



COST ES1206: Working Group 2

Use of GNSS tropospheric products for high-resolution, rapid-update NWP and severe weather forecasting



Eric Pottiaux, Royal Observatory of Belgium (ROB)

Siebre de Haan, Koninklijk Nederlands Meteorologisch Instituut (KNMI)

- Quick introduction (objectives, outcome, WP structure...)
- Short summary of the status of WG2 activities
- Possible collaboration with E-GVAP, EUMETNET, EUCOS...

- Main topic: GNSS for severe weather monitoring (GNSS4SW), more precisely

“Use of GNSS tropospheric products for high-resolution, rapid-update NWP and severe weather forecasting”

- Working group chaired by Siebren de Haan and Eric Pottiaux
- Tomography, nowcasting and high-resolution rapid-update NWP

Establish standards and methods

- Review existing and define user requirements of enhanced/new products from WG1
- Setup policies and standardize **exchange format** (incl. **horiz. gradients** and slant delays)
- Standardize the method used to convert the ZTD to IWV
- Recommendations and methods for operational GNSS nowcasting tools
- Investigate the setup of a hub facility (collaboration with E-GVAP)
- Develop, validate and exchange methods for initialisation of NWP models using horizontal gradients and slant delays

Set up a database for real-time positioning applications

- Inventory NWP data usable to enhance **real-time positioning**
- Define and generate specific benchmark datasets for validation by WG1
- Setup a benchmark database for exchange and validation (incl. all input+output)

Set up a database for nowcasting and NWP case studies

- Inventory interesting nowcasting cases + organise detailed analysis of special case studies
- Define and generate specific benchmark datasets
- Setup a benchmark database for exchange and validation (incl. all input+output)

Assess the benefit of enhanced/new WG1 products

- Evaluate and validate the information content of the enhanced/new products
- Study error sources and correlations
- Assess the benefit of **multi-GNSS tropospheric products** in NWP and for severe events
- Evaluate and validate the information content from tomography products

Assessment reports and guidelines on standardised methods and data formats (collaboration with WG1) for the initialization of NWP models using new and enhanced operational GNSS tropospheric products and for use in nowcasting.

Promotion and dissemination of these standardised methods (STSMs, summer schools, workshops).

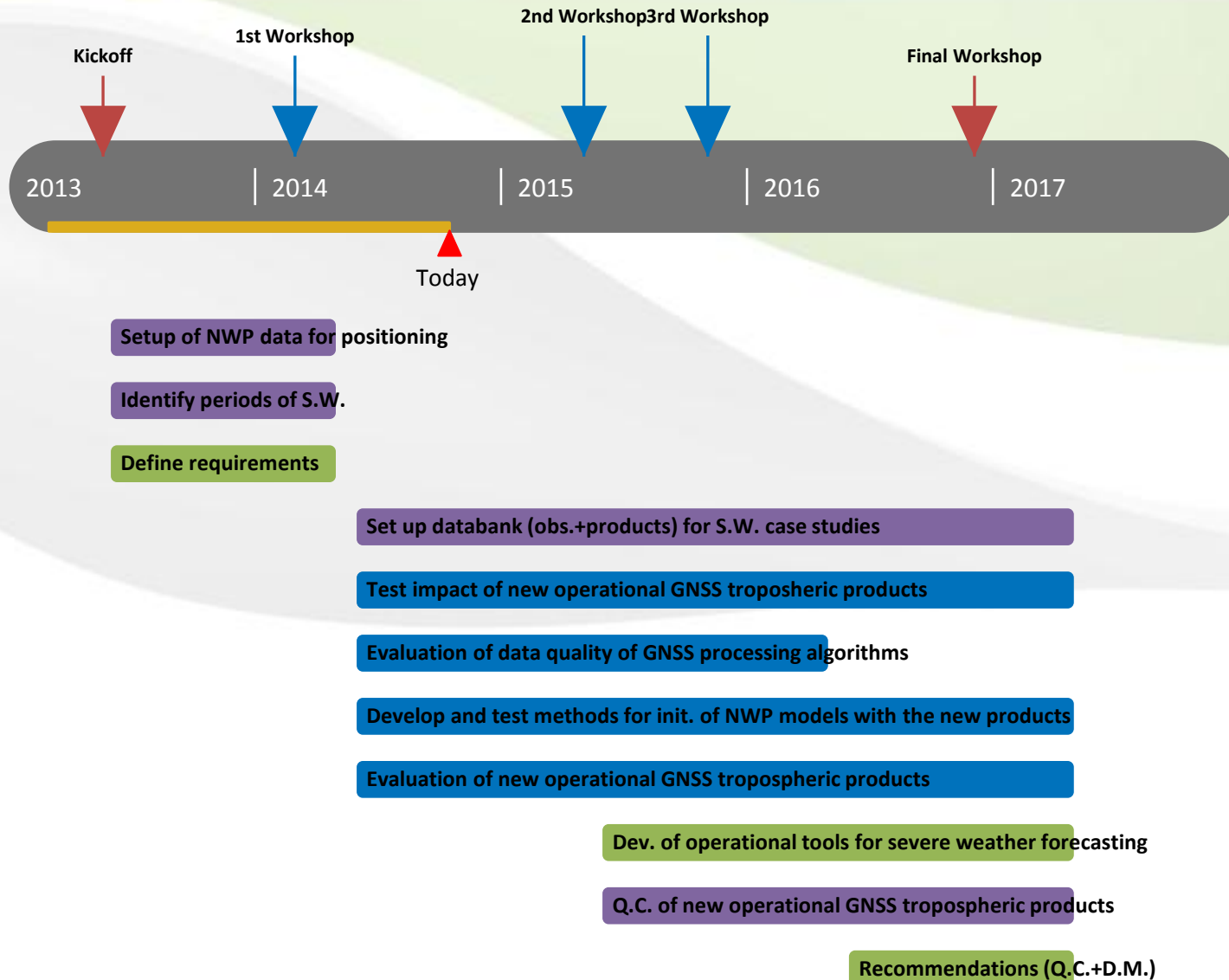
Produce requirements for enhanced and new operational GNSS tropospheric products.

Benchmark datasets for test, assessments and validations (for each method/product).

Database with severe weather case studies.

Recommendations and methods for operational GNSS nowcasting tools.

Identify new ground-based GNSS data providers for operational NWP and severe weather monitoring in the data sparse regions such as Eastern and South-Eastern Europe.



- We held the state-of-the-art workshop with numerous good talks
- We defined 7 sub-WGs/WP2.x listed below
- Found leaders/responsible for all (but 1) WP2.x
- Determined the people involved in those WP2.x
- Identified clear cross-topics with WG1 and WG3
- Since last meeting, we carried out a number of inquiries/questionnaires (e.g. NWP models, user requirements...)



	Sub-workgroup	Leader	Liaison
1	Nowcasting	Eric Pottiaux	WG1/3
2	Tomography	Witold Rohm	WG1
3	NWP Nowcasting and NWP Assimilation	Gemma Halloran (nee Bennitt)	WG1
4	Standardization	Siebren de Haan	WG1
5	Benchmark/Database/Exchange Format	Jonathan Jones	WG1/3
6	ZTD2IWV	Siebren de Haan / Eric Pottiaux	WG3
7	User Requirement review	TBD (temporary Eric Pottiaux)	WG1

WP2.NOW

Non-numerical Nowcasting

Leader(s): Eric Pottiaux

WP2.TOMO

Tomography for Nowcasting and NWP

Leader(s): Witold Rohm

WP2.NWP

NWP nowcasting and NWP Assimilation

*Leader(s): Gemma Halloran (nee
Bennit)*

WP2.STAND

Standardization / Data Monitoring / QC

Leader(s): Siebren de Haan

WP2.BENCH

Benchmark / Databases / Exchange format

Leader(s): Jonathan Jones

WP2.ZTD2IWV

ZTD/IWV conversion methods

*Leader(s): Siebren de Haan/Eric
Pottiaux*

WP2.UR

Product User Requirements for nowcasting and NWP

Leader(s): Eric Pottiaux (temp)

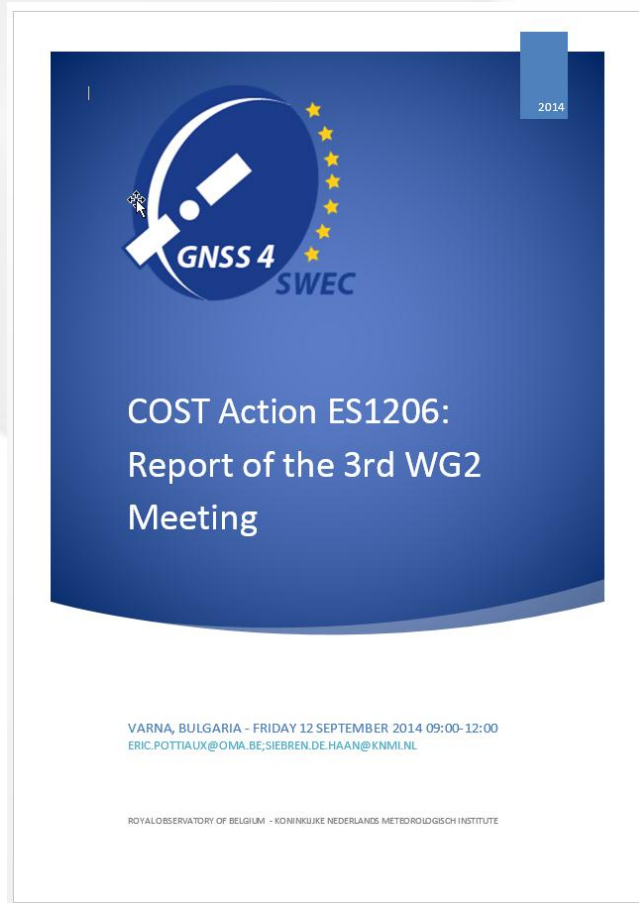
	Sub-workgroup	Leader	Liaison
1	Nowcasting	Eric Pottiaux	WG1/3
2	Tomography	Witold Rohm	WG1
3	NWP Nowcasting and NWP Assimilation	Gemma Halloran (nee Bennitt)	WG1
4	Standardization	Siebren de Haan	WG1
5	Benchmark/Database/Exchange Format	Jonathan Jones	WG1/3
6	ZTD2IWV	Siebren de Haan / Eric Pottiaux	WG3
7	User Requirement review	TBD (temporary Eric Pottiaux)	WG1

What we are still missing:

- A clear list of tasks per sub-WG2's (to be updated along the Action)
- List of people willing to contribute actively to those tasks (+coordinator/leader?)
- Defined benchmark campaign(s) and corresponding repositories
- Based on the list of tasks (above) foster STSMs to tackle them + paper in S.I.
- Prepare the two next workshops



Quelle: <http://borisgloger.com/>



- Need to define clear task lists per WP2.x
- Need of coordinated STSMs for WG2
- WG2 presentations are online at gnss4swec.knmi.nl
- Feedback deadline: 31 October 2014



2-way benefits

Exchange of Expertise
(STSM)

Sharing Means: Hub
Facility, Monitoring
and Quality Checks...

(Continuous) review of
user requirements &
take into account
operational criteria

Standardisation of the
exchange format

Benchmark, case
studies, repositories
and data

NWP Model data
output for RT
positioning

ZTD2IWV method s:
standardisation &
NWP model output for
ZTD2IWV nowcasting

Link to professional
forecaster

Description, Members, Leaders, Tasks, Deliverables...

WORK PACKAGES

Lead: Eric Pottiaux

Members: Alain Geiger, Enrique Priego De Los Santos , Eric Pottiaux, Evgenia Egova, Filippas Tymvios, Henrik Vedel, Hugues Brenot , Jaroslaw Bosy, Jonathan Jones, Kalev Rannat, Laurent Morel, Nadezhda Yordanov, Rui Fernandes, Siebren de Haan, Witold Rohm, Xin Yan, Roger R, Igor Kerin, Birgitta Pace

Tasks:



T0	First Inventory existing GNSS-based tools and products for nowcasting (state-of-the-art workshop)
T1	Review nowcasting product requirements (with WG2.UR and WG1)
T2	Define severe weather benchmark + setup a database of case studies
T3	Test and assess the impact of existing and new GNSS-based products using the benchmark campaign(s)
T4	Identify best practices in GNSS nowcasting and propose operational tools for severe weather forecasting
T5	Q.C. and monitoring for GNSS products (collaboration with E-GVAP and EUCOS?)

Deliverables:



D8	GNSS nowcasting workshop on tools and practices for monitoring and forecasting severe weather
D12	Test impact of new operational GNSS tropospheric products for selected severe weather cases
D13	Development of operational tools for severe weather forecasting, in collaboration with E-GVAP and EUCOS

Main Achievements in Y1:

- Inventory of current possible (direct) GNSS-based nowcasting product (presented at Munich)
- This should be completed with tomography product(s) for nowcasting (feasible?)

Request for Y2:

- Determine nowcasting cases for the benchmark and start filling the database (liaison WG2.BENCH)
- Determine products requirements for horizontal gradients and tomography products (liaison WG1&WG2.UR)
- Inventory of open questions that we want to answer (use later to define specific tasks)
- Enhance involvement of professional nowcasters/forecasters

Leader: Witold Rohm

Members: Alain Geiger, Cedric Champollion, Florian Zus, Gregor Moeller, Hugues Brenot, Jaroslaw Bosy, Krzysztof Kroszczynski, Micheal Bender, Witold Rohm, Xin Yan, Andre Se

Tasks:



T0	Review state-of-the-art in GNSS-tomography
T1	Define the list of possible tomography products + characterize them for each field of application
T2	Define products requirements for each tomography product and each field of application (liaison with WG1 and WG2.UR)

Deliverables



D12	Test impact of new operational GNSS tropospheric products for selected severe weather cases
D13	Development of operational tools for severe weather forecasting, in collaboration with E-GVAP and EUCOS

Main Achievements in Y1:

- Review tomography models in terms of performance
- Define requirements for NWP

Request for Y2:

- Select the region for tomography benchmark
- Obtain high quality STD/SWD/SI WV from WG.1.
- Process the idealised case study

Leader: Gemma Halloran

Members: Florian Zus, Gemma Halloran, Henrik Vedel, Jana Sanchez, Jaroslaw Bosy, Jaroslov Resler, Jelena Bojarova, Kalev Rannat, Kefei Zhang, Krzysztof Kroszczynski, Magnus Lindskog, Micheal Bender, Mile Mate, Pierre Bosser, Roland Potthast, Siebren de Haan, Sigurður Þorsteinsson, Witold Rohm, Xin Yan, Jean-Francois Mafhouf, Roger R

Tasks: (TBD)



Deliverables:



D5	GNSS NWP workshop: Strengths and weaknesses of the current NWP models w.r.t. GNSS DA
D11	Develop/fine tune and test methods for initialisation of NWP models with the new GNSS tropospheric products
D12	Test impact of new operational GNSS tropospheric products for selected severe weather cases
D13	Development of operational tools for severe weather forecasting, in collaboration with E-GVAP and EUCOS

Main Achievements in Y1:

- Inquiry/questionnaire + summary of NWP models (domain, product assimilated...)
- Inquiry/questionnaire + summary of interest for new product (e.g. slants and gradients) + domain of assimilation
- Suggestion to WG1 for benchmarking periods (6 slots of 1 week in 2012/2013)

Request for Y2:

- Agree on the case study periods and fill the repositories

Leader: Siebren de Haan

Members: Eric Pottiaux, Henrik Vedel, Jonathan Jones, Siebren de Haan, Witold Rohm, Jean-Francois Mafhouf, Roger R

Tasks: (TBD)



Deliverables:



D7	Evaluation of data quality of GNSS processing algorithms including GLONASS
D8	Evaluation of new operational GNSS tropospheric products (GRD, STD, TOMO) based on selected test cases
D10	QC of the operational GNSS tropospheric products delivered by the new ACs
D14	Recommendations for quality control and data monitoring

→ Needs benchmark products etc... before being started (somewhere end of Y2 or beginning Y3).

Leader: Jonathan Jones

Members: Eric Pottiaux, Gemma Halloran, Henrik Vedel, Jonathan Jones, Siebren de Haan

Tasks:



T0	Setup a repository server for support of GNSS positioning
T1	Setup a repository server for nowcasting of severe weather cases (description, input, output...)
T2	Setup a repository server for assimilation in NWP analysis (ZTD, gradients, slants...)
T3	Identify periods of severe weather cases to define WG1 campaign periods (for estimation of gradients, slant delays, etc.)

Deliverables



D3	An atmospheric NWP data repository for support of GNSS positioning, in collaboration with WG1
	A data repository for nowcasting and NWP analysis of severe weather cases
D4	Inventory of periods of severe weather cases to define WG1 campaign periods

Main Achievements in Y1:

- Request at U.K. Met. Office to use the E-GVAP server for COST ES1206 as well (decision pending)

Request for Y2:

- Finalise the setup of the repositories
- Starts filling the repositories with data, products and descriptions (metadata)!

Leaders: Siebren de Haan/Eric Pottiaux

Members: Eric Pottiaux, Henrik Vedel, Siebren de Haan, Birgitta Pace

Tasks:



T0	Create link between WG2 and WG3 (possibly also WG1) on this topic
T1	Inquiry/Review ZTD2IWV conversion methods for nowcasting and NWP
T2	Provide feedback to WG3 tasks on IWV conversion
T3	Test NWP model forecast fields as input for ZTD2IWV conversion

Deliverables



Dx	Standardized ZTD2IWV conversion method for nowcasting and NWP
-----------	---

- **Still to be started**
- **We need to find a way to coordinate this with WG3.ZTD2IWV**

Lead: (TBD, temporary Eric Pottiaux)

Members: (TBD)

Tasks:



T0	Inquiry/Questionnaire about the need to update/add products requirements for each product and application
T1	Create a link to E-GVAP
T2	Update the existing product requirement document used within E-GVAP

Deliverables:



D4	Identify periods of severe weather cases to define WG1 campaign periods
Dx	Product Requirement Document

Main Achievement in Y1:

- Inquiry about the need for U.R. updates (based on the E-GVAP PRD)
- No need to update existing U.R. now
- Need to add requirements about tomography products
- Assess the need of U.R. updates throughout the whole COST Action (continuously) → will resend the (adapted) inquiry again later

Request for Y2:

- Find a leader/coordinator
- Create a first guess of requirements for horizontal gradients and for tomography products
- Send again the inquiry/questionnaire for update? Or wait Y3?
- Send the updated document for review within E-GVAP?

Assessment reports and guidelines on standardised methods and data formats (collaboration with WG1) for the initialization of NWP models using new and enhanced operational GNSS tropospheric products and for use in nowcasting.

Promotion and dissemination of these standardised methods (STSMs, summer schools, workshops).

Produce requirements for enhanced and new operational GNSS tropospheric products.

Benchmark datasets for test, assessments and validations (for each method/product).

Database with severe weather case studies.

Recommendations and methods for operational GNSS nowcasting tools.

Identify new ground-based GNSS data providers for operational NWP and severe weather monitoring in the data sparse regions such as Eastern and South-Eastern Europe.

Main Deliverables

	Year 1	Year 2	Year 3	Year 4
Workshop on reviewing the state-of-the-art	X			
Review/define requirements for data exchange format for GNSS gradients, slant delays etc. in collaboration with WG1	X			
Set up of atmospheric NWP data repository for support of GNSS positioning, in collaboration with WG1	X			
Identify periods of severe weather cases to define WG1 campaign periods (for estimation of gradients, slant delays, etc.	X			
GNSS NWP workshop: Strengths and weaknesses of the current NWP models regarding assimilation of ground-based GNSS data		X		
Establish database of obs. and products for severe weather case studies		X	X	X
Evaluation of data quality of GNSS processing algorithms including GLONASS		X	X	
Evaluation of new operational GNSS tropospheric products (gradients, slant delays, 3D tomography) based on selected test cases in collaboration with WG1		X	X	X
GNSS nowcasting workshop on tools and practices for monitoring and forecasting severe weather			X	
QC of the operational GNSS tropospheric products delivered by the new ACs		X	X	X
Develop/fine tune and test methods for initialisation of NWP models with the new GNSS tropospheric products		X	X	X
Test impact of new operational GNSS tropospheric products for selected severe weather cases		X	X	X
Development of operational tools for severe weather forecasting, in collaboration with E-GVAP and EUCOS			X	X
Recommendations for quality control and data monitoring				X
Final workshop				X

Workshops, Summer Schools, STSMs and Reports

