ISO Register of Geodetic Codes and Parameters

Status and Future

Larry Hothem (Vice-Chair)
Control Body for the ISO RGCP

... building the foundation of the geospatial infrastructure, brick by brick ...
Acknowledgement

Mike Craymer, Geodetic Survey of Canada is the Chair, Control Body for the ISO Registry of Geodetic Codes and Parameters
Background

• November 1994 - ISO TC211 established

• 1995-2005 - project teams organized to work on standards and technical specifications related to geodetic information and coordinate systems

• 2005-2007 – initial call to host the geodetic registry

• 2007 – TC211 Resolution of 2007-11-02
ISO TC211 Resolution 400 (2007-11-02)

Control body for the ISO geodetic registry network

1. Instructed the Chairman to establish the control body for the ISO geodetic registry network;
   • the Chairman shall approach IAG for their nomination of a chair.
   • the Secretariat shall send out a call for nominations to serve as a member of the control body.

2. ISO/TC 211 resolves that the control body shall
   • consist of geodetic experts nominated from P-members.
   • control body may invite geodetic experts from liaison members to join the control body

3. The control body shall draft a terms of reference in cooperation with the secretariat
Referenced Documents for the ISO Geodetic Registry

• ISO TS 19127:2005 - Geodetic codes and parameters
  – Defines rules for the population and maintenance of registers of geodetic codes and parameters
  – Revision pending – TC211 is seeking a project lead and experts

• ISO IS 19111:2007 - Spatial referencing by coordinates
  – Data model for reference systems
  – Registry information must conform to requirements of ISO 19111

• ISO IS 19135-1:2014 (New) - Procedures for item registration
  – Rules for managing a register of items, including submission of information
  – New version, replacing 2005 version, pending final review and adoption
Initial Concepts (1 of 2)

**Figure 1**
The proposed ISO geodetic registry network

**Figure 2**
BKG and OGP geodetic registers
International Association of Geodesy

• Global Geodetic Observing System (GGOS)

• GGOS Bureau for Standards and Conventions
  – ISO Registry for Geodetic Codes and Parameters (RGCP)
The GGOS Bureau for Standards and Conventions

D. Angermann (1), T. Gruber (2), M. Gerstl (1), R. Heinkelmann (3),
U. Hugentobler (2), L. Sánchez (1), P. Steigenberger (2)

(1) Deutsches Geodäatisches Forschungsinstitut (DGFI), München
(2) Institut für Astronomische und Physikalische Geodäsie (IAPG), TU München
(3) Deutsches GeoForschungsZentrum Potsdam, Germany
A key GGOS goal: Integration of the "three pillars"

What do we need?
- Consistency among the data sets from all geodetic techniques
- Common standards and conventions (across all IAG components)
- Refined analysis and combination methods as a basis for consistent products

How to reach this goal?
The Bureau for Standards and Conventions was established as a GGOS Component to support this major goal.

(from Plag and Pearlman 2009)
Objectives and tasks of the BSC

- The key objective of the BSC is to ensure that **common standards and conventions** are adopted and implemented by all IAG components as a fundamental basis for the generation of **consistent IAG/GGOS products**.

- Major tasks of the BSC are (according to ToR):
  - to **keep track of the observance** of adopted geodetic standards and conventions applied by the IAG Services,
  - to **review and evaluate** all actual standards and conventions,
  - to **identify gaps** and to initiate steps to close them,
  - to **propagate** geodetic standards and conventions to the wider scientific community and promote their use.
Numerical standards for geodesy

- ... are officially defined by the Geodetic Reference System 1980 (GRS80, Moritz 2000) and by the corresponding IAG resolutions.
- Best estimates of the fundamental parameters (Groten 2004)
- IERS Conventions 2010 (Petit and Luzum 2010)
- Different standards for gravity (e.g., EIGEN, GOCE, EGM2008)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>GRS80 (Moritz 2000)</th>
<th>Fund. param. (Groten 2004)</th>
<th>IERS 2010</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>$GM_{\text{Earth}}$</td>
<td>398.6005</td>
<td>398.6004418</td>
<td>398.6004418</td>
<td>$[10^{12} \text{m}^3 \text{s}^{-2}]$</td>
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<td>6378136.62</td>
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<tr>
<td>- zero-tide</td>
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<tr>
<td>Flattening factor ($1/f$)</td>
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<td>$[10^{-6}]$</td>
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Contradictory definitions of numerical standards!

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# Heights and ellipsoid parameters

![Diagram showing height components and their relationships](image)

**Formula:**

\[ H = h - N \]

- \( h \): Ellipsoidal height
- \( H \): Physical height
- \( N \): Geoid height

## Table: Heights and Ellipsoid Parameters

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<td>Petit and Luzum 2010</td>
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<td>Groten 2004</td>
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<td>- GRS80 for transformation geocentric → ellipsoidal</td>
<td>6378137.0</td>
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<td>Moritz 2000</td>
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Heights and ellipsoid parameters

\[ H = h - N \]

- \( h \): ellipsoidal height
- \( H \): physical height
- \( N \): geoid height

This equation is NOT fulfilled, if different ellipsoid parameters are used!

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Common standards and conventions are of crucial importance for the generation of consistent IAG/GGOS products that shall be consistently applied for processing geometric and gravimetric observations.

Some examples for the current status have been shown, indicating that there are several inconsistencies related to standards and conventions.

Users (in particular those who are NOT specialized in geodesy) may have difficulties to use geodetic products correctly and to know exactly whereupon they refer to.

The product-based inventory compiled by the BSC identifies deficiencies regarding standards and conventions and will give recommendations on how to resolve inconsistencies and gaps.
Recent Activities

• ISO Geodetic Registry Implementation
  – Open source registry management software in development
    • Lead: Prof. Dr. –Ing. René Thiele, University of Applied Sciences, Frankfurt, Germany
    • Hosted on server at Norwegian Mapping Authority, Hønefoss, Norway
  – Monthly telecons since November 2013
  – Initial data loaded for testing and demonstration

• Control Body Membership
## Control Body Membership

<table>
<thead>
<tr>
<th>P-Members</th>
<th>External Liaisons</th>
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<tbody>
<tr>
<td>Australia (Pending)</td>
<td>IAG (Chair &amp; Vice-Chair)</td>
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<td>Canada</td>
<td>DGWIG</td>
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<tr>
<td>China (Pending)</td>
<td>FIG</td>
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<td>France</td>
<td>IHO</td>
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<tr>
<td>Finland</td>
<td>ISPRS (possible interest)</td>
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<td>Germany</td>
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<tr>
<td>Italy</td>
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<tr>
<td>Japan</td>
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<tr>
<td>Republic of Korea (pending)</td>
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<tr>
<td>Saudia Arabia</td>
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<td>South Africa</td>
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<tr>
<td>United Kingdom</td>
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<tr>
<td>United States</td>
<td></td>
</tr>
</tbody>
</table>

Neil Weston, NGS/NOAA (Principal) and Dan Mullaney (Alternate)
• Agenda
  – Review of registry implementation and status of enhancements
  – Review of data model implemented in the registry
  – Consider list of international reference systems with which to “seed” the registry for public release.
  – Discuss pending TC211 activity to revise 19127
    • Encourage CB members to serve as experts
Matters requiring resolution

- Registry item validation and approval process
- Item codes (structured vs sequential numbering)
- Report generation (PDF, csv) of register items
- Possibility of future access to external registers in the registry
- Concerns with lack of representation of modern reference systems in ISO 19111 and 19127
  - Geoid-based vertical datums
  - Dynamic 3D reference systems
  - Treating UTM zones as separate CRS’s
ISO Geodetic Registry Implementation

- **Open Source Software** for management and publication of Geodetic Codes & Parameters.

- **Compliant** to ISO 19135 (Model, Roles, Procedures).

- **Providing item classes** in conformance with ISO 19111.

- Implemented as a **service interface** (REST, SOAP).

- **AJAX based web application** (Spring Framework)
Conceptual Model

Diagram:

- Coordinate Reference Systems
- Coordinate Operations
- Datums
- Coordinate Systems
- Identified Objects

Connections:
- Coordinate Reference Systems to Coordinate Operations
- Datums to Coordinate Systems
- Identified Objects to Coordinate Systems
- Coordinate Systems to Datums
- Coordinate Operations to Identified Objects
Conceptual Model

Coordinate Reference System
(example: ETRS89)

is comprised of

Datum
(example: European Terrestrial Reference System 1989)

and

Coordinate System
(example: ECR geocentric)
Scope

• **Management Procedures (Pending)**
  – Submission of a Proposal.
  – Approval process.
  – Withdrawal.
  – Appeal.
Scope

• Types of item proposals (Pending)
  – Addition
  – Clarification
  – Supercede
  – Retirement
  – Invalidation
**Scope**

• **Roles (Pending)**

  - **Register Owner**: Organization that establishes a *register*
  - **Register Manager**: Organization to which management of a register has been delegated by the register owner
  - **Control Body**: Group of technical experts that makes decisions regarding the content of a register
  - **Submitting Org.**: Organization authorized by a register owner to propose changes to the content of a register
Submission
Approval
Appeal
*** DEMONSTRATION VERSION ONLY ***

This registry is for demonstration purposes only. The current content of the registry is provided only to demonstrate the features and capabilities of the registry software.

The registry content should NOT be used for any other purposes.

In no way should the content be considered valid data!

ISO Registry of Geodetic Codes and Parameters

The ISO Registry of Geodetic Codes and Parameters is a structured database of coordinate reference systems and transformations that is accessible through this on-line registry system. The register includes only systems and transformations of international application. It does not include all possible coordinate reference systems and transformations.

This registry is provided under the auspices of ISO Technical Committee 211 on geographic information/geomatics and conforms to ISO standards ISO 19111:2007 (Spatial referencing by coordinates), ISO/TS 19127:2005 (Geodetic codes and parameters), ISO 19135:2005 (Procedures for item registration) and its soon to be published revision ISO 19135-1 (Procedures for item registration - Part 1: Fundamentals), and ISO 19135-2:2012 (Procedures for item registration -- Part 2: XML schema implementation).

The registry may be used free of charge but its use is subject to acceptance of the Terms and Conditions of Use. Users of the registry may query and view data and generate reports via anonymous guest access. Users may also submit proposals for new additions or clarifications to the registry.

The registry also provides a web service interface, allowing geospatial software to query and retrieve information from the register. Information on using the web services is available in the registry user's guide.
### Geodetic Codes & Parameters

**Overview**

**Contents**

- **Show** 10 items per page

<table>
<thead>
<tr>
<th>Item ID</th>
<th>Name</th>
<th>Item class</th>
<th>Status</th>
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<tbody>
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<td>RGF93</td>
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<td>Geodetic CRS</td>
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Future Activities

• Membership – Control Body
  – Seeking additional members

• Registry Implementation
  – Continue monthly telecons
  – Implement approval process and test
  – Continue loading registry with initial set of reference systems & transformations of international application
  – Planning public release Nov 2014 at 20th anniversary of TC 211