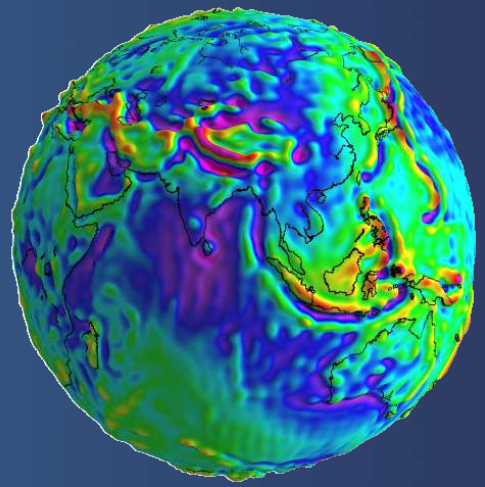
DANISH NATIONAL SPACE CENTER

International Association of Geodesy

I G F S



THE DANISH NATIONAL SPACECENTER IS A RESEARCH CENTER UNDER THE MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

The International Gravity Field Service and GGOS

Rene Forsberg – Geodynamics Dept,
Danish National Space Center
Steve Kenyon – National Geospatial-Intelligence Agency, USA

Structure of the IGFS - International Gravity Field Service

International Gravimetric Bureau (BGI) – *Director Richard Biancale (temporary)*

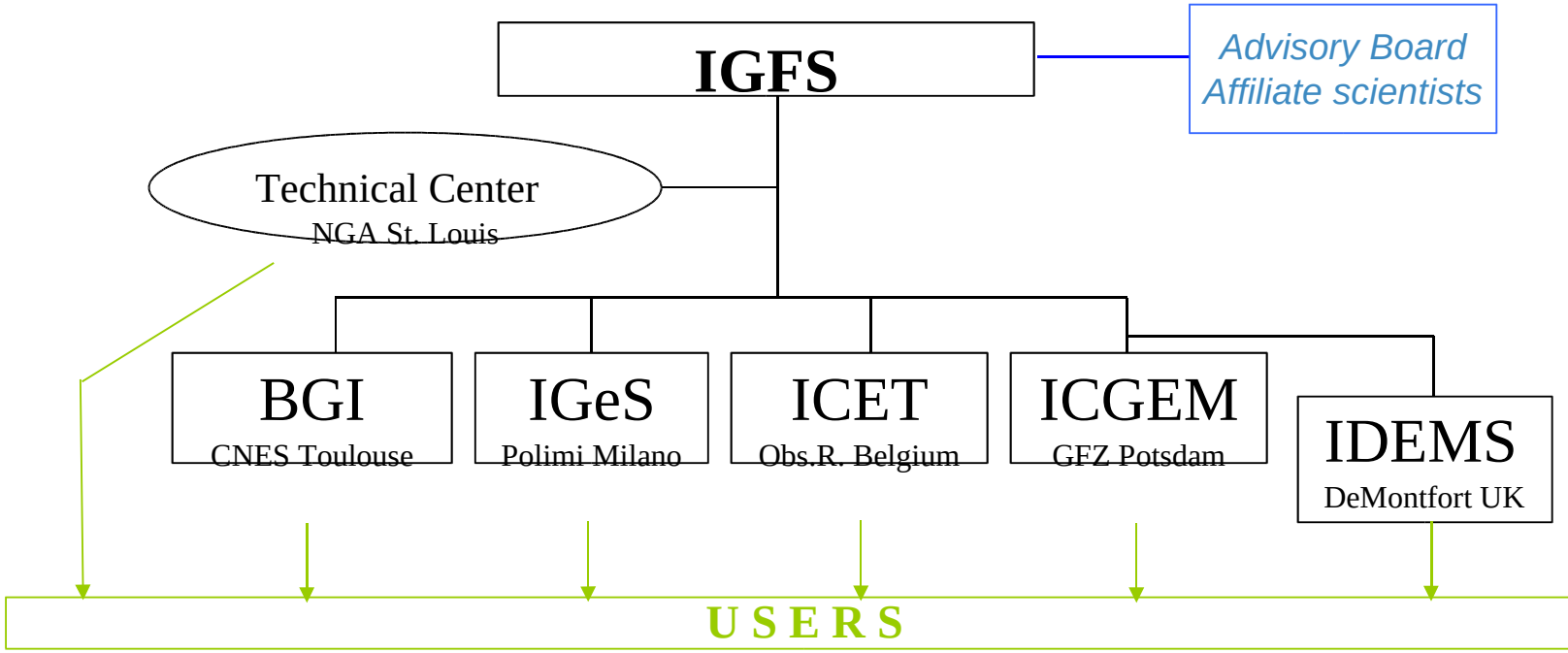
International Geoid Service (IGeS) – *Director R. Bazarghi*

International Center for Earth Tides (ICET) – *Director B. Ducarme (to retire 2007)*

International Center for Global Earth Models (ICGEM) – *Director J.Kusche*

International DEM Service (IDEMS) – *Director P. Berry*

Technical Center of the IGFS – chief geodesist S. Kenyon, NGA



International Gravity Field Service

Documents

Terms of Reference

Advisory Board

Minutes of 1st Advisory board meeting, Nice 2004

Minutes of 2nd Advisory board meeting, Cairns 2005

Joint Working Group on Evaluation of Global Models

Position paper on Gravity Field and GGOS (Sapporo 2003)

Periodicals

Newtons Bulletin - BGI/IGeS Joint Journal

Bulletin d'Information des Marées Terrestres

Meetings

Workshop on Height Systems, Geoid and Gravity of the Asia-Pacific Ulaanbaatar, Mongolia June 6-8, 2006

Report of Mongolia Workshop

1st IGFS General Assembly Istanbul, Turkey Aug 28-Sep 1, 2006

International Workshop Gravity and Geoid in South America Buenos Aires, Sep 25-29, 2006

For IGFS information contact rf@dnsc.dk

Last update: Aug 24, 2006 by rf
Web page design: Henriette Skourup

International Association of Geodesy

DANISH NATIONAL SPACE CENTER

IGFS chair: Rene Forsberg
Geodynamics Department
Danish National Space Center

IGFS is a new unified "umbrella" IAG service, which will
- Coordinate collection, validation, archiving and dissemination of gravity field related data
- Coordinate exchange of software of relevance for gravity field actitivities
- Coordinate courses, information materials and general public outreach relating to the earth's gravity field

The overall goal of IGFS is to coordinate the servicing of the geodetic and geophysical community with gravity field-related data, software and information. The combined data of the IGFS entities data will include both satellite-derived global models, terrestrial, airborne, satellite and marine gravity observations, earth tide data, GPS leveling data, digital models of terrain and bathymetry, as well as ocean gravity field and geoid from satellite altimetry. Both the static and the temporal variations of the gravity field will be covered by the IGFS.

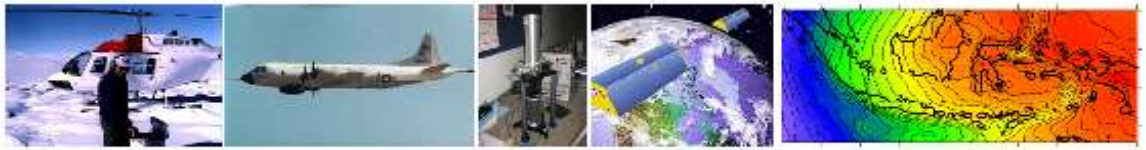
IGFS is *not* handling gravity field data distribution directly - IGFS will function as a unifying service for the following gravity-field related IAG services - *"IGFS Centres"*:

BGI - International Gravity Bureau - collection, archiving and distribution of gravity data
IGeS - International Geoid Service - collection and distribution of geoid models, geoid schools
ICET - International Center for Earth Tides - collection and archiving of global earth tide data
ICGEM - International Centre for Global Earth Models - distribution of satellite and surface spherical harmonic models
IDEMS - International DEM Service - Global Digital Terrain Models

IGFS Technical Centre - National Geospatial-Intelligence Agency [geodesy - G&G dept] - advise on global models, geoid and gravity, supplementing other services

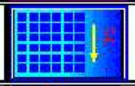
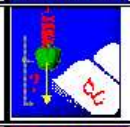
The IGFS was established by the International Association of Geodesy Executive Board at the General Assembly in Sapporo, Japan, August 2003, and is an IAG "level-2" service under IAG Commission 2 - Gravity Field. One of the main arguments for establishing IGFS was to provide a more focussed role of the gravity field, as one of the three fundamental pillars in IAG's first project - GGOS, the Global Geodetic Observing System. For more background information on GGOS and IGFS click here (presentation for Cairns 2005)

Another important role of the IGFS is to take initiative and coordinate international data collection projects, such as e.g. the Arctic Gravity Project, and the ongoing development of the new NGA high-resolution spherical harmonic reference model EGM06, complete to degree and order 2160.



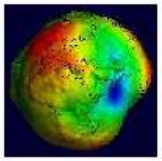
www.igfs.net

PROVIDED SERVICES :

DOCUMENTATION ONLINE Publications,thesis,reviews,forums and, maps	
CONSULTING land data	
CONSULTING sea data	
CONSULTING reference stations	
DOWNLOADING of data grids,...	
TUTORIALS	
CONTACTS with BGI	
SOFTWARE	
FORMATS	
DETAILED SERVICES	

http://bgi.cnes.fr:8110

http://www.iges.polimi.it/



ICGEM

GFZ Potsdam

ICGEM Home

Table of available Models

Evaluation of Models

Model References Table

Visualization of Geoid Models

Tutorial

Service for Computing Data from Models

Guest Book

Monthly Models from GRACE

Evaluation Service

Software Download Service

International Association of Geodesy

GFZ POTSDAM

ICGEM

International Centre for Global Earth Models (ICGEM)

ICGEM is one of six centres of the International Gravity Field Service (IGFS) of the International Association of Geodesy (IAG).
The other five Centres are

- Bureau Gravimetrique International (BGI) at CNES / CRGS, Toulouse, France
- Digital Elevation Model Centre (DEM) at Montfort University, UK
- International Centre for Earth Tides (ICET) at Obs. Royal de Belgique, Brussels, Belgium
- International Geoid Service (IGeS) at Politecnico di Milano, Milan, Italy
- Technical Support Centre of IGFS at NGA, Saint Louis, USA

Services of ICGEM

- collecting and long-term archiving of all existing global gravity field models
- validation of global gravity field models by standardized procedures
- collecting and long-term archiving of software for global gravity field models, manipulation and transformation
- user interface for getting access to global gravity field models, validation results and manipulation software
- web site for tutorials on global gravity field models, user interaction with the service and online software application
- contribution to IGeS schools
- yearly activity report

ICGEM Centre's staff at GFZ Potsdam

- Peter Schwintzer (Director) †
- Franz Barthelmes
- Wolfgang Köhler
- Hartmut Pflug

We mourn Peter Schwintzer, who died unexpectedly on 24 December 2004

Last modified 26.4.2005 Wolfgang Köhler

http://icgem.gfz-potsdam.de/ICGEM/ICGEM.html

http://www.astro.oma.be/ICET

ICET

International Center for Earth Tides

Federation of Astronomical and Geophysical Data Analysis Services, FAGS
World Data Center-C For Earth Tides

For any request please contact: Bernard DUCARME

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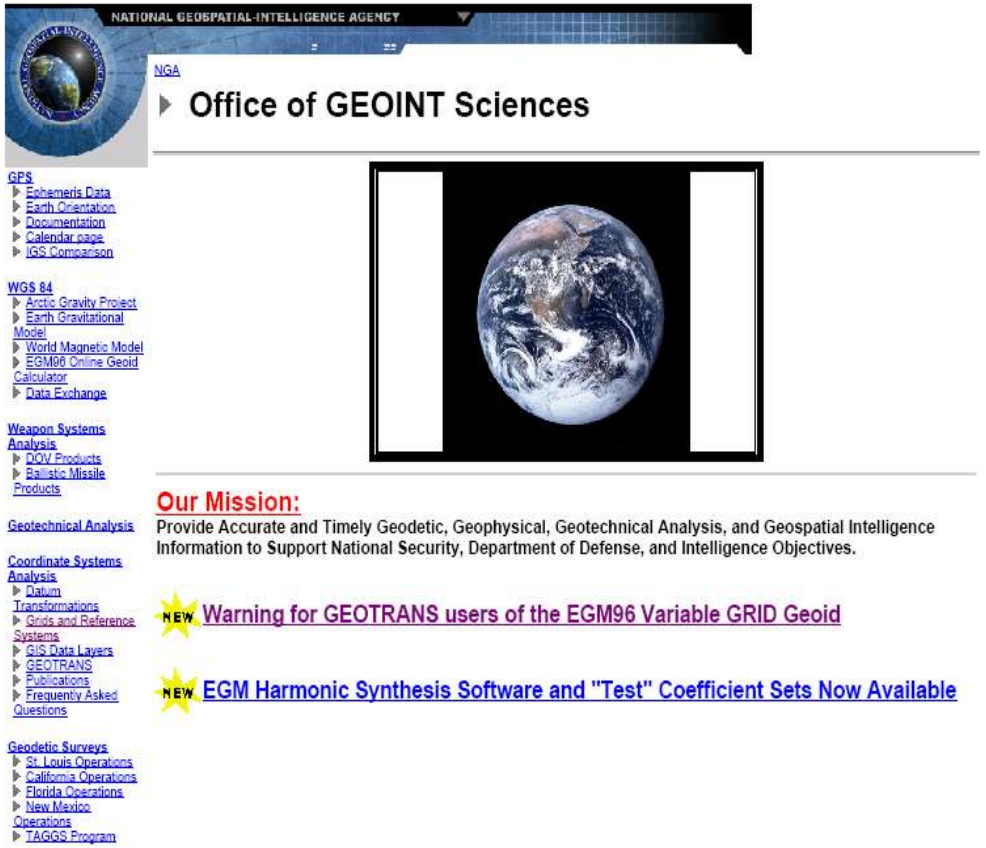
www.cse.dmu.ac.uk/EAPRS/iag/index.html

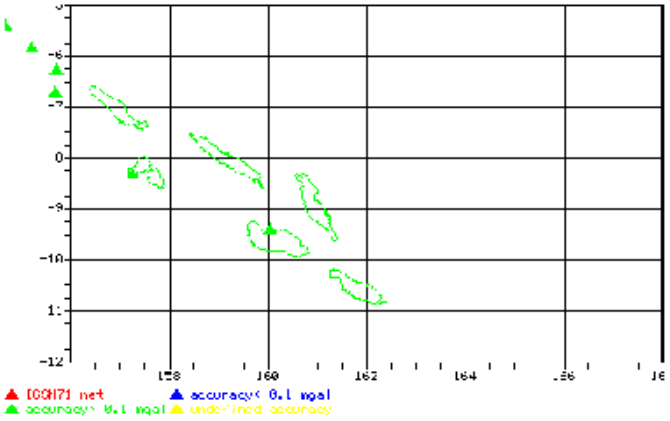


NGA is also acts as a "gravity field service" ... e.g. EGM06/WGS84 development, gravity info etc.
http://earth-info.nima.mil/GandG/

Core of a service: Online information ..

BGI example – reference gravity

BGI DATABASE EXTRACTION
Gravity reference stations :



The portrayal of boundaries and the states' names must not be taken as implying approval by BGI of the political status

If you want a more complete station description, withe the microfiche number of their sketch, click on the butto

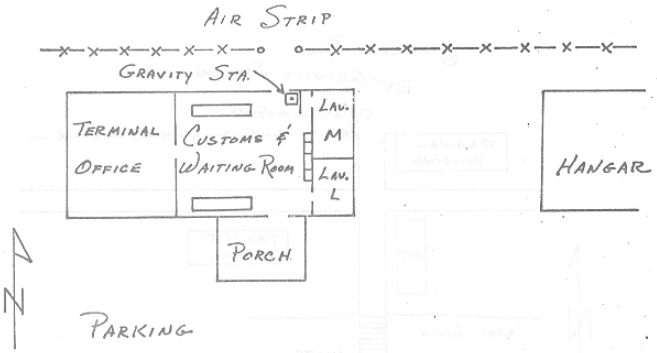
reference station description

GRAVITY BASE STATION

LATITUDE 09° 25.5'S (1)	STATION DESIGNATION HONIARA
LONGITUDE 160° 03' E (1)	COUNTRY/STATE Solomon Islands/Guadacanal
ELEVATION 3.05 METERS (1)	ADOPTED GRAVITY VALUE
REFERENCE CODE NUMBERS ACIC 3800-1	ESTIMATED ACCURACY ± 0.6 mgals / DATE MONTH/YEAR 10/70

DESCRIPTION AND/OR SKETCH

Station is located in the air terminal building at Honiara Airport, known as Henderson Field. The old air terminal has been destroyed. The station is in the waiting room of the terminal building in the right corner facing the exit door, on tile from each wall. (1)



REFERENCE SOURCE
(1) Personal Communication US TOPOCOM 5 Feb 70

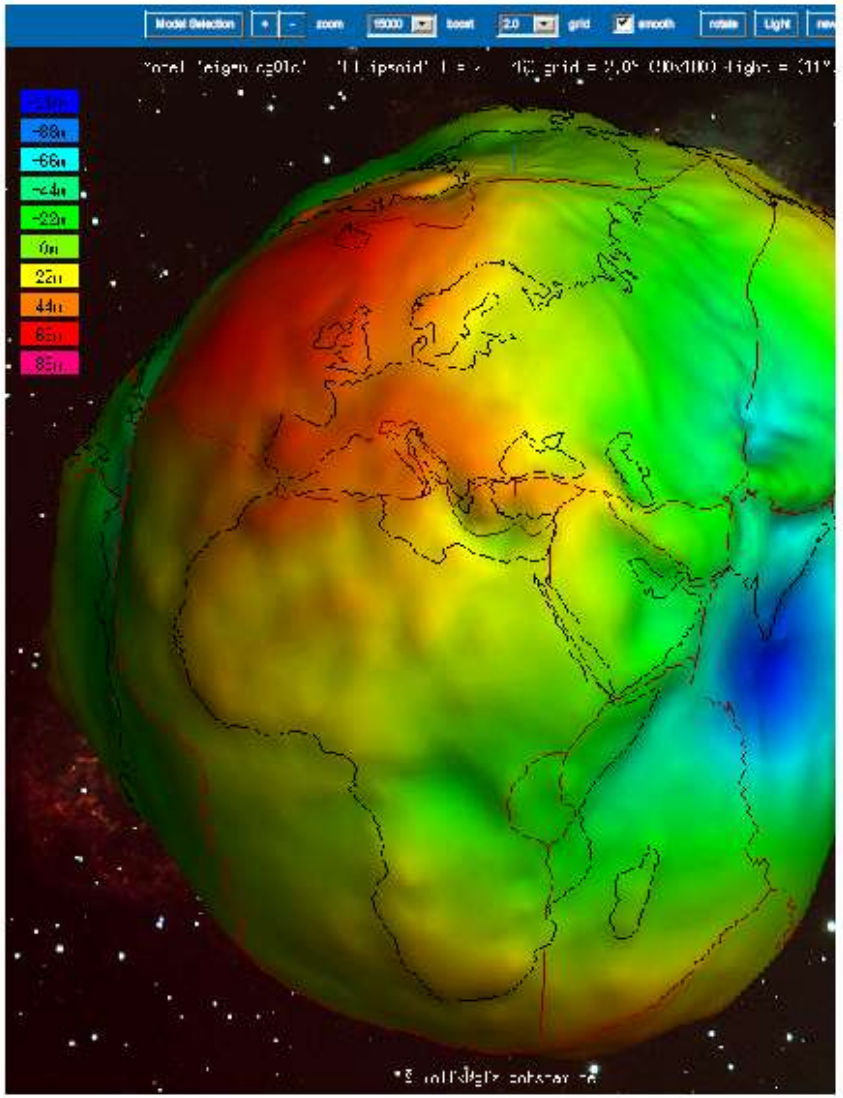
ACIC HQ FORM FEB 69 0-415

Core of a service: Online information ..

GRACE example – ICGEM

- *100+ spherical harmonic models ”in stock”*
- *Online visualisation*
- *Online computation of grids*
- *Both static and temporal fields*

(but no U Texas and JPL monthly solutions)



Current IGFS activities

- Meetings:
- Workshop on Height systems, Geoid and Gravity of the Asia-Pacific - Mongolia, June 2006
- 1st International Symposium of the IGFS in Istanbul, Turkey, September 2006.
- International Workshop on Gravity and Geoid in South America - Buenos Aires, Sep 25-29, 2006
- *Workshop on gravity and geoid for East Africa – Addis Abeba, Oct 2007?*

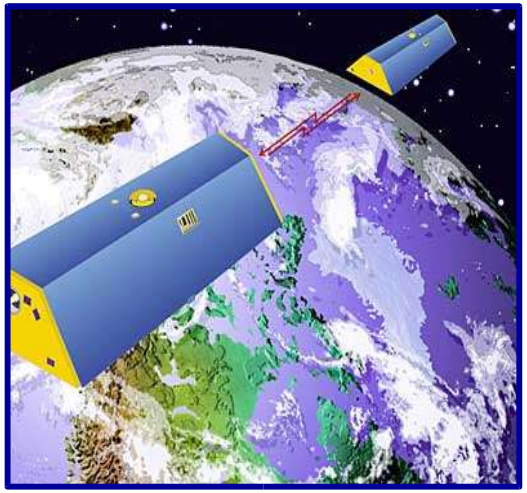
- Other service activities:
- *Schools: Microgravimetry school, BGI/ICET, Geoid schools (IGeS)*
- *Joint bulletin: Newton's Bulletin – technical journal of the BGI and IGeS.*

Current IGFS activities (continued)

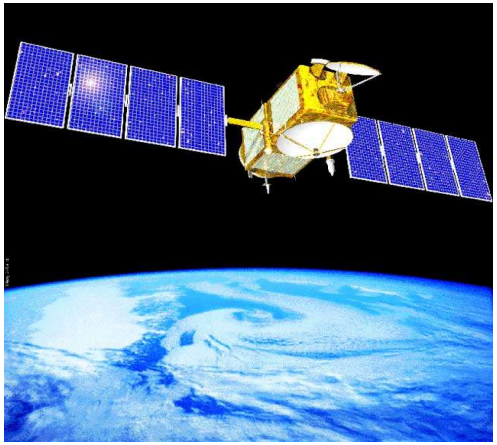
- Joint IAG Commission 2 / IGFS working group for validation of new EGM07 ultra-high resolution (n_{max} = 2160) global gravity field model – *new "official" GGOS reference model?*
- IGFS active support of the release of regional gravity field data for various regions of the world to enhance the overall quality of geopotential combination models.
- Working group on absolute gravimetry standards and global net – *H. Wilmes, BKG/Germany*

Earth Gravitational Model

Next … EGM 2007



- **CHAMP and GRACE satellite gravity missions**
  - **100x improvement in the accuracy with which large regional features of the gravitational field can be modeled**



- **Need for higher-resolution model of the gravitational field and geoid**
  - **5’ x 5’ resolution**
  - **n=m=2160**
  - **15 cm global RMS accuracy goal for geoid**

Progression of EGMs

EGM96

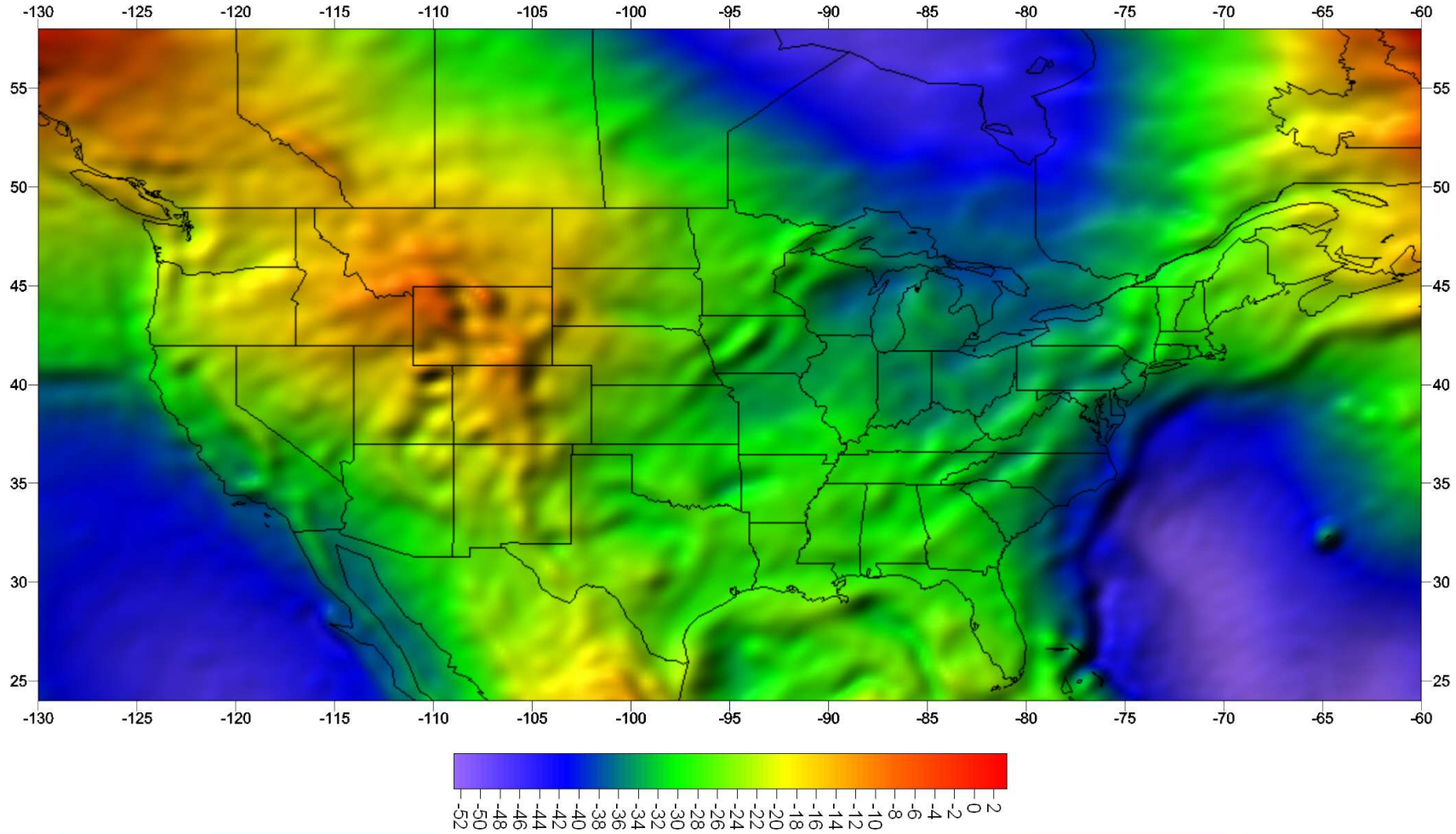
- 30'x30' resolution
- 50 cm RMS accuracy
- 70 x 70 error propagation
- 40 satellites used for long λ's
- GEOSAT
- 30 M surface gravity values
- 29 elevation codes
- 130 K coefficients

EGM07

- 5'x5' resolution
- 15 cm RMS accuracy
- 2160 x 2160 error propagation
- GRACE used for long λ's
- MSS from retracked ERS-1, GEOSAT, TOPEX, etc.
- 55 M surface gravity values
- SRTM, ICESAT
- 4.7 M coefficients

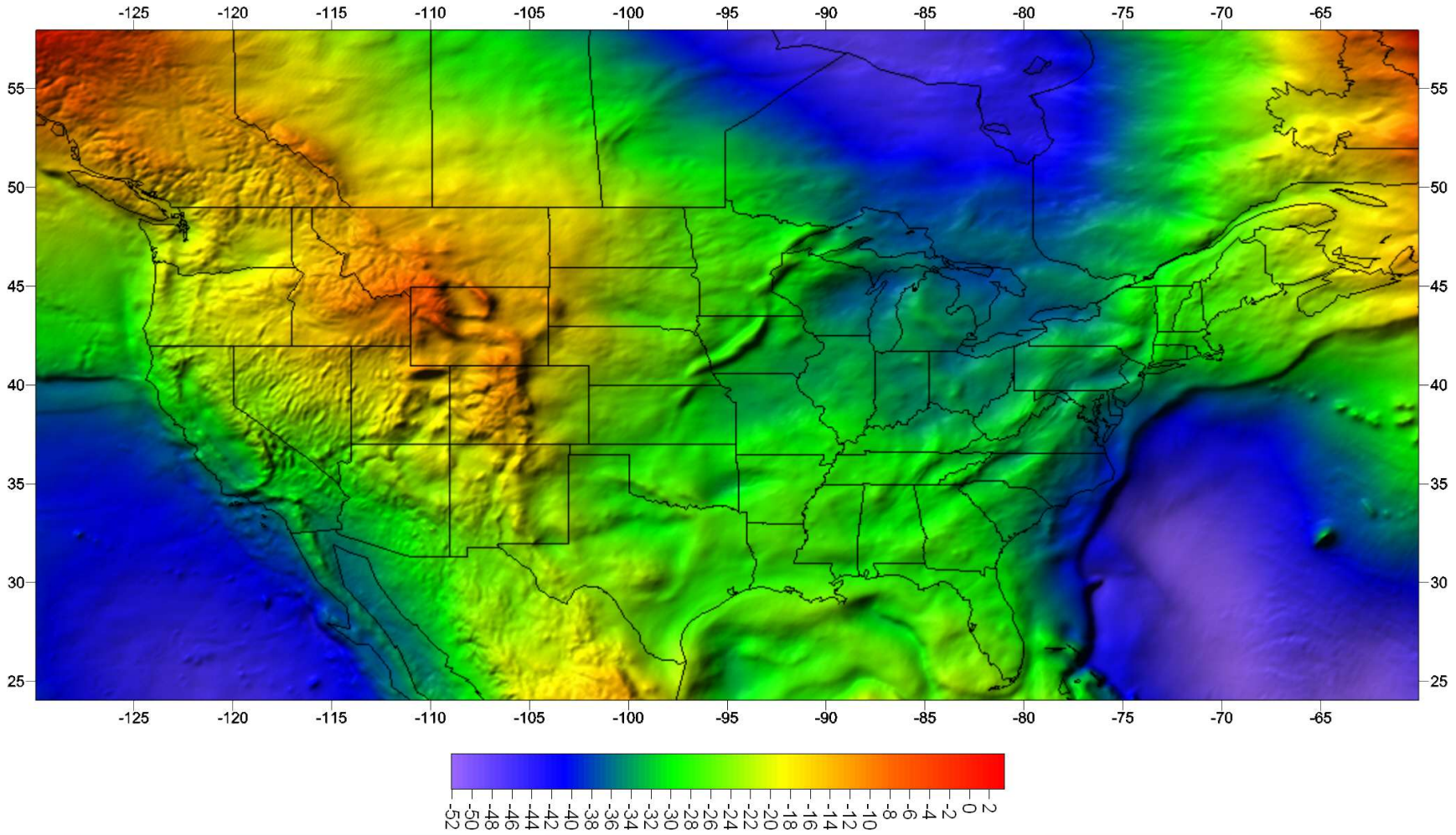
Earth Gravitational Model 1996

15‘x15’ Geoid Height Grid for the US

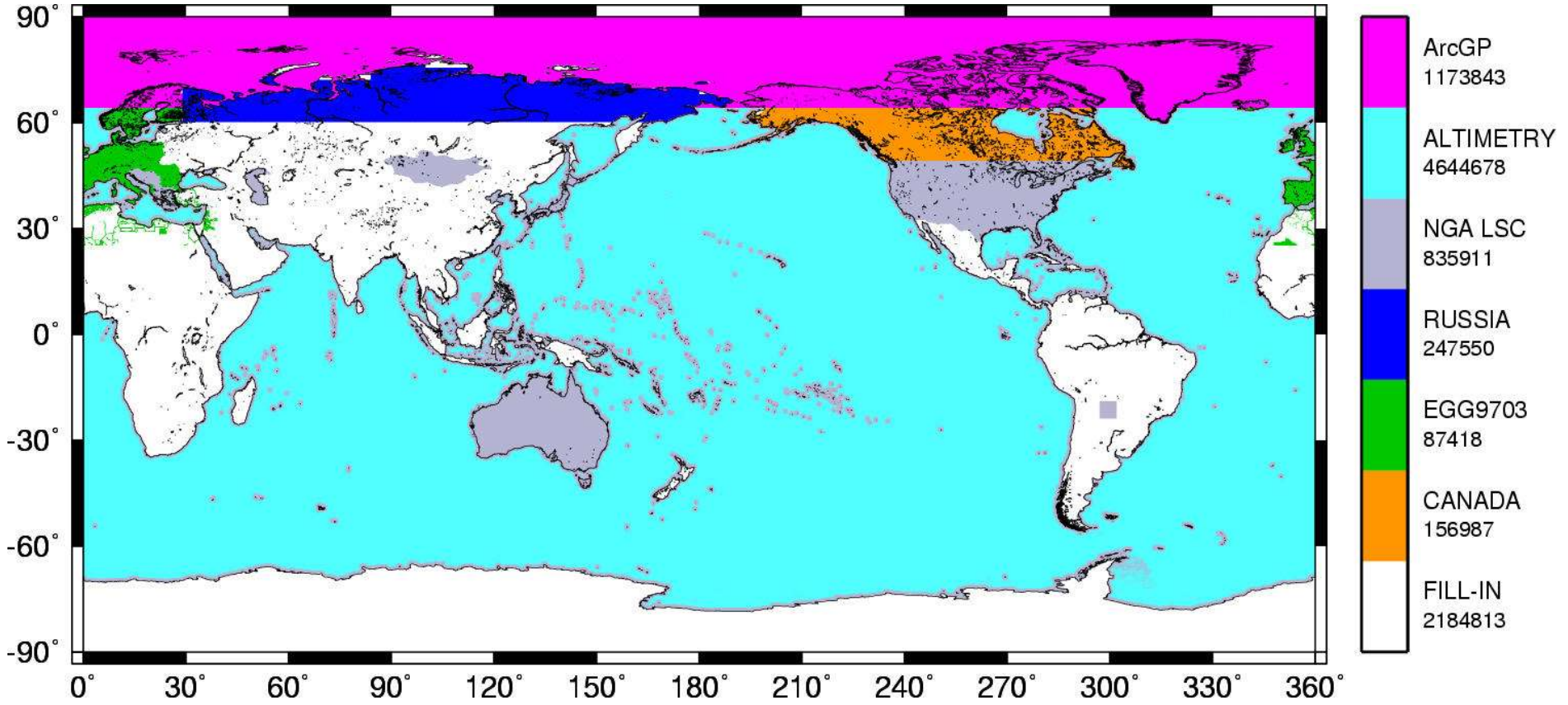


Earth Gravitational Model 2007

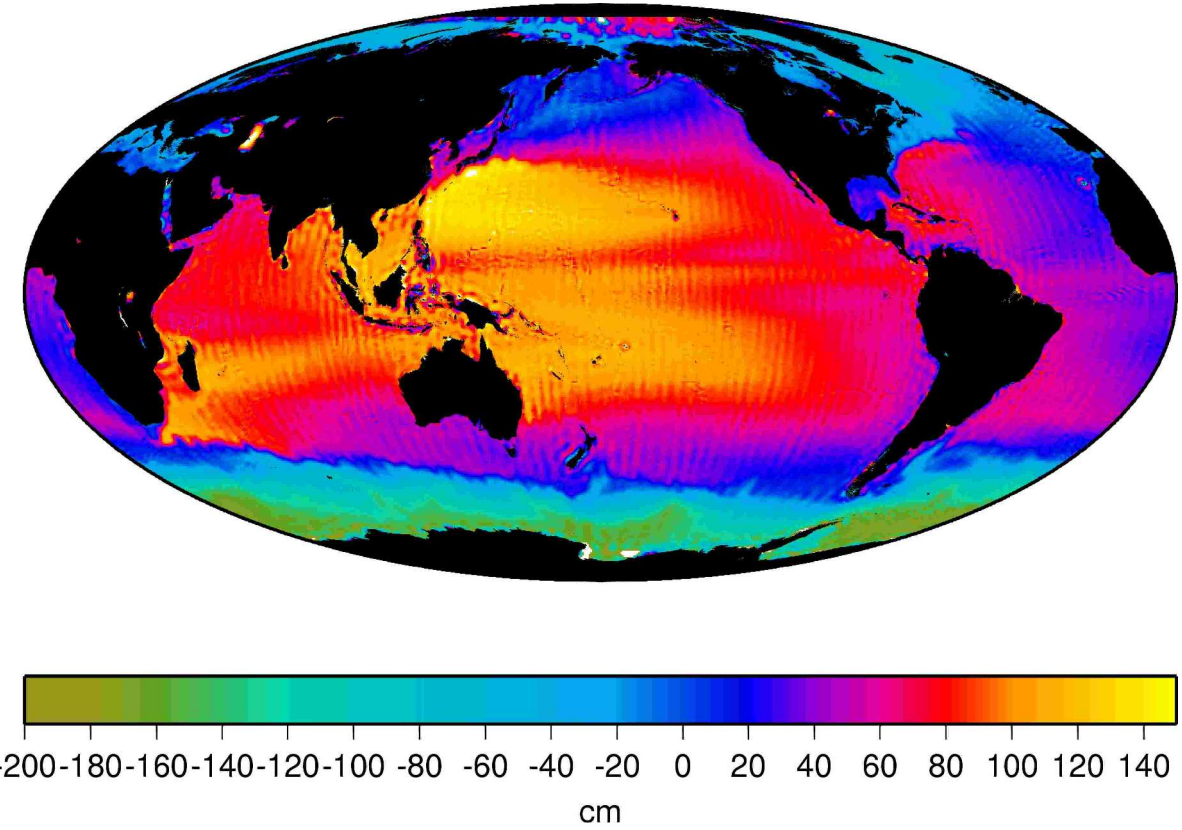
5‘x5’ Geoid Height Grid for the US



5′×5′ Gravity Anomaly Data Sources (v080306)

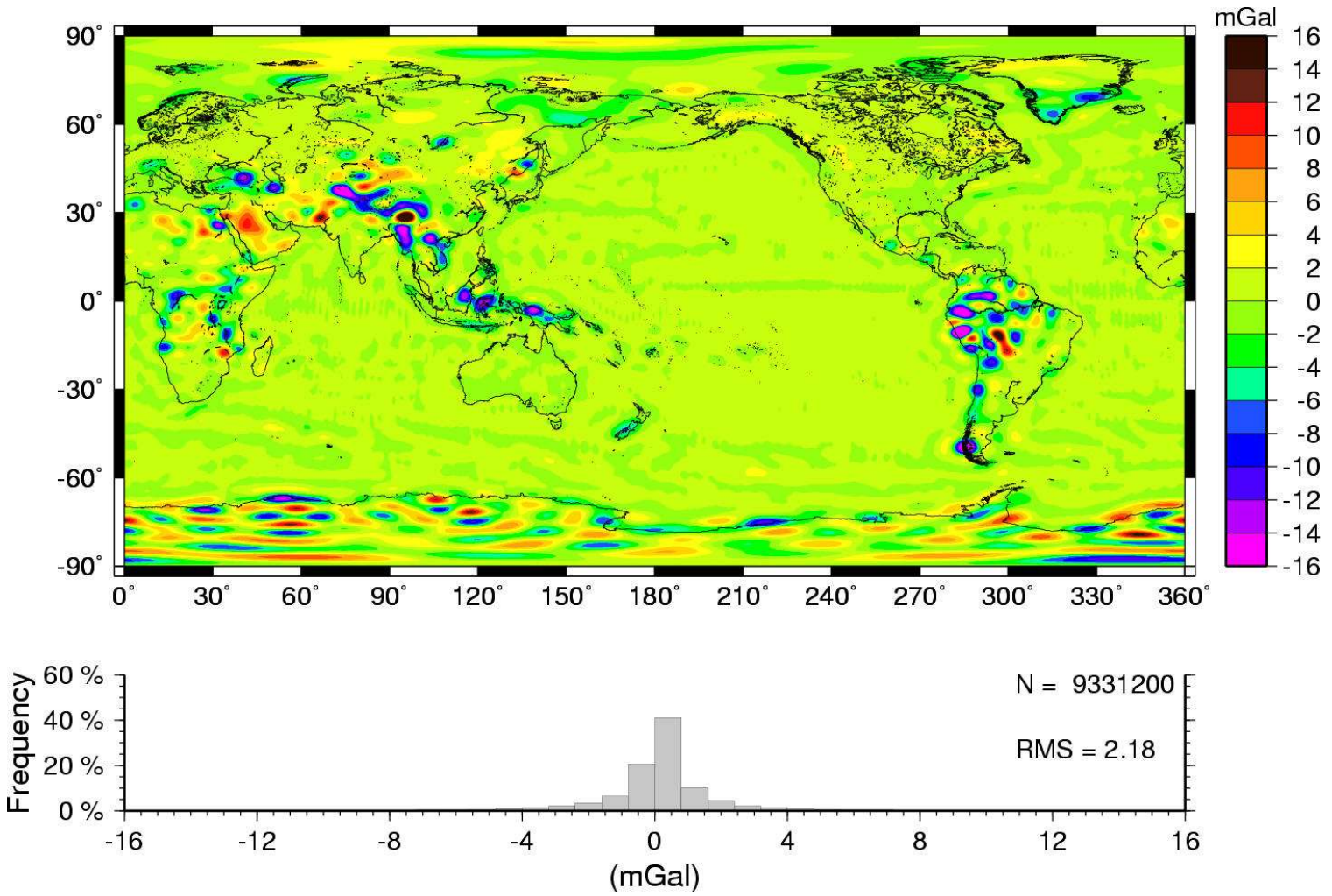


"Striping" Problems Associated with GRACE



Dynamic Ocean Topography: GSFC00 MSS minus GGM02C_EGM96 Geoid (from *Chambers and Zlotnicki*, 2004)

PGM2006B Residual Gravity Anomalies (Nmax=160)



GPS/Leveling Comparisons Over CONUS

GPS/Leveling Comparisons Globally

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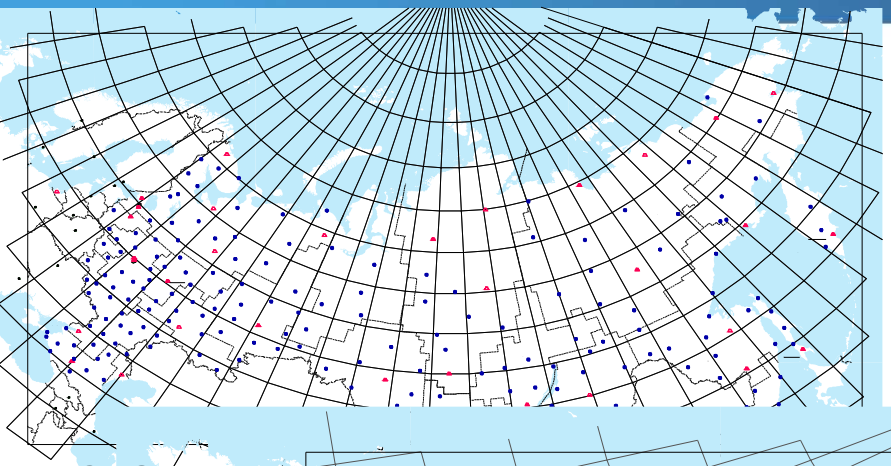
International Association of Geodesy

IGFS

GPS levelling data – evaluation of geoids *(Russia example, G. Demianov, Tsniigaik)*



GPS

Levelling

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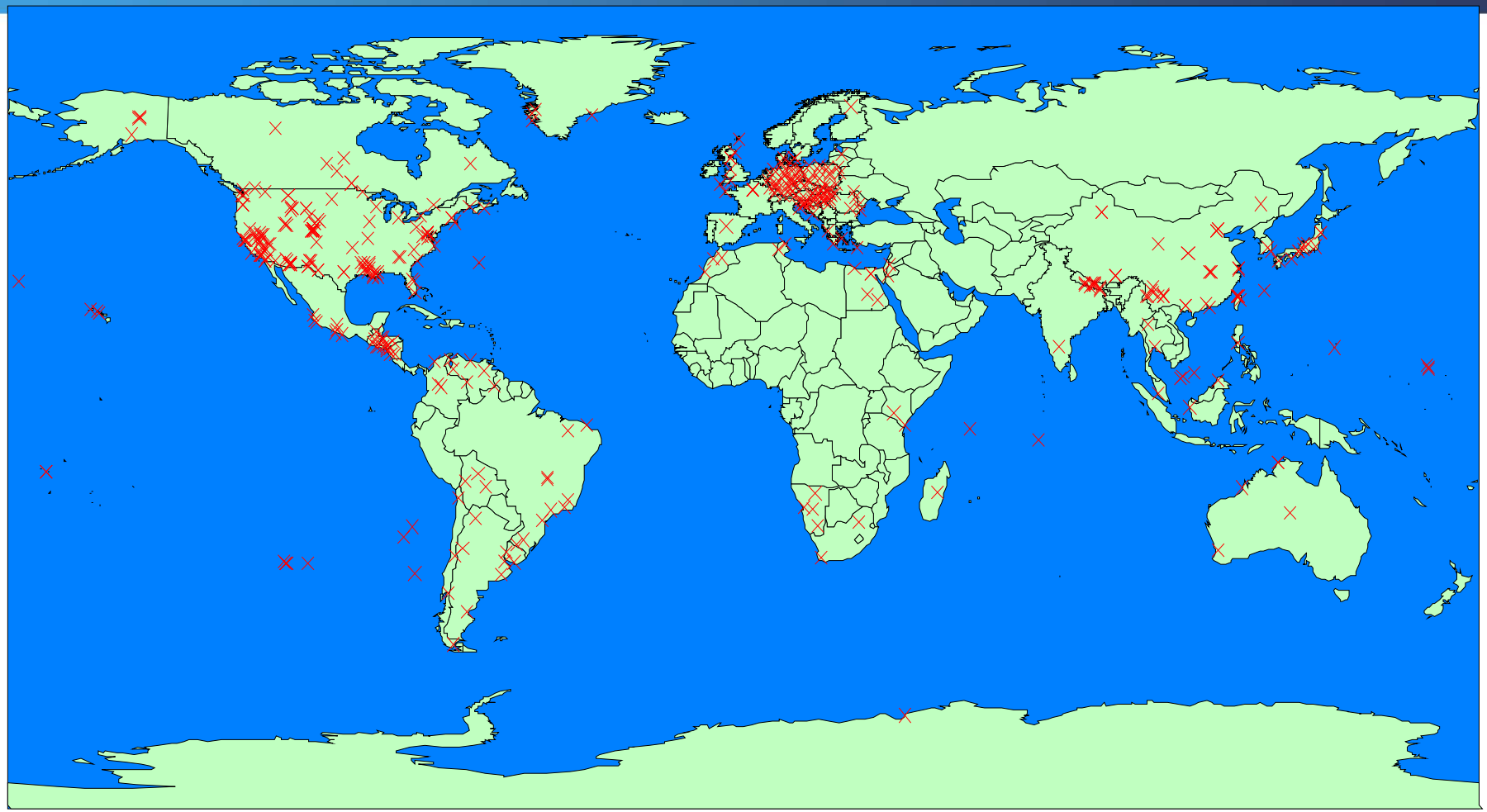
Absolute gravimetry network (NGA)



Need more co-located observatories (VLBI, Laser, GPS, abs.grav., …)
Many regional initiatives (”5-D networks”) - ECGN/Europe, NGOS/Nordic ..) ..

Absolute gravity database and standardization: BKG

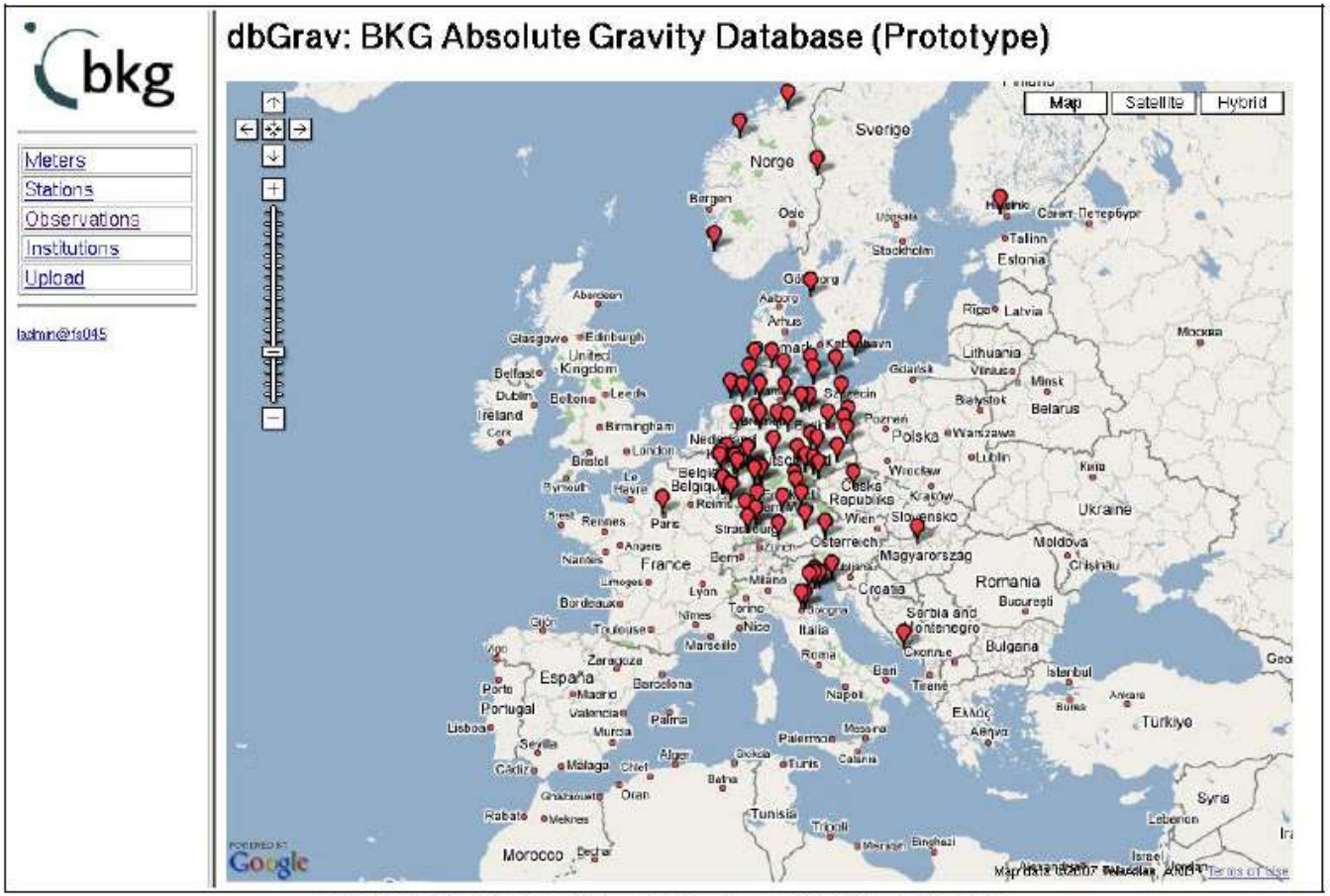
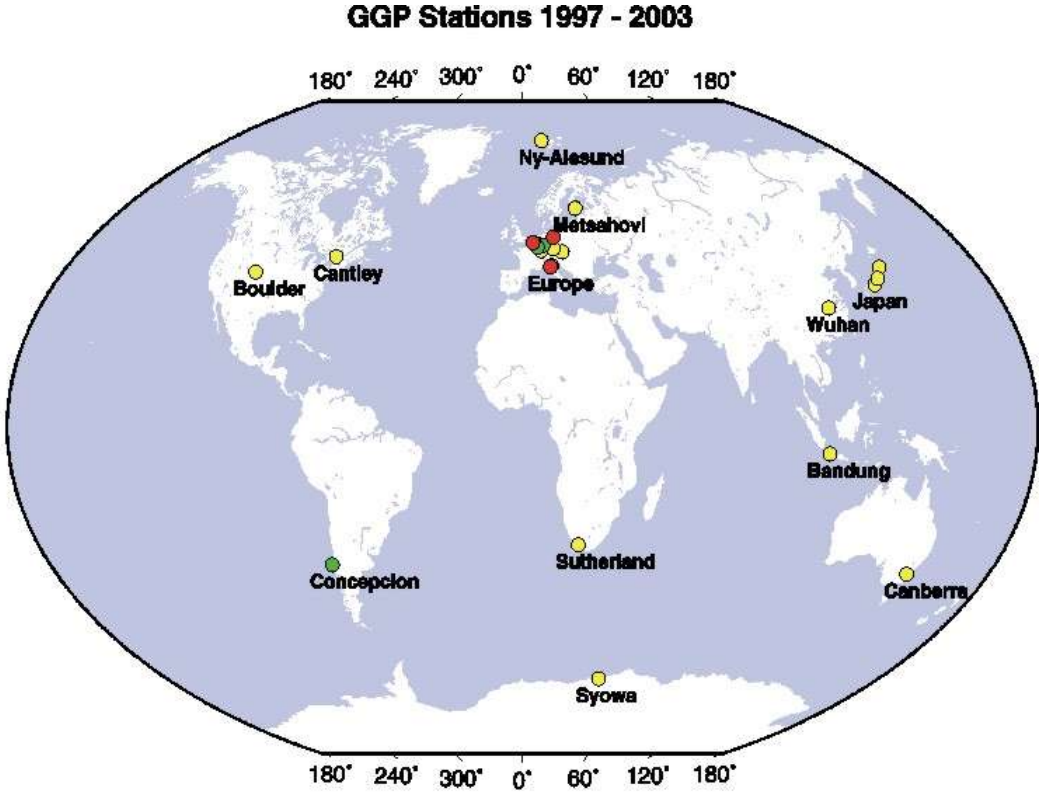


Figure 3: Frontpage of the user interface with interactive map

Superconducting gravimetry cooperation ..

– Global Geodynamics Project … ~ 20 sites

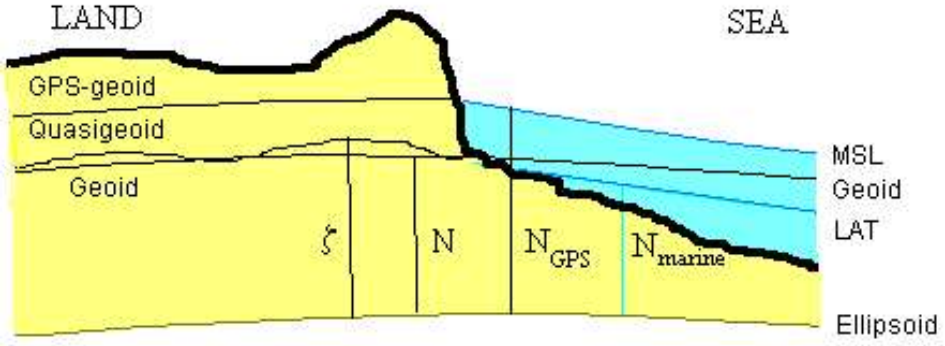


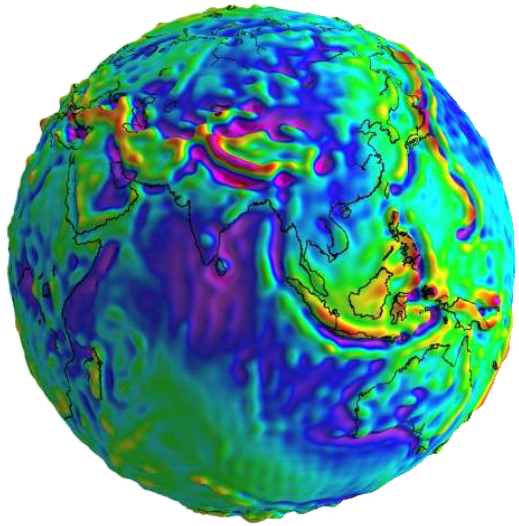
- ICET earth-tide sites:
~200 stations

Gravity field ”products” for GGOS

Essential to limit products to ”globally relevant” quantities:

- Global gravity field models – spherical harmonics – consistent methodology … *satellite-only (n ~ 200), combination (n ~ 360 or 2160)*
- Global vertical datum (6 mm ~10^{-9})
- Precise refined geoid models .. *especially around key GGOS station sites*
- Absolute and superconducting gravity networks





How to improve IGFS and the gravity field services?

* Conventions and recommendations for gravity field products ..

*** Improving the global gravity field data base**
Coordinated global campaigns (e.g., absolute gravity)
Coordinated efforts for terrestrial gravity data + GPS/levelling data release ..
Coordinated efforts for airborne gravimetry over unsurveyed regions (e.g., Antarctica) ..

**** Web:*** *conventions, access to basic data, background info ..*
A one-stop web site for all gravity related information?
Tutorials and background material for physical geodesy?

**** Do we need one unified gravity field model for GGOS??***
(EGM07 the first candidate model? But how about time changes?)

Need to have soon: A Central Bureau (IERS model)

The vision for IGFS

- ”Seamless” online service to a broad set of users:
scientific, government and commercial .. through a distributed set of service centers (BGI, IGeS, ICGEM ..)

- Standards and conventions recommendations
Endorsement of International Earth Geopotential Models

- Coordinated effort for global surveys and data exchange

- Complete set of gravity-relevant services
GRACE highlight needs for easier access to model corrections such as geodynamics effects (ICE5G), tides ..


Photo # NH 96772-KN USNS Henson (T-AGS-63)