

# Status of GNSS Meteorology Activities at ROB

*Eric Pottiaux, Royal Observatory of Belgium (ROB)  
Solar-Terrestrial Centre of Excellence (STCE)*

## Status since November 2013

- No **important change** to the official operational system (**ROBH**)
- The service has performed well and was stable - all user requirements (NWP) are satisfied
- Only **one major problem** due to corruption of the coordinates (caused by the processing of 1 site) – pointed by Météo France during my summer holiday → Saw the e-mail late (after about 1-2 week(s)) but **fixed within 1 day**

*ROB has 4 processing systems and provides solutions from 3 of them to E-GVAP:*

## ROBH

*Input:* Hourly RINEX files  
*Update cycle:* Hourly  
*Purpose:* NWP data assimilation

*Operational*  
~ **375** stations  
*Proc. time:* 13-16 min.

## ROBQ

*Input:* Real-time GNSS observations (NTRIP)  
*Update cycle:* Sub-hourly – every 15 Minutes  
*Purpose:* nowcasting + rapid-cycle NWP data assimilation

*Demo*  
~ **326** stations  
*Proc. time:* 8-13 min.

## ROBT

*Input:* Hourly RINEX files  
*Update cycle:* Hourly  
*Purpose:* Tests + prepare next ROBH

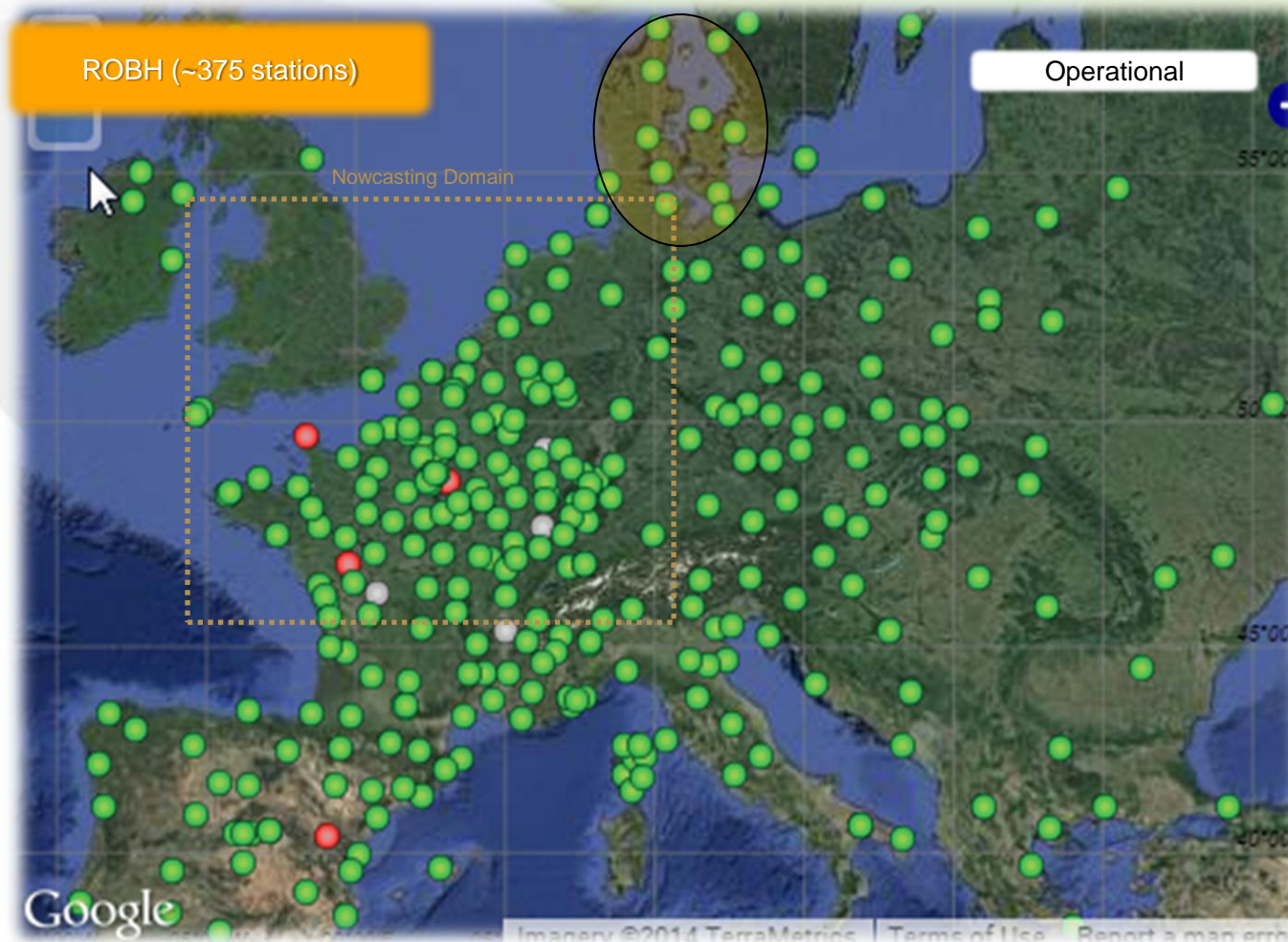
*Tests (for R&D)*  
~ **647** stations  
*Proc. time:* 29-50 min.

## ROBP

*Input:* Daily RINEX files  
*Update cycle:* Daily (latency of 6 days)  
*Purpose:* CRD + validation + prepare for re-analysis

*Internal only*  
~ **884** stations  
*Proc. time:* 13-19 hours

# European stations included in ROBH



Targeted Application:  
regional NWP

European Network

~375 GNSS Stations

GPS-Only



ZTD-Only

15-min Sampled ZTD

Hourly Update Cycle

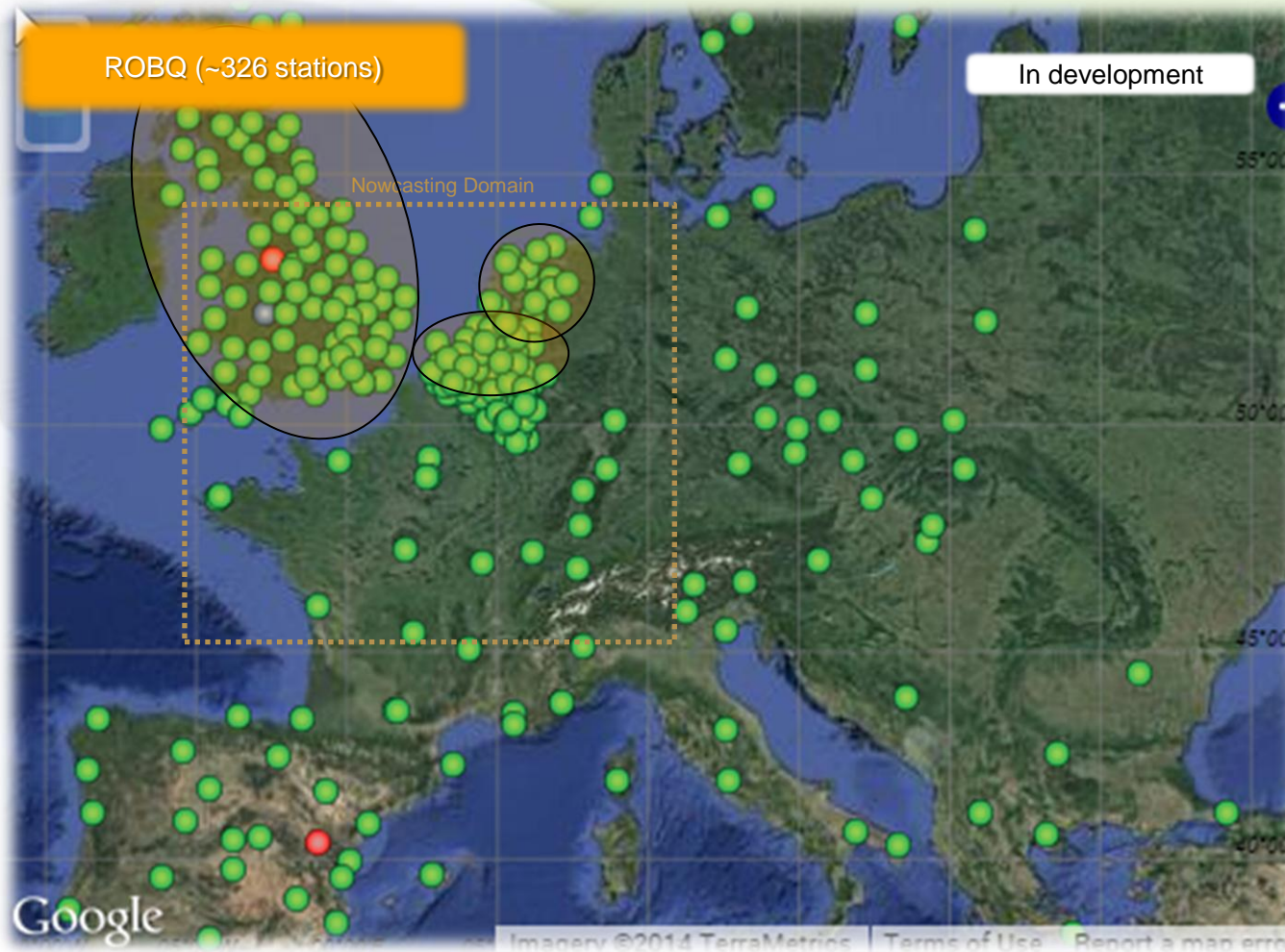
Latency < 90 min

Status: 16 October 2014 (Several stations are located outside the represented domain).

10 Danish sites added to processing (ROBT, and ROBH last week)



# European stations included in ROBQ



Targeted Applications:  
rapid-update NWP  
and nowcasting

European Network

~326 GNSS Stations

GPS-Only



ZTD-Only

15-min Sampled ZTD

15-Min Update Cycle

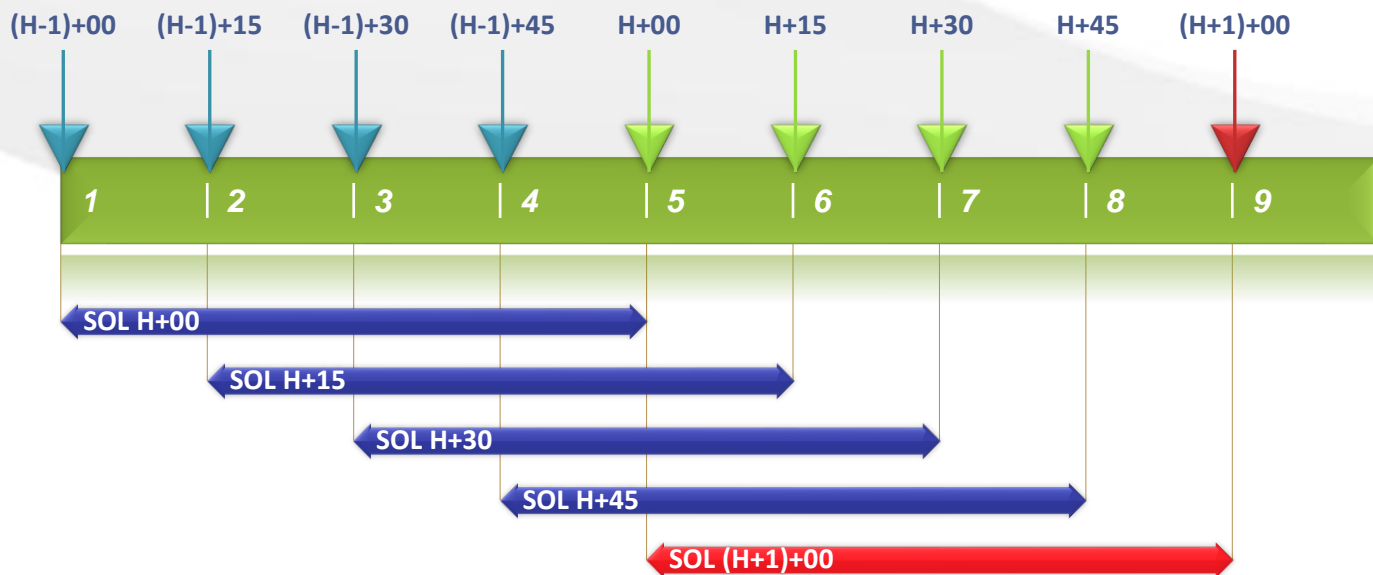
Latency < 30 min

*Status: 16 October 2014 (Several stations are located outside the represented domain).*

Full FLEPOS+NETPOS+U.K. OSNet stations added

# ROBQ is now running every 15min!

- ROBQ has been switched to sub-hourly and the new file naming convention (v2.2) implemented (cost\_s\_t\_201410140315\_201410140414\_xxxx\_robq.gz)
- Different implementation of other A.C. (e.g. METR) processing 15-min-batches, here it is 60-min batches (such as ROBH) but shifted forward by 15-min



## ■ Questions:

- Q0: Can I start uploading to E-GVAP server every 15 min ?
- Q1: Content should be 1 hour or truncated to the last 15 min?
- Q2: Under only one solution name? Or as different solutions (because of overlapping):  
cost\_s\_t\_201410140300\_201410140359\_xxxx\_ro00.gz  
cost\_s\_t\_201410140315\_201410140414\_xxxx\_ro15.gz  
cost\_s\_t\_201410140330\_201410140429\_xxxx\_ro30.gz  
cost\_s\_t\_201410140345\_201410140444\_xxxx\_ro45.gz

- Main efforts concentrated on porting our processing systems to the new version of the Bernese GNSS software (5.2), with focus on ROBP which is the mandatory step prior porting ROBH, ROBQ, ROBT
- Support for Bernese GNSS Software v 5.0 will be discontinued on March 2015
- Assessment ongoing, results are now +/- satisfactory (in terms of coordinates)



2014-2015

# ROADMAP FOR E-GVAP

# Switch to the new Bernese GNSS Software (5.2)

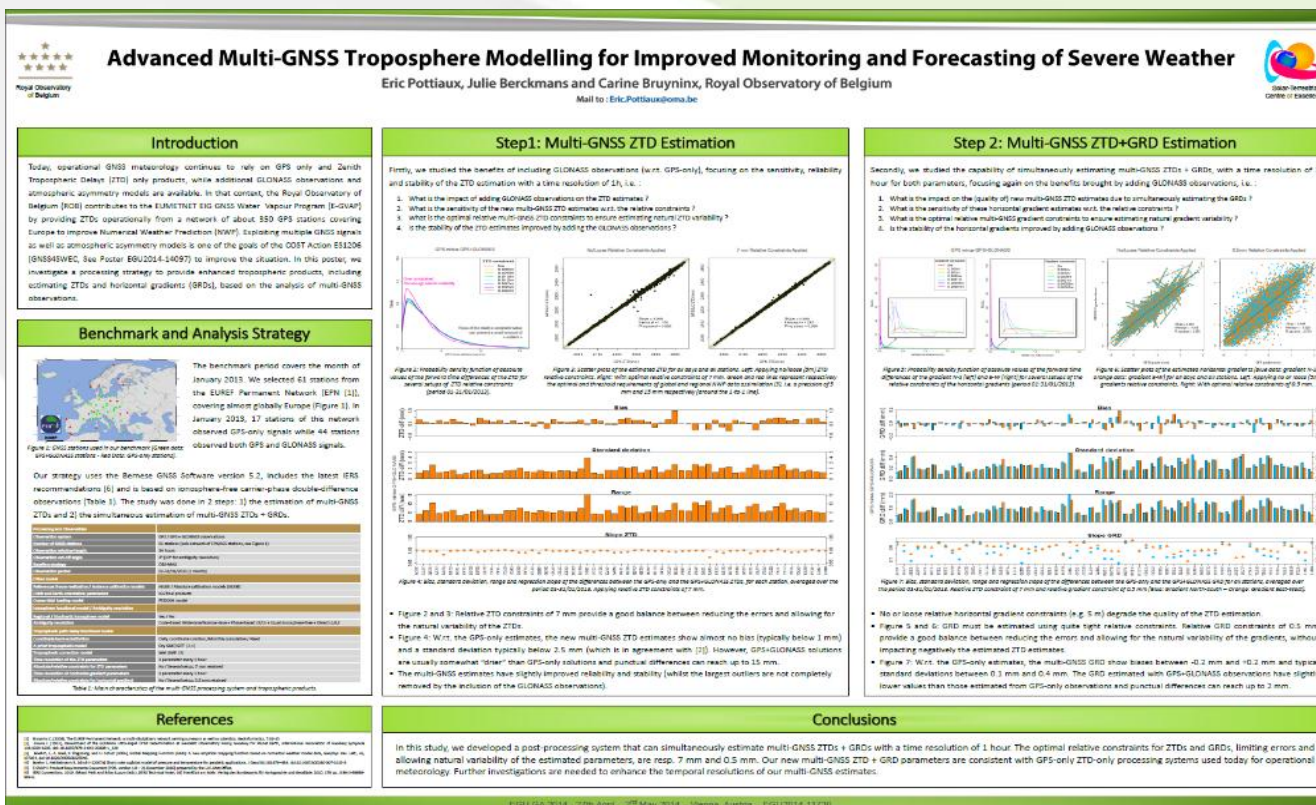
1. Finish the switch of **ROBP** to the **Bernese software version 5.2** (Still some bugs/problems to fix but should be operational by the end of 2014)
2. Start porting **ROBQ** and **ROBT** to the **Bernese software version 5.2** and stop computing them with BSW 5.0
3. **Improve automation and robustness** (site exclusion, monitoring, handling of problems...)
4. Start porting and switch **ROBH** to the **Bernese software version 5.2** and stop computing them with BSW 5.0
5. **Global processing system (ROBG)**, using the new Bernese software 5.2 (based mainly on IGb08 stations) in support of Global NWP models?

# Continue the new cycle of R&D related to GNSS4SWEC **ROADMAP FOR 2014-2017**



# Multi-GNSS Tropospheric Products

Presented at EGU2014 ([ftp://ftp.dmi.dk/EGU-2014/EGU2014-11730\\_Pottiaux.pdf](ftp://ftp.dmi.dk/EGU-2014/EGU2014-11730_Pottiaux.pdf))



- GPS-Only versus GPS+GLONASS ZTD and gradients
- New Bernese GNSS software 5.2
- Post-processing and hourly time resolution

**Main Results :** Optimal relative constraints for ZTDs and GRDs, limiting errors and allowing natural variability. Multi-GNSS ZTDs consistent with GPS-only. Further investigation needed (e.g. higher temporal resolution).

## Belgian Active Geodetic Network

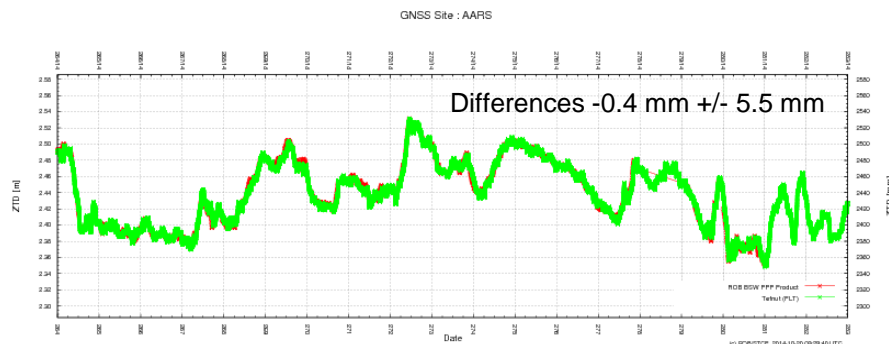
Targeted Applications:  
High Resolution NWP, Nowcasting and Tomography



The Belgian Active Geodetic Network (from 2003/2004 – now, ~ 76 stations)  
(source: <http://www.ngi.be>)

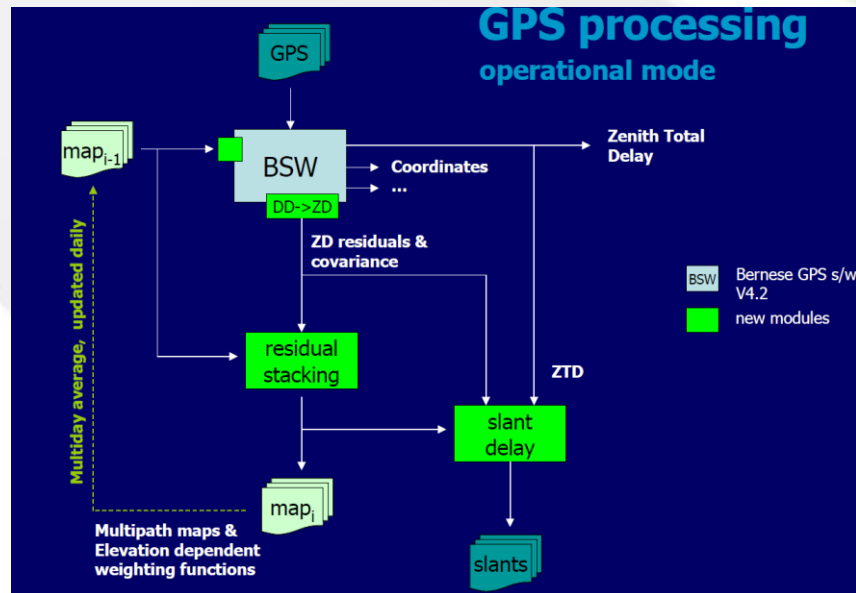
Baseline length: 20-30 km

Fine Water Vapour Structure

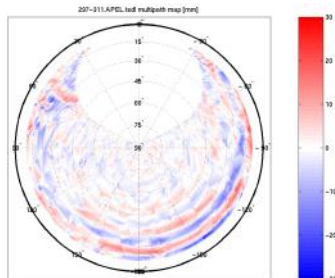


- Development of a GNSS nowcasting toolbox  
(See presentation of 1<sup>st</sup> GNSS4SWEC workshop)
- GOP-ROB Collaboration:
  - Using Tefnut to generate real-time tropospheric products including asymmetry information
  - Focused on the Belgian dense network (+IGS)
  - First results obtained by P. Vaclavovic (STSM)
- Work continued and presented at the IGS Workshop 2014
  - Comparison w.r.t to ROB Bernese PPP + DD solutions + IGS Final troposphere product
- Can be further exploited to contribute to GNSS4SWEC, e.g. setup a Real-time Demonstration Campaign





Van der Marel et al. 2005



- Multipath and slant delay algorithms and programs originally developed by HvM (TOUGH program)
- Fortran and Matlab Codes
- Modified and ported to run with BSW 5.2 (Fortran part)
- First results need to be produced and analysed