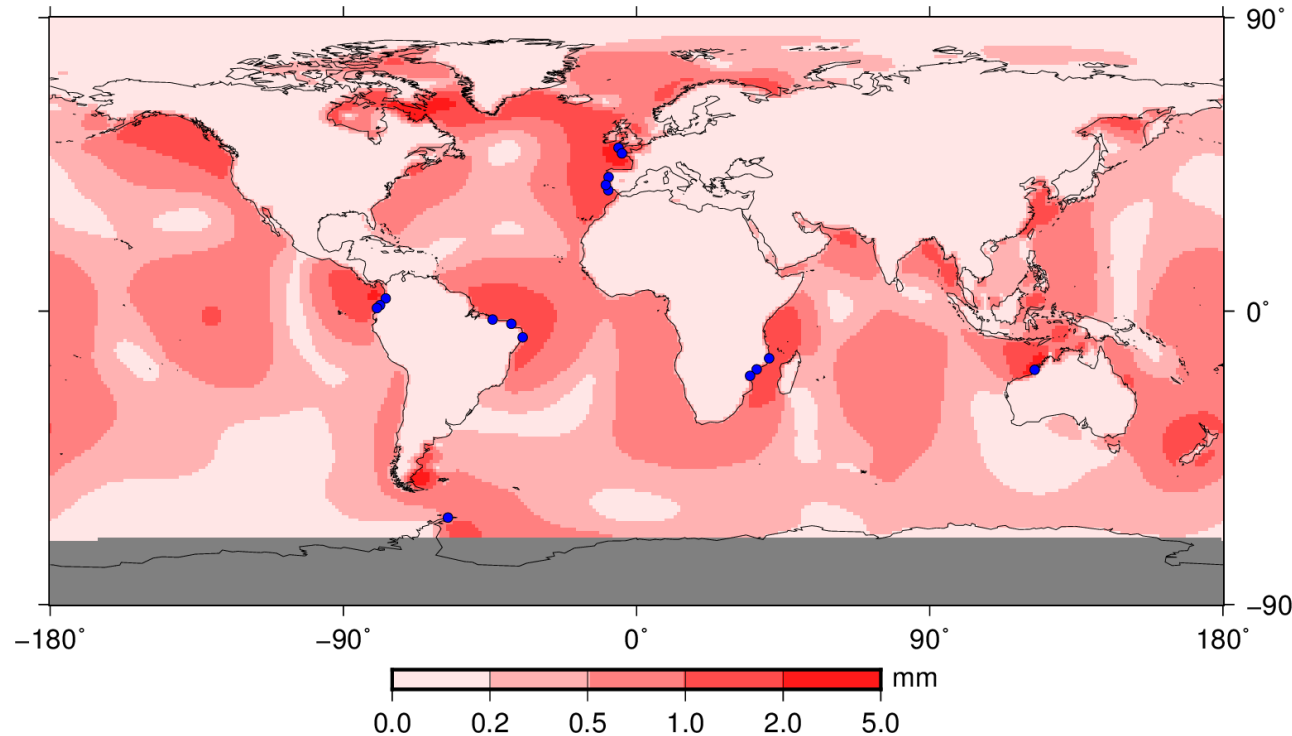
is operational!



Please Visit: <http://nuvem.di.ubi.pt>

Periodic Loading effects in tropospheric delays

- 1) The Earth's surface deforms due to the weight of the ocean tides (OTL).
- 2) If this loading effect is not taken into account during the GPS processing, ZTD errors of up to 10 mm can occur.
- 3) However, OTL corrections are not perfect, especially at coastal sites where OTL is several cm and mismatches between predicted and actual OTL can reach the cm level.
- 4) Using the latest ocean tide models and an improved elastic model of the Earth, better OTL and therefore better ZTD estimates will be produced for selected coastal sites.



Difference in vertical ocean tide loading (computed using tide model FES2004, harmonic M2) using the standard PREM and modified PREM elastic Earth model. The blue dots represent GNSS stations that will be analysed in this project (Bos et al., 2015).

In the figure the differences in OTL values reach 5 mm. However, this is only for 1 tidal period although the largest one (period M2 = 12.45 hours). The same happens at other tidal frequencies and if you add them all up together you reach the centimeter level mentioned in the bullet points.

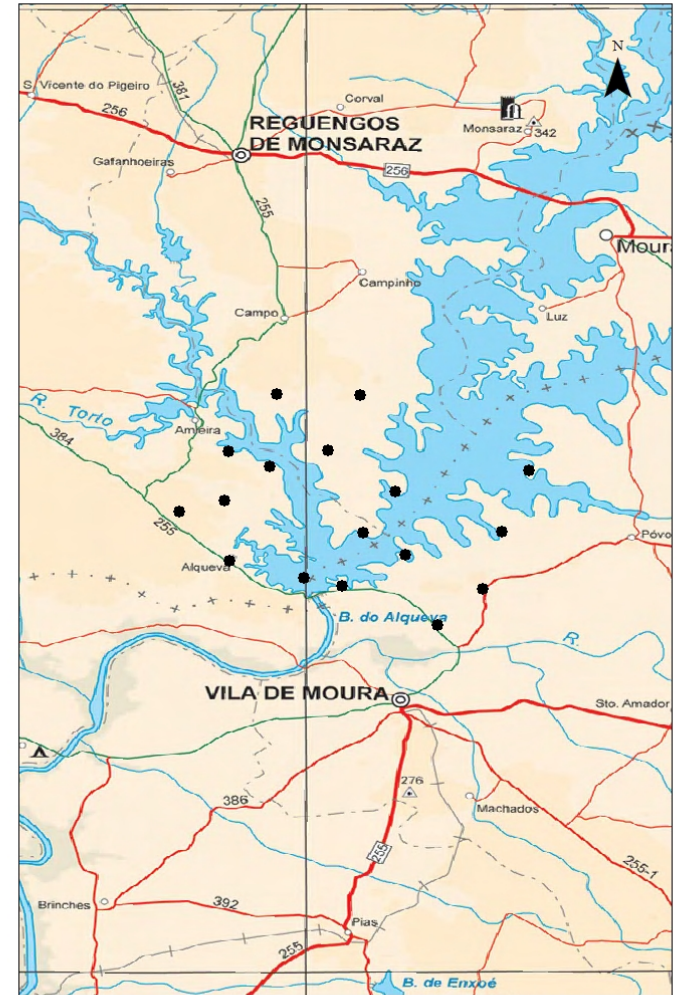
GNSS network

ALEX - ALqueva hydro-meteorological EXperiment

ALEX project is a campaign of hydro-meteorological observations over the Alqueva lake, one of the largest dams and artificial lakes in Europe. It includes observations of the water column, atmospheric column, and water-air interface. It was also installed 15-station GNSS network to study the diurnal cycle of water evaporation.

more info:

<http://www.alex2014.cge.uevora.pt/>



Legend

● GNSS Station

0 3 6 12 Km

the end...