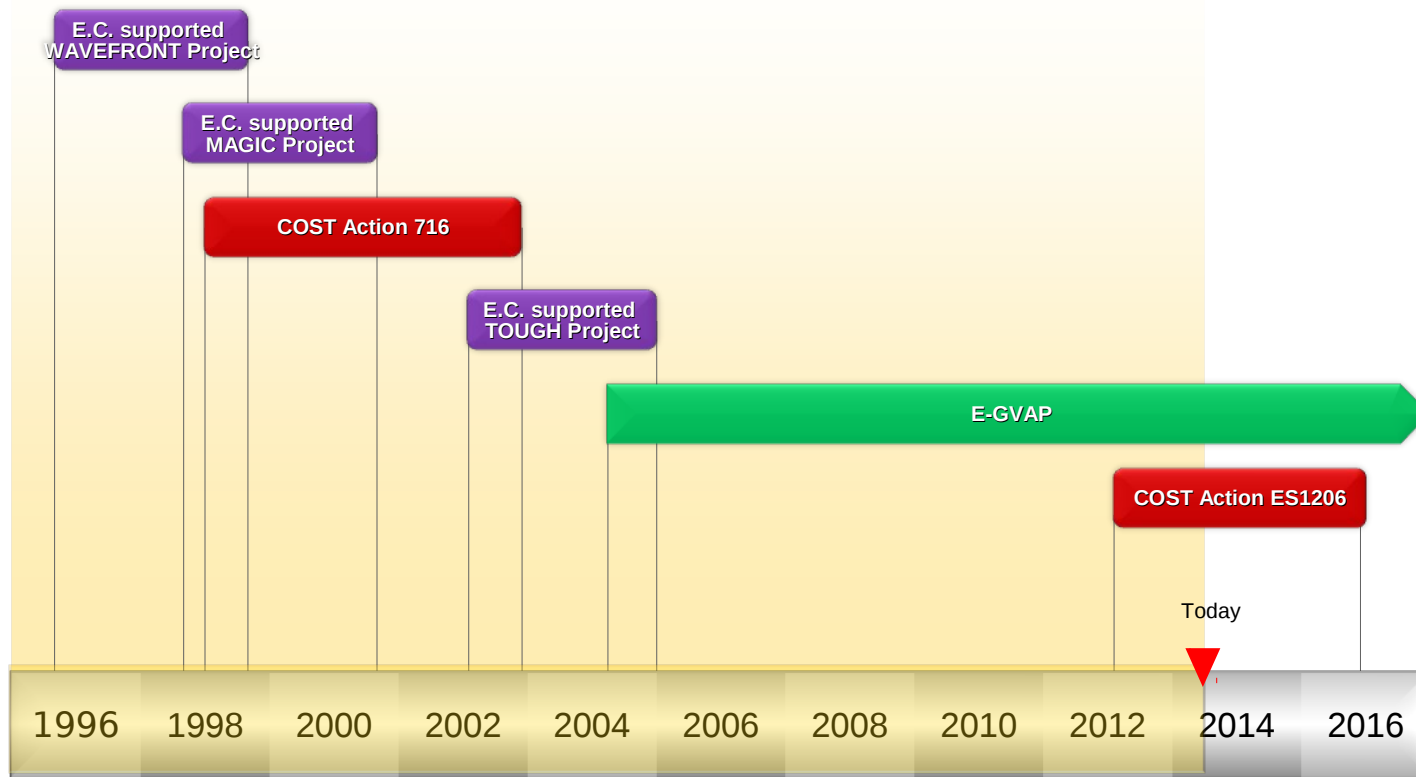




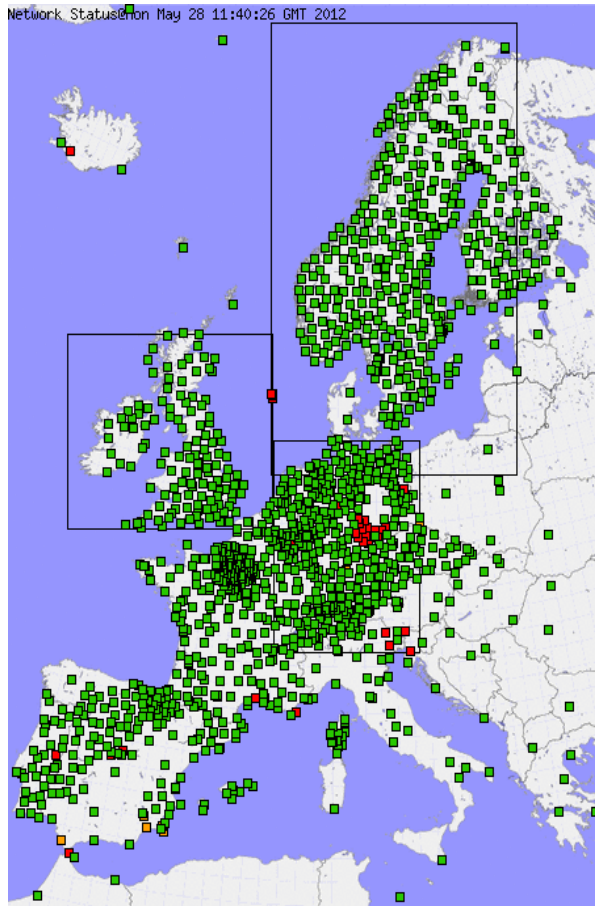
ES1206: Advanced GNSS Tropospheric Products for monitoring Severe Weather Events and Climate (GNSS4SWEC)

Training School Introduction

History of European GNSS-Meteorology Projects



Current Status (E-GVAP)



- Project focusing on GPS-only *hourly processing*, delivering *only* Zenith Total Delay (*ZTD*) in *90mins*
- *Operational assimilation* at Euro National Met Services. ZTD has a positive impact on NWP forecast skill scores
- *~2000 European sites*' delivering *~15M* ZTDs per month
- Surface T and P used for *conversion* to Integrated Water Vapour (*IWV*)
- GPS IWV has been used in research experiments for more than 10 years
- Data monitoring and Quality Checking in place (+improving)

HIRLAM (U11) Precipitation Forecast
(without GPS)

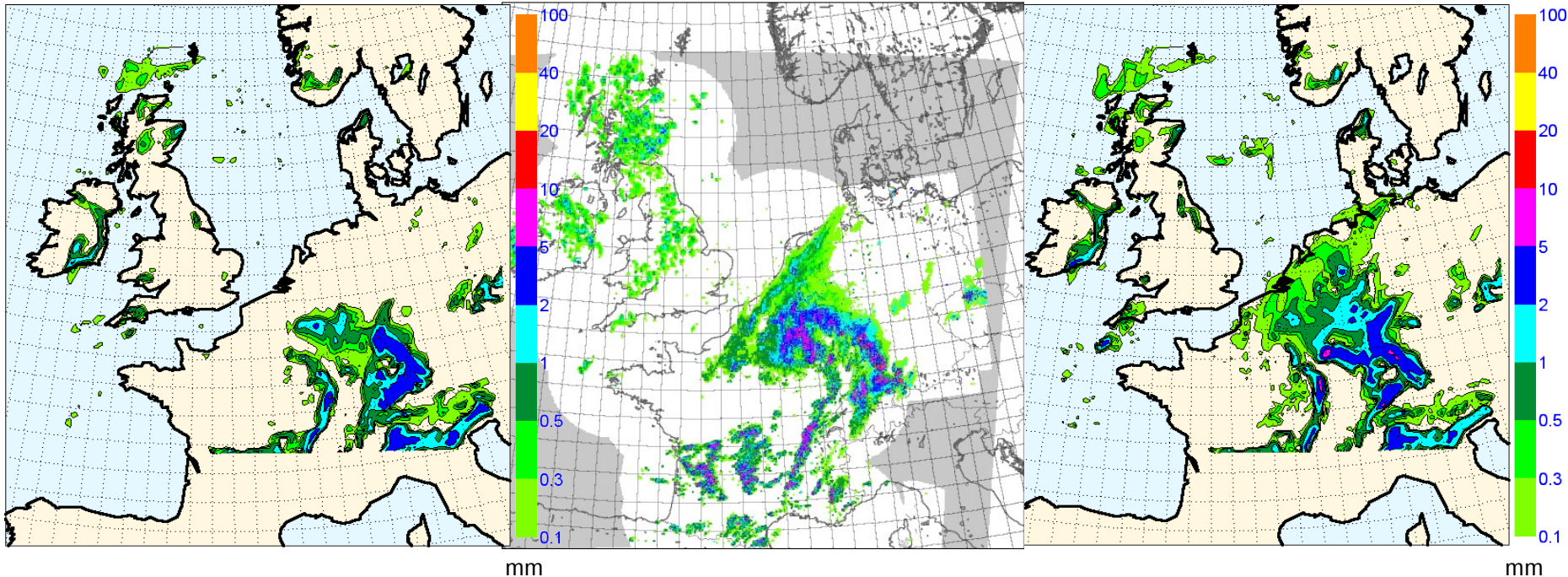
16 to 17 UTC on 11 May 2010

Radar Hourly Precipitation
Observations

16 to 17 UTC on 11 May 2010

HIRLAM (U11) Precipitation Forecast
(with GPS)

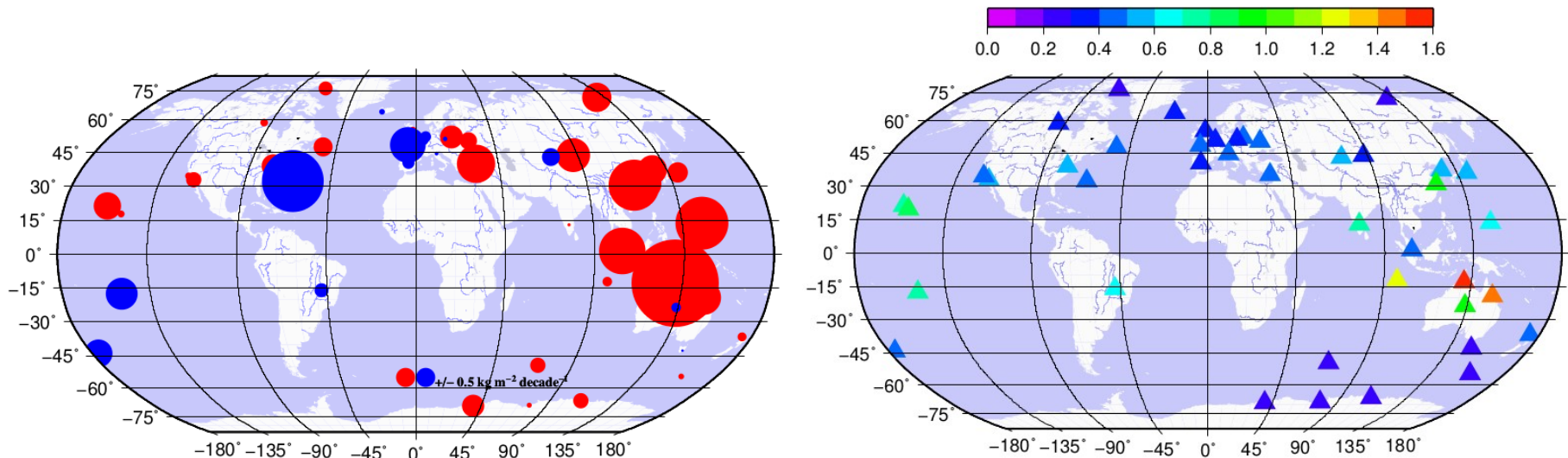
16 to 17 UTC on 11 May 2010



Example of positive impact observed in NWP for precipitation forecast and also has positive impact on cloud cover and surface temperature forecasts

- Long term model validation
 - NCEP model - good seasonal and inter-annual variations but underestimation of IWV of <40% in tropics and <25% in Antarctica
- Linear IWV trends
 - Global trend: -1.65 to +2.32 kg/m² per decade
 - Global trend uncertainty: 0.21 to +1.52 kg/m² per decade

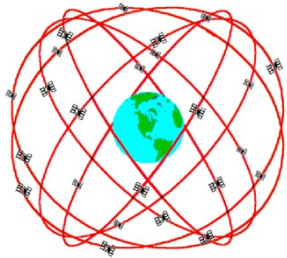
<http://publications.lib.chalmers.se/records/fulltext/157389.pdf>



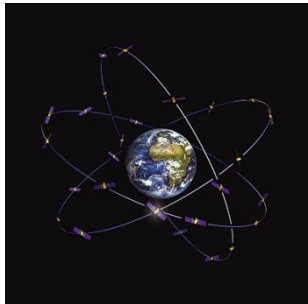
Developments in the Meteorological Requirements

- New hi-res NWP models require ZTD with improved timeliness and greater spatial and temporal resolutions (e.g. Met Office UKV 1.5km)
- Advanced GNSS products are desired for obtaining more information about troposphere (vertical resolution of water vapour, azimuthal anisotropy etc.)
- Sub-hourly processing would greatly increase usefulness of GNSS products for nowcasting and IWV displays
- Climate community only now starting to use GNSS tropospheric products (e.g. Hadley Centre)

Developments in GNSS

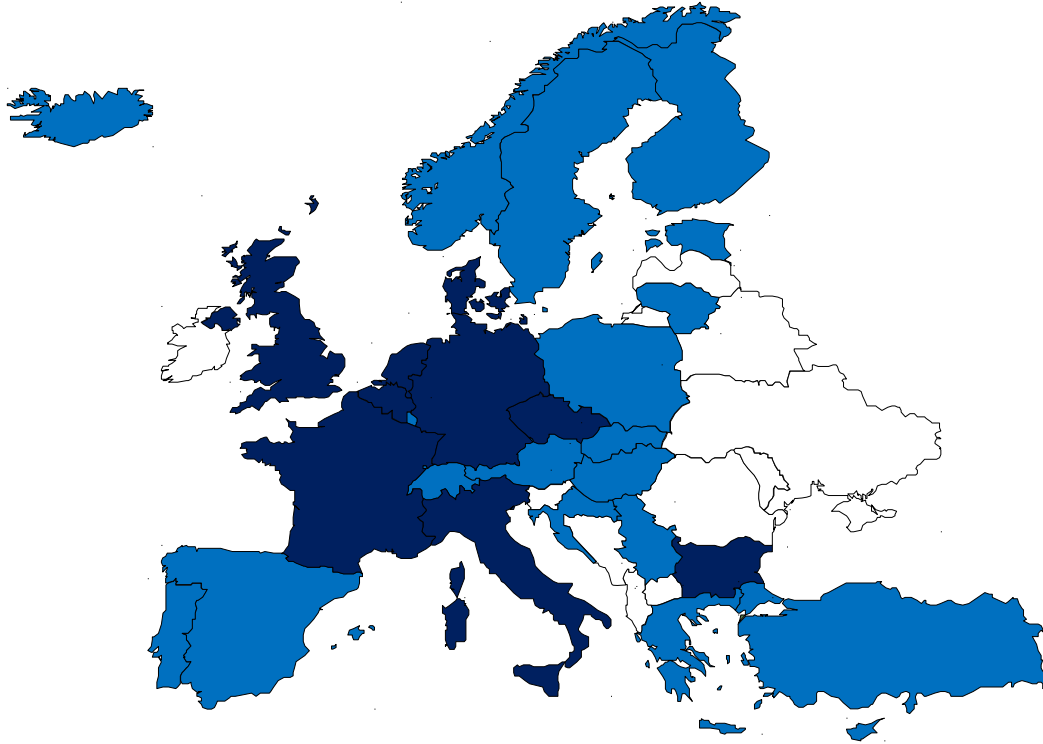


- More GNSS constellations (GPS + GLONASS, Galileo etc...) = new geometries, increased number of observations etc
- Real-time NTRIP raw data streaming
- Real time PPP processing schemes
- Continued R&D working towards more advanced tropospheric products (slants, gradients, tomography)
- Single frequency processing
- Long-term, homogenised GPS products available (EPN/IGS/CODE/others), valuable for climate analysis?





COST Action ES1206 GNSS4SWEC



*Dark Blue: Countries involved in Management Team
Blue: Countries participating in the Action*

4 year Action (2013 – 2017)

29 European Countries

5 non-EU Countries (USA,
Canada, Aus, HK, TN)

100+ participants from 60+
institutions

COST Actions support:
Meetings
Workshops
STSMs
Publications and outreach
Training Schools

High-Level Objectives

- Coordinate the development of **new multi-GNSS** solutions and assess the benefit to meteorology and climate analysis
- Assess the potential of **new GNSS products** for use in nowcasting and rapid cycle NWP
- Determine the added value of the re-processed GNSS tropospheric data to the current state-of-the-art **climate** research
- Establish a database of reference tropospheric solutions to validate reprocessed GNSS ZTD/IWV against **climate** quality data from a range of other instrumentation
- Stimulate the exploitation of atmospheric data as an input to improve **Real-Time GNSS** positioning and navigation
- Standardize the conversion of ZTD to IWV
- Stimulate exchange of data and expertise in the field of GNSS Meteorology

ES1206: Management

Action Chair: Jonathan Jones (Met Office)
Action co-chair: Guergana Guerova (Univ. of Sophia)

**WG1 - Advanced GNSS
Processing Techniques**

Chair: Jan Dousa (GOPE)
Co-chair: Galina Dick (GFZ)

WG1

37 participants

19 countries

**WG2 - GNSS for Severe
Weather Monitoring**

Chair: Siebren de Haan (KNMI)
Co-chair: Eric Pottiaux (ROB)

WG2

38 participants

21 countries

**WG3 - GNSS for Climate
Monitoring**

Chair: Olivier Bock (IGN)
Co-chair: Rosa Pacione (e-geos)

WG3

25 participants

17 countries

Main Aims of the Action

- 1 *Coordinate the development of new, multi-GNSS techniques and products.*
- 2 *Improve the understanding of short-term atmospheric processes.*
- 3 *Promote the use of, and determine the impact of, re-processed long-term GNSS tropospheric datasets for climate.*
- 4 *Link its activities to the IGS and EUREF, and work in support of E-GVAP.*
- 5 *Coordinate the exploitation of GNSS and meteorological data for mutual benefit.*
- 6 *Lead to a consolidation of collaborating groups.*



ES1206: GNSS4SWEC



Questions

http://www.cost.eu/domains_actions/essem/Actions/ES1206
<http://gnss4swec.knmi.nl/>

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And Enjoy !

