The Implementation of the ECGN Stations – Status of the 1st Call for Participation

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EUREF Symposium 2004
Bratislava, June 2-4

European Combined Geodetic Network - ECGN

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Contents

(1) Objectives and History
(2) 1st Call for Participation, Validation of the Proposals
(3) ECGN Standards, Guidelines
(4) Present Status, ECGN Meta Data Base
(5) Conclusions for Continuation, Data Analysis, 2nd Call

(1) Objectives

ECGN

Integrated European Reference System for Spatial Reference and Gravity

- Maintenance of long time stability of the terrestrial reference system with an accuracy 10^{-9} for Europe especially in the height component
- In-situ combination of geometric positioning (GPS) with physical heights and other Earth gravity parameters in 1 cm-accuracy level
- Modelling of influences of time depended parameters of the solid Earth of the Earth gravity field, the atmosphere, the oceans, the hydrosphere for different applications of positioning

- **Contribution to the European gravity field modelling as contribution to a global gravity model**
- **Modelling of gravity field components to validate the satellite gravity missions CHAMP, GRACE und GOCE**
- **Platform for further geo-components (GMES, GEOSS, GGOS)**

European Combined Geodetic Network

A common project of

- **IAG Sub-Commission for Europe EUREF (IAG SC1.3a)**

And

- **IAG Inter-Commission Project *Vertical Reference Frames* (ICP1.2)**

With connections to

- **European Gravity and Geoid Project (IAG CP 2.1)**
- **EuroGeographics and the Joint Research Centre (JRC) of the EC - INSPIRE**
- **Bureau International des Poids et Mesures (BIPM), absolute gravimeter comparison campaings (under discussion with BIPM)**

History

- ECGN Working Group – Jan. 2003
- 1st call for Participation – April 2003
- 1st Meeting of ECGN WG – September 2003
- Letter to ECGN organisations – Nov. 2003
- Reminder – March 2004
- 2nd Meeting of ECGN WG – May 2004

(2) 1st Call for Participation: Implementation of ECGN Stations

This call concerns the elaboration of the observation network of ECGN stations with the standard observation techniques:

- GNSS (GPS/GLONASS, GALILEO) – permanent
- Gravity (super conducting gravimeter and/or absolut gravimeter) – permanent or repeated
- Levelling connections to the of UELN/EVRS – repeated
- Tide gauges – permanent
- Meteorological parameters – permanent.

Validation of the 1st Call proposals

(ECGN Working Group Meeting, EUREF Symposium 2003, Toledo/ September 4-5, 2003, Frankfurt/Main)

- Agreement about the criteria to evaluate the proposals of the 1st call and discussed the individual proposals
- Validation of the proposed stations
- Discussion of the ECGN standards
- Letters to the organisation participating ECGN

- describing the status of their stations within ECGN,
- questions for further details concerning the ECGN stations,
- the technical guidelines and forms for the different observation techniques and the ECGN meta data base.

ECGN Station Status (26-May-2004)

- **Proposed: 72 Stations in 20 European Countries**
  - 8 core
  - 42 ok
  - 7 candidate
  - 15 proposed

  Two European stations with super conducting gravimeter were not proposed.
- **Criteria for the four categories:**
  - core station - if criteria for ECGN are fulfilled and there are additionally some special conditions like fundamental station/observatory and/or measurements of SG exist
  - station ok - if criteria are fulfilled at present or will fulfilled in the future e.g. are planed
  - candidate station - few of the criteria are not fulfilled (e.g. perm GPS not yet realised)
  - proposed station - some more criteria are at present and perhaps will not be fulfilled in the future.

core station
station
candidate station
proposed station
super conducting gravimeter
tide gauge

ECGN status 1st call proposals

- 20 countries
- 72 stations with

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

(3) ECGN Standards and Guidelines (i)

- for each main observation technique (GPS, gravity measurements, levelling, tide gauge) guidelines and forms for acquisition of data were prepared
- they include details about the execution of measurements, the expected accuracy as well as information about collecting of data
- generally already existing data bases will be used for ECGN project

Guidelines (ii)

- **GPS**
  - all ECGN stations should be included to the European Permanent GPS network (EPN)
  - therefore the stations have to fulfil the requirements of EPN.
  - Standards for GPS EPN Stations (see EPN Central Bureau (see: http://www.epncb.oma.be)
- **Gravity measurements**
  - ECGN Standards for absolute gravity measurements (see ECGN Website – PDF File)
  - for the absolute gravity measurements a own data base will be established.
  - Standard for SG observations - Global Geodynamic Project GGP (see: http://www.eas.slu.edu/GGP/ggpas.html)

Guidelines (iii)

- **Levelling**
  - all ECGN stations should be connected to the United European Levelling Network - UELN (see http://evrs.leipzig.ifag.de)
  - the rules for connection the ECGN station to UELN are described in the guideline and the corresponding measurements data should be registered in the ECGN Levelling Form
  - ECGN Standards Levelling Connection of the ECGN Station and Levelling Form (see ECGN Website – PDF/DOC File)
- **Tide Gauges**
  - for Tide Gauge measurement the data of Permanent Sea Level Observing System (PSMSL) (http://www.pol.ac.uk/psmsl/datainfo/contrib.html) and the project European Sea Level Service (ESEAS) shall be used
  - ECGN Standards for Tide Gauge measurements (see ECGN Website – PDF File)

Guidelines (iv)

- **Local Ties**
  - the observation of different techniques should be in a close range according to the conditions of the ECGN station
  - each type of observation has its own marker and one marker has to be declared as main marker
  - to this marker the local ties have to be known
  - ECGN Standard for Local Ties Determination (see ECGN Website – PDF File)

2nd ECGN Working Group Meeting, Walferdange, May 17-18, 2004

Agenda:

1. Actions since the 1st ECGN Working Group meeting
2. Status of the establishment of the ECGN stations, possible complements of the network
3. Topicality of the guidelines for the different measuring techniques
4. Questions of the organization of the absolute gravimeter measurements and comparisons
5. Establishment of the database for absolute gravimeter measurements
6. Preparation of the 2nd Call for Participation

(4) Present Status, ECGN Meta Data Base

- **Meta Data**
  - in general the ECGN project based on existing data
  - only the information about the data i.e. meta data should be collect
  - therefore in the meta data form the availability of the data and the access to the data should be described
  - the local ties are also a part of the form
  - ECGN Meta Data Form (see ECGN Website – PDF/TXT File)

Status of Meta Data Forms (1)

Country	ECGN points		Meta data form / Status report available
Austria	Graz Trafelberg	Haflekar Pfänder	yes (for 3 stations)
Bulgaria	Sofia Varna	Rojen	
Czech Republic	Geodetic Observatory Pency GOPE		
Denmark	Smidstrup Suldrup	Qaqortoq / Greenland	status report
Estonia	Suurupi		
Finland	Degerby Joensuu Metsähovi	Sodankylä Vaasa	
France	Strasbourg J9 Welschbruch (Vosges Mountains)	Brest	
Germany	Helgoland Moxa Sassnitz	Wettzell Bad Homburg	yes
Great Britain	Herstmonceux	Newlyn	yes
Italy	Bologona	Medicina	
Latvia	Riga	Irbene (candidate)	
Lithuania	Vilnius		
Moldavia	Balti (candidate) Comrat (candidate)	Chishinau (candidate)	
Netherlands	Tscherlling Ijmuiden	Westerbork	

Status of Meta Data Forms (2)

Country	ECGN points		Meta data form / Status report available
Norway	Bodø Ny-Alesund Stavanger Tromsø	Trondheim Trysil Vardø	
Poland	Borowa Gora		status report announced
Portugal	Gaia Lagos	Cascais	yes
Spain	A Coruña Albacete Alicante Almeria Caceres Ceuta *(Ebre)* Huelva La Palma La Rioja	*(Madrid)* Malaga Palma de Mallorca *(San Fernando)* Santander Sonseca Valencia Vigo Yebes *() points not quite clear*	
Sweden	Borås Kiruna Mårtsbo	Onsala Skellefteaa (Furuögrund) Visby	
Switzerland	Zimmerwald		yes

(5) Conclusions for Continuation, Data Analysis, 2nd Call

The working group discussed further several details like

- cooperations with the European groups of IVS and ILS
- combination of SLG and AG measurements (which should be in the responsibility of the ECGN station owner)
- data policy of SG measurements
- comparison of time series of AG measurements, GPS and tide gauges.

Station distribution:
Additional stations in France (Montpellier, Grasse, La Rochell, Marseilles, Chite), Hungary (Penc), Luxembourg (Walferdange), Poland, Slovakia and Iceland are necessary.

Guidelines:
An update of the technical guidelines is currently not necessary.

Absolute gravity:
A service, which supports the realization of absolute gravimeter measurements and the exchange of experiences on an international level is still missing. Generally, the absolute gravimeter measurements should organized and financed on a national level by the owners of the instruments. Measurements in countries with no absolute gravimeter instrument are organized in bilateral cooperation.

Absolute gravimeter comparison:
The absolute gravimeter instruments for ECGN measurements has to be compared to each other. It will be recommended to take part at the calibration campaigns ones per year in general, but at least ones in two years.

The currently existing data bank at the Bureau Gravimetrc International (BGI) do not fulfil the requirements of the project:

ECGN WG is preparing standards for an absolute gravity data base. The model of a decentralized ECGN data bank was favoured. That means, each station owner and each instrument owner should provide the necessary information in a common format on its own web page.

GPS:
A recomputation of the EPN network for investigations of secular height changes at the ECGN station is necessary.

TIME VARIATIONS OF HEIGHTS

- **SEASONAL VARIATIONS**

  - compare SG variations with GRACE data

  - mass variations (from GRACE) give surface loading changes and hence seasonal variations in GPS/SLR/VLBI

- **SECULAR VARIATIONS**

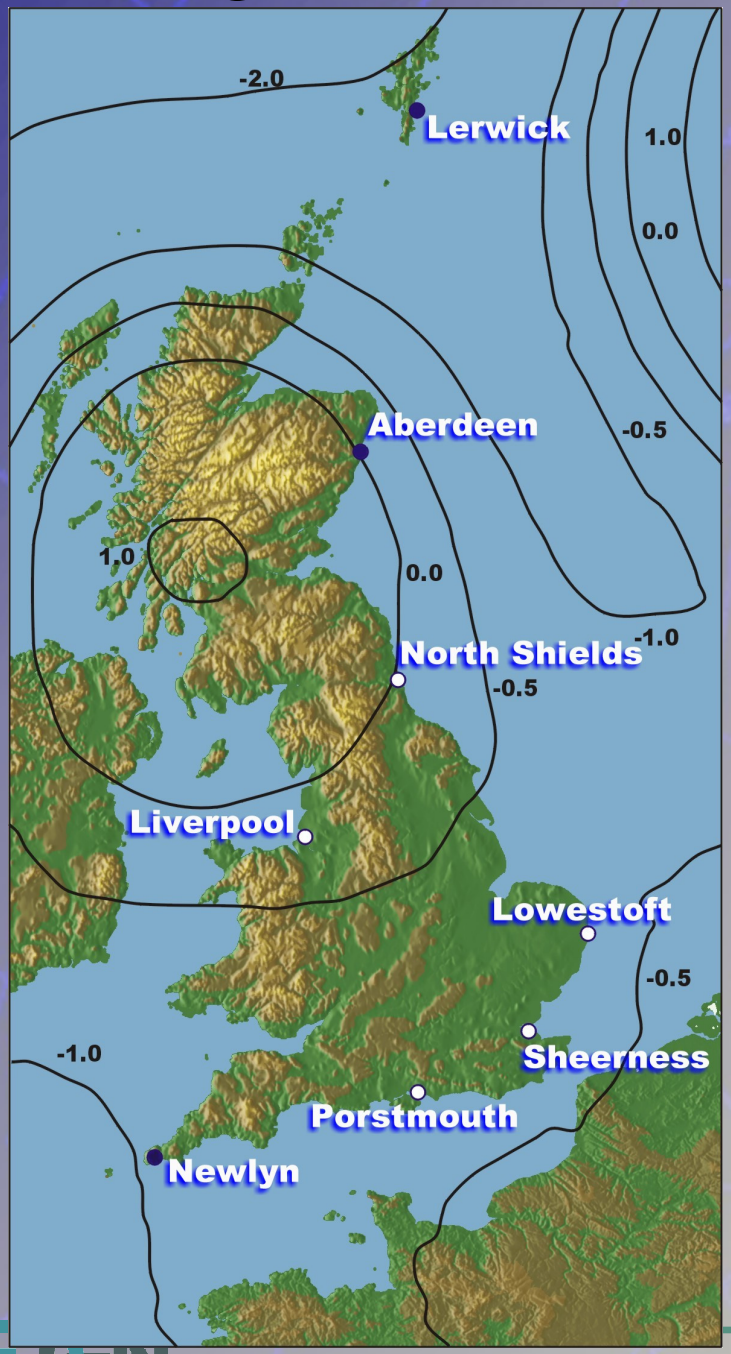
  - GPS vertical rates have accuracy of

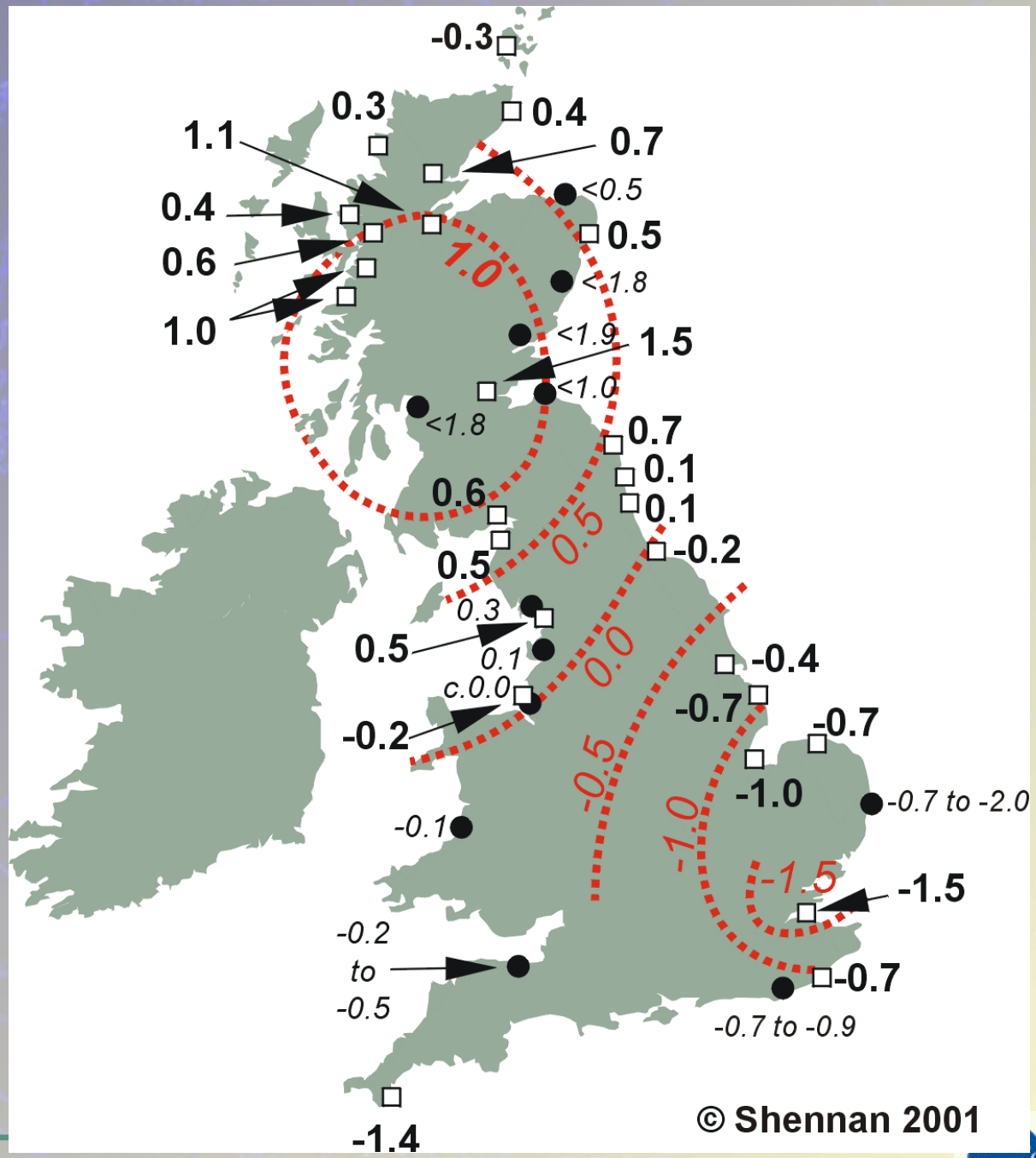
  2-3mm/year (reference frame)

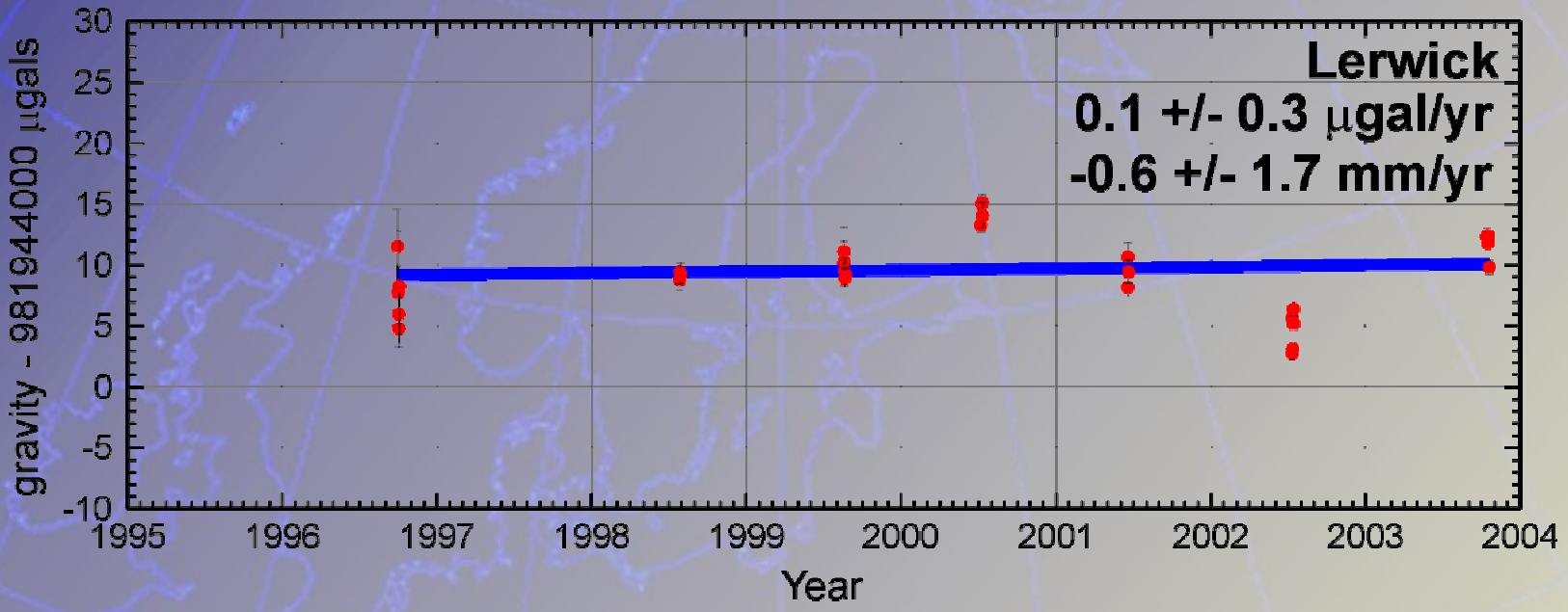
  - AG obs. give independent vertical rates

  - also compare EPN at coastline with geological rates and tide gauge rates.

Post-glacial rebound






Lerwick
0.1 +/- 0.3 μgal/yr
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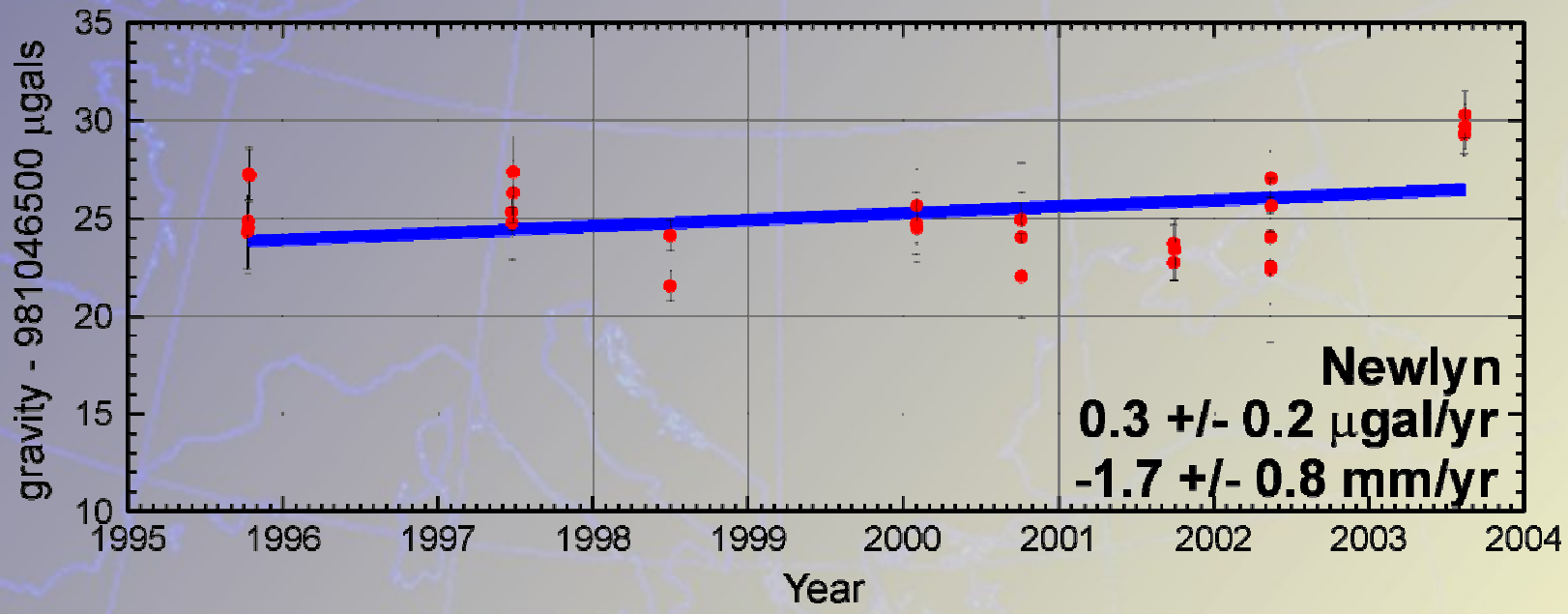
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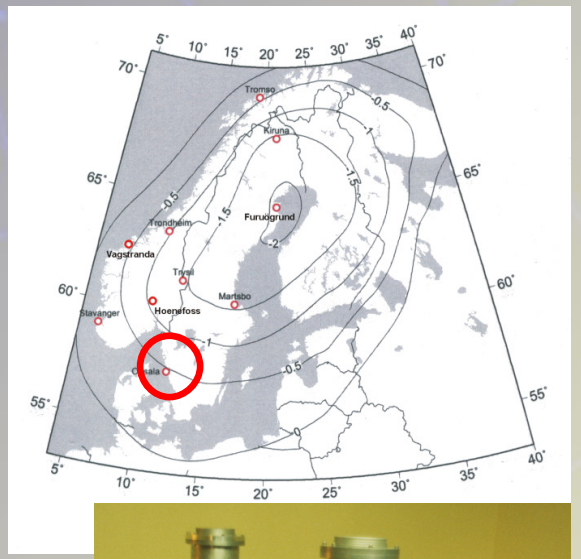
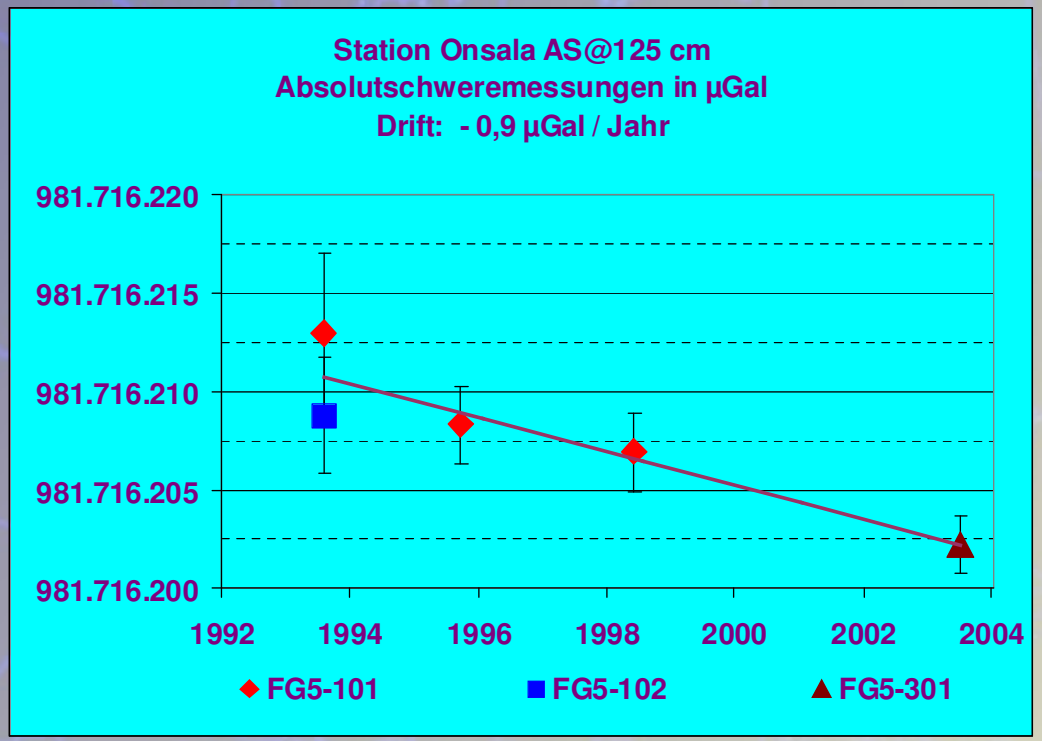
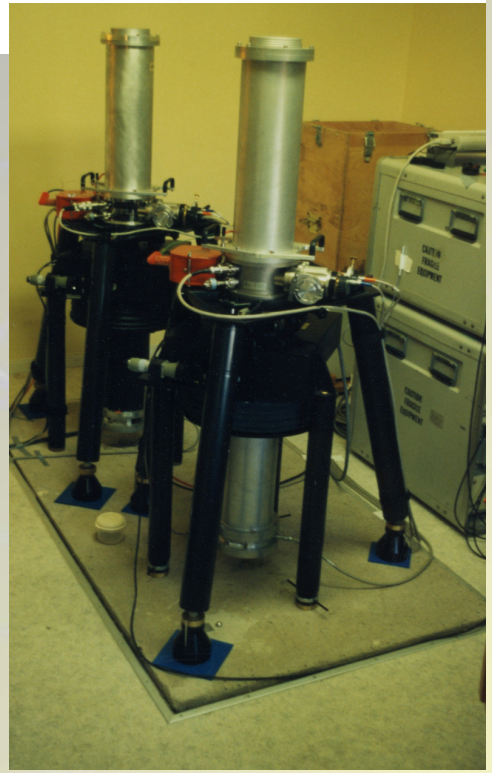
2004

Observed gravity changes

Onsala / Schweden

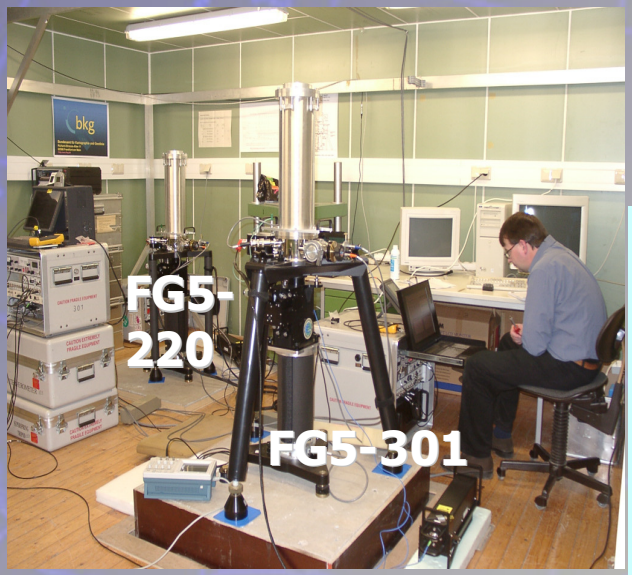




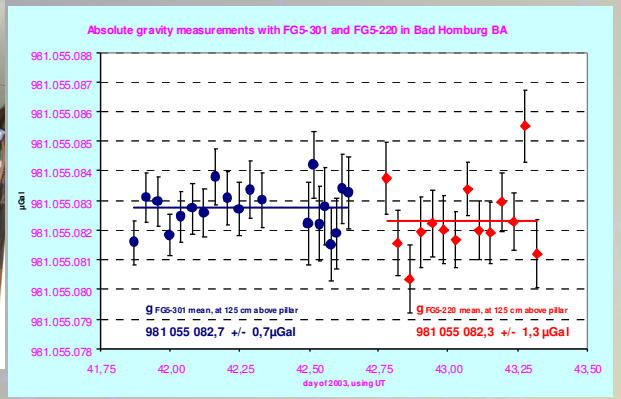


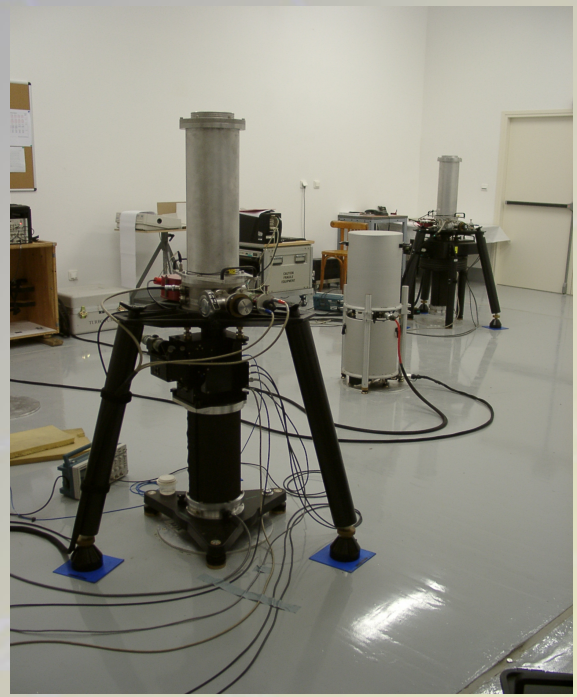
Gravity System / Gravity Standard
Actions for the Validation of the Absolute Gravimeter

- Gravity standards
- Repeated measurements at stations with known gravity variations
  - Combination with super conducting gravimeter measurements
  - Time series of AG
- Comparison of AG
  - International: BIPM
  - Regional
  - Bilateral



Comparison of two Absolute Gravimeter at Bad Homburg, 2003





International Comparison Campain at BIPM 2001

Methodology and Analysis (2nd Call postponed)

The second ECGN call is still a matter of further discussions. It will include the status of the project (stations, data availability, meta database, data policy). In a second call it could be asked for:

- Methodical investigations for the combination of spatial observation data with gravity field related data
- AG/SG combination
- AG/SG array for GOCE validation
- Combination of space techniques (GPS/GLONASS, GALILEO, VLBI, SLR)
- Single station analysis of different observation techniques
- Analysis centers for the combination of time series of all ECGN stations
- Establishment of co-operations to solve the above mentioned questions

ECGN Web Site

- **ECGN Home Page Address: http://www.bkg.bund.de/ecgn**
- **ECGN Website *Guidelines and Forms* with links to guidelines and forms for the different observation techniques**

  LINK Startpage -> Guidelines und Forms
- **or Links from BKG-Website http://www.bkg.bund.de Rubriks Geodesy or Information Services**