Danube Basin Soil Database

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Soil Information System (SIS) on Danube river basin

- Flood Risk Assessment Project
- Georeferenced Soil Database of Europe
Materials used for database construction


- LISFLOOD, a distributed water-balance, flood simulation and flood inundation model, Version 1.0 (Ad de Roo et.at., EC/JRC, 2002).

- The procedures and experiences developed in the pilot project creating the digital soil database for the Odra basin at the scale 1:250,000 (Warsaw, 2001)
1. Develop and test in real time a pre-operational pan-European Flood Alert System (EFAS) based on LISFLOOD with 1-10 day lead-time, focusing on the Elbe and Danube river basins.

2. Evaluation of flood defence and mitigation plans for the Elbe and Danube catchments through scenario modelling of engineering, land-use change including urban expansion and climate change effects on flood risk in view of regional sustainability and environmental preventive measures.

3. Development of a framework on Sustainable Urban Development and Integrated Management of extreme events, including concepts and methods for integrated territorial management at EU, river basin and regional level.

4. Scientific and technical support towards a European approach related to other weather driven natural hazards.

5. Contribute to the ERA and Enlargement through networking and training activities.

**LISFLOOD model – evaluation of flood risk in different time interval**
LISFLOOD model
„Cascade“ structure of LISFLOOD model

LISFLOOD-WB: a water balance model (daily time step)
LISFLOOD-FS: a flood simulation model (hourly time step)
LISFLOOD-FP: a floodplain inundation model (second time step)

Input data:
- CORINE land cover;
- Soil database parameters (soil texture and depth);
- Flow rates (the river channel network);
- Meteorological data (precipitation, temperature, wind, humidity)
- Geological Data
- Digital Elevation Model

Output data:
- Annual results and daily discharge (Water balance module);
- Daily-weekly Results and hourly Discharge (Flood simulation module);
- Hourly- daily results, Flood extent (Floodplain inundation Module)
Use of Soil data in LISFLOOD model

**Inputs**
- bulk density
- topsoil texture
- subsoil texture
- depth to bedrock
- Parent material
- Organic matter content

**HYPRES**
- Infiltration parameters
- topsoil Van Genuchten parameters
- subsoil Van Genuchten parameters
- Groundwater parameters

**HYPRES**
- infiltration
- h/v transport
- h/v transport
- water storage
- groundwater
Georeferenced Soil Database of Europe (1:250,000)

**Structure** and **contents** of database are defined according to Manual of Procedures, Vers. 1.1 from 2003 (ESB, IES/JRC), EUR 18092 EN.

**The purposes** of the present Manual are:

- To define the structure and contents of the database.
- To describe the methods of georeferencing the data.
- To outline suggested procedures for regional mapping and sampling programmes.
- To prescribe a format of data storage.
- To ensure inter-regional and inter-country harmonization of data acquisition, processing and interpretation.
- To pave the way for the creation of a user-friendly soil database which will cater for present and future demands for specific soils information.
General Structure of the Database

Topological dataset | Objects | Semantic dataset | Geometric dataset
---|---|---|---
Organization | Horizon | measurements | geometry
Organization | Soil body | spatial estimates |
Organization | Soilscape | definition |
Limits | Soil region | measurements |
Limits | | spatial estimates |
Limits | | description |
Limits | | definition and description |

= Table(s)  = Object  = 1:1 relation  = 1:n relation
Information of Soil Regions
Level

Soil regions
For soils on soil region information level are typical similar soil forming conditions. They are the largest units of soil description and typical associations of dominant soils occurring in areas limited by typical climate and/or typical parent material. Each soil region is characterized by following attributes:

- Parent material
- Dominant parent material
- Climatic data
- Altitudes and major landforms.
Information on Soil Scape level

Soilscape

Information on soilscape level represents that part of soil cover, which groups soil bodies having former or present functional relationships, and can be represented at scale 1:250 000. Main diagnostic criterion for delimitation of soil units according to morphological attributes is relief. The most important role play morphological attributes as: slope, slope length, altitude, curvature, etc. Information on soilscape level is the basis for geometric part of the database.
Information on Soil body level

Soil body
It is a portion of the soil cover of with diagnostic characteristics resulting from similar processes of soil genesis. Soil body description comprises also morphological and analytical attributes of the main horizons.

Database to this time consist mainly of soil data from river basins: Elbe, Odra and Meuse. National soil survey of Italy is also part of this database. In this time the Danube basin data are collected according to the Manual of procedures (Vers. 1.1).
Danube Basin

Figures

Area: 817,000 km²
Length: 2,857 km
Alt. of source: 1,078 m
Population: ± 80 mil.

DANUBE BASIN DATABASE MEETING
Explanatory meeting for contributors of data,
JRC/Ispra/Soil&Waste Unit
22–23 January, 2004

Representatives from: Austria, Czech Republic,
Hungary, Slovakia, JRC

Point data:
• Soil body definition table;
• Soil body measuring table;
• Horizon measurement table.
≈ 1 200 points/country
## Structure of Danube basin soil database

### Soil body definition table

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Type</th>
<th>Mandatory</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil_body (key)</td>
<td>char 10</td>
<td>yes</td>
<td>33.2.SB81</td>
<td>Code soil body (SB821) within soil region (33.2)</td>
</tr>
<tr>
<td>sb_wrb</td>
<td>char 10</td>
<td>yes</td>
<td>stn-vr -LV</td>
<td>WRB-classification ¹</td>
</tr>
<tr>
<td>sb_mat</td>
<td>char 3</td>
<td>yes</td>
<td>900</td>
<td>Parent material ²</td>
</tr>
<tr>
<td>sb_obst</td>
<td>char 1</td>
<td>yes</td>
<td>1</td>
<td>Depth to obstacle for roots ³</td>
</tr>
</tbody>
</table>
## Structure of Danube basin soil database

### Soil body measurement table

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Type</th>
<th>Mandatory</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil_body</td>
<td>char 10</td>
<td>yes</td>
<td>33.2.SB821</td>
<td>code soil body (SB821) within soil region (33.2)</td>
</tr>
<tr>
<td>sbsm_X</td>
<td>num 5</td>
<td>yes</td>
<td>12.10</td>
<td>X-coordinate representative soil profile (eastern latitude)</td>
</tr>
<tr>
<td>sbsm_Y</td>
<td>num 4</td>
<td>yes</td>
<td>35.20</td>
<td>Y-coordinate representative soil profile (longitude)</td>
</tr>
<tr>
<td>sbsm_alt</td>
<td>num 4</td>
<td>yes</td>
<td>812</td>
<td>Surface altitude (meter a.s.l.)</td>
</tr>
<tr>
<td>sbsm_depw</td>
<td>num 3</td>
<td>yes</td>
<td>20</td>
<td>average depth to water table (dm)</td>
</tr>
</tbody>
</table>
Structure of Danube basin soil database

Soil horizon measurement table

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Type</th>
<th>Mandatory</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil_body</td>
<td>char 10</td>
<td>yes</td>
<td>33.2.SB821</td>
<td>code soil body</td>
</tr>
<tr>
<td>body_hor</td>
<td>char 3</td>
<td>yes</td>
<td>1ap</td>
<td>code soil horizon</td>
</tr>
<tr>
<td>sbhm_top</td>
<td>num 3</td>
<td>yes</td>
<td>0</td>
<td>starting depth horizon (cm)</td>
</tr>
<tr>
<td>sbhm_bot</td>
<td>num 3</td>
<td>yes</td>
<td>20</td>
<td>ending depth horizon (cm)</td>
</tr>
<tr>
<td>sbhm_clay</td>
<td>num 2</td>
<td>yes</td>
<td>20</td>
<td>clay content (%)</td>
</tr>
<tr>
<td>sbhm_clayQ1</td>
<td>char 10</td>
<td>yes</td>
<td>NLD01_1988</td>
<td>country, lab and year of analysis</td>
</tr>
<tr>
<td>sbhm_clayQ2</td>
<td>char 1</td>
<td>yes</td>
<td>m</td>
<td>quality estimate of analysis</td>
</tr>
<tr>
<td>sbhm_silt</td>
<td>num 2</td>
<td>yes</td>
<td>40</td>
<td>silt content (%)</td>
</tr>
<tr>
<td>sbhm_siltQ1</td>
<td>char 10</td>
<td>yes</td>
<td>NLD01_1988</td>
<td>country, lab and year of analysis</td>
</tr>
<tr>
<td>sbhm_siltQ2</td>
<td>char 1</td>
<td>yes</td>
<td>m</td>
<td>quality estimate of analysis</td>
</tr>
<tr>
<td>sbhm_sand</td>
<td>num 2</td>
<td>yes</td>
<td>40</td>
<td>sand content (%)</td>
</tr>
<tr>
<td>sbhm_sandQ1</td>
<td>char 10</td>
<td>yes</td>
<td>NLD01_1988</td>
<td>country, lab and year of analysis</td>
</tr>
<tr>
<td>sbhm_sandQ2</td>
<td>char 1</td>
<td>yes</td>
<td>m</td>
<td>quality estimate of analysis</td>
</tr>
<tr>
<td>sbhm_stgr</td>
<td>char 2</td>
<td>yes</td>
<td>vv</td>
<td>stone/gravel abundance and size</td>
</tr>
<tr>
<td>sbhm_stgrQ1</td>
<td>char 10</td>
<td>yes</td>
<td>NLD01_1988</td>
<td>country, lab and year of analysis</td>
</tr>
<tr>
<td>sbhm_stgrQ2</td>
<td>char 1</td>
<td>yes</td>
<td>m</td>
<td>quality estimate of analysis</td>
</tr>
<tr>
<td>sbhm Om</td>
<td>num 4.1</td>
<td>yes</td>
<td>8.1</td>
<td>organic matter content (%)</td>
</tr>
<tr>
<td>sbhm OmQ1</td>
<td>char 10</td>
<td>yes</td>
<td>NLD01_1988</td>
<td>country, lab and year of analysis</td>
</tr>
<tr>
<td>sbhm OmQ2</td>
<td>char 1</td>
<td>yes</td>
<td>m</td>
<td>quality estimate of analysis</td>
</tr>
</tbody>
</table>
Identifiers of Soil body measurement table

Profile_sm_X
X – coordinate of described soil profile information (eastern longitude). Units are degrees.centidegrees.

Profile_sm_Y
Y – coordinate of described soil profile (northern latitude). Units are degrees.centidegrees.

Profile_sm_alt
Surface altitude in meters above sea level, potentially below sea level. In case below sea level minus – sign characterizes this fact.

Profile_sm_depw
The annual average water table depth in decimeters. Unknown depths or absence of a water table is indicated by a minus sign: a - sign preceding any number between 1 and 99 indicates a depth deeper than the number (example: -35 indicates a water table depth deeper than 3.5 meter); -99 indicates absence of a water table.
Soil Profiles

Soil profiles acquired from States within the Basin: 7,695 points

**Projection used:**

The ETRS89 Lambert Azimuthal Equal Area Coordinate Reference System (ETRS-LAEA) is a single projected coordinate reference system for all of the Pan-European area. It is based on the ETRS89 geodetic datum and the GRS80 ellipsoid.
### Soil textural classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No texture</td>
<td>Peat soils</td>
</tr>
<tr>
<td>1</td>
<td>Coarse</td>
<td>18% &gt; clay and ≥ 65% sand</td>
</tr>
<tr>
<td>2</td>
<td>Medium</td>
<td>18% ≤ clay &lt; 35% and ≥ 15% sand, or</td>
</tr>
<tr>
<td>3</td>
<td>Medium fine</td>
<td>18% ≤ clay and 15% ≤ sand &lt; 65%</td>
</tr>
<tr>
<td>4</td>
<td>Fine</td>
<td>&lt;35% clay and &lt;15% sand</td>
</tr>
<tr>
<td>5</td>
<td>Very fine</td>
<td>≥ 60% clay</td>
</tr>
</tbody>
</table>

Where: sand=fraction between 50 and 2000 μmeter; silt=fraction between 2 and 50 μmeter; clay= fraction smaller than 2 μmeter
Texture classes (after CEC, 1985)
## Parent material

<table>
<thead>
<tr>
<th>Level</th>
<th>Criteria for subdivision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Class</strong></td>
<td>Most recent rock formation process (sedimentation, diagenesis, intrusion, volcanism, metamorphism)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Class</th>
<th>100 Energy level of deposition and facies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>200 Dominant process of (bio)chemical sedimentation</td>
</tr>
<tr>
<td></td>
<td>300 Acidity level of igneous rocks and depositional mode of volcanic efflata</td>
</tr>
<tr>
<td></td>
<td>400 Degree and type of metamorphism and acidity of associated minerals</td>
</tr>
<tr>
<td></td>
<td>500 Type of alluvial deposition (marine, fluvial, lake, mass movement) and parent rock in case of weathering residuum</td>
</tr>
<tr>
<td></td>
<td>600 Type of (peri)glacial deposition</td>
</tr>
<tr>
<td></td>
<td>700 Texture of eolian sediment</td>
</tr>
<tr>
<td></td>
<td>800 Type of deposition or accumulation of organic materials</td>
</tr>
<tr>
<td></td>
<td>900 Origin of anthropogenic deposits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>100 Texture and mineralogy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200 Consistency or mineralogy</td>
</tr>
<tr>
<td></td>
<td>300 Mineralogy or degree of consolidation of efflata</td>
</tr>
<tr>
<td></td>
<td>400 Mineralogy</td>
</tr>
<tr>
<td></td>
<td>500 Age or energy level of deposition or mass movement or in situ character of weathering residuum</td>
</tr>
<tr>
<td></td>
<td>600 Texture</td>
</tr>
<tr>
<td></td>
<td>700 Texture and resulting physiography</td>
</tr>
<tr>
<td></td>
<td>800 Nutrient status or degree diagenesis</td>
</tr>
<tr>
<td></td>
<td>900 Texture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subtype</th>
<th>100 Mineralogy or texture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200 Consistency and morphological appearance</td>
</tr>
<tr>
<td></td>
<td>300 Mineralogy or texture of efflata (material from volcanic eruptions)</td>
</tr>
<tr>
<td></td>
<td>400 Mineralogical features or morphological appearance</td>
</tr>
<tr>
<td></td>
<td>500 Texture and stoniness</td>
</tr>
<tr>
<td></td>
<td>600 -</td>
</tr>
<tr>
<td></td>
<td>700 -</td>
</tr>
<tr>
<td></td>
<td>800 Degree of composting</td>
</tr>
<tr>
<td></td>
<td>900 -</td>
</tr>
</tbody>
</table>
Root obstacle reasons

Codes for root obstacle reason:

- T – toxic
- L – lowox
- R – rock
- I – imper

The following classes of depth are distinguished in the soil profile:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Depth to obstacle for roots 0 - 10 cm</td>
</tr>
<tr>
<td>2</td>
<td>Depth to obstacle for roots 10 - 25 cm</td>
</tr>
<tr>
<td>3</td>
<td>Depth to obstacle for roots 25 - 50 cm</td>
</tr>
<tr>
<td>4</td>
<td>Depth to obstacle for roots 50 - 100 cm</td>
</tr>
<tr>
<td>5</td>
<td>Depth to obstacle for roots &gt; 100 cm</td>
</tr>
</tbody>
</table>

Reason and depth to obstacle for roots = Code of root obstacle reason + Class of Depth

Example: R3
Contributors

Available
- Slovak Republic
- Austria
- Czech Republic
- Romania
- Hungary
- Bosnja–Herzegovina
- Slovenia

Pending
- Bulgaria
- Croatia
- Germany

Missing
- Serbia
- Ukraine
- Moldovja