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Developments of the EUREF GNSS Services and Reference Networks

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Outline

- **Definition and Realization of European Geodetic Reference Systems**
- **EUREF's activities in alignment to IAG strategy**
- **Long Term Assurance of IAG Services**
- **Conclusions, Summary**

(1) Definition and Realization of European Geodetic Reference Systems

EUREF

- Sub-commission 1.3a of the International Association for Geodesy (IAG)
- Works on the "best effort" (voluntary) basis and provides all its data and products free of charge to the public

ETRS89 (European Terrestrial Reference System 89)

- The datum is fixed to the stable part of the European Plate at the epoch 1989.0 based on EUREF GNSS Permanent Network in ITRFxx
- European Commission adopted ETRS89 as the geodetic reference for geo-referenced information of the EC

EVRS (European Vertical Reference Frame 2007)

- Related European Vertical Datum (NAP), realized by the United European Levelling Network (UELN)
- The use of EVRF 2007 vertical reference by EC geographic data is planned.

EPN is the Densification of ITRF2005 and the Realization of ETRS89

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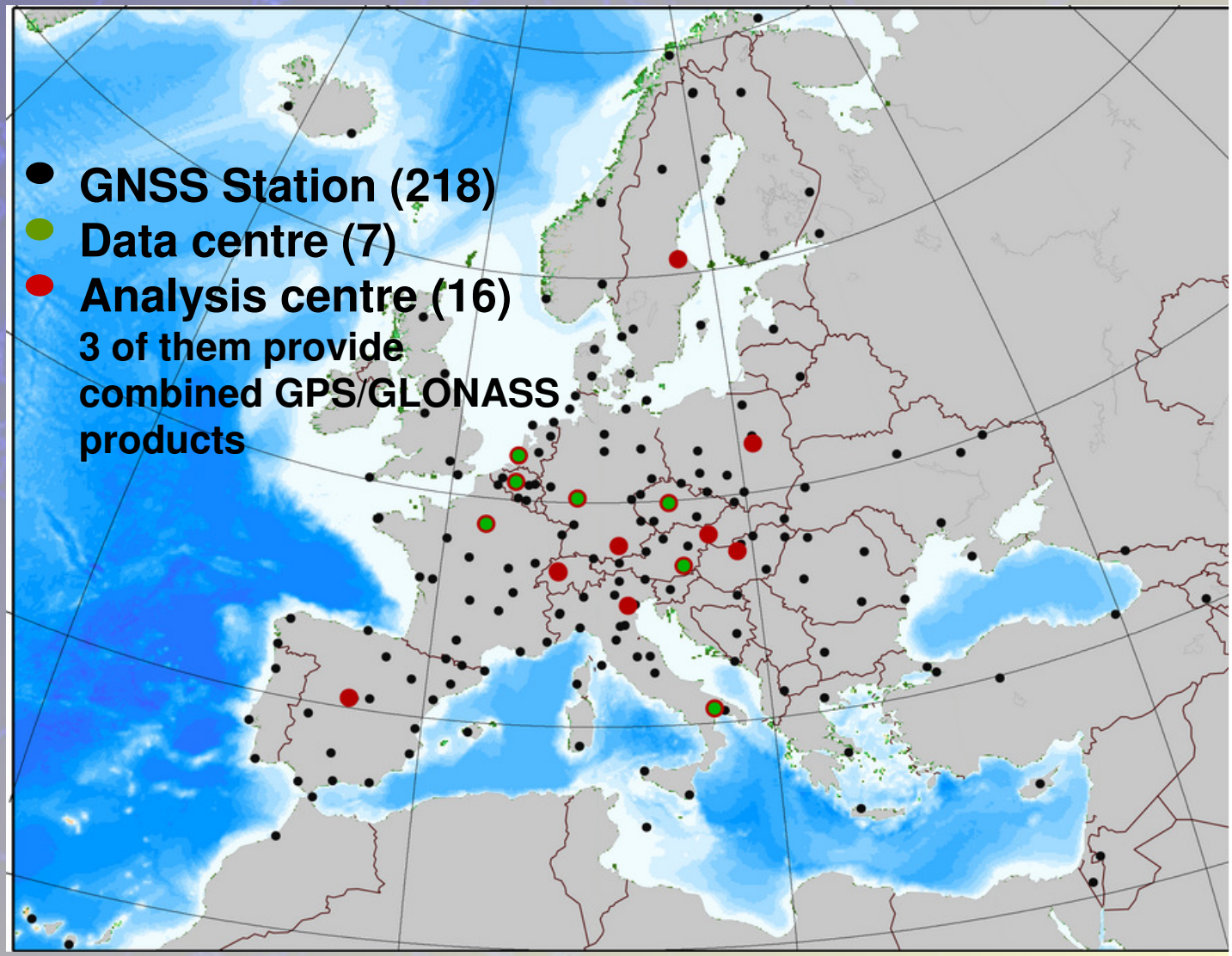
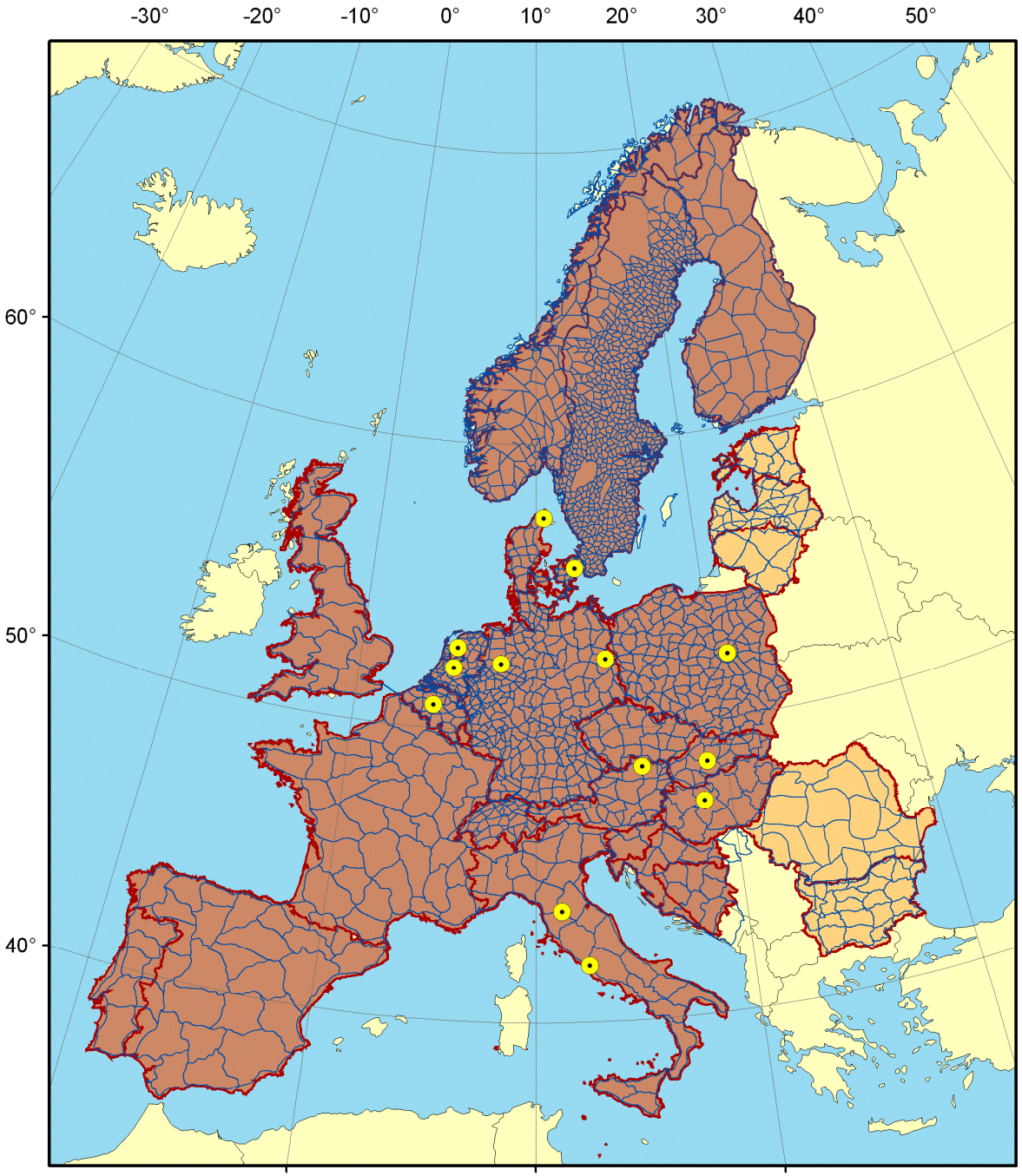
- 218 permanent GNSS stations (80 GPS/ GLONASS)
- 87 of them are IGS stations
- 38 European countries are covered
- About 100 contributing agencies & univ. (altogether 130)





UELN lines and datum points of EVRF2007

No. of datum points: 13

No. of nodal points: 800

Accuracy: 1.1 mm per km

Datum points of EVRF2007

Extension of UELN

up to 1998

as from 2003

UELN lines

Outline

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- Definition and Realization of European Geodetic Reference Systems
- **EUREF's activities in alignment to IAG strategy**
- The Need for Sustainability of IAG Services
- Conclusions, Summary

EUREF Regional Densification of ITRF2005

- Using the cumulative solution of EPN weekly results to realise a European densification of ITRF2005
- Providing a “reference coordinate and velocity list” in ITRF2005
- Transformed to ETRF00

EPN Re-processing

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Motivation/Experiences

- Improvement of EPN time series
- Improved models for data analysis
- Decreased sensitivity of antenna problems
- Decreased seasonal amplitudes
- Long-term periodic signals of several stations disappeared

Objective:

- Densification of ITRFxx
- Realization of ETRS89
- European 3D-velocity field

Actions:

- Pilot re-processing done in 2007/08 by MUT* and ROB
- Project on the basis of PDR05 is in work (TU Dresden, BKG)
- "Official" EUREF re-processing will follows the IGS schedule and standards (2009-10)
- Continuously re-processing for EPN monitoring

* Military University of Technology, Warsaw

EPN Real-time activities (EUREF-IP)

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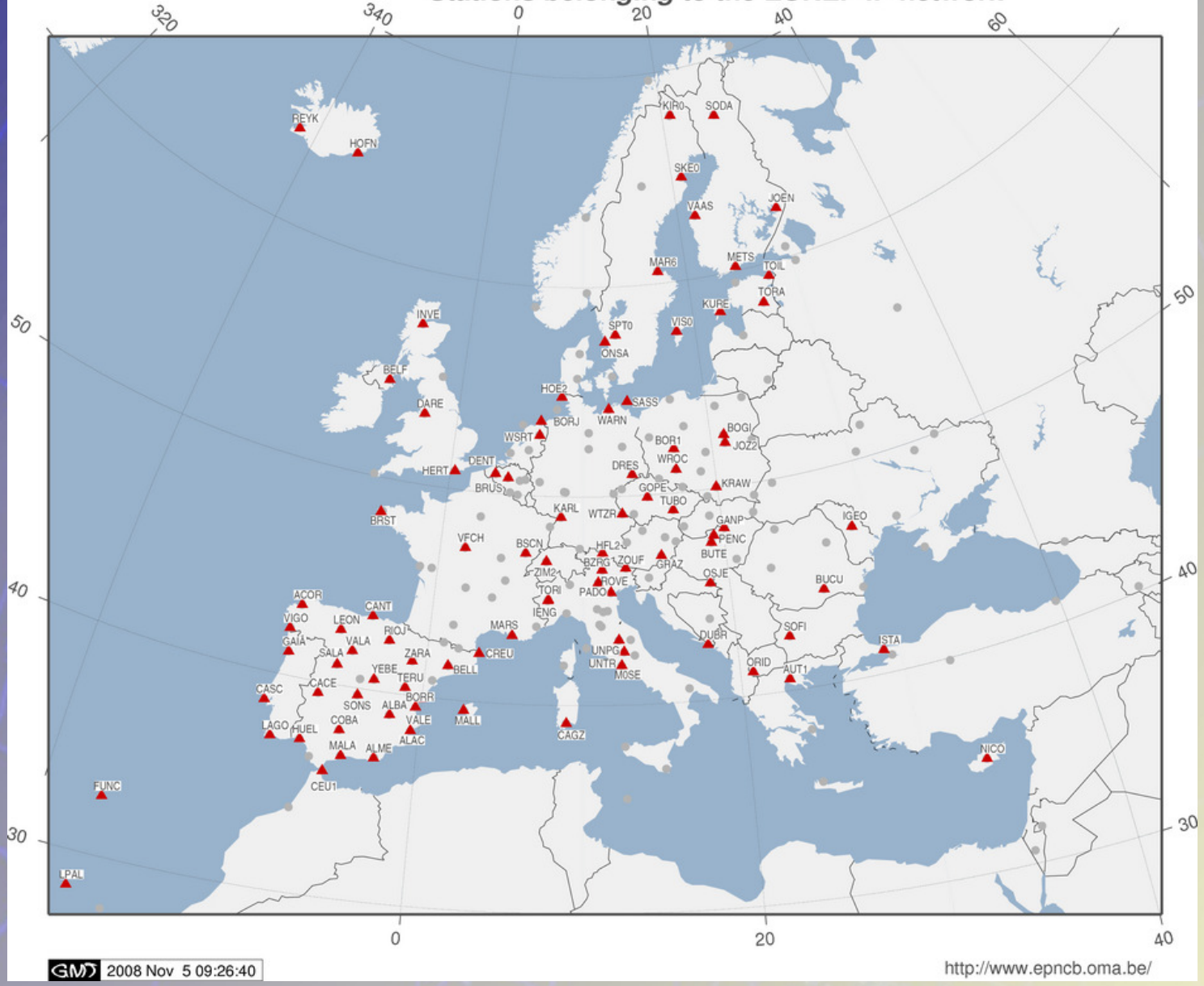
GNSS real-time data streaming has been successfully developed within EUREF

- Special Project "EUREF-IP" was created in 2002
  Goal: DGNSS infra-structure through the Internet
- Meanwhile, wide range of geodetic receivers equipped with Ntrip ("Networked Transport of RTCM via Internet") technology
- Currently (Nov, 5) 96 EUREF Permanent Network (EPN) stations (out of 218) with real-time capability (52 of them GPS+GLONASS)
- EPN data streams are received at central broadcaster which provides the users with access to the streams
- SP EUREF-IP moved towards EPN routine operations at the end of 2007

EUREF Permanent Tracking Network

Stations belonging to the EUREF-IP network



EUREF Real-Time GNSS Product Area

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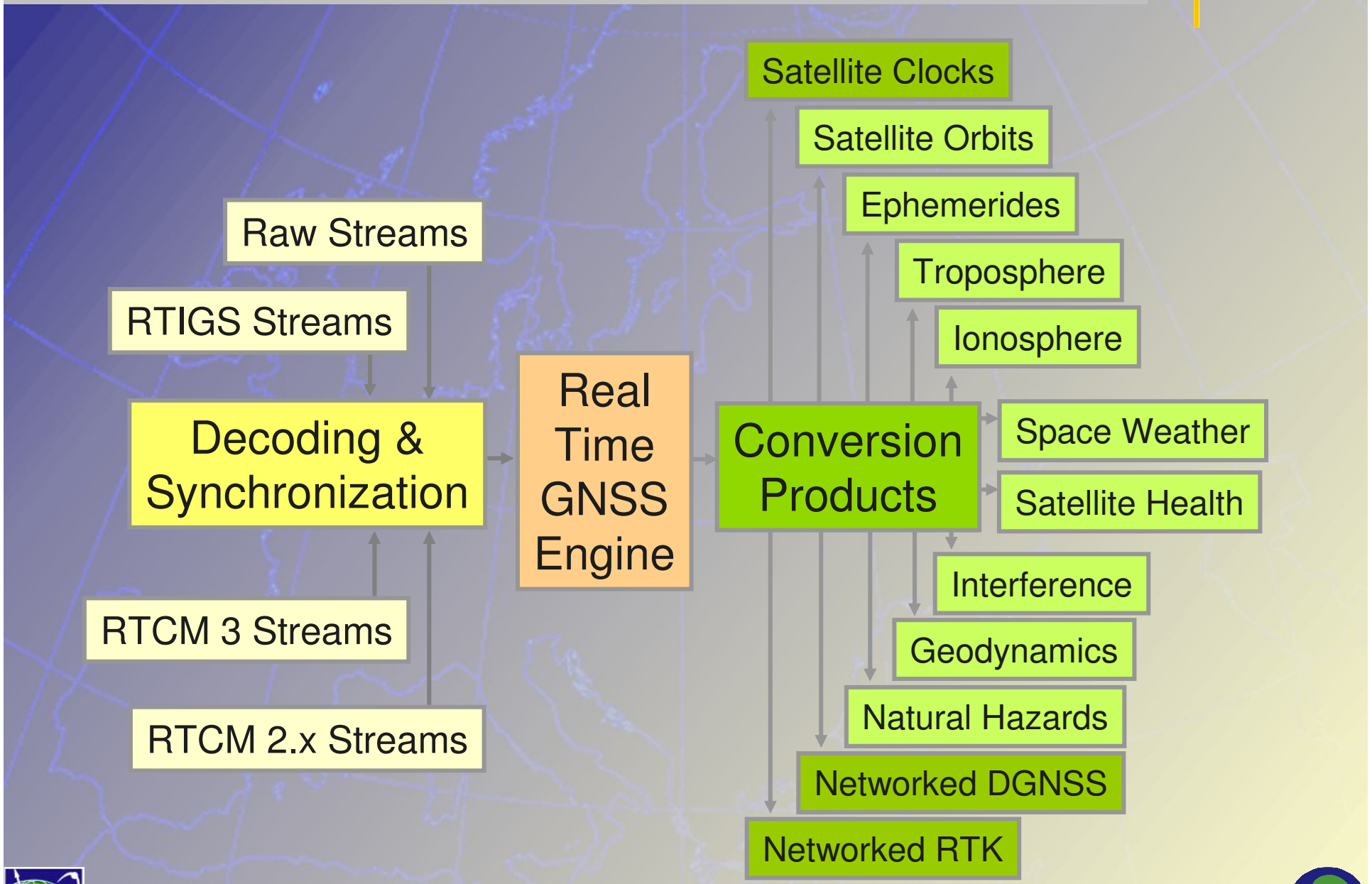

Example: GNSS RT Application for Geohazard Monitoring

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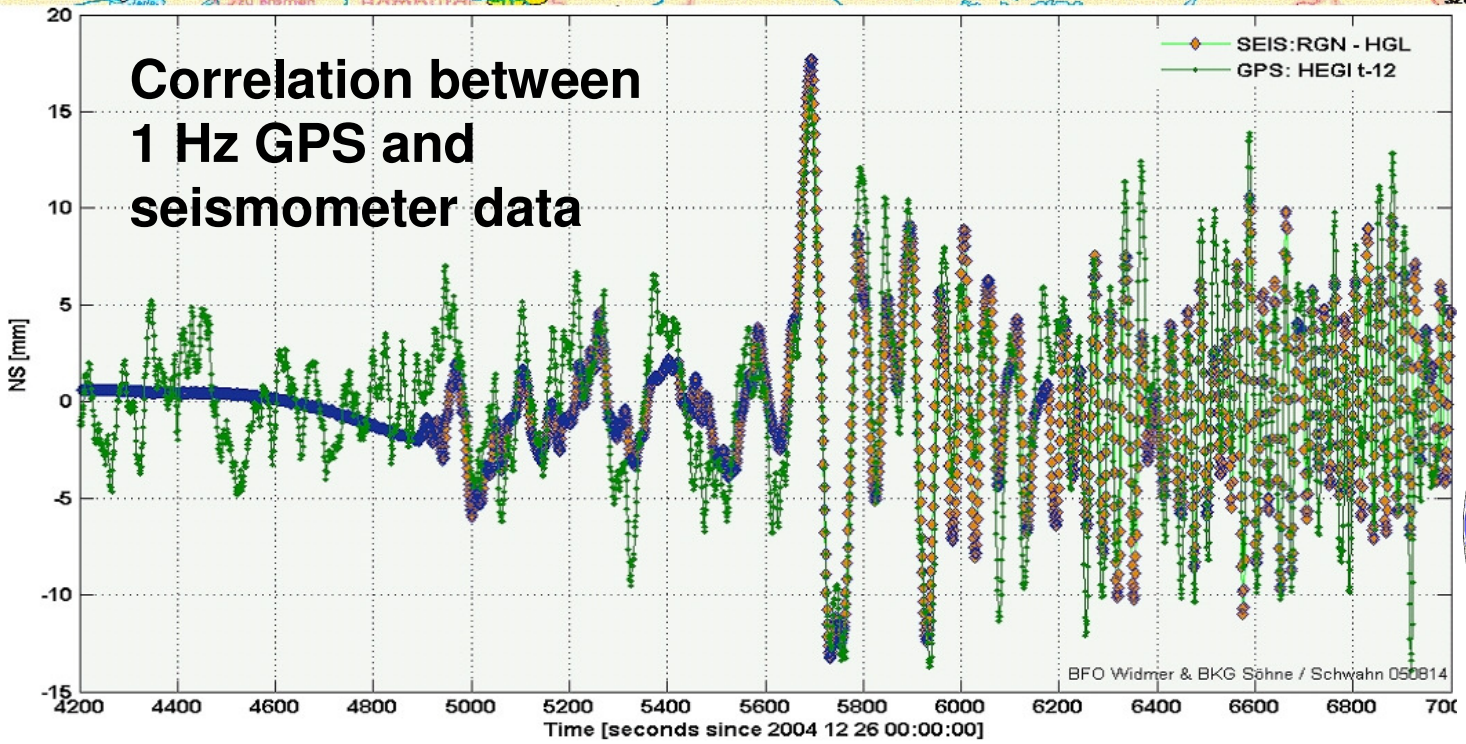
The Love wave caused by the Sumatra-Andaman earthquake has reached Germany approx. 5530 seconds since 00:00:00 UTC, Dec 26, 2004 from the East direction after a travel time of approx. 2000 seconds.

IGS station Helgoland

1 Hz GPS data, Bernese Software 5.0, kinematic mode



European Combined Geodetic Network – ECGN
A Regional GGOS Component

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- 21 countries
- 74 stations

With

- GNSS (EPN)
- absolut gravity
- levelling to EVRS
- 6 super coducting grav.
- 15 tide gauges

- 8 ECGN core
- 42 ECGN
- 7 candidate
- 15 proposed

Status and Techniques (Standard: GPS, absolute gravity, levelling)

core station	●	super conducting gravimeter	○
station	•	tide gauge	△
candidate station	■		
proposed station	✦		

(Addendum from 2007 ICG-2)

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Is there a need

- **for the creation of a legal basis for International Geodetic Reference Systems**
- **through an International Treaty**
- **prepared by ICG?**

Background

IAG

- **created as "Mitteleuropäische Gradmessung" in 1862**
- **changed in "Internationale Erdmessung" in 1889**
- **works on the basis of an International Treaty between Prussia and German and Non-German member states**

- **was closed in 1917 and lost its legal basis**
- **continued 1931 as non- governmental organization through foundation of Section Geodesy as part of IUGG**

(Section Geodesy was renamed 1932 in IAG).

(4) Long Term Assurance of IAG Services
Present Situation

- The IAG Services and Commissions currently organized on a voluntary basis are the key components for all global geodetic activities
- The IERS, IGS and the IVS play special roles in the current IAG structure by their well-rehearsed interactions with international organisations and scientific unions
- The existing geodetic IAG Services are the building blocks for the infrastructure and products of Global Geodetic Observing System (GGOS) of IAG which will be serving GEOSS, and provide contributions to the scientific community and to the public
- However the geodetic reference system activities are not supported for the time being by long-term international agreements

(4) Long Term Assurance of IAG Services

In our own matter - Geodetic Observatories

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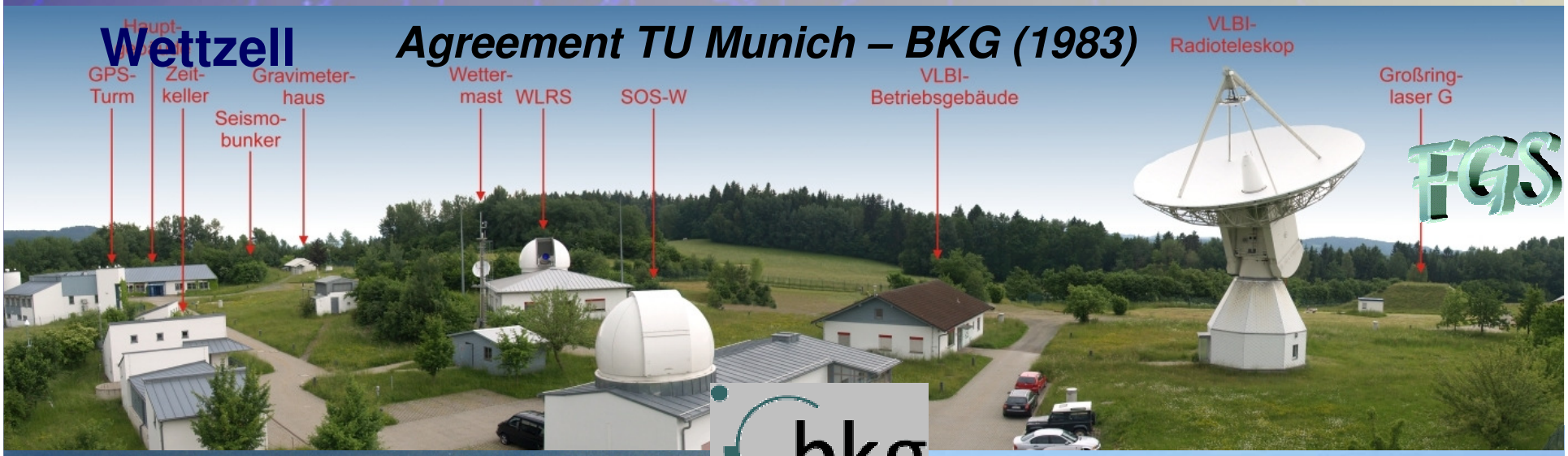
BKG and TU Munich consider sustainability of the IAG Services and availability of the necessary infrastructure as a key element for the long term success of geodetic services



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(4) Considerations, Conclusions, Summary

- The long term assurance of the IAG Services can be improved only when the organisations responsible for the IAG Services will bindingly agree on a joint strategy
- The operational components of IAG and GGOS should be further developed to intergovernmental tasks (under the umbrella of IAG)
- Governmental agencies should come together to discuss and decide on the sustainable availability of geodetic services and their integration into GEOSS
- (Remark: As GEOSS is an intergovernmental organizations they would at the same time facilitate the entrance of GGOS to these body. In return the governmental agencies should be given the possibility of actively shaping the organisational structure)

(4) Summary

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EUREF

- supports the IAG (IGS, GGOS, …) items in EUROPE
- will certainly be an important partner in the implementation of INSPIRE (EC), GGOS (IAG), GEOSS (GEO)
- Assistance in developing standards for monitoring GNSS networks (NTRIP, EUREF-IP)
- Develops of GNSS real-time applications in geodynamics
- Supports for Site Quality, Integrity and Interference Monitoring in real time and post-processing mode

www.euref-iag.net

www.euref.eu