COST-716, EUMETNET and possible role of EUREF

Hans VAN DER MAREL, Elmar BROCKMANN

Delft University of Technology, Aerospace Engineering (DEOS/MGP) Netherlands

swisstopo
Wabern, Switzerland
COST-716 Action

Exploitation of Ground-Based GPS for Climate and Numerical Weather Prediction Applications for Europe

- Action in force September 1998 (duration 5 years)
- Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Netherlands, Norway, Spain, Sweden, Switzerland and UK.
- 4 working groups:
  1. State of the art….
  2. Demonstration project….
  3. Applications…
  4. Towards operational…
- Workshops:
  1. 1st Workshop 10-12 July, 2000, Oslo, Norway
  2. 2nd Workshop 28-29 January, 2002, Potsdam, Germany
  3. 3rd Workshop 1-3 December, 2003, De Bilt, Netherlands
- Action finished April 2004
NRT demonstration

Started March 2001

Status March 2004:
- 420 stations
- 10 operational ACs:
  - GFZ, GOPE, IEEC, ASI, LPT, NKG, NKGS, ACRI, SGN, BKG

http://www.knmi.nl/samenw/cost716.html
NRT analysis centers

GPS analysis centers which contribute to the NRT demonstration are:

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACRI</td>
<td>ACRI Sciences de Terre, Valbonne, France</td>
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<tr>
<td>ASI_</td>
<td>Agenzia Spaziale Italiana, Matera, Italy</td>
</tr>
<tr>
<td>BKG_</td>
<td>Bundesamt für Kartographie und Geodäsie, Frankfurt, Germany</td>
</tr>
<tr>
<td>GOPE</td>
<td>Geodetic Observatory, Pecny, Czech Republic</td>
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<tr>
<td>GFZ_</td>
<td>GeoForschungsZentrum, Potsdam, Germany</td>
</tr>
<tr>
<td>IEEC</td>
<td>IEEC, Barcelona, Spain</td>
</tr>
<tr>
<td>LPT_</td>
<td>Federal Office of Topography, Wabern, Switzerland</td>
</tr>
<tr>
<td>NKG_</td>
<td>Nordic Geodetic Commission - Statens Kartverk, Norway</td>
</tr>
<tr>
<td>NKGS</td>
<td>Nordic Geodetic Commission - Onsala Space Obs. Sweden</td>
</tr>
<tr>
<td>SGN_</td>
<td>Institut Geographique National, Paris, France</td>
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Different processing strategies and software are used.
NRT GPS data providers

GPS data providers which contribute to the NRT demonstration are:

- International GPS Service (IGS)
- EUREF Permanent GPS Network (EPN)
- National Mapping Agencies (OS,BKG,SAPOS,SWEPOS,NMA,LPT,...)
- National Meteorological Services (Met.Office, DWD, ...)
- Universities and research networks
- Private companies

GPS data collection is handled by the analysis centers:

- uses IGS and EPN data centers, completed with several local data centers, resulting in a dense network
- analysis centers often have access to unique sources of data which are otherwise not available to the public
- analysis independent from EPN and IGS
COST716 Data Flow

- AC’s compute ZTD (Zenith Total Delays) in hourly batches
  - Download GPS data from various data providers (15 –20 min)
  - Processing, each AC use different strategies/software (20-25 min)
- ZTD within 1h45m to UK Met Office in the COST format (ftp)
  - Acts as a gateway to participating meteorological institutes
  - Converted into BUFR format (used on the GTS)
    - Operational since beginning of March 2004!
    - ZTD data is filtered (only IGS, EPN and those stations w/ permission)
- Ftp-mirror at TUD/Delft (holds the full archive)
- The ZTD is converted to IWV at KNMI using
  - Measured pressure and temperature at GPS site
  - Pressure and temperature interpolated from nearby synoptic sites
  - Displayed on the WWW; IWV data available by ftp
    - http://www.knmi.nl/samenw/cost716.html
- The ZTD are used for NWP assimilation trials by WG/3
Number of COST 716 stations
Delay for 75% of Observations to Arrive
COST 716 conclusions

- Demonstration experiment exceeded expectations!!
- Shown to meet operational requirement in terms of timeliness and accuracy
- ZTD’s are used directly for NWP (no combination), must be available in 1h 45m (> 70% of the data)
- Timely available GPS data is essential for success
  - on a continental or global scale (NRT reference network)
  - on a local scale for the necessary density
  
  *But improvement still needed (gaps in network, reliability and latency)*
- Slight positive impact in case of heavy precipitation
- Extremely valuable data for validation and monitoring
- New nowcasting applications
The way ahead...

- Research continued within TOUGH project (2003-2006)

- EUMETNET project proposed at COST final workshop
  - Organisation of National Meteorological Services
  - Special project proposed to take actions to prepare the European GPS water vapour network to function operationally
  - Proposal written by John Nash (Met.Office)
  - 3 year project to be started in 2005

- Organise a geodetic interface to the EUMETNET project*)
  - Task given to Hans van der Marel, Elmar Brockmann, Hans-Peter Plag and Gerd Gendt by the COST 716 MC
  - Suggested to contact EUREF and IGS first
  - Letter of COST 716 chair to EUREF/TWG chair

*) the mandate is a little broader: the complete meteorological community

EUREF TWG Meeting, Budapest, Hungary, March 22-23 2004
Targeting Optimal Use of GPS Humidity Measurements in Meteorology

Shared-cost project co-funded by EU (5th framework programme)

Objectives
- Optimise assimilation of GPS ZTD into NWP
- Methods for derivation and use of GPS slant delays
- Run a research mode data collection (cont’ of COST 716)
- Investigate benefit of using GPS-data into NWP

Partners:
- Met.Services: DMI (DK), SMHI (SE), Met Office (UK), INM (ES), KNMI (NL), FMI (F)
- Analysis Centers: ACRI-ST (F), Chalmers (SE), NMA (N), ASI (I), IEEC (ES), Swiss Topo (CH), GOP (CZ)
- Universities: L’Aquila (I), Delft (NL) and Purdue (US)

Started February 2003 and runs through January 2006
EUMETNET (E-GVAP) Objectives

- Take actions to prepare and coordinate future operational processing of GPS water vapour on both European and national scales
- Transfer from research funding to operational service as fast as possible in liaison with the geodetic community
- Suitable standards for processing will be agreed with the geodetic GPS community (incl. naming)
- Establish a data hub for GPS ZTD and quality monitoring facility
- Activities will be designed to improve meteorological collaboration with operators of national GPS sensor networks,
  - by sharing facilities for reducing operational costs
  - by providing feedback of meteorological data
- Liaise with geodetic data processing centers to establish a long term policy for processing operational GPS water vapour measurements, and to co-ordinate national/regional processing efforts to ensure availability of data from the whole of Europe
- Promote methods of introducing the use of GPS water vapour measurements to operational meteorologists
EUMETNET (E-GVAP) Organisation

- Run by a responsible member providing a PM
- Operational liaison group to manage interaction with the wider GPS sensing community
- Expert team on data processing and standards
- Expert team on promoting the use of the observations
- Financial costs per year
  - PM 30k
  - Liaison group meetings 15k
  - Expert team meetings 10k
  - Contract to support hub/central processing 30k
  - Project travel 10k
Potential benefits for GPS community

- **Cost sharing**
  - Common stations
  - Communications

- **NRT quality monitoring hub**

- **Use of meteorological products**
  - Pressure for atmospheric loading effects
  - Pressure to compute a-priori ZTD for GPS processing
  - Mapping functions from numerical weather models
  - Atmospheric delay corrections for Network RTK

- **Use of meteorological services**
  - Calibration of pressure sensors
  - Management of meteo equipment at GPS sites by NMS
What could be EUREF’s role?

- Several areas of shared interest have been identified
- Possible benefits for EUREF and the contributing partners
- EUREF has been progressing as well
  - EUREF is already going towards (Near) Real-time
  - EUREF is already “densifying” (Certification initiative)
  - EUREF is becoming the reference for GPS in Europe at large, implicit and explicit standardization

Should there be a role for EUREF?, how to do it?

- EUREF TWG could play a coordinating role and liaise with the analysis centers (Special WG? Troposphere WG? role of AC workshops?)
- At the symposium most of the major GPS providers (NMA, others) are represented
- Open for discussion