Issues in standard harmonization of GRID and Units in both marine science and geographical information system

The 7th Science Day of GEBCO meetings

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Eunmi Chang, Hyo Hyun Sung
(Ewha Womans University)
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I. Issues in the past

Purposes of work

Issues in standardization
Grid data

Needs to satisfy

ISOTC 211 s-56, s-100
GRID Concepts
Technology Oriented Standard
Methods

I. Issues in the past

- Current Status review
- Case Studies In Korea
- Harmonization Issues We front
Issues in the past

The world of geo-statistics is primarily the abstract world of 0D (point objects) geo-semantic and geo-statistical information, not to be confused with concrete 1D, 2D & 3D (spatial objects) geographic features modeled in the INSPIRE project, in Europe.

All micro data should be stored in the geo-statistical world of points and grids or alternative systems of regular tessellations.

ISO TC 211 people have focused on geographic feature rather than gridded data. ISO 19000 series started to deal with geographic feature model at first, then added more standards in gridded data later.

The GEBCO_08 Grid — a global 30 arc-second grid, and 1 minute data

Geophysical data + survey data + interpolation -> continuous errata

Multi-beam data sets are not defined in ISO/TC 211 data model
GEBCO inner group

GEBCO gridded data

- WGS-84
- Vertical datum issues
- Undersea Feature Identification
- Different Concepts
- Accuracy Enhancement
- Geomagnetic field
- UTM GPS-GLONASS
- 30 arc data

I. Issues in the past
II. Difference in concepts

GRID concepts: Why different?

Different Object

Physical Feature Example

Terrestrial Realm & Marine Realm & Atmospheric Realm

Grid Unit in interest are different among each realm

Different Concept

GRID concepts developed in different background

Pixel, grid, raster data

Access to object is limited

Generating Bathymetric data
- Survey method, optimization
- Interpolation Unit= grid size
- extrapolation or Interpolation

Information Service Realm
Big data : machine readable data

How to response to client’s answers

Service data Unit
- Various data are integrated into grid
- Inter-disciplinary works and models
Physical Feature Examples

Physical Features Examples

Bathymetry

USGS, Topography

US, Meteorology

II. Difference in concepts
Different in GRID concept

- **Data structure**
  - lattice
  - pixel
  - Grid Framework + hierarchy

- **Interpolation Unit**
  - Point clouds
    - ex) In Wessex
II. Difference in concepts

Grid is regarded as Units for data collection & data production

Grid is regarded as Units for integrated data search

**GRID in Marine Science Information**

**Marine Science Data Service**
- search
- sharing
- synchronization
- Alert Service
- Common work
- Manipulation
- Data collection
- Application analysis

**Management system**
- User Authentication
- Statistics
- Log manager
- Agency Statistics
- Agency information
- Status checks
- Current Status

**Integrated DB**
- Meta data
  - Geophysical data
  - Geochemical data
  - Marine biology data
- Survey Data
- Remotely Sense data

**GIS DB: GEBCO Bathymetry**

**Users**
- Universities
- Research Institutes

**Manager**
- maintenance
Data Grid are ones being set up for analyzing the huge amounts of data that will be generated by the CMS (Compact Muon Solenoid), ATLAS (A Toroidal LHC ApparatU), ALICE (A Large Ion Collider Experiment) and LHCb (LHC beauty) experiments at the Large Hadron Collider (LHC).
### Marine Science Information Service

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Ocean Science Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>World ocean database (WOD)</td>
<td>NOAA/NOADC</td>
<td>biology data, buoy data, chlorophyll, nutrients, ocean currents, oxygen, plankton, salinity, satellite data, sea level, snow &amp; ice, profile data</td>
</tr>
<tr>
<td>ARGO international data center (GDAC)</td>
<td>ARGO</td>
<td>ARGO FLOAT 3000 centers, temperature/salinity profiling floats</td>
</tr>
<tr>
<td>Ocean biological information system (OBIS)</td>
<td>Ocean (CoML)</td>
<td>126,000 species 28,400,000 findings</td>
</tr>
<tr>
<td>Satellite data for sea surface (AVISO)</td>
<td>AVISO</td>
<td>Large-scale circulation, Meso-scale circulation, Operational oceanography, Tides, Mean Sea Level, Greenhouse effect, Seasons, Ice, Climate, Atmosphere, wind and wave, Hydrology and land, Coastal applications, Biology, Navigation by area</td>
</tr>
</tbody>
</table>

GRID are regarded as data service unit: resolution
<table>
<thead>
<tr>
<th>Definition</th>
<th>Symbol</th>
<th>Period (year)</th>
<th>Unit</th>
<th>Description</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absolute Salinity</strong></td>
<td>SA</td>
<td></td>
<td></td>
<td>The mass fraction of all dissolved solid mineral substances in a certain mass of seawater</td>
<td></td>
</tr>
<tr>
<td><strong>Sorensen Salinity</strong></td>
<td>SS</td>
<td>1901</td>
<td>%</td>
<td>The mass (in grams) of the dry residue of all solid mineral dissolved substances contained in one kilogram of seawater provided that bromine and iodine are replaced with the equivalent amount of chlorine, all carbonates are transformed into oxides, and all organic substances are cremated at a temperature of 480°C</td>
<td></td>
</tr>
<tr>
<td><strong>Knudsen-Sorensen Salinity</strong></td>
<td>SK-S</td>
<td>1902-1969</td>
<td>%</td>
<td>Salinity is directly proportional to the amount of chlorine in seawater, where chlorine can be measured accurately by a simple chemical analysis.</td>
<td>0.01‰</td>
</tr>
<tr>
<td><strong>Cox</strong></td>
<td>SCOX</td>
<td>1969-1981</td>
<td>%</td>
<td>It merely gives chlorinity as a function of conductivity of seawater relative to standard seawater</td>
<td></td>
</tr>
<tr>
<td><strong>Practical Salinity Unit in 1978</strong></td>
<td>S1978</td>
<td></td>
<td>psu or unitless</td>
<td>Salinity be defined using only conductivity of the sea water sample to the conductivity of the standard potassium chloride (KCl) solution at a temperature of 15 °C and standard atmospheric pressure</td>
<td>15°C: 0.0008 psu 0.0015 in case of T:-1.8-30°C, S: 2-42, P: 0-10000 dbar</td>
</tr>
</tbody>
</table>
### National GRID SYSTEM in USA

<table>
<thead>
<tr>
<th>Agency</th>
<th>US FGDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purposes</td>
<td>Location Based Service Enhancement, Efficient Disaster Response</td>
</tr>
<tr>
<td>Grid Frame</td>
<td>100km×100km, 1km×1km, 100m×100m, 10m×10m, 1m×1m</td>
</tr>
<tr>
<td>Numbering</td>
<td>Two digit county unit, Four digit city unit, Six digit block, Eight digit household</td>
</tr>
<tr>
<td>Standard</td>
<td>UTM⇒100km×100km (Square⇒1km×1km)</td>
</tr>
</tbody>
</table>
### National GRID SYSTEM in UK

#### Purposes
- National Grid Reference System
- Military purposes
- One coordinate system
- Military technologies application to civil realms
- To reduce the error virtual standard origins are setting

#### Grid Framework
- 100km × 100km
- 10km × 10km
- 1km × 1km
- 100m × 100m
- 10m × 10m

<table>
<thead>
<tr>
<th>NGRS</th>
<th>Good points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alphabet 2 digit</td>
<td>• Alphabet 2 digit</td>
</tr>
<tr>
<td>Alphabet 2 digit + number2 digit</td>
<td>• Alphabet 2 digit + number2 digit</td>
</tr>
<tr>
<td>Alphabet 2 digit + number 4 digit</td>
<td>• Alphabet 2 digit + number 4 digit</td>
</tr>
<tr>
<td>Alphabet 2 digit + number 6 digit</td>
<td>• Alphabet 2 digit + number 6 digit</td>
</tr>
<tr>
<td>Alphabet 2 digit + number 8 digit</td>
<td>• Alphabet 2 digit + number 8 digit</td>
</tr>
</tbody>
</table>
National GRID SYSTEM in Korea

Korean National GRID including Marine Territories

100㎢(10km×10km)

Purpose
- National Grid Reference System
- LBS service Enhancement

Marine requirement
+ coastal zone management
+ sea and ocean information
+ marine science information

Grid Framework
- 10km × 100km
- 4km × 4km
- 1km × 1km
- 100m × 100m
- 30m × 30m
# Marine Science Information Service for Application

<table>
<thead>
<tr>
<th>Demands</th>
<th>Security</th>
<th>Tourism</th>
<th>Disaster</th>
<th>Resource</th>
<th>Marine Industry</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Demands</th>
<th>Environment</th>
<th>Policies</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water pollution Waste Cold Pool</td>
<td>Land Filling Coastal Management Management of Port Island Management</td>
<td>Sea level rising Sea Warming Sea Surface Temperature Ocean Acidification</td>
</tr>
</tbody>
</table>
Conclusions

1. GRID concepts are different in each field: survey and mapping, geophysical science, marine sciences, coastal management, computing science.

2. GEBCO has focused on Data Generation rather than Data Service.

3. Interoperability in standards in ISO TC 211 and Marine side will be encouraged, which covers multi-beam data.

4. National GRID frameworks are widely prepared for Terrestrial Parts. The GRID framework should include Marine parts. Proper input from hydrography are required.

5. To meet the social demands, standards in Unit and Grid framework should be discussed with various aspects.
Thank you