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The Availability of Input Data on the global level for Biophysical Process Modelling - Global EPIC

Michael Fuchs [michael.fuchs@bgr.de]

Rainer Baritz [rainer.baritz@bgr.de]

Biophysical Process Modelling - Global **EPIC**
- The Availability of Input Data **-**

Input Data Categories

- ➢ **Climate**

- ➢ **Soil**

- ➢ **Topography**

- ➢ **Land Cover / Management Practice**

East Anglia data years 1901-2002

East Anglia scenario data 2001-2100 for 18 various scenarios
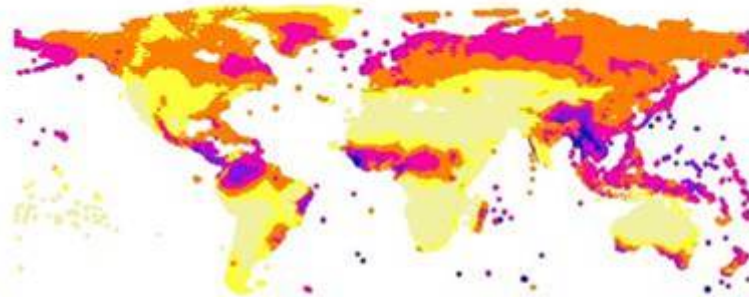
Monthly values in regular 0,5° grid:

- ➢ Minimum temperature [°C]

- ➢ Maximum temperature [°C]

- ➢ Precipitation [mm]

- ➢ Cloud cover [%]

- ➢ Vapour pressure [hPa]

- ➢ Wet days [number per month] *(derived from precipitation)*

- ➢ Radiation [MJ/m²] *(derived from cloud cover)*

Climate
example: mean values for 100 years

Wet days in August
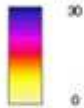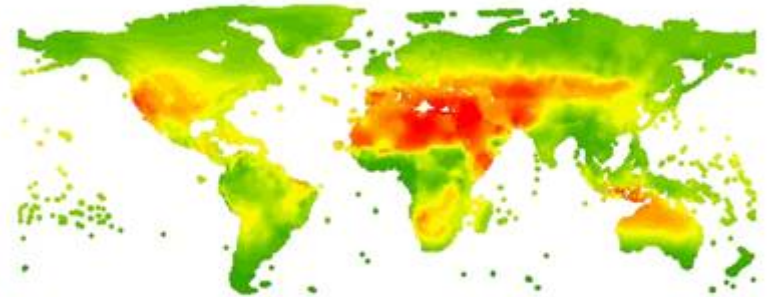
Radiation in August
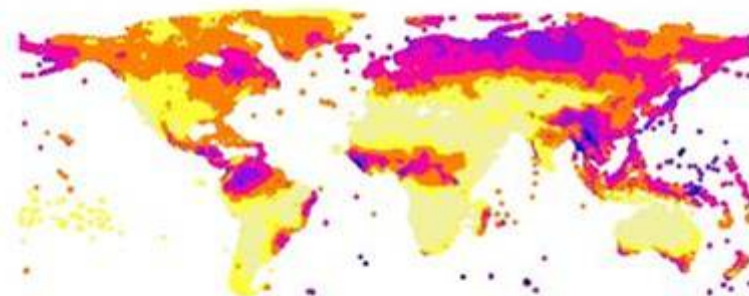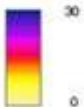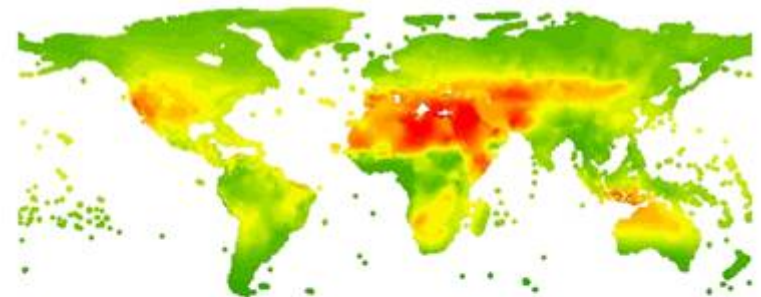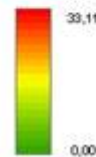
Reference Evapotranspiration yearly and monthly; source: IIASA/FAO
(taken from East Anglia climate data)

Evapotranspiration [mm/a]

0 - 250	750 - 1.000	1.500 - 1.750	2.250 - 2.500
250 - 500	1.000 - 1.250	1.750 - 2.000	2.500 - 2.750
500 - 750	1.250 - 1.500	2.000 - 2.250	> 2.750 [max=3.064]
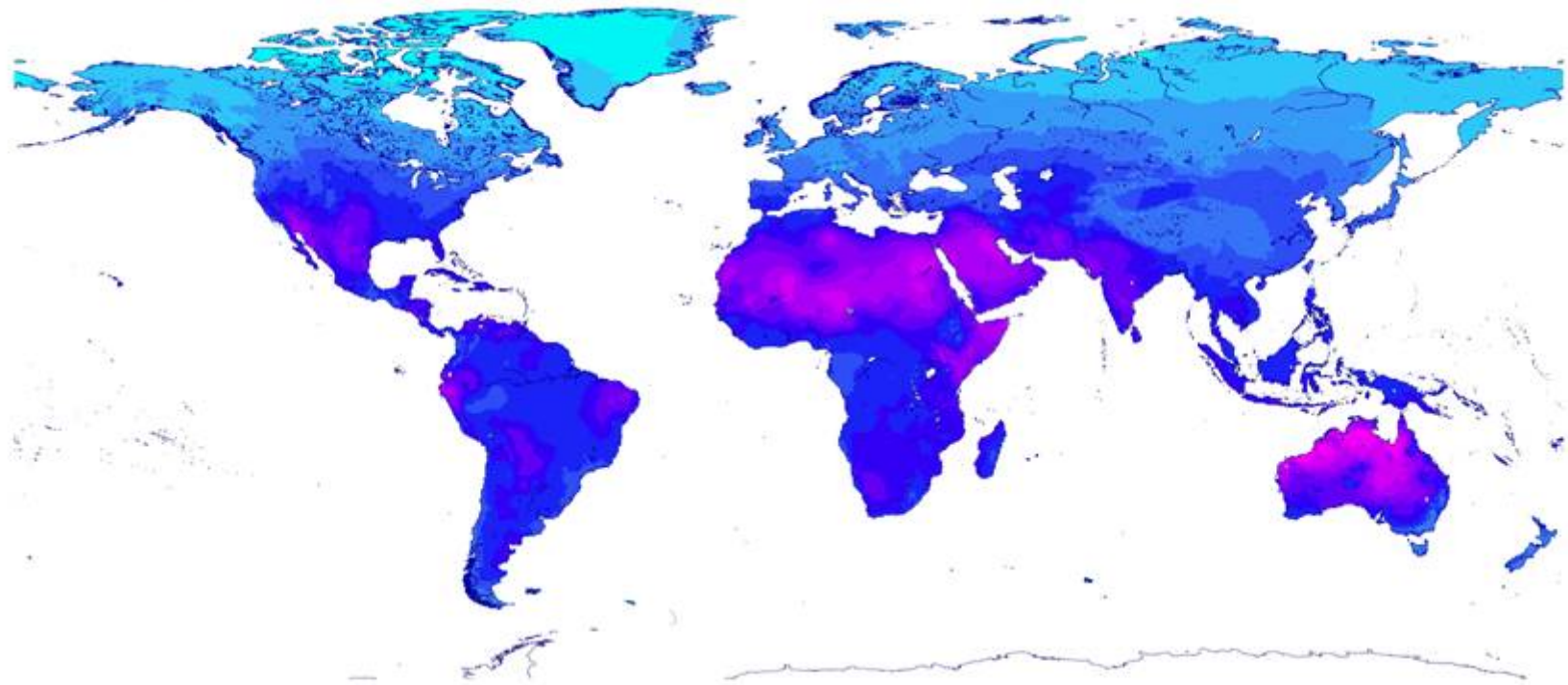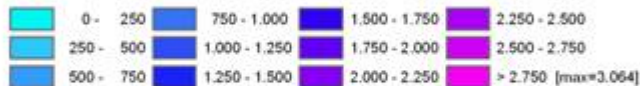
5.000   0   5.000 km

Grid with estimated reference evapotranspiration per month with
a spatial resolution of 30 arc minutes. Data on reference
evapotranspiration been prepared by IIASA for FAO for global
agro-ecological assessment studies.

Crop evapotranspiration - Guidelines for computing crop water requirements
FAO - Food and Agriculture Organization of the United Nations Rome, 1998

THE DIGITAL SOIL MAP OF THE WORLD

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Version 3.6, completed January 2003

http://www.fao.org/ag/agl/agll/wrb/wrbmaps/htm/soilres.htm
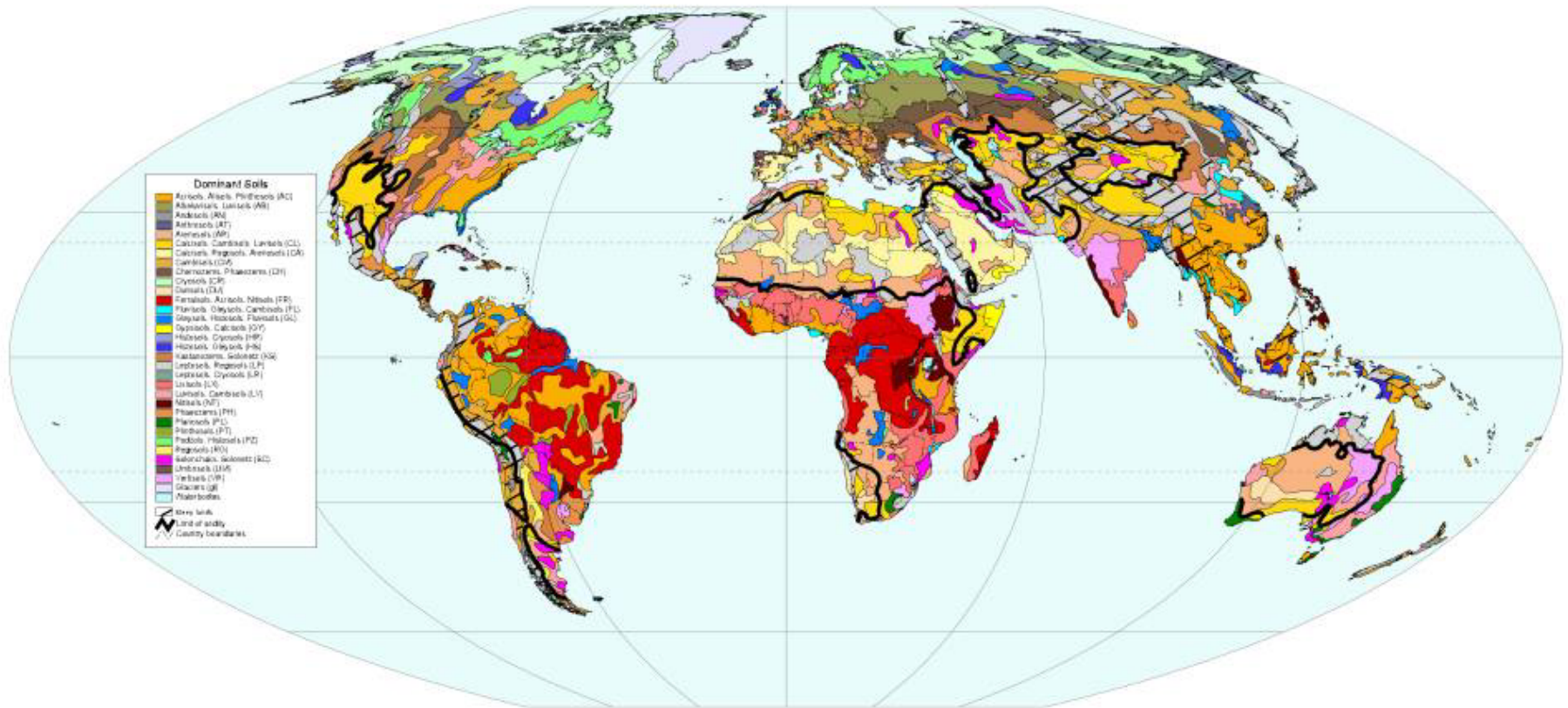
Projection Flat Polar Quartic
(Original scale 1:30 000 000 approx)
© FAO/EC/ISRIC, 2003

THE DIGITAL SOIL MAP OF THE WORLD

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Ten major continental regions:

- Africa
- North America
- Central America
- South America
- Europe and West of the Ural
- Central and North East Asia
- Near East
- Far East
- South East Asia and
- Australasia

are available as ArcGIS vector files
with 4930 **soil map units** altogether

THE DIGITAL SOIL MAP OF THE WORLD
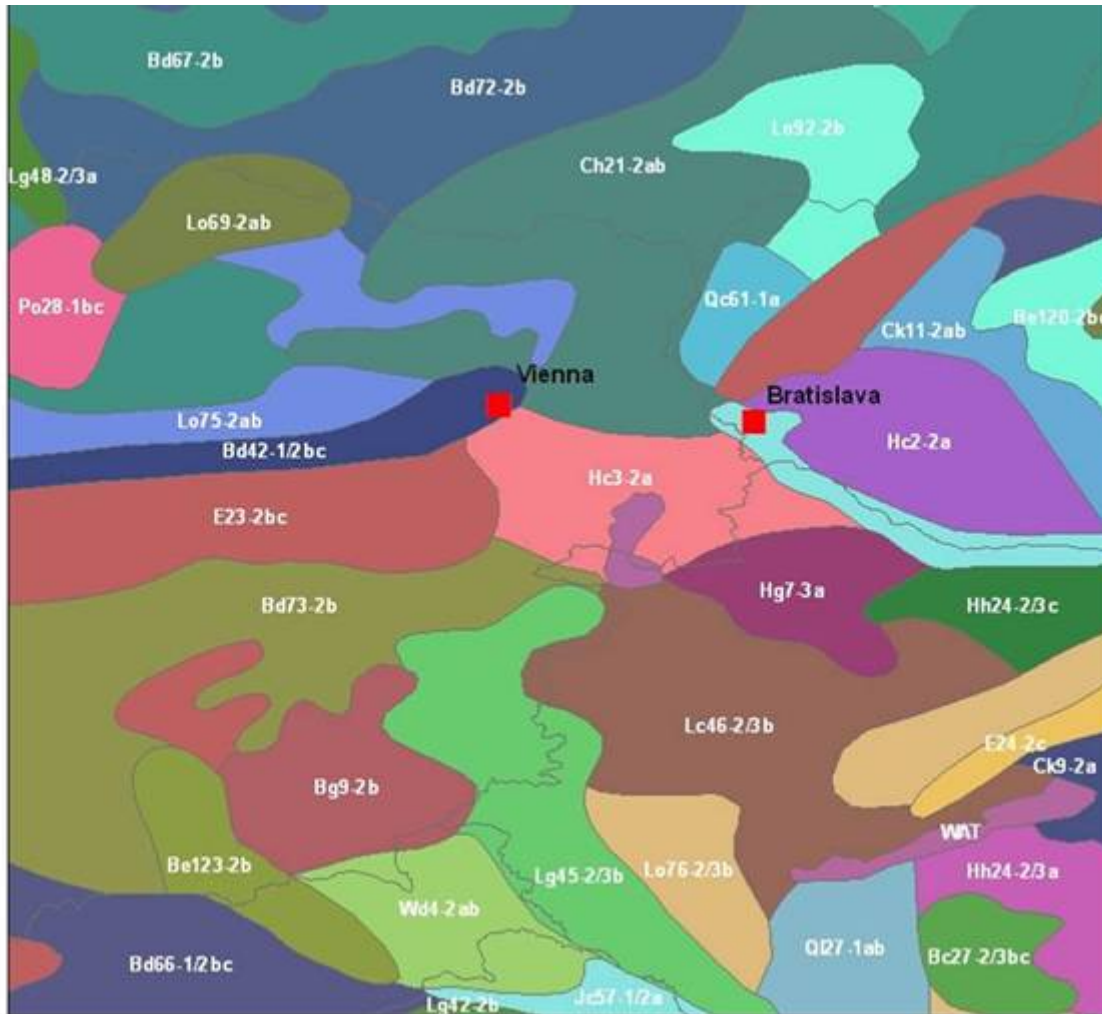
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Soil Map Units

each **soil map unit** is subdivided in **dominant** soil **subdominant** soil(s) and (associated) inclusion soil(s)

for example:

Hc3-2a

calcaric phaeozems (Hc)	50%
gleyic phaeozems (Hg)	30%
calcaric fluvisols (Jc)	10%
calcaric regosols (Rc)	10%

Bd42-1/2bc

dystric cambisol (Bd)	40%
gleyic cambisol (Bg)	20%
eutric gleyosol (Ge)	20%
eutric cambisol (Be)	10%
orthic luvisol (Lo)	10%

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statistical weighted averages for physical and chemical parameters exist for each **soil unit** ; divided into top (0-30 cm) and sub (30-100 cm) soil.

- sand%top sand%sub   **sand content**
- silt%top silt%sub   **silt content**
- clay%top clay%sub   **clay content**
- pH2Otop pH2Osub   **pH**
- OC%top OC%sub   **organic carbon**
- N%top N%sub   **nitrogen**
- BS%top BS%sub   **base saturation**
- CECtop CECsub   **cation exchange capacity**
- CECclaytop CECclaysub   **cation exchange capacity clay**
- CaCO3%top CaCO3%sub   **$CaCO_3$**
- BDtop BDsub   **bulk density**
- C/Ntop C/Nsub   **carbon/nitrogen proportion**

physical and chemical parameters for **soil unit** calcaric phaeozems (Hc)

with 50% of area of **soil map unit Hc3-2a**

Soil unit symbol	sand top	sand sub	silttop	silt sub	Clay top	clay sub	pH top	pH sub	OC top	OCs ub	N top	N sub	BSt op	BS sub	CEC top	CEC sub	CEC clay top	CEC clay sub	CaCO₃ top	CaCO₃ sub	BD top	BD sub
HC	40,8	40,8	22,5	25,7	36,8	33,4	7,9	8,4	2,17	0,8	0,19	0,09	98	92	39,3	40,5	92	93	3,1	21,9	1,2	1,4
HC 1	75	70	15	15	10	15	7,2	8,2	2	0,8	0,16	0,08	90	98	10	15	93	97	0,5	5	1,2	1,5
HC 2	56,9	56,8	23	21,2	20,2	22	7,8	8,3	1,59	0,59	0,17	0,09	95	83	15,9	18,3	78	93	2,7	8,2	1,2	1,4
HC 3	8,5	8,8	21,5	34,9	70	56,3	8,2	8,6	3,33	1,23	0,24	0,09	100	100	62,7	62,7	92	92	3,4	35,5	1,2	1,4

Linkage

  Soil map unit

    Soil unit 1

      physical or chemical parameter 1

      …

      physical or chemical parameter m

    …

    Soil unit n

THE DIGITAL SOIL MAP OF THE WORLD

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Organic Carbon content in top soil (0-30 cm) for the dominant Soil in Soil Map Unit

organic carbon [%]

< 1	8 - 15	
1 - 2	15 - 30	
2 - 4	> 30	
4 - 8		

5.000   0   5.000 km
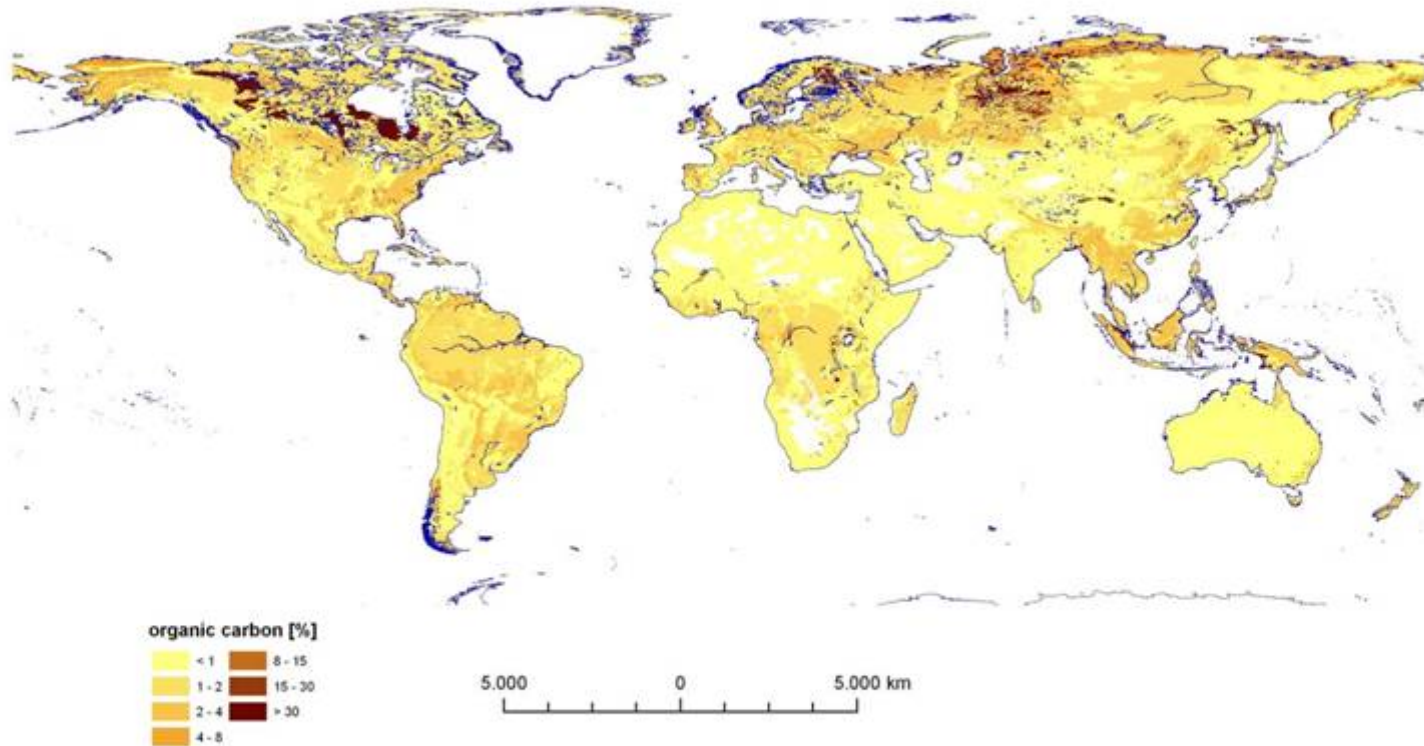
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Information about soil depth and soil drainage are available for each **soil map unit**

particular depth class:

- very shallow
- shallow
- moderately deep
- deep
- very deep
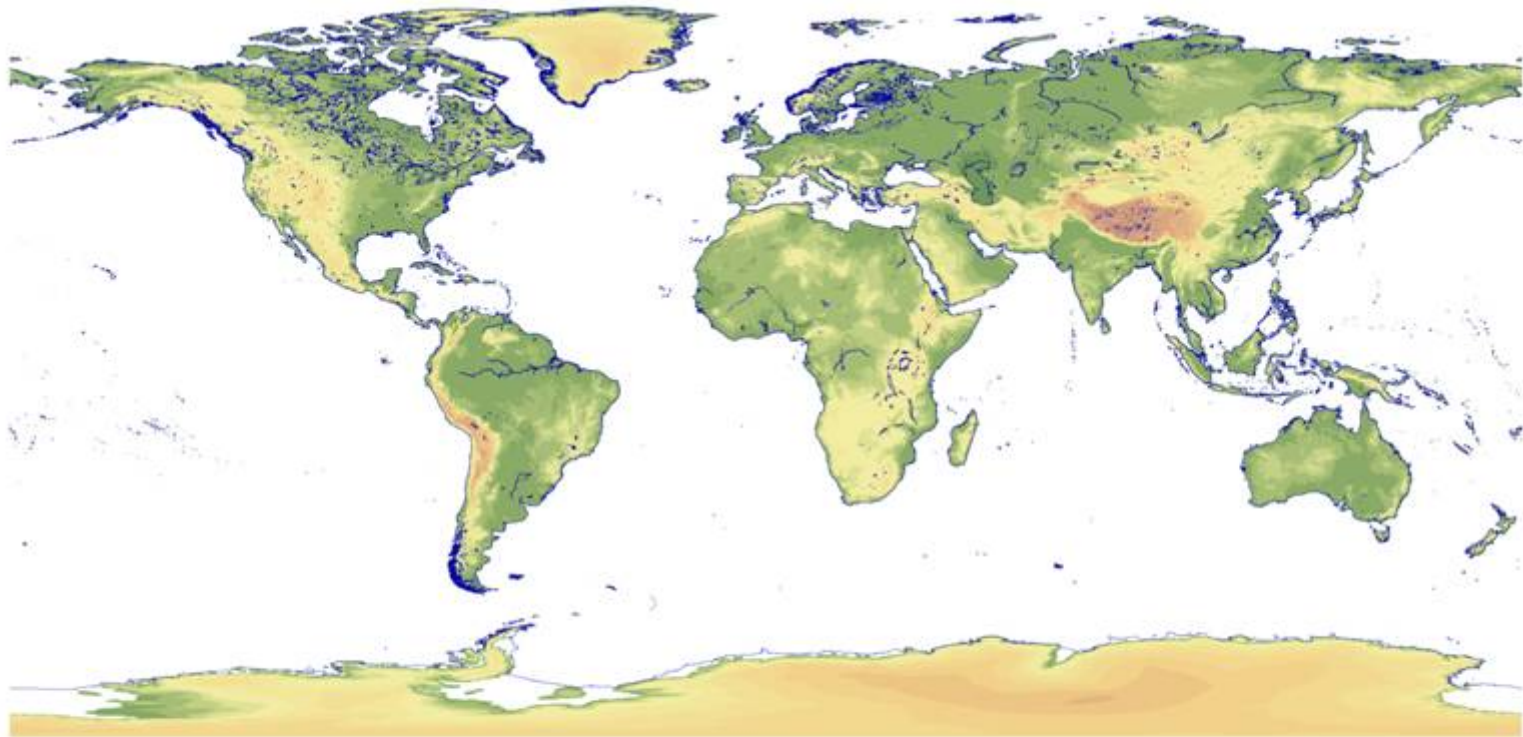
particular drainage class:

- excessively drained
- somewhat excessively drained
- well drained
- moderately well drained
- imperfectly drained
- poorly drained
- very poorly drained

Information about soil suitability are available for each **soil map unit** in 3 classes

GTOPO30 - global digital elevation model
regularly spaced at 30-arc seconds (approximately 1 kilometer)

elevation class [m]

-407 - 0	1.000 - 1.500	3.500 - 4.000	6.000 - 6.500
0 - 250	1.500 - 2.000	4.000 - 4.500	6.500 - 7.000
250 - 500	2.000 - 2.500	4.500 - 5.000	7.000 - 7.500
500 - 750	2.500 - 3.000	5.000 - 5.500	7.500 - 8.000
750 - 1.000	3.000 - 3.500	5.500 - 6.000	8.000 - 8.752

5.000   0   5.000 km

GTOPO30 global digital elevation model (DEM) 1994
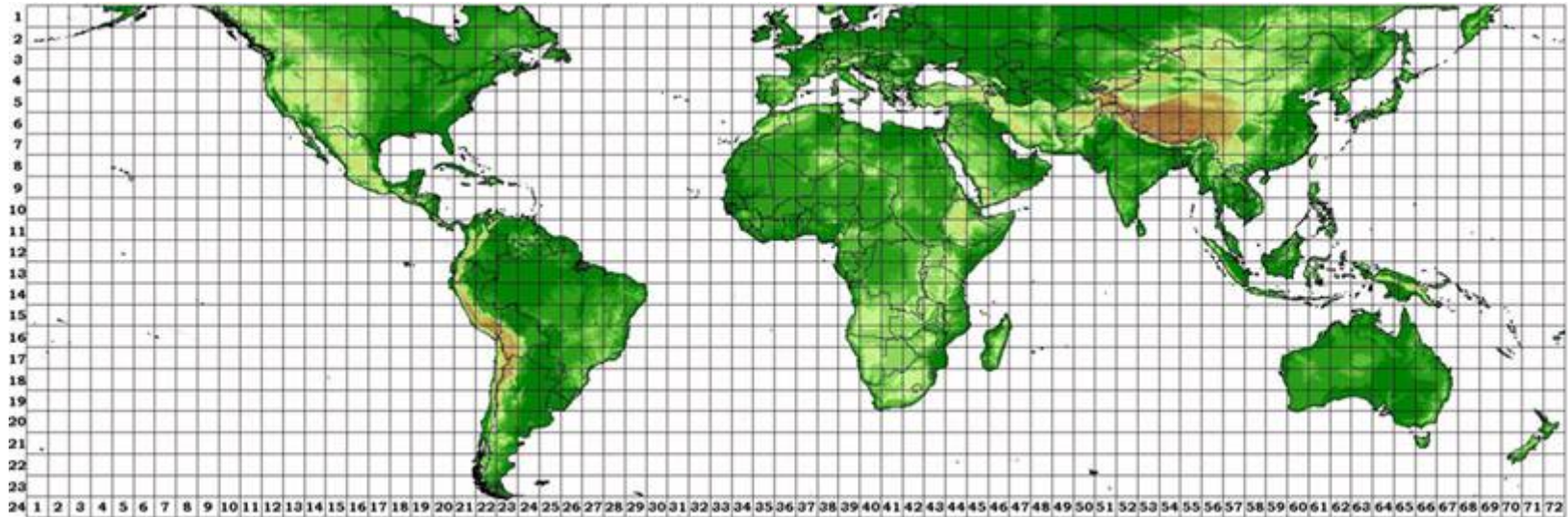
Source: CGIAR Consortium for Spatial Information (CGIAR-CSI)

VERSION 2 NOW INCLUDES ALL AREAS OF THE WORLD, INCLUDING AUSTRALASIA
AND SMALL ISLANDS THAT WERE NOT PREVIOUSLY AVAILABLE. THE DATASET IS
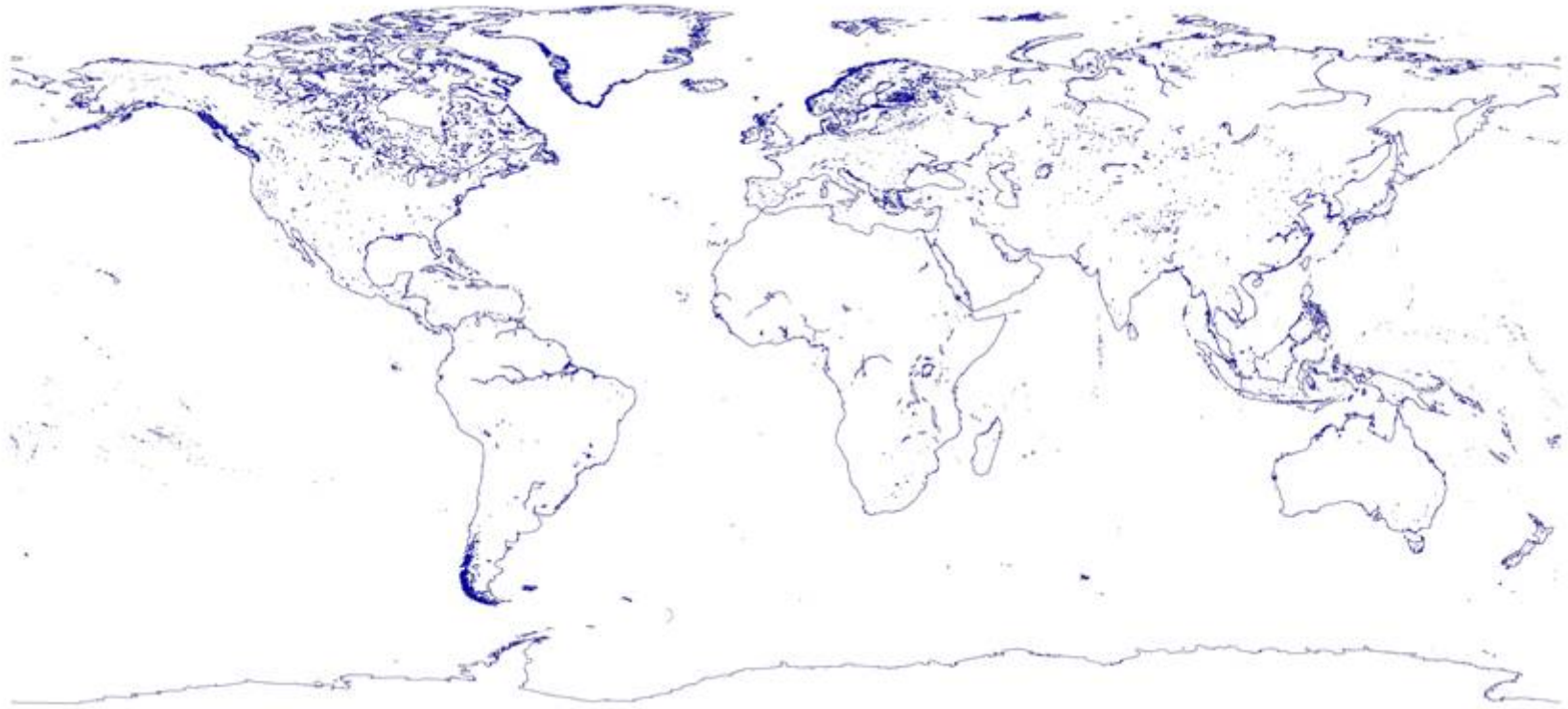ALSO INTERPOLATED USING IMPROVED INTERPOLATION METHODS, AND HAS BEEN
CLIPPED AROUND SHORELINES.

- The Availability of Input Data **-**
GSHHS - A Global Self-consistent, Hierarchical,
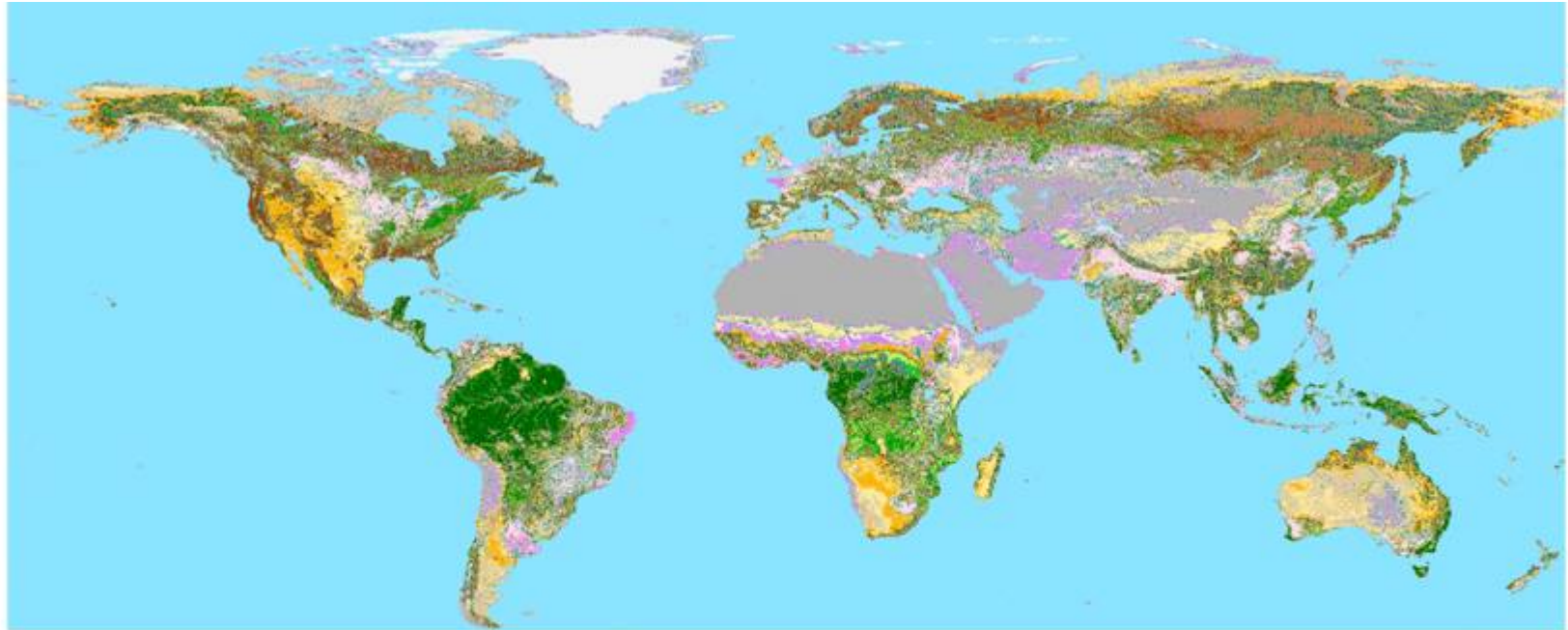High-resolution Shoreline Database

Source: National Geophysical Data Center NGDC

- The Availability of Input Data **-**
Global Land Cover 2000 database (Beta Version); source: **JRC**
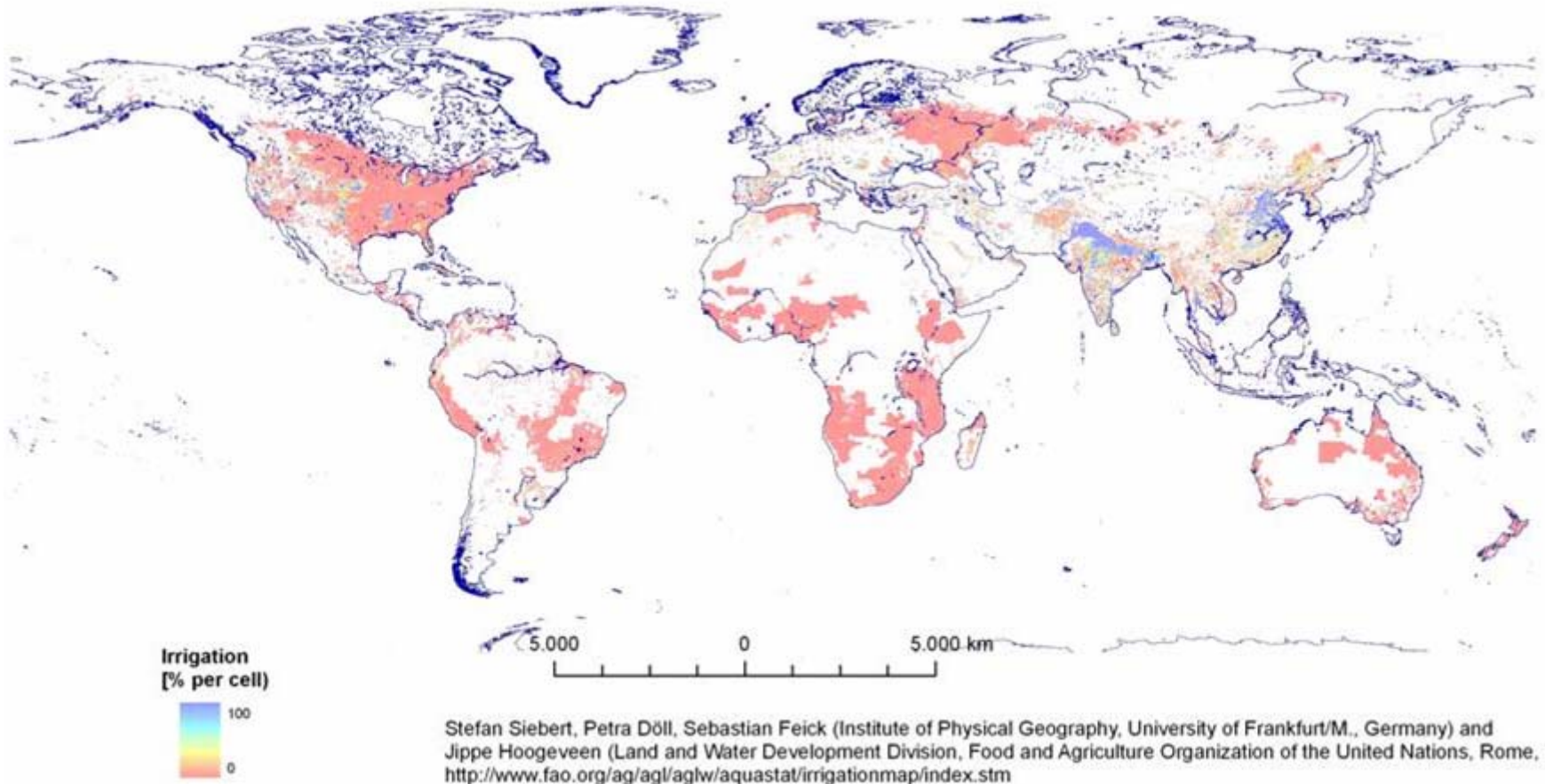regularly spaced at 30-arc seconds (approximately 1 kilometer)

Land cover/use

🟥 Artificial surfaces and associated areas	🟩 Mosaic: Tree Cover / Other natural vegetation	Sparse herbaceous or sparse shrub cover	Tree Cover, needle-leaved, deciduous
Bare Areas	No data	Tree Cover, broadleaved, deciduous, closed	Tree Cover, needle-leaved, evergreen
Cultivated and managed areas	Regularly flooded shrub and/or herbaceous cover	Tree Cover, broadleaved, deciduous, open	Tree Cover, regularly flooded, fresh water
Herbaceous Cover, closed-open	Shrub Cover, closed-open, deciduous	Tree Cover, broadleaved, evergreen	Tree Cover, regularly flooded, saline water
Mosaic: Cropland / Shrub and/or grass cover	Shrub Cover, closed-open, evergreen	Tree Cover, burnt	Water Bodies
Mosaic: Cropland / Tree Cover / Other natural vegetation	Snow and Ice	Tree Cover, mixed leaf type	

Part of Fifth Framework Programme 1999-2002 for Research of the European Commission;
Global Environment Information System (GEIS)

Irrigation
[% per cell]

100

0

Stefan Siebert, Petra Döll, Sebastian Feick (Institute of Physical Geography, University of Frankfurt/M., Germany) and Jippe Hoogeveen (Land and Water Development Division, Food and Agriculture Organization of the United Nations, Rome, Ita
http://www.fao.org/ag/agl/aglw/aquastat/irrigationmap/index.stm

The map depicts the percentage of each 0.5° by 0.5° cell that was equipped for irrigation around 1995.

5x5 minutes distribution maps for 20 major crops
derived administrative data for 20 major crop types
method: Entropy + Spatial allocation
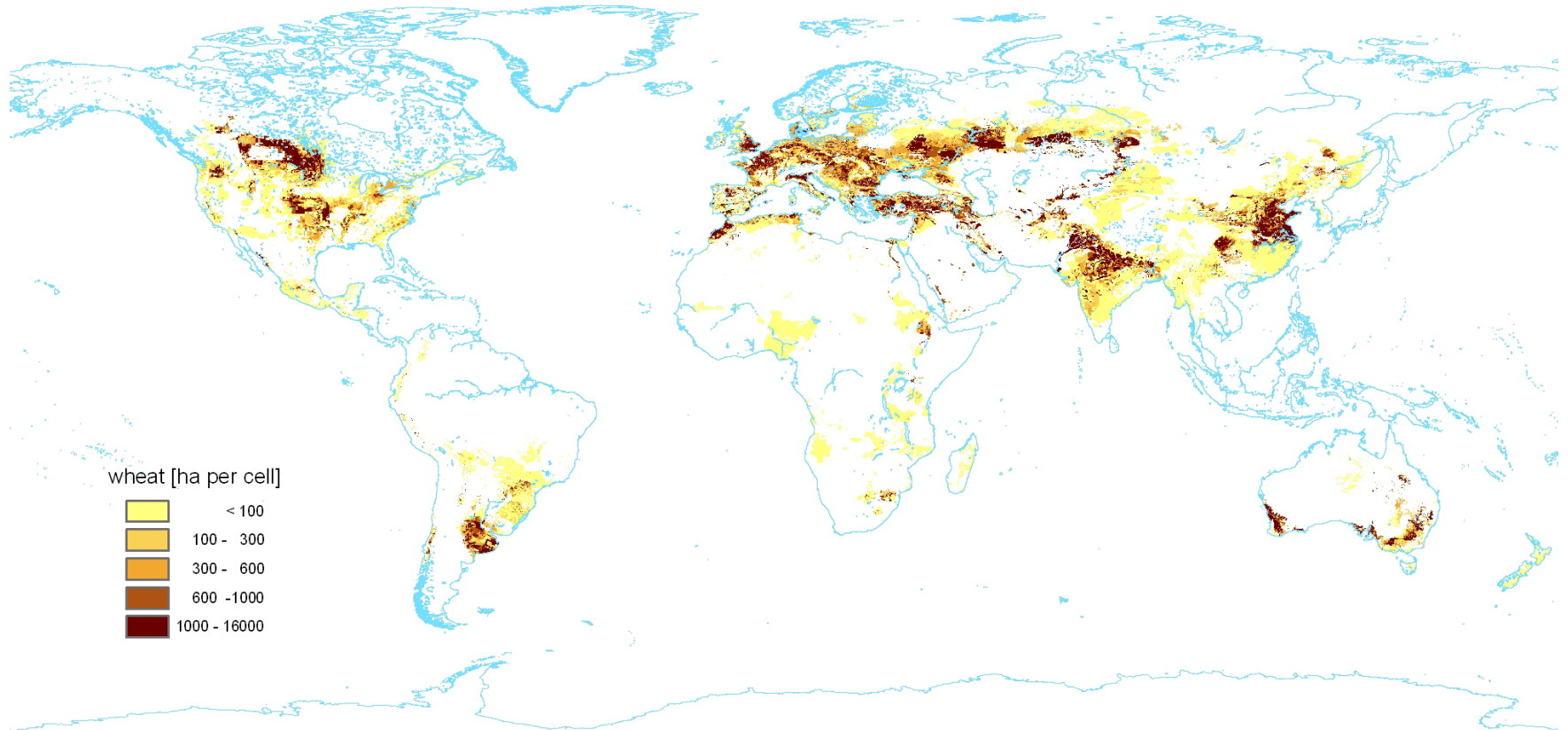
➢ wheat, rice, maize, barley, millet, sorghum
➢ potato, sweet potato and yams, cassava
➢ banana and plantain
➢ dry beans, other pulse
➢ sugar cane, sugar beets
➢ cotton, other fibres
➢ soybean, groundnuts, other oil crops
➢ coffee

rice [ha per cell]
< 100
100 - 300
300 - 600
600 - 1.000
1.000 - 9.000

rice

International Food Policy Research Institute; Yu, Wood & Wood-Sichra 2006
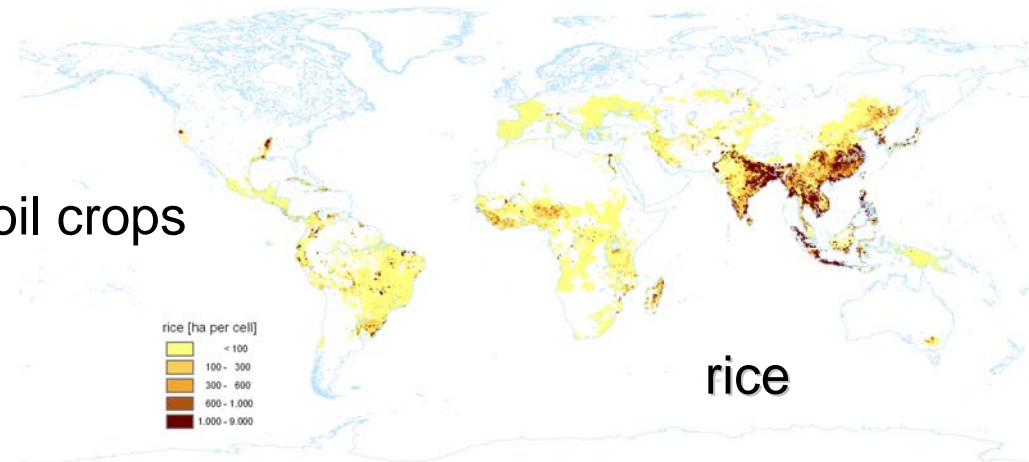
- The Availability of Input Data **-**
   Global Crop Maps   source: International Food Policy Research Institute

wheat [ha per cell]

	< 100
	100 - 300
	300 - 600
	600 - 1000
	1000 - 16000

International Food Policy Research Institute; Yu, Wood & Wood-Sichra 2006

Selected results

Climate, Soil and Terrain Constraints	provides data on occurrence and spatial distribution of climate, soil and terrain constraints to rain-fed crop production.
Crop yields	presents maximum attainable yields and long-term achievable yields by climate zone.
Suitability for rain-fed crops	presents crop suitability results for individual crops and crop groups, under rain-fed conditions.
Suitability for rain-fed and irrigated crops	presents crop suitability results for individual crops and crop groups, under rain-fed and irrigated conditions.
Land with rain-fed cultivation potential	presents estimates of total and per capita availability of land with rain-fed production potentials.
Where irrigation matters	highlights mapping units where irrigation would greatly improve cereal production.
Best cereal type	presents which cereal is best where from respectively agronomic, food energy or gross value of production viewpoint.
Multiple cropping productivity	presents estimates of overall land productivity potential when considering multicropping systems.
Current land cover	indicates how land with crop production potential currently is used, in particular in relation to forest ecosystems.
Climate sensitivity	presents preliminary results for a number of temperature and rainfall sensitivity scenarios.

- The Availability of Input Data - Management Practice Auxiliarly Data
Agro-ecological zones (AEZ); for example: length of growing period
source: IIASA/FAO

5.000   0   5.000 km

Length of
Growing Period

0	- 89	- 179	- 269	- 364	365+
- 29	- 119	- 209	- 299	365	
- 59	- 149	- 239	- 329	365	
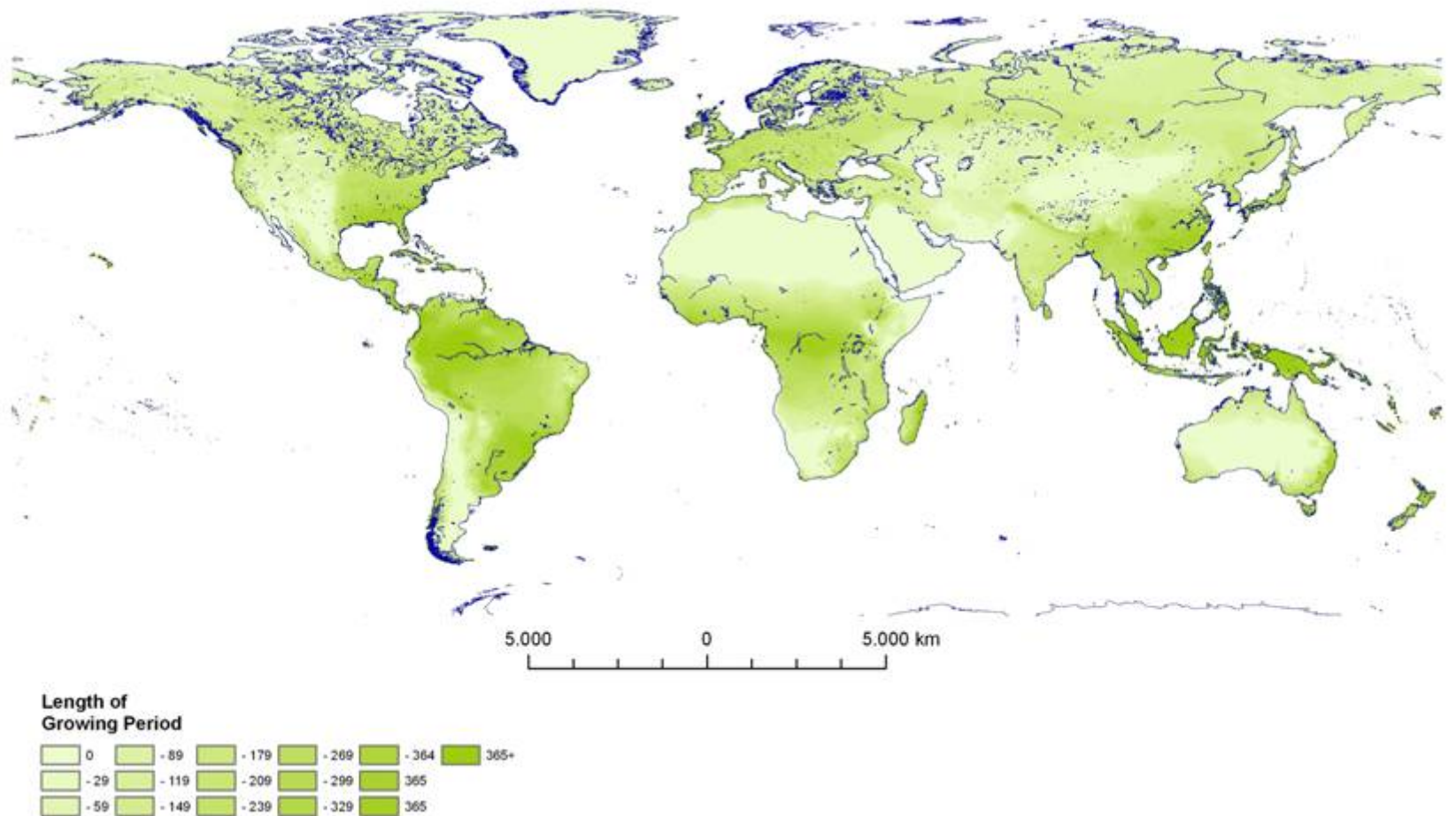
Net Primary Productivity; source: Global Earth Observation in Support of Climate Change and Environmental Security Studies

region: world
- period: April 1998 - present
- frequency: every 10 days
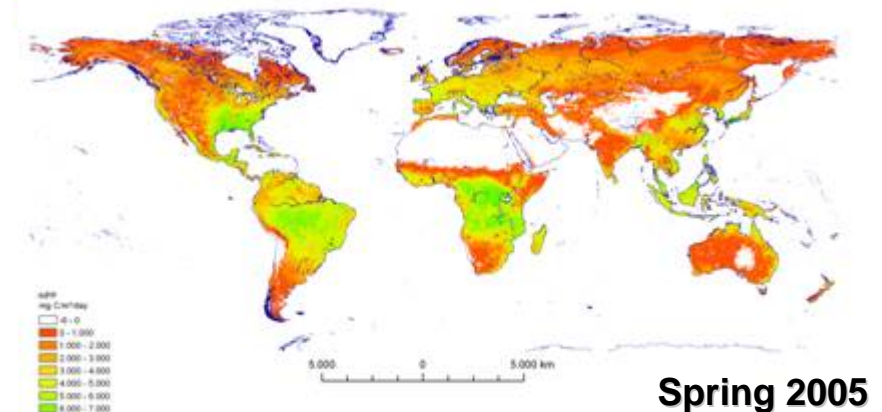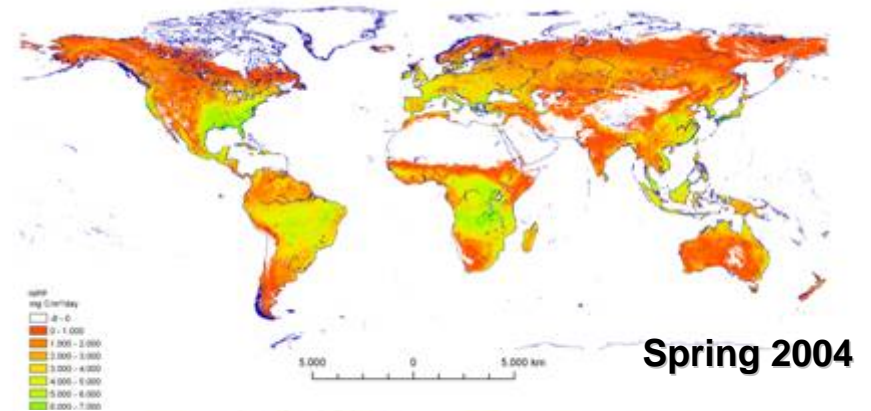- type: raster
- resolution: 1 km x 1 km
- format: HDF
- size:
  - global coverage: ± 1.2 Gb
  compressed: ± 150Mb
  - regional coverage: ± 80 Mb
  compressed: ± 20Mb
- units: mgC/m^2/day

Spring 2004

Spring 2005

Net Primary Productivity or NPP products represent repeatable estimates of the net flux of carbon between the atmosphere and terrestrial vegetation. It quantifies these carbon fluxes by combining a simplified carbon exchange model with satellite observations (SPOT-VEGETATION S10 (SPOT VGT S10) images). Source: VITO Belgium.

Source: National Geophysical Data Center NGDC

A01: NGDC *Monthly Generalized Global Vegetation Index from NESDIS NOAA-9 Weekly GVI Data (APR 1985 - DEC 1988).*

A02: *Monthly Experimental Calibrated Global Vegetation Index from NOAA-9 and 11 (April 1985 – December 1990).*

A03: Leemans and Cramer *IIASA Mean Monthly Values of Temperature, Precipitation, and Cloudiness on a Global Grid.*

A04: Legates and Willmott *Average Monthly Surface Air Temperature and Precipitation (re-gridded).*

A05: ***Olson*** World Ecosystems, 57 attributes

  30 CFS Cool Farmland + settlements, more or less snowy

  31 MFS Mild/hot farmland + settlements

A10: Wilson and Henderson–Sellers G*lobal Land Cover and Soils Data for GCMs.*

A11: Staub and Rosenzweig *Zobler Soil Type, Soil Texture, Surface Slope, and Other Properties.*

A12: Webb, Rosenzweig, and Levine *Global Soil Particle Size Properties.*

A13: FNOC *Elevation, Terrain, and Surface Characteristics.*

A15: Edwards *Global Gridded Elevation and Bathymetry.*

A16: UNEP/GRID *Gridded FAO/UNESCO Soil Units.*

B01: Fedorova, Volkova, and Varlyguin *World Vegetation Cover*

B02: Bazilevich *Global Primary Productivity*

B03: ***Bailey*** Ecoregions of the Continents

5 domains, 31 divisions, 100 provinces

28 PERMANENTLY HUMID WESTERN OCEANIC BROADLEAF FORESTS

32 FOREST-ALPINE MEADOWS

Conclusions

➢ For all categories the necessary input layer and data are available

➢ Most of them under GNU-like licenses

➢ To build homogeneous areas for biophysical modelling the useful application of the data sets depends

     on their resolution

and

     on their type of stratification

Expert knowledge is essential in this process.