Some European Initiatives in Floods Prediction

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European Flood Alert System (EFAS)

- Increase flood forecasting lead time (3 – 10 days)
- Catchment based (no administrative boundaries)
- Provide help in interpretation of different weather forecasts and EPS

- Give overview of flood situation in Europe
- Potential early warning for international aid organisations
- Give comparable results across Europe
- Harmonisation of hydrological data and data exchange in Europe

JRC developed and tested a prototype of EFAS to a pre-operational state during FP6

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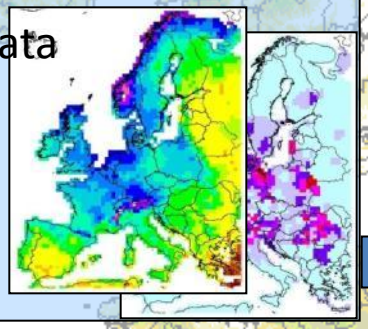
Meteo data

-ECMWF

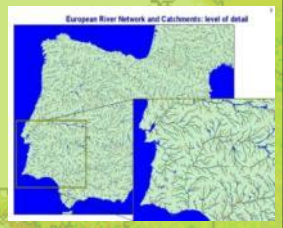
-DWD

-DMI…



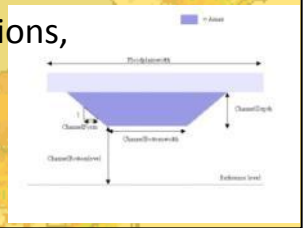
JRC European Data

-Soil, Surface, river catchment system, …

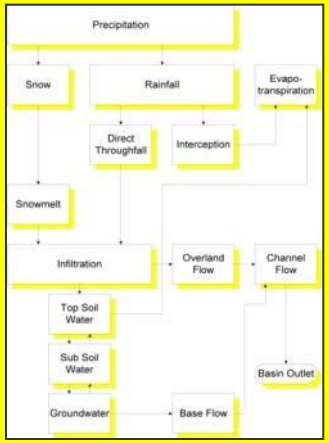


Member States data

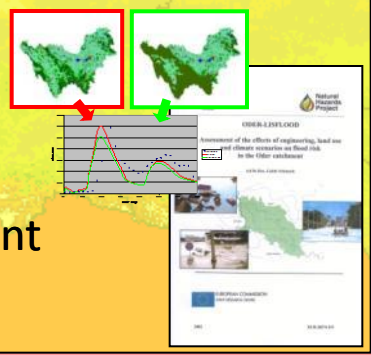
-River dimensions, Alert levels



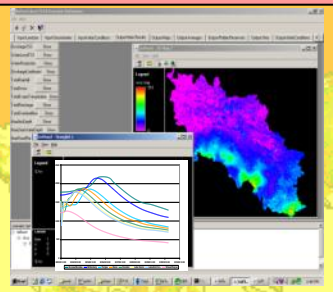
LISFLOOD



River basin management



Flood simulation & forecasting



Elbe

Danube

Douro

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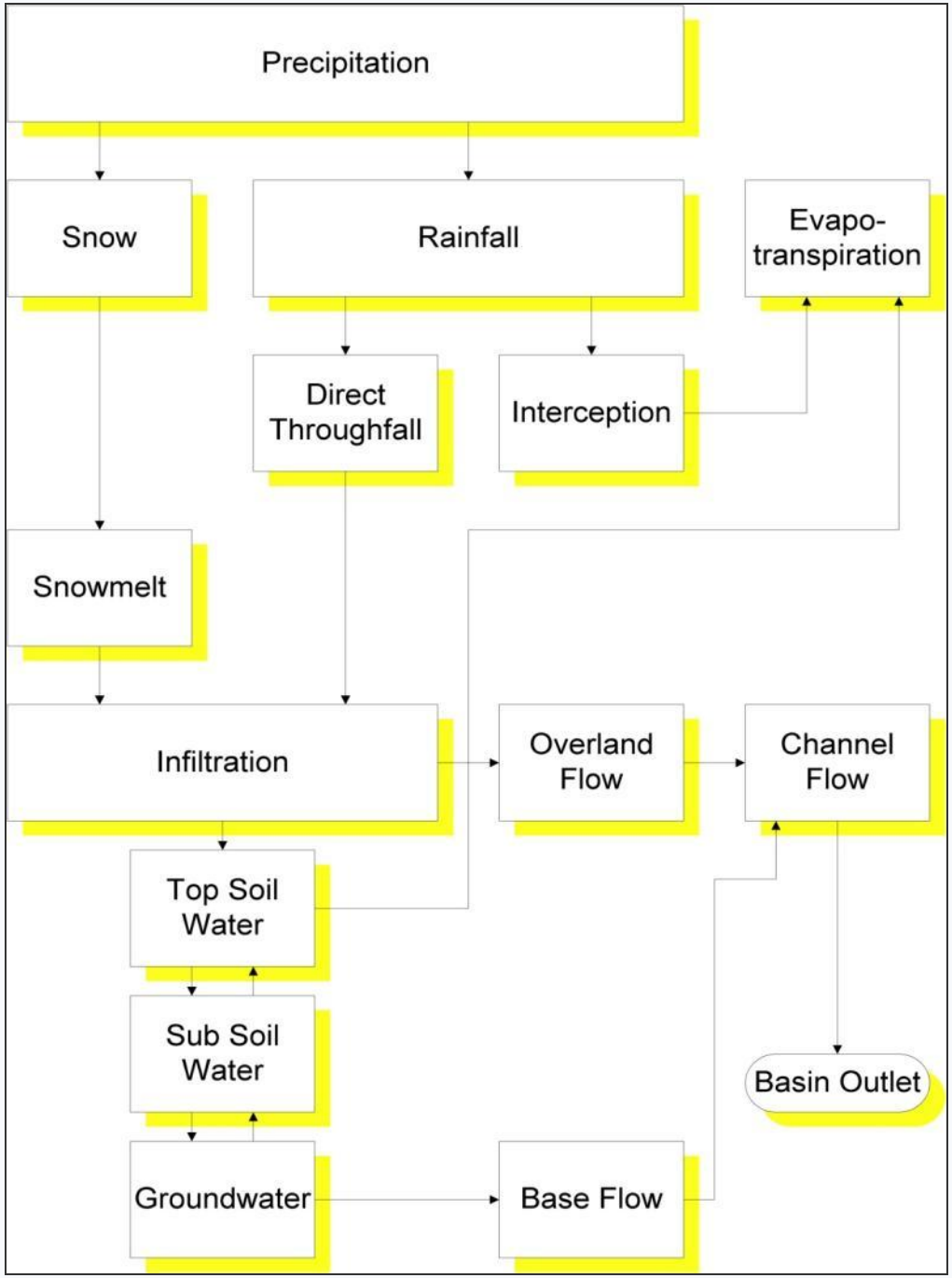
LISFLOOD model



„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)

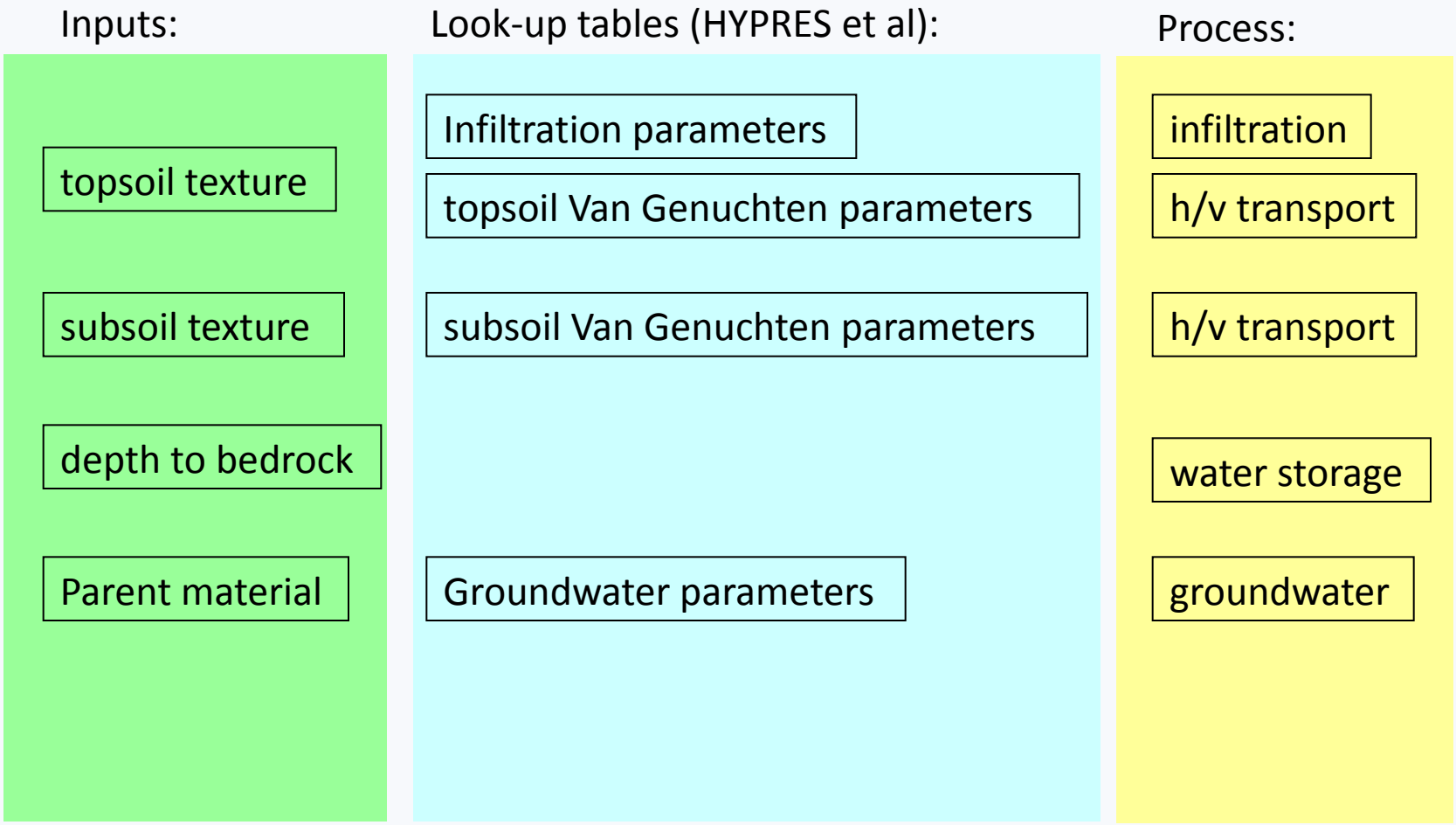
Input data:

- 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 of daily discharge (Water balance module);
- Daily-weekly Results and hourly Discharge (Flood simulation module);
- Hourly- daily results, Flood extent (Floodplain inundation Module)

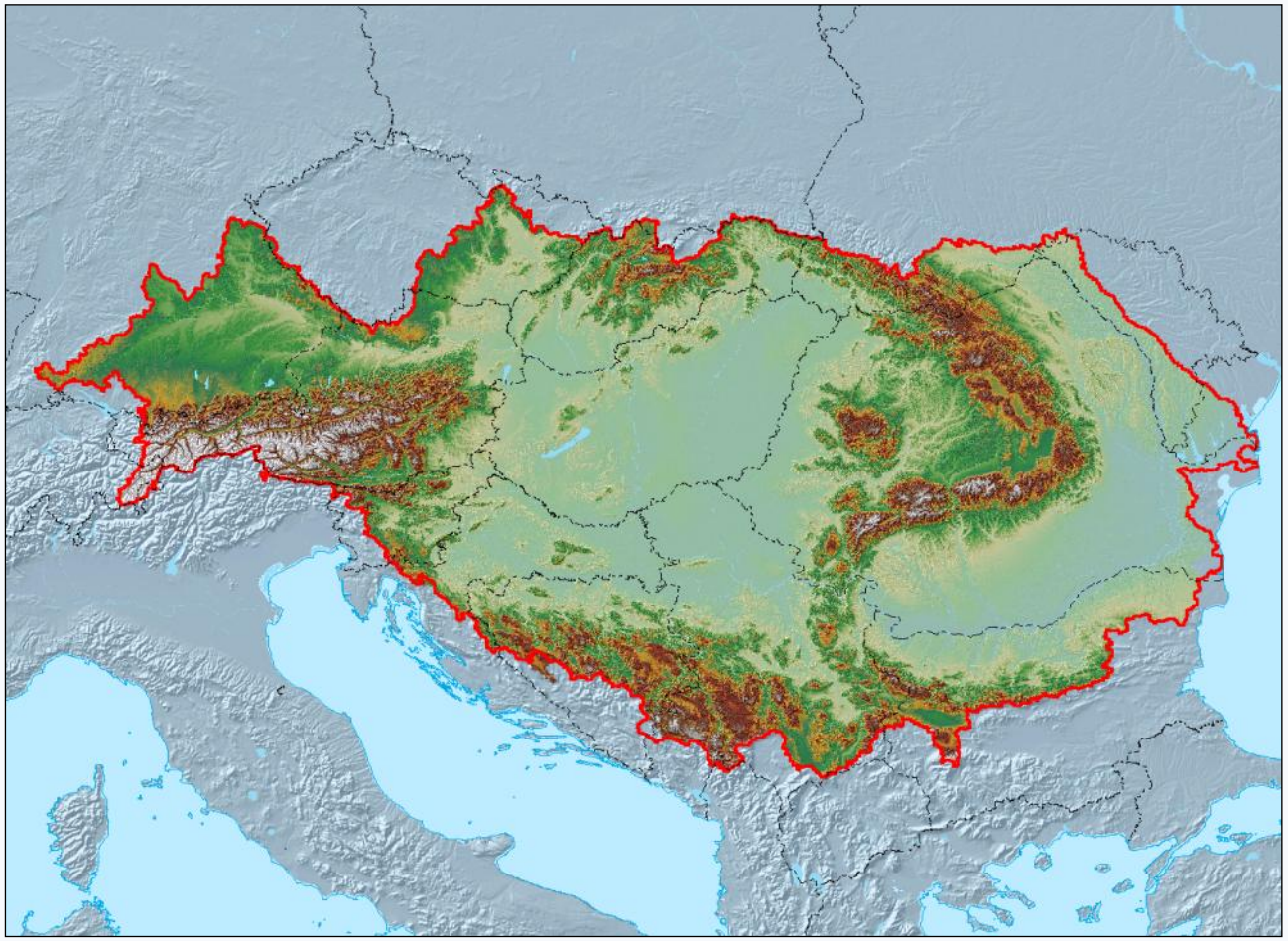
Soil data use in LISFLOOD model



Danube Basin

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

For the map of the Danube basin is used the ***ETRS89 Lambert Azimuthal Equal Area Coordinate Reference System (ETRSLAEA)*** which 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.



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Soil Information System (SIS) on Danube river basin

- Flood Risk Assessment Project

- Georeferenced Soil Database of Europe

(according to the guidelines for the map 1:250,000 database)

Part of the Data ESDAC - European Soil Data Center

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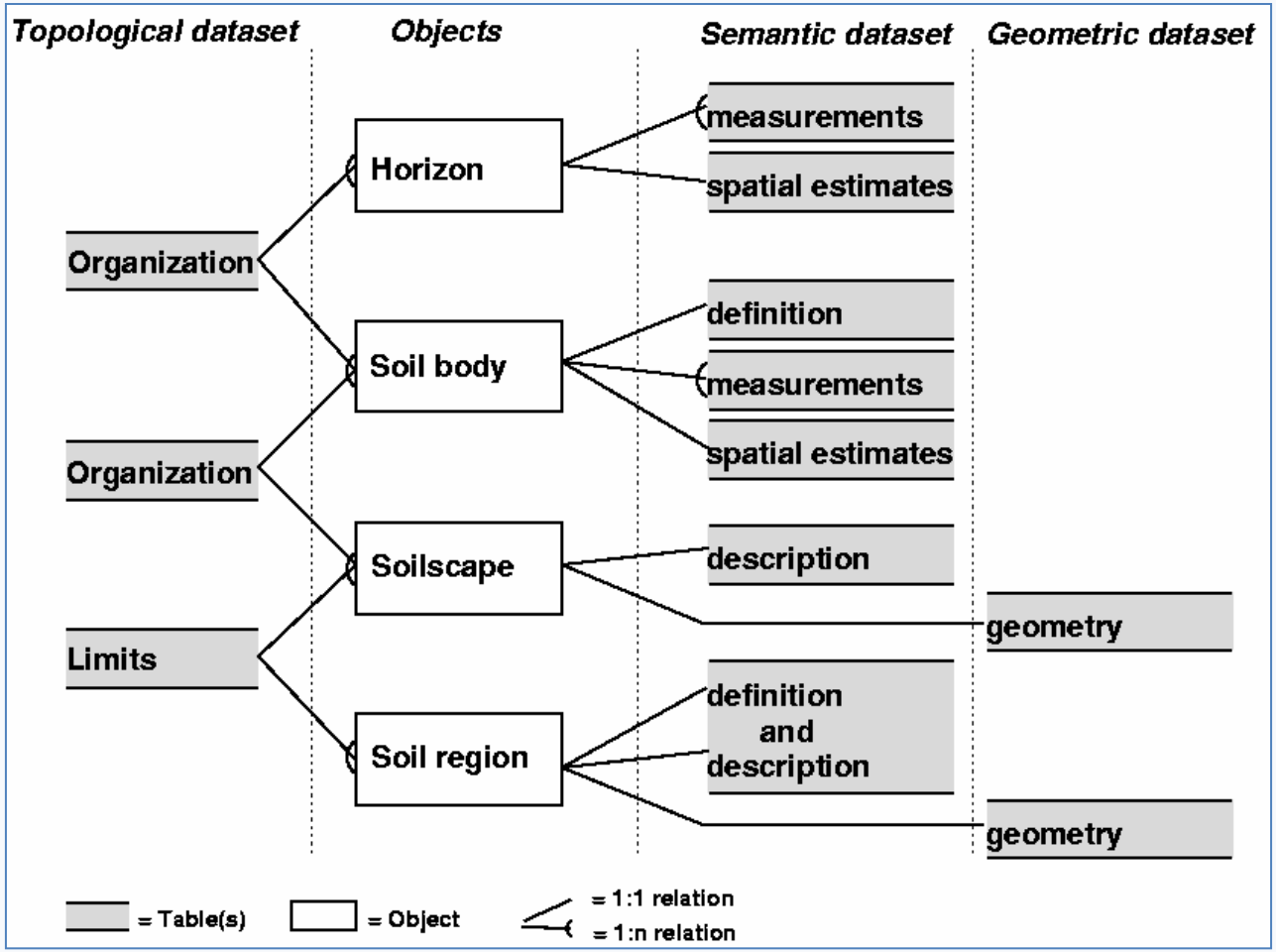
General structure of Georeferenced Soil Database of Europe, 1:250,000

(*as actual till present*)



Structure of Danube basin soil database

- Soil body definition table;
- Soil body measurement table;
- Soil horizon measurement table

Definition

Soil body

Soil body is a portion of soil cover with diagnostic characteristics resulting from similar processes of soil genesis. Morphological and analytical attributes of the main horizons are part of soil body description.

Structure of Danube basin soil database

Soil body definition table

Identifier	Type	Mandatory	Example	Description
soil_body (key)	char 10	yes	33.2.SB81	Code soil body (SB821) within soil region (33.2)
sb_wrb	char 10	yes	stn-vr -LV	WRB-classification [1]
sb_mat	char 3	yes	900	Parent material [2]
sb_obst	char 1	yes	1	Depth to obstacle for roots [3]

Structure of Danube basin soil database

Soil body measurement table

Identifier	Type	Mandatory	Example	Description
soil_body (key)	char 10	yes	33.2.SB821	code soil body (SB821) within soil region (33.2)
sbsm_X	num 5	yes	12.10	X-coordinate representative soil profile (eastern latitude)
sbsm_Y	num 4	yes	35.20	Y-coordinate representative soil profile (longitude)
sbsm_alt	num 4	yes	812	surface altitude (meter a.s.l.)
sbsm_depw	num 3	yes	20	average depth to water table (dm)

Structure of Danube basin soil database

Soil horizon measurement table

Identifier	Type	Mandatory	Example	Description [1]
soil_body (key)	char 10	yes	33.2.SB821	code soil body
body_hor (key)	char 3	yes	1ap	code soil horizon
sbhm_top	num 3	yes	0	starting depth horizon (cm)
sbhm_bot	num 3	yes	20	ending depth horizon (cm)
sbhm_clay	num 2	yes	20	clay content (%)
sbhm_clayQ1	char 10	yes	NLD01_1988	country, lab and year of analysis
sbhm_clayQ2	char 1	yes	m	quality estimate of analysis
sbhm_silt	num 2	yes	40	silt content (%)
sbhm_siltQ1	char 10	yes	NLD01_1988	country, lab and year of analysis
sbhm_siltQ2	char 1	yes	m	quality estimate of analysis
sbhm_sand	num 2	yes	40	sand content (%)
sbhm_sandQ1	char 10	yes	NLD01_1988	country, lab and year of analysis
sbhm_sandQ2	char 1	yes	m	quality estimate of analysis
sbhm_stgr	char 2	yes	vv	stone/gravel abundance and size
sbhm_stgrQ1	char 10	yes	NLD01_1988	country, lab and year of analysis
sbhm_stgrQ2	char 1	yes	m	quality estimate of analysis
sbhm_om	num 4.1	yes	8.1	organic matter content (%)
sbhm_omQ1	char 10	yes	NLD01_1988	country, lab and year of analysis
sbhm_omQ2	char 1	yes	m	quality estimate of analysis

Aggregating data into Soil Groups

Morphogenetic principle used:

1. similar soil properties of genetic horizons:
   - morphologic
   - physical
   - chemical
   - biological
2. Similar/the same soil creation processes

Result:

10 Soil Groups

Soil Groups in Danube Basin

SOIL GROUP	SOIL UNIT (WRB, 1994)
G1	Lithic Leptosols Rendzi-Lithic Regosols
G2	Skeletic, Umbric, Dystric, Mollic, Eutric, Cambi-Dystric, Cambi-Eutric, Rendzic Leptosols; Calcaric, Stagni-Calcaric, Chromi-Calcaric Cambisols
G3	Haplic, Ca;caric Vertisols; Haplic, Areni-Haplic, Verti-Haplic, Luvi-Haplic, Cambi-Haplic, Stagni-Gleyic Chernozems; Mollic, Hapli-Gleyic, Verti-Gleyic, Gleyi-Haplic Chernozems, Mollic, Histi-Mollic Gleysols
G4	Greyic, Luvic Phaeozems; Haplic, Calcic, Albi-Haplic, Stagni-Haplic, Chromic Luvisols, Luvic Arenosols; Albic, Albi-Dystric, Albi-Chromic Luvisols, Albi-Luvic Arenosols, Haplic, Stagnic Glossisols
G5	Eutric, Dystric, Molli-Eutric, Andic, Chromic Cambisols, Cambic, Haplic, Skeletic Umbrisols; Eutric, Pachic, Vitric , Silic, Umbri-Silic Andosols
G6	Haplic, Cambic, Umbric, Gleyic, Stagnic, Foli-Haplic, Histi-Haplic podzols
G7	Haplic, Fluvic, Arenic, Histi-Mollic, Histi-Umbric, Histic Gleysols; Haplic, Leptic, Fibric Histosols
G8	Eutric, Dystric, Calcaric, Vertic Fluvisols
G9	Haplic, Gleyic, Mollic, Sodic Solonchaks, Salic Fluvisols; Haplic, Gleyic, Albi-Haplic Solonetz
G10	Urbi-Anthropic Regosols, Anthropo-Skeletic Leptosols

Typical altitudes for Individual Soil Units Occurence, land use and land cover in Danube Basin

SOIL UNIT (WRB, 1994)	ALTITUDE (m a.s.l.)	SOIL USE PLANT COVER
Lithic Leptosols, Rendzi-Lithic Leptosols	1800 – 2665	Alpine meadows
Eutric, Dystric, Calcaric, Skeli-Eutric, Clayi-Eurtic Regosols, Skeletic Leptosols, Haplic, Calcaric Arenosols	130 - 600	Arable land, orchards, forest
Skelic, Umbric, Dystric, Mollic, Eutric, Cambi-Dystric, Cambi-Eutric Leptosols	1300 - 1800	Alpine meadows
Rendzic, Foli-Rendzic, Skeli-Rendzic, Chromi-Rendzic Leptosols	200 - 2000	Forest, alpine meadows, partly arable land
Calcaric, Stagni-Calcaric, Chromi-Calcaric Cambisols	200-800	Arable land, orchards, forest
Haplic, Calcic, Calcaric Vertisols	till 200	Arable land
Haplic, Areni-Haplic, Verti-Haplic, Luvi-Haplic, Cambi-Haplic, Stagni-Gleyic Chernozems	110 - 300	Arable land
Mollic Fluvisols, Hapli-Gleyic, Verti-Gleyic, Gleyi-Haplic Chernozems, Mollic, Histi-Mollic Gleysols	95 - 200	Arable land
Greyic, Luvic Phaeozems	150 - 350	Arable land
Haplic, Calcic, Albi-Haplic, Stagni-Haplic, Chromic Luvisols, Luvic Arenosols	150 - 480	Arable land

Typical altitudes for Individual Soil Units Occurence, land use and land cover in Danube Basin

SOIL UNIT (WRB, 1994)	ALTITUDE (m a.s.l.)	SOIL USE PLANT COVER
Albic, Albi-Dystric, Albi-Chromic Luvisols, Albi-Luvic Arenosols, Haplic, Stagnic Glossisols	150 - 600	Arable land, orchards, greenwood (oak-trees)
Eutric, Skeli-Eutric, Verti-Eutric, Andic, Luvi-Eutric, Eutri-Chromic Cambisols	145 - 800	Greenwood, orchards, arable land,
Dystric, Dystri-chromic Cambisols	(200) 600 - 1400	coniferous wood, pasture
Eutric Andosols	500 - 800	Greenwood, arable land
Vitric, Silic (Umbri-Silic) Andosols	800 - 1500	Pasture
Haplic, Humic, Cambic, Umbric Podzols	(800) 1400 – 2000; also about 200	Alpine meadows, scrubs, coniferous wood
Dystric, Eutric Planosols, Luvic, Albic, Haplic, Gleyic, Histi-Haplic Stagnosols	200 - 1000	Greenwood, permanent grassland, arable land
Haplic, Fluvic, Arenic, Histi-Mollic, Histi-Umbric Gleysols	Usually from 95 m till stream's springs	Mainly permanent grassland, partly arable land
Haplic, Leptic, Fibric Histosols, Histic Gleysols	Lowlands-uplands	Peat exploitation
Eutric, Dystric, Calcaric Fluvisols	Alluvial parts of streams	Arable land, permanent grasslands, meadow forrest
Haplic, Gleyic, Mollic, Sodic Solonchaks	100 - 130	Mainly grassland
Haplic, Gleyic, Albi-Haplic Solonetz	100 - 130	Mainly grassland

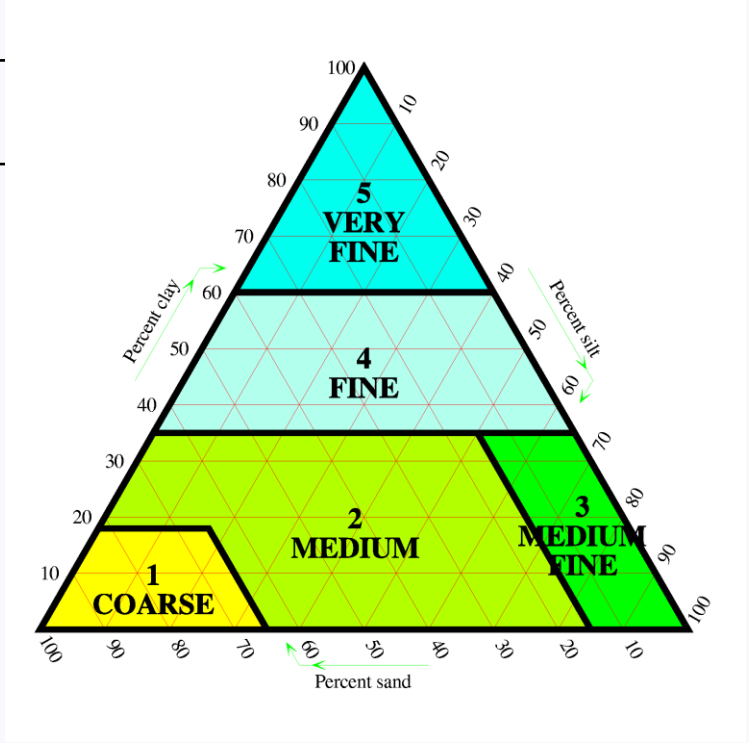
The European Soil Database, V2.0
(1:1 M)

Main components of the database

1. The Soil Geographical Database of Eurasia at scale 1:1,000,000 (SGDBE)
2. The Pedotransfer Rules Database (PTRDB)
3. The Soil Profile Analytical Database of Europa (SPADE -1, SPADE -2)
4. The Database of Hydraulic Properties of European Soils (HYPRES)

Texture class: Surface soil

TEXT1	Dominant surface textural class.
TEXT2	Secondary surface textural class.
(Present in:	*STU)*
0	No information
9	No texture (histosols, ...)
1	Coarse (clay < 18 % and sand > 65 %)
2	Medium (18% < clay < 35% and sand > 15%, or clay < 18% and 15% < sand < 65%)
3	Medium fine (clay < 35 % and sand < 15 %)
4	Fine (35 % < clay < 60 %)
5	Very fine (clay > 60 %)



Water Management

WM1	Normal presence of a water management system in agricultural land (on > 50% STU).
(Present in:	*STU)*
0	No information
1	Yes, agricultural land normally has a water management system
2	No, agricultural land normally has no water management system

Water Management: Purpose

WM2		Purpose of the water management system.
(Present in:	*STU)*	
	0	No information
	1	To alleviate waterlogging (drainage)
	2	To alleviate drought stress (irrigation)
	3	To alleviate salinity (drainage)
	4	To alleviate both waterlogging and drought stress
	5	To alleviate both waterlogging and salinity

Water Management: Type

WM3		Evident type of water management system.
(Present in:		*STU)*
	0	No information
	1	Pumping
	2	Ditches
	3	Pipe underdrainage (network of drain pipes)
	4	Mole drainage
	5	Deep loosening (subsoiling)
	6	'Bed' system (ridge-funow or steching)
	7	Flood irrigation (system of irrigation by controlled flooding as for rice)
	8	Overhead sprinkler (system of irrigation by sprinkling)
	9	Trickle irrigation

Water Regime

WR	Dominant annual average soil water regime class of the soil profile.
(Present in:	*STU)*
0	No information
1	Not wet* within 80 cm for over 3 months, nor wet within 40 cm for over 1 month
2	Wet within 80 cm for 3 to 6 months, but not wet within 40 cm for over 1 month
3	Wet within 80 cm for over 6 months, but not wet within 40 cm for over 11 months
4	Wet within 40 cm depth for over 11 months

* Wet = waterlogged; defined as: a matric suction of < 10 cm, or a matric potential of > -1 kPa

Pan European Soil Erosion Risk Assessment - PESERA

These data have been prepared by the PESERA Project, European Commission funded fifth framework project - contract "QLK5-CT-- 1999-01323". Further details are described in:

"Pan-European Soil Erosion Risk Assessment: The PESERA Map, Version 1 October 2003. Explanation of Special Publication Ispra 2004 No.73 (S.P.I.04.73)."
Kirkby, M.J.et al. (2004). European Soil Bureau Research Report No.16, EUR 21176, 18pp. and 1 map in ISO B1 format.
Office for Official Publications of the European Communities, Luxembourg

Model run: PESERA 103, October 2003, with Global Correction
Map produced by: Institute for Environment and Sustainability

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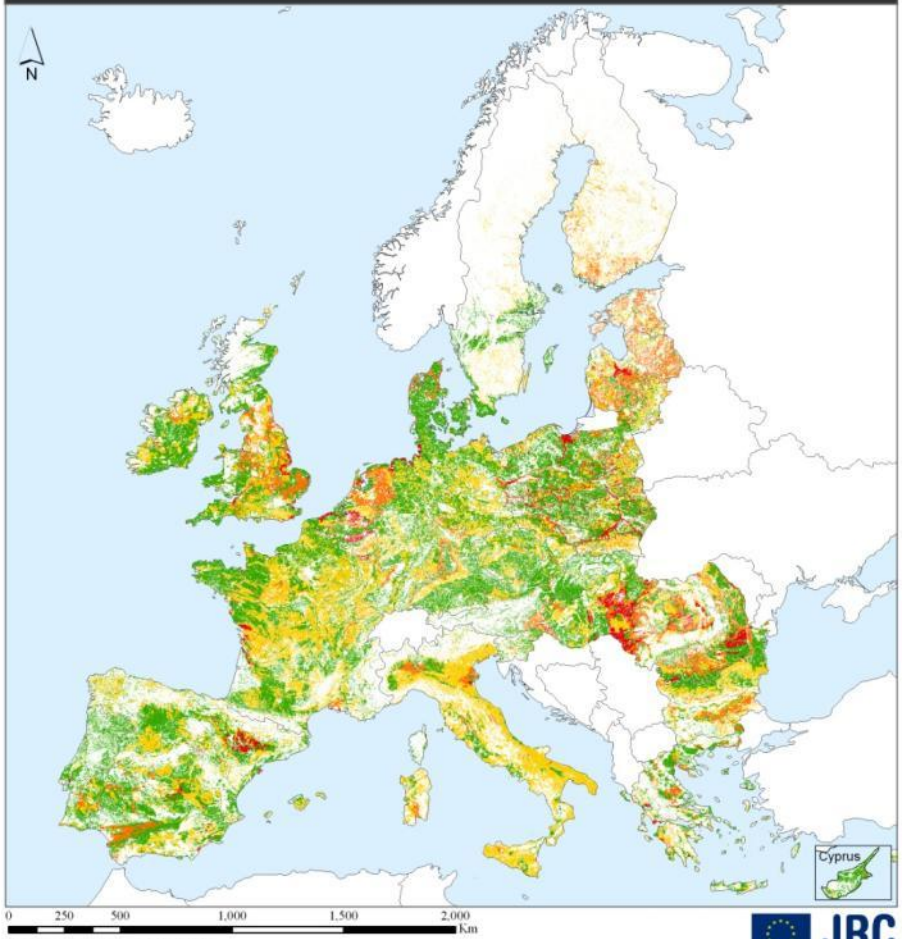
ies Institute for Environment and Sustainability

Soil Erosion in t/ha/yr
- 0 - 0.5
- 0.5 - 1
- 1.0 - 2.0
- 2.0 - 5.0
- 5.0 - 10.0
- 10.0 - 20.0
- 20.0 - 50.0
- >50

Urban
Lakes

Coordinate Reference System:
ETRS89 Lambert Azimutal Equal Area

The natural susceptibility of soils to compaction



Natural susceptibility to compaction

- No soil
- Low
- Medium
- High
- Very high
- No evaluation

This map shows the natural susceptibility of agricultural soils to compaction if they were to be exposed to compaction. The evaluation of the soil's natural susceptibility is based on the creation of logical connections between relevant parameters (pedotransfer rules). The input parameters for these pedotransfer rules are taken from the attributes of the European soil database, e.g. soil properties: type, texture and water regime; depth to textural change and the limitation of the soil for agricultural use. Besides the main parameters auxiliary parameters have been used as impermeable layer, depth of an obstacle to roots, water management system, dominant and secondary land use. It was assumed that every soil, as a porous medium, could be compacted.

MAP INFORMATION

Spatial coverage: 27 Member States of the European Union where data available.

Pixel size: 1km
Projection: ETRS89 Lambert Azimuthal Equal Area

Input data - source
Soil data - European Soil Database v2
Land Use - CORINE Land Cover 2000

BIBLIOGRAPHIC INFORMATION

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Digital datasets can be downloaded from
http://eusoils.jrc.ec.europa.eu/

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EU Floods Directive

Directive 2007/60/EC on the assessment and management of flood risks entered into force on 26 November 2007.

Its aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity.
The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015.
The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU.

How to decrease the flood risk

- *Technical measures*
  - reservoirs
  - polders / retention areas
  - increase floodplain storage
  - increase dyke heights
- *Environmental measures*
  - land use planning
    - catchment: (reforestation / afforestation, set aside etc)
    - floodplain: re-allocation of flood prone settlements
  - (long-term: combat climate change..)

Literature and source of slides, useful information

De Roo, A.P.J., Thielen, J. and Gouweleeuw, B.T., 2002. LISFLOOD, a distributed water balance, flood simulation and flood
inundation model. User manual version 1.0. European Commission, Special Publications No. 1.02.131.

Jones, R.J.A., Houskova, B., Bullock, P. and Montanarella, L. 2005. Soil Resources of Europe, Second edition. European Technical Report: EUR 20559 EN, Office for Publications of the European Communities, Luxemburg.

Finke, P. et al., 2003. The Georeferenced Soil Database for Europe, Manual of Procedures Vers. 1.1 by ESB Scientific Committee,
European Commission, JRC, EUR 18092 EN.

- http://eusoils.jrc.ec.europa.eu/
- http://floods.jrc.ec.europa.eu/

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