ES1206: Advanced GNSS tropospheric products for monitoring severe weather and climate

Start date: 17/05/2013

End date: 16/05/2017

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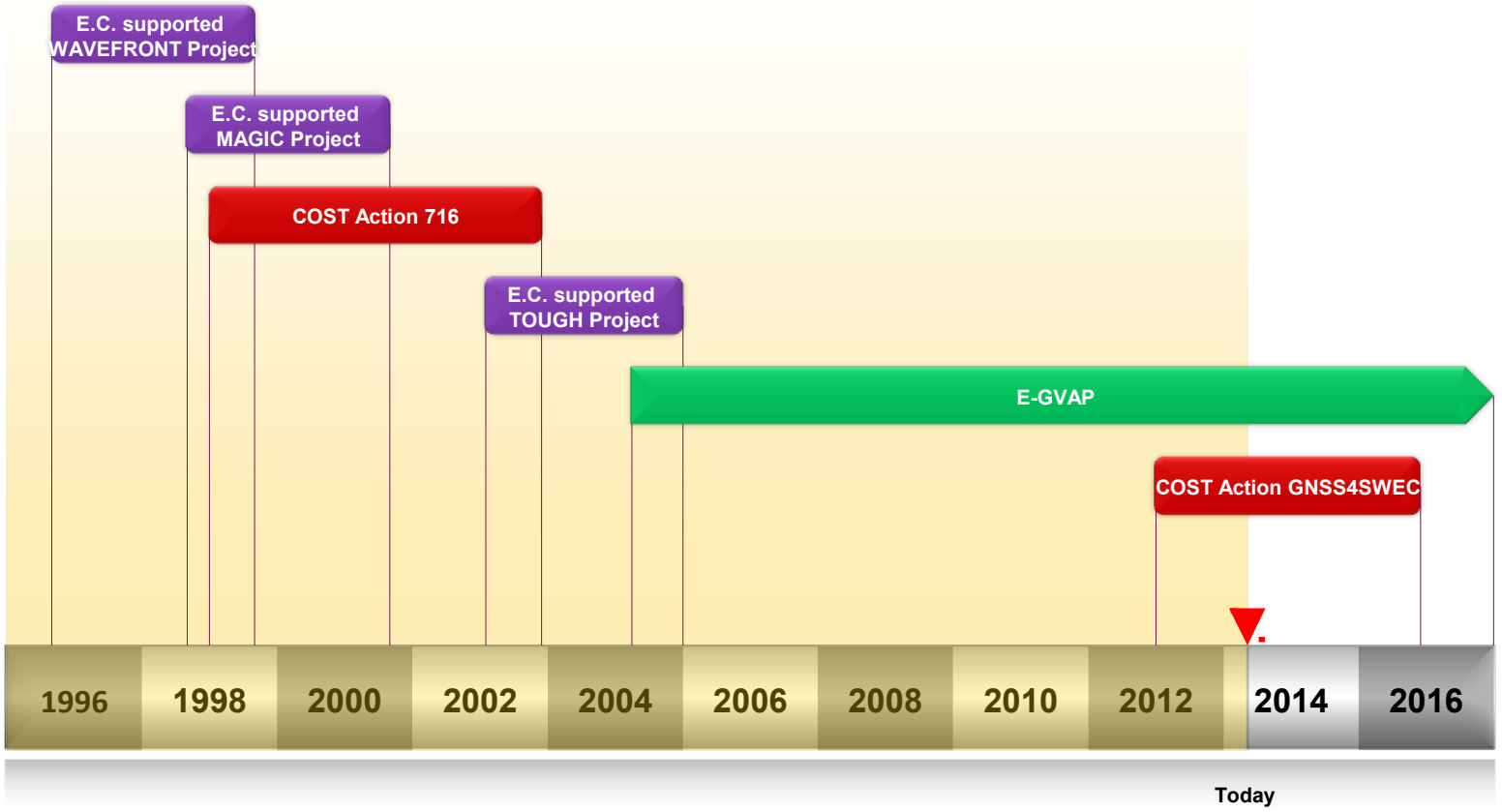
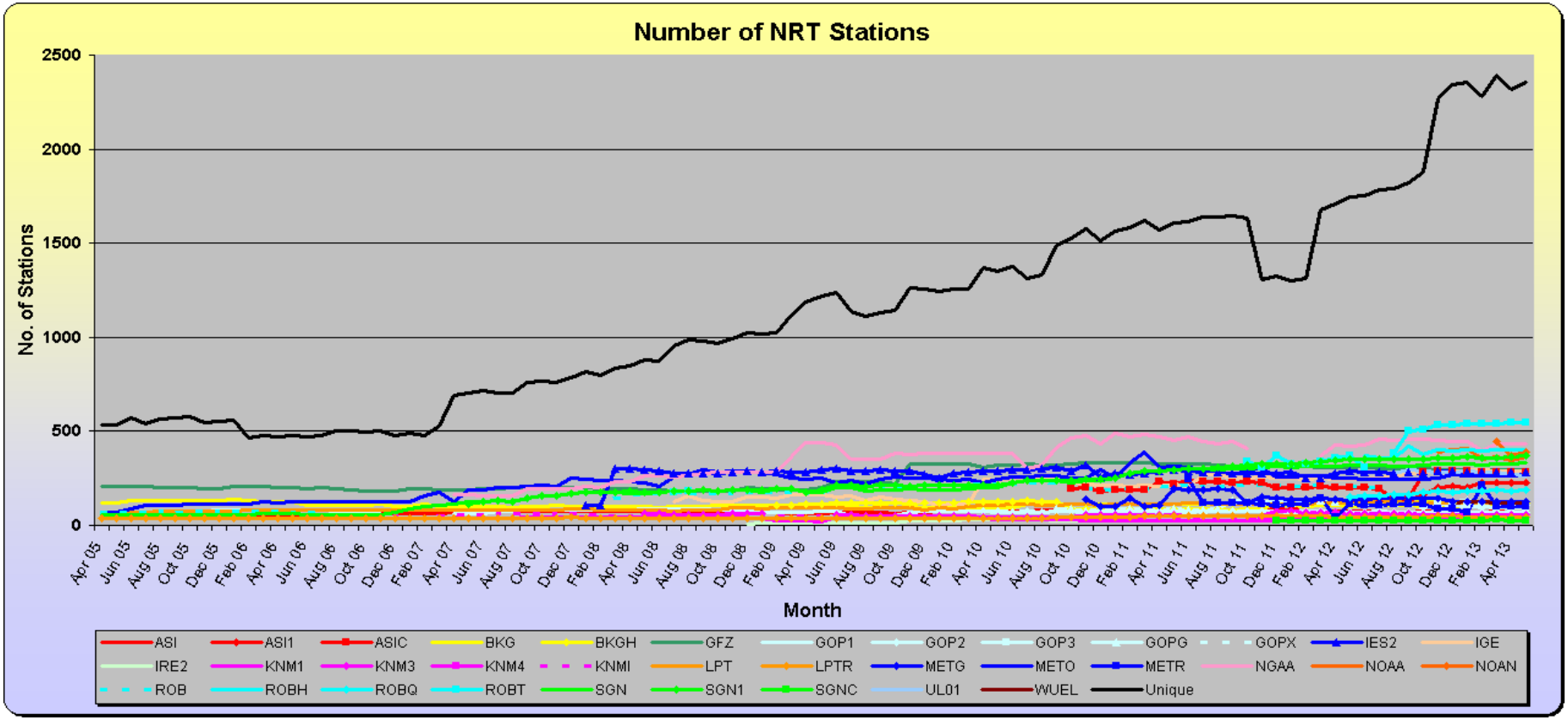
COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

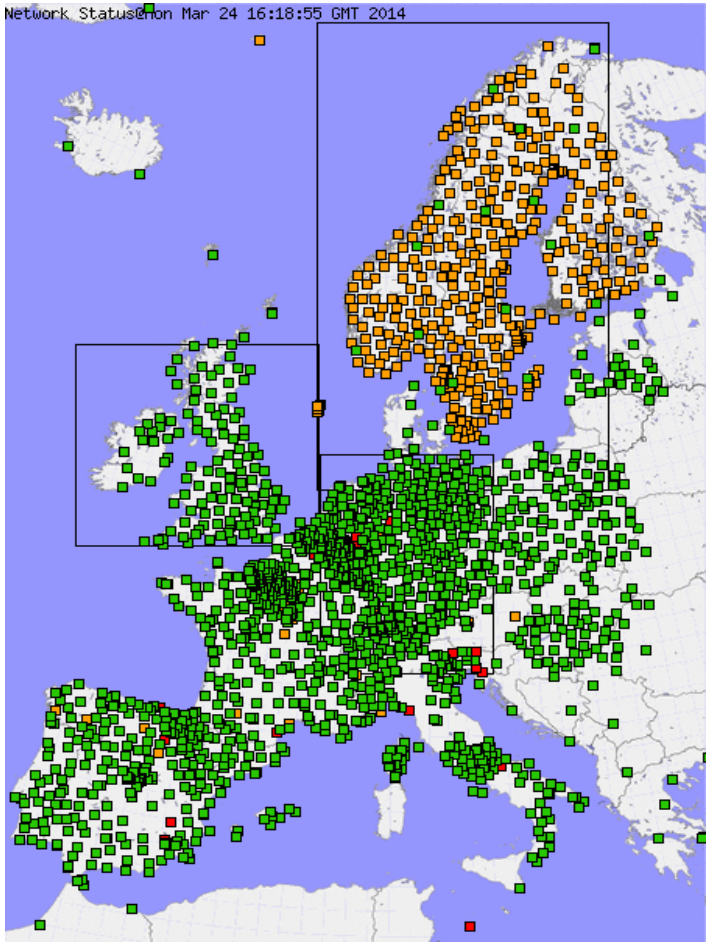
History of European GNSS-met



European NRT GNSS Stations



Current Status – E-GVAP

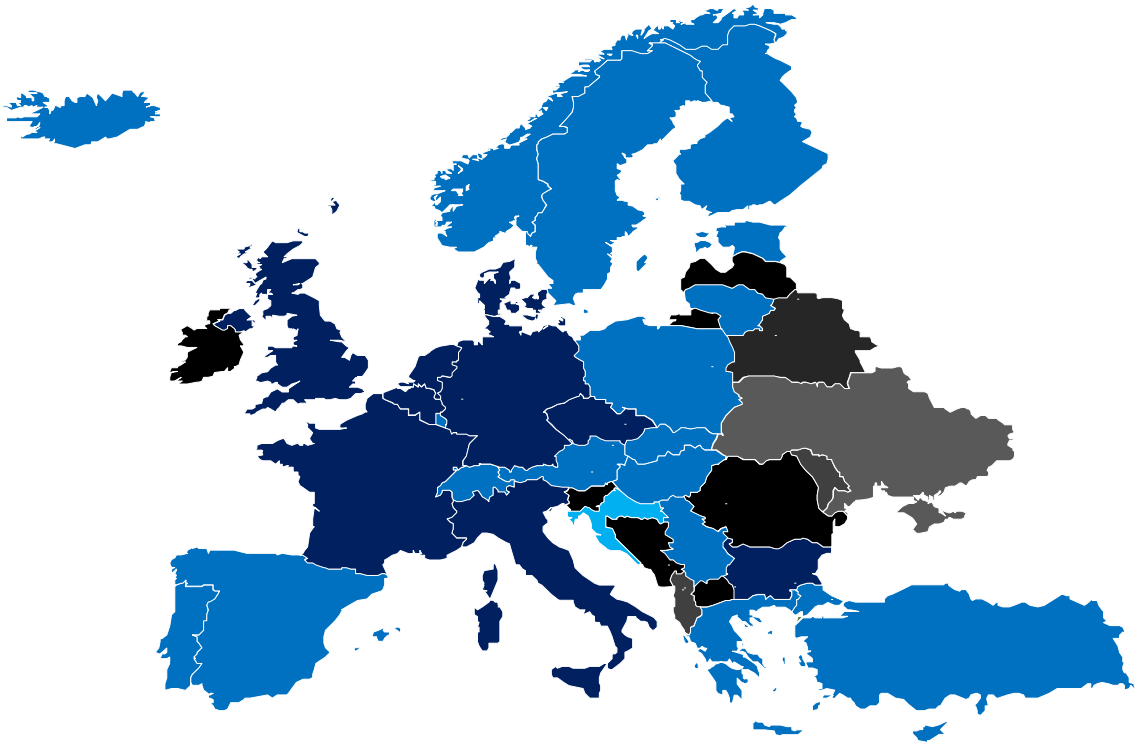


- Focus on delivering **GPS-only hourly processed ZTDs** in 90mins for NWP assim.
- Operational assimilation at a few Euro NMHSs, many others under testing. Use of ZTD has a positive impact on NWP forecast skill
- ~1800 **European** sites' delivering ~14M ZTDs per month
- T and P used for conversion to Integrated Water Vapour (IWV) by some ACs
- MoUs in place for long-term data access
- Data monitoring and Quality Checking in place (+improving)

Reasons for a new COST Action

- New hi-res NWP models and nowcasting require ZTDs with improved timeliness - NTRIP raw data streaming + RT products now available
- New products desired with vertical distribution of water vapour distribution - advanced tropospheric products are available from GNSS R&D community (slants, gradients, RT, single-freq. etc) + multi-GNSS - more SVs, new frequency combinations, new geometries etc
- Climate community starting to use GNSS-tropo products -long-term, homogenised GNSS products are now available (IGS/EPN/CODE/others) for climate analysis

ES1206: GNSS4SWEC



4yr project (2013-2017)

28 COST Countries

130+ Participants from 60+ institutes

7 NCIs (UoNB, IGS, NCAR, UoA, G.Aus, RMIT, UoHK)

1 COST NNC (OTC Tunisia)

Dark+Light Blue: Participating Countries
Dark Blue: Involved in Core Team

http://www.cost.eu/domains_actions/essem/Actions/ES1206

ES1206

- ES1206 will enhance existing and develop new, multi-GNSS tropospheric products, assess their usefulness in severe weather forecasting and climate monitoring, and improve GNSS accuracy via improved atmospheric modelling

- Some of the specific objectives to be addressed are:
  - Coordinate the development of new multi-GNSS solutions
  - Assess the potential of the new GNSS tropospheric products
  - Determine the value of GNSS tropospheric products to climate research
  - Establish a database of reference tropospheric solutions (GNSS+other)
  - Stimulate the use of atmospheric data as an input in real-time positioning
  - Standardize the conversion of ZTD to IWV
  - Stimulate exchange of data and expertise throughout Europe

Working Groups

WG1Advanced GNSS processing techniques: coordinate the activities of the geodetic R&D community to ensure the next generation of GNSS tropospheric products (real-time ZTDs, slants, tomography etc) are applicable for use in meteorology.

WG2 GNSS for Severe Weather Monitoring: coordinate the application of existing and the development of new GNSS tropospheric products for high-resolution rapid-update NWP and forecasting of severe weather

WG3 GNSS for Climate Monitoring: develop collaborative activities between the geodetic community and the climate community and assess the benefit of GNSS for climate research

Action Activities Year 1

- MC Meeting, Brussels, May 2013
- Core Group Meeting, Sept 2013
- MC Meeting, Valencia, October 2013
- Working Group Meetings, Valencia, October 2013
- Core Group Meeting, Prague, Dec 2013
- 'State-of-the-art' Workshop, Munich, Feb 2014
- GRUAN ICM6, Washington DC, March 2014
- Core Group Meeting, Vienna, April 2014

Action Achievements Year 1

- Action website established: http://gnss4swec.knmi.nl/
- 22 sub-groups created within the 3 WGs to coordinate work on specific topics
- Database established for climate validation at GOP, CZ
- Database established for severe weather case studies at UKMO
- 130+ new stations added to operational European GNSS network
- Warsaw University (PL) now processing GNSS in NRT
- Sofia University (BG) soon to be processing GNSS
- Paper defining the state-of-the-art in Europe for GNSS-meteorology in progress
- STSMs

STSMs

Furqan Ahmed	Luxenbourg	France	Impact of Assimilating GNSS-derived ZTD from Luxembourg and the Greater Region into NWP model AROME
Kalev Rannat	Estonia	Germany	Improved processing and use of GNSS Zenith Total Delay and Integrated Water Vapour data for Climatolology
Tomasz Hadas	Poland	Canada	Neutral atmosphere delay model for Precise Point Positioning
Witold Rohm	Poland	UK	Application of GNSS tomography for severe weather studies
Pavel Vaclavovic	Czech Republic	ROB	Developing of ultra-fast tropospheric products
Tzvetan Simeonov	Bulgaria	Luxenbourg	Tropospheric products processing for Bulgarian ground-based GNSS network
Peter Szabo	Hungary	Bulgaria	Tropospheric products from GNSS and ALADIN-Climate regional climate model for East-Southeast Europe
Jan Dousa	Czech Republic	Turkey	Installing new analysis centre for near real-time GNSS troposphere monitoring in Turkey
Jan Dousa	Czech Republic	Greece	Installing new analysis center for near real-time GNSS troposphere monitoring in Greece
Gokhan Gurbuz	Turkey	Hungary	Develop a near real-time GNSS processing system for the Turkish GNSS stations (Istanbul and Ankara).
Karina Wilgan	Poland	Switzerland	Parameterized refractivity models and GNSS path delays in view of GNSS Severe Weather Monitoring
Riccardo Biondi	Italy	Belgium	GNSS atmospheric water vapour detection for extreme events

Action Activities Year 2

- Training School, Varna, Sept 2014
- MC Meeting, Varna, Sept 2014
- Working Group Meeting, Varna, Sept 2014
- Core Group Meeting, ~Jan 2015
- Workshop, Thessaloniki, Apr/May 2015
    - WG1: Ultra-fast and multi-GNSS products
    - WG2: Strengths/weaknesses of NWP in GNSS
    - WG3: Assessment of reprocessed GNSS products
- MC Meeting, Thessaloniki, Apr/May 2015
- Core Group Meeting, Vienna, April 2015

Objectives for Year 2

- WG1
  - Continue the coordination of new GNSS tropospheric products
  - Develop models which use NWP data as input into RT GNSS processing
- WG2
  - Evaluate the quality and assess the impact of new GNSS products (slants, gradients etc) for severe weather
  - Populate Severe weather database
- WG3
  - Develop diagnostic tools for quantifying climate trends and variability
  - Assess impact of reprocessed GNSS tropospheric products in NWP reanalysis and in climate models
  - Continue to populate climate database and push for better connection with climate community

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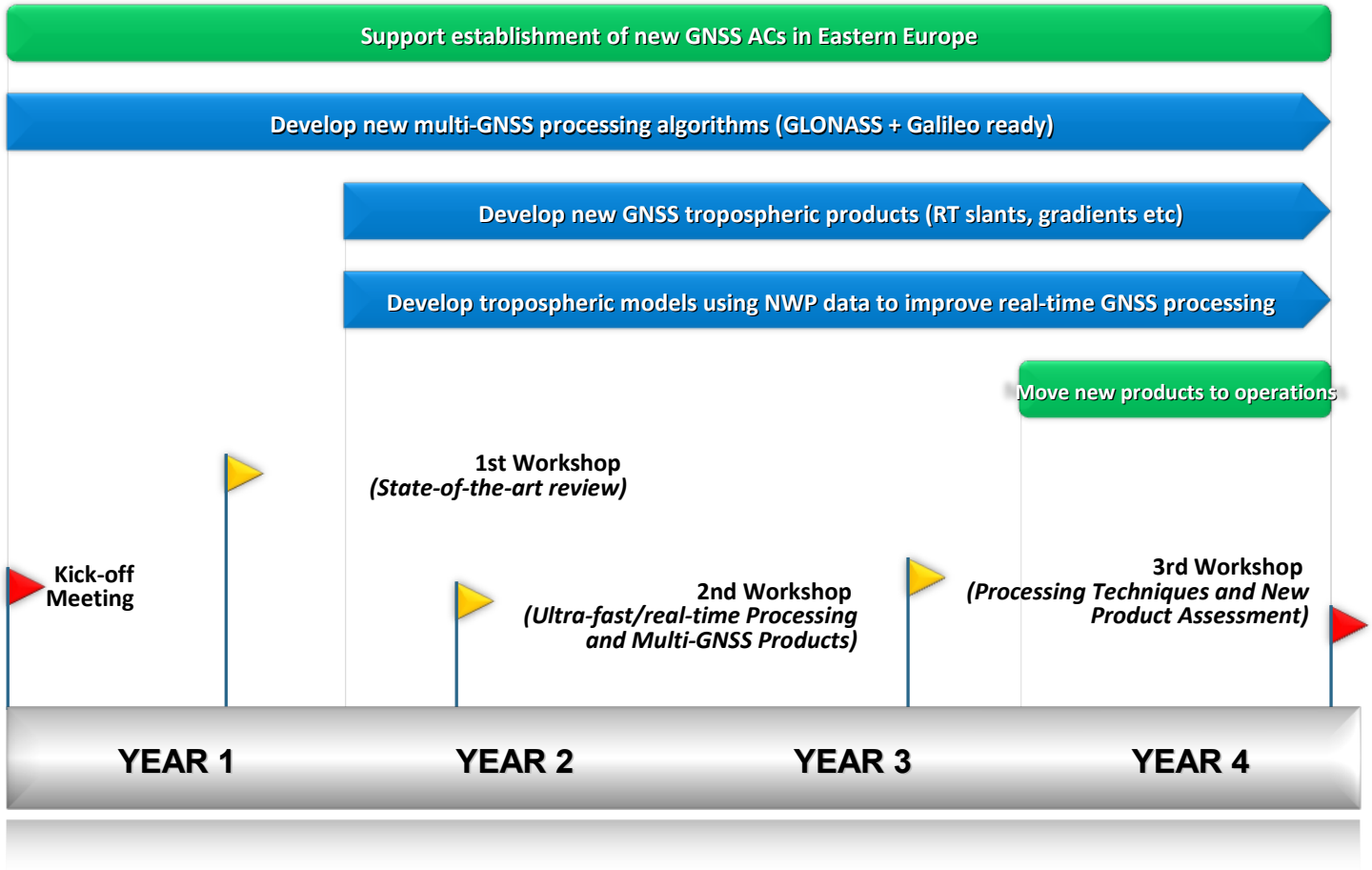
WG1 Objectives



Green = Guidelines/reviews, Blue = Developments, Purple = Databases

WG2 Objectives

DB of NWP data for positioning

DB of Sev. Weather case studies

Define user requirements

Evaluate quality of new GNSS processing algorithms (incl. GLONASS)

Evaluate new GNSS tropospheric products (gradients, slants etc)

Develop and test methods for init. of NWP models with the new products

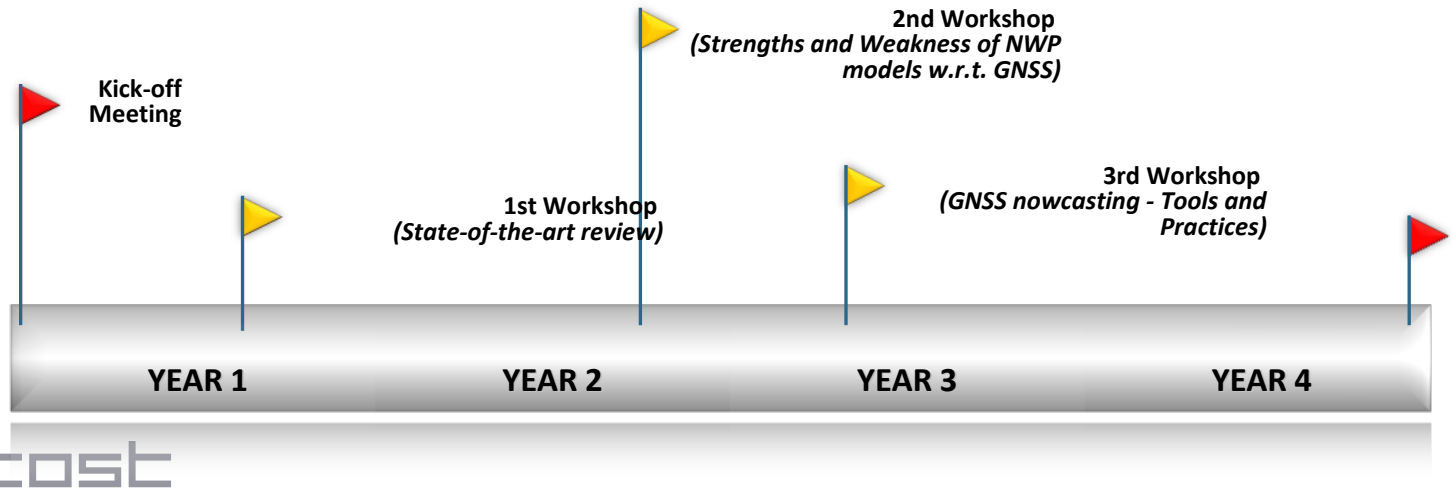
Set up databank (obs.+products) for S.W. case studies

Test impact of new GNSS tropospheric products for selected severe weather case studies

Develop operational tools for severe weather forecasting

Q.C. of new operational GNSS tropospheric products

Recommendations (Q.C. etc)



WG3 Objectives