EuroRegionalMap and EuroGlobalMap

A Technical Challenge Building
European Spatial Reference Data

Anja Hopfstock, Marcus Brühl (BKG), Nathalie Delattre (IGNB), Andreas Pammer (BEV), Stefan Flury (swisstopo)

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Content

• Introduction to EuroRegionalMap (ERM) and EuroGlobalMap (EGM)

• Presentation of the workflow and usage of ESRI software
  • Data model and data formats
  • National data production
  • Building a European-wide dataset

• Conclusion / Future
EuroGeographics

- Association of European National Mapping and Cadastral Agencies
- currently 49 member organisations from 42 countries
- **Vision** → Interoperability of European mapping & other GI data

### Projects
- Harmonisation
- Data models
- Spatial reference data

EuroRegionalMap
1: 250,000

EuroGlobalMap
1: 1 Mio
European Datasets

- Uniform Geodetic Reference System
- Common specification for all participating countries
- No gaps or overlaps along the boundaries
- European wide coverage
- Common marketing and licensing conditions

Other advantages of ERM / EGM:
- Authorised data of NMCAs
- Assured maintenance and update of data
- High quality standard
- Detailed documentation, Metadata (ISO 19115)
- Online delivery
European Datasets

- Authorised data
- Comparable content / density of objects
- Seamless water & transportation network

- Authorised data
- Comparable content / density of objects
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<table>
<thead>
<tr>
<th>EuroRegionalMap (ERM)</th>
<th>EuroGlobalMap (EGM)</th>
</tr>
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<tbody>
<tr>
<td>1:250 000</td>
<td>1:1 Mio</td>
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</table>

| 7 countries → ERM 2006: 31 countries | 32 countries → EGM 2006: 32 countries |

| Geodetic Datum: ETRS89 (~WGS84) |
| Coordinate System: Geographic in Decimal degree |
| Accuracy: 125 m | Accuracy: 1000 m |
| **Themes:** Administrative boundaries, Hydrography, Transportation, Settlements, Named Locations |
| Vegetation, Miscellaneous | Spot elevation |

| Delivery formats: ArcExport (e00), ArcGIS Geodatabase, Shape, MapInfo |
Organisation of work for ERM / EGM

- Decentralised organisation of work
  - All participating countries produce their own data according to the specification

- QA/QC by Regional Coordinators

- Data Integration and final data assembly by project leader:
  - ERM: IGN Belgium
  - EGM: NLS Finland
Workflow

**Data Model**
- Common specification
- Definition of data formats
- Technology, Guidelines

**National Data Production**
- Derivation from national database
- Editing
- QA/QC

**European Reference Data**
- Data exchange
- Edgematching
- QA/QC
Data Formats

- Previous data formats: ArcInfo Coverage, data exchange also in Shape-File
- ERM / EGM Update 2006: Geodatabase $\Leftrightarrow$ Coverage

Problems:
- Coordinate precision
- Codepages
- Annotation
Investigation of Problems in Data Exchange

• Precision
  • Interrelation between precision, cluster-tolerance and coordinate displacement
  • Max displacement of coordinates in different data formats of 4 cm with chosen spatial reference
  • Topology can be recovered

• Codepages
  • Conversion of text attributes in country-specific codepages to Unicode and vice versa
  • Description of workflow and tools

• Annotation
  • No satisfying result yet
Implementation into ArcGIS Geodatabase

- Requested by customers
- More possibilities in data modelling (e.g. Feature Classes with Subtypes)
- Coded/Range values for attributes (Domains)
- Topological relationships
- Names in Unicode (all European Characters available)

Coverage with Codepage

Geodatabase with Unicode

→ Improvement of Data Production and Quality Control
Data Schema

- UML model

Theme/Layer

ERM Database

Feature class

ADMIN
Administrative Boundaries

HYDRO
Hydrography

MISC
Miscellaneous

NAME
Named Location

POP
Settlement

TRANS
Transportation

VEG
Vegetation and Soil

COASTA
Area

COASTL
Line

SPRINGP
Point

DAMC
Point

BI020
Dam/Weir

BI030
Lock

BA020
Foreshore

BA010
Coastline/Shoreline

BB081
Shoreline Construction

BH170
Spring/Water Hole

Feature
Data Model

→ Implementation as ArcGIS Personal Geodatabase:
  • Definition of coordinate system, X/Y extent, precision
  • One feature dataset (→ setting topology)
  • Feature classes, one annotation feature class (Named Locations)
  • Features as subtypes
  • Domains for attributes
  • Tables with relationship classes

UML (Visio) ↔ XML ↔ Schema Wizard ↔ Geodatabase
## National Data Production

- Import from previous ERM / EGM Version
- Import from national Database

<table>
<thead>
<tr>
<th>ArcCatalog: Load</th>
<th>Interactive procedure</th>
</tr>
</thead>
</table>
| ESRI Production Line Toolset (PLTS) | Automated procedure  
                          | Cross-Reference Database contains selection and attribute reference |
| FME                   | Automated procedure with FME workbench  
                          | Diverse data formats  
                          | Selection and attribute reference  
                          | Geometric selection  
                          | Calculate/Set attribute values |
National Data Production

• Editing according ERM / EGM specification:
  • Generalisation
  • Geometric resolution: area, line, point offset

• Attribute completeness
  • E.g. populating administrative key codes, National hydrographic identifier, Road numbers

• Tools:
  • Geoprocessing tools
  • Models, scripts
Data production Switzerland

- Building cross-reference documentation, starting from the target model it describes the derivation from the source
  - Documentation of production
  - Maintenance and update
  - Source for metadata production
- Derivation and transformation of data
- Editing the derived data
  - Topological relationship with other layers
  - Correction
  - QA/QC
Derivation of ERM
Administrative Boundaries (CH)

### Source
- National database
  - VECTOR200
- SABE

### Target
- ERM

[Diagram showing data structures and relationships between source, target, and ERM tables.]

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*EuroRegionalMap and EuroGlobalMap*
## Quality Control

- Checking compliance with specification
- Identify feature and attribute discrepancies and inconsistencies
- Feature density, generalisation degree

| **PLTS Data Reviewer (Knowledgebase)** | • Automated validation of attribute domains as well as combinations of attributes  
| | • Validation of minimum dimensions |
| **GDB Topology** | • Validation of topology  
| | • Not all relationships can be defined |
| **Scripts** | • Validation of generalisation degree,  
| | • Attribute completeness |
| **Visual control** | • Necessary as not all checks can be automated (e.g. feature density) |
Quality Control - Examples

- Automated validation of attribute domains: e.g. watercourse width
Quality Control - Examples

• Validation of topology for the database

Administrative boundary in BND is not consistent with the agreed international boundaries
Quality Control - Examples

• Python script: Automated validation of generalisation degree

Start SumStat at Wed, 19 Apr 2006 15:54:53
Delete output tables SumStat_* if they exist.

Feature Class: PolbndL_Lambert
ShapeType of PolbndL_Lambert: Polyline
:) Found item Countverts and Dist
Perform Summary Statistics
Mean distance between vertices: 131.673244294
End Processing...PolbndL_Lambert

Feature Class: PolbndA_Lambert
ShapeType of PolbndA_Lambert: Polygon
:) Found item Countverts and Dist
Perform Summary Statistics
Mean distance between vertices: 114.670274347
End Processing...PolbndA_Lambert

End SumStat at wed, 19 Apr 2006 15:55:02

• Python Script: Attribute Completeness

Item Statistics (Attribute Completion rate)
Start at Fri, 21 Apr 2006 16:31:41

Feature Class: WatercrSL
------------------------
Field: EXS
Value = 724 --> 117 objects - 0%
>>> Value = 993 --> 14484 objects - 99%
------------------------
Field: HOC
Value = 4 --> 94 objects - 0%
Value = 5 --> 14507 objects - 99%
------------------------
Field: HYC
Value = 6 --> 11 objects - 0%
Value = 8 --> 14590 objects - 99%
------------------------
Field: LOC
Value = 8 --> 12108 objects - 82%
Value = 40 --> 24 objects - 0%
Value = 984 --> 2469 objects - 16%
------------------------
Field: NHI
>>> Value = N_P --> 14601 objects - 100%
------------------------
Field: NAMAL
Quality Control - Examples

- Visual Control

![Map with marked non-navigable and pseudo nodes](image)
European wide dataset

- Data Exchange:
  - Personal Geodatabase (for single layer)
  - Export as coverage (e00) → for countries working with ArcInfo
  - Through Internet based services (e.g. Projectplace)

- Edgematching:
  - Bilateral edgematching along international boundaries:
    - Geometric matching (common endpoints or consistent geometry of boundaries)
    - Create cross-border network (e.g. watercourses, roads)
    - Complete attribution of features on the boundary
Edgematching - Examples

- Create cross-border network, e.g. watercourses Germany - Austria

- Complete attribution of features on the boundary

<table>
<thead>
<tr>
<th>Attributes for border crossing point</th>
<th>Original AT</th>
<th>Original CZ</th>
<th>EGM</th>
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<tbody>
<tr>
<td>NAMN1</td>
<td>Schrattenberg</td>
<td>Valtice</td>
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<tr>
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<td>NLN1</td>
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Conclusion / Future

- EuroRegionalMap / EuroGlobalMap meet the requirements of European spatial reference data
- ESRI ArcGIS provides improved possibilities in data modelling, production and QA/QC
- Implementation of PLTS and FME
- Improved functionality of ArcGIS desirable

- Availability of ERM / EGM:
  - Version 2.0 (2006) available

- Customers:
  - European Commission (EuroStat)
  - International River Commissions of Rhine, Elbe, Danube
  - Alpine Convention
European datasets

Thank you for your attention!

• Contact:
  • EuroGeographics (Online Ordering & Delivery System): www.eurogeographics.org