The global water model WaterGAP 2: Hydrology model

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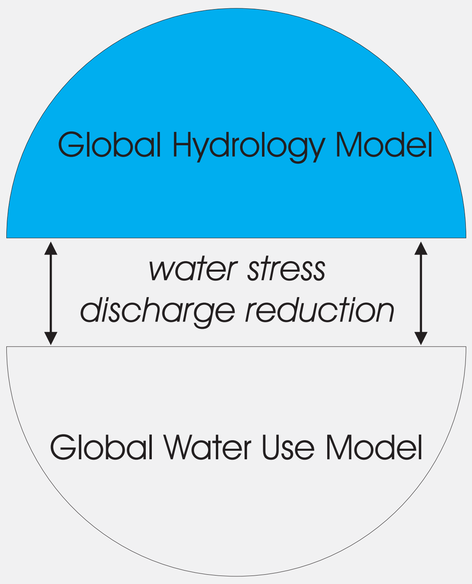
WaterGAP, a global model of water availability and water use, has been developed to assess the current water resources situation and to estimate the impact of global change on water scarcity. With a spatial resolution of 0.5°, the raster-based model is designed to simulate the characteristic macro-scale behavior of the terrestrial water cycle, including the human impact, and to take advantage of all pertinent information that is globally available.



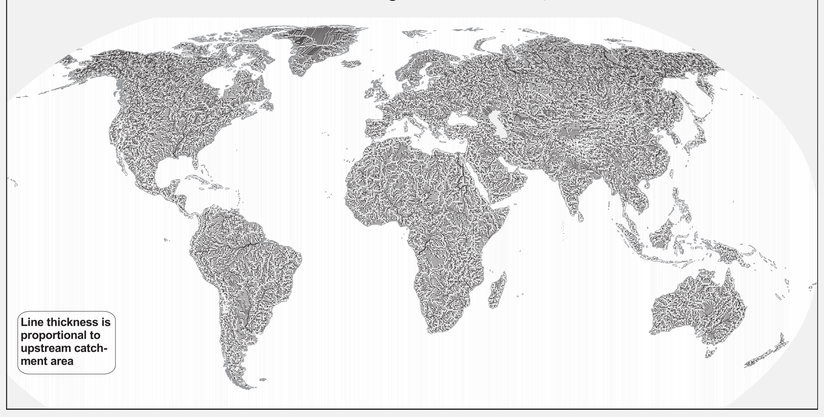
The Global Hydrology Model computes total runoff (sum of surface runoff and groundwater recharge) and river discharge.

1) For each cell, the daily vertical water balance (canopy, soil, open water) is calculated.
2) The total runoff from land is partitioned into surface runoff and groundwater recharge (see bottom of poster) and is then transported to the downstream cell (via lakes and wetlands).

The model is calibrated against measured discharge for 50% of the global land area.

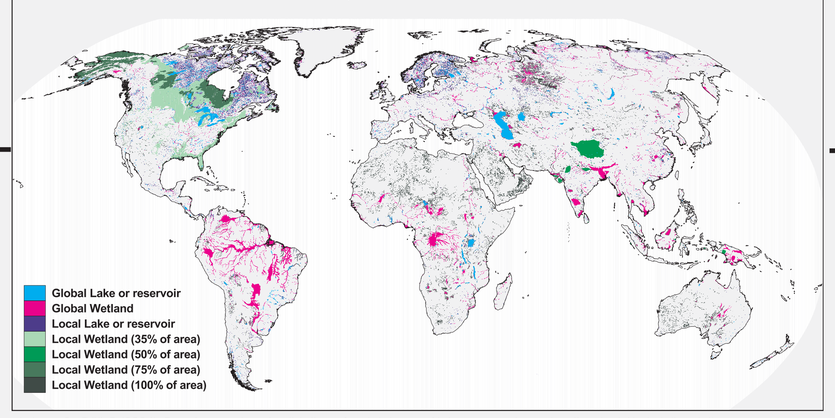
Döll, P., Kaspar, F., Lehner, B. (2003): A global hydrological model for deriving water availability indicators: model tuning and validation. Journal of Hydrology, 270 (1-2), 105-134.

30 minute drainage direction map



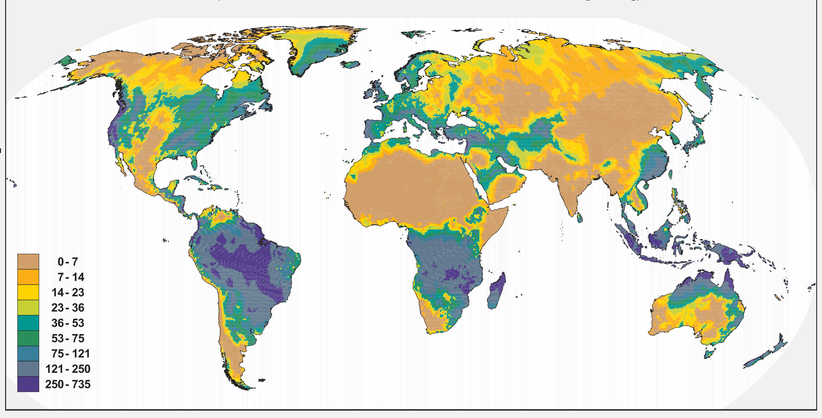
Döll, P., Lehner, B. (2002): Validation of a new global 30-min drainage direction map. Journal of Hydrology, 258(1-4), 214-231

1 minute wetlands, lakes and reservoirs data set



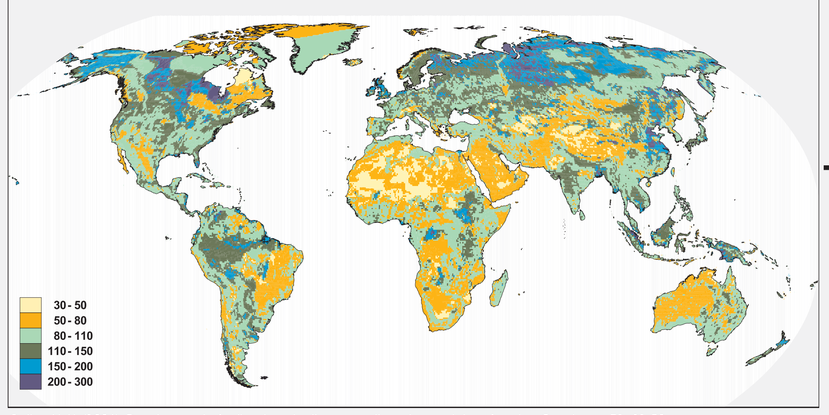
Lehner, B., Döll, P. (2004): Development and validation of a database of lakes, reservoirs and wetlands. J. Hydrol. (In print)

Climate (example: precipitation January 1969 [mm])



New, M., Hulme, M., Jones, P. D. (2000): Representing twentieth century space time climate variability. Part II: Development of 1901-96 monthly grids of terrestial surface climate. J. Climate 13, 2217-2238.

Available soil water capacity in uppermost meter [mm]



Batjes, N. H. (1996): Development of soil water retention properties using pedotransfer rules. Geoderma 71, 31-52.

Land cover

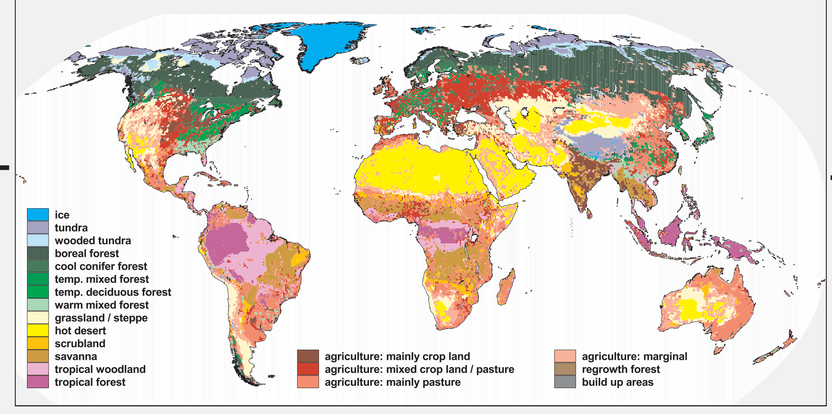
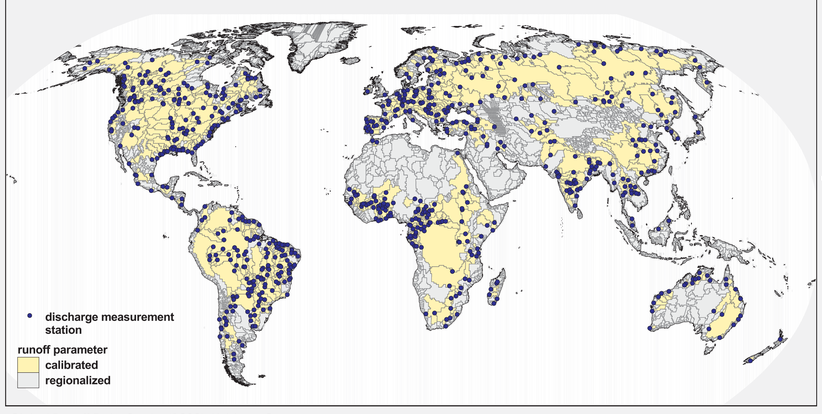


IMAGE 2.1: Alcamo, J., Leemans, R., Kreileman, E. (1998): Global Change Scenarios of the 21th Century. Elsevier, Oxford.

Discharge measurement stations

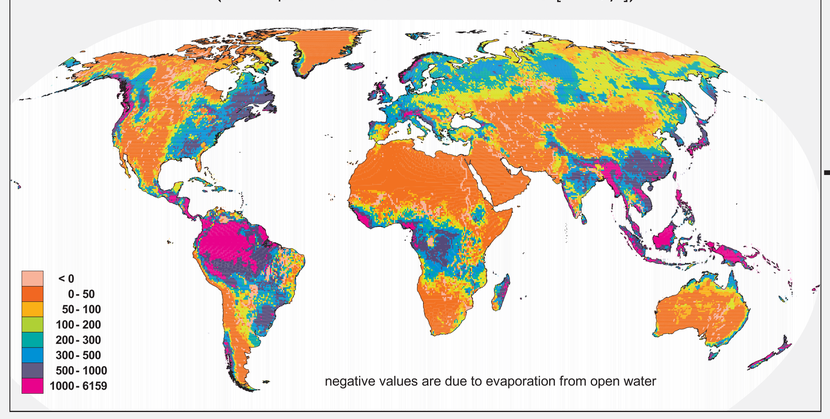


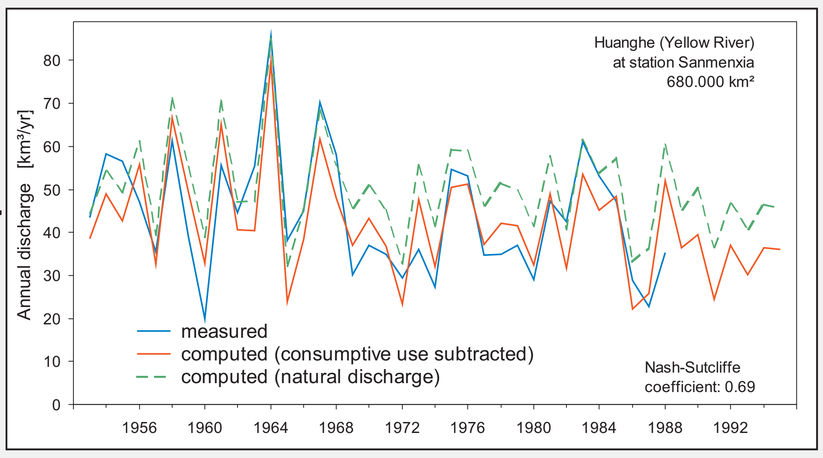
Global Runoff Data Center (1999), Koblenz, Germany

0.5° climate data (1901-1995 monthly values of precipitation, temperature, number of wet days, sunshine)

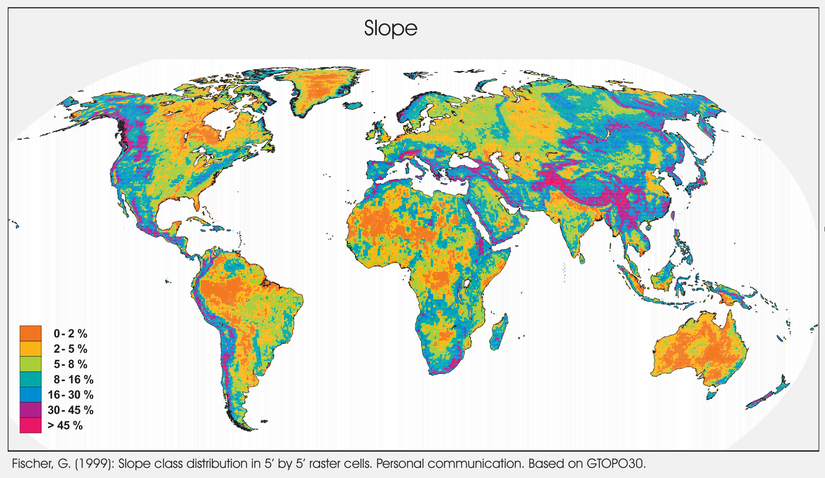
for scenarios: changes in climate, land cover

Runoff (example: total cell runoff 1961-90 [mm/yr])



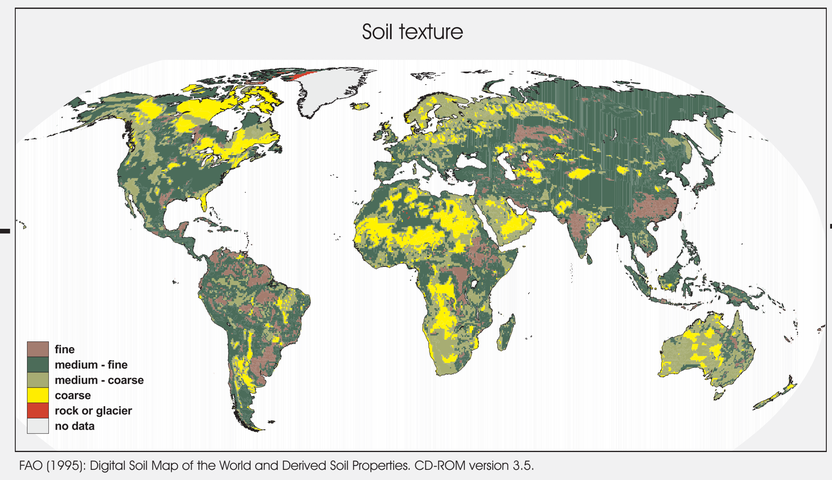


Slope



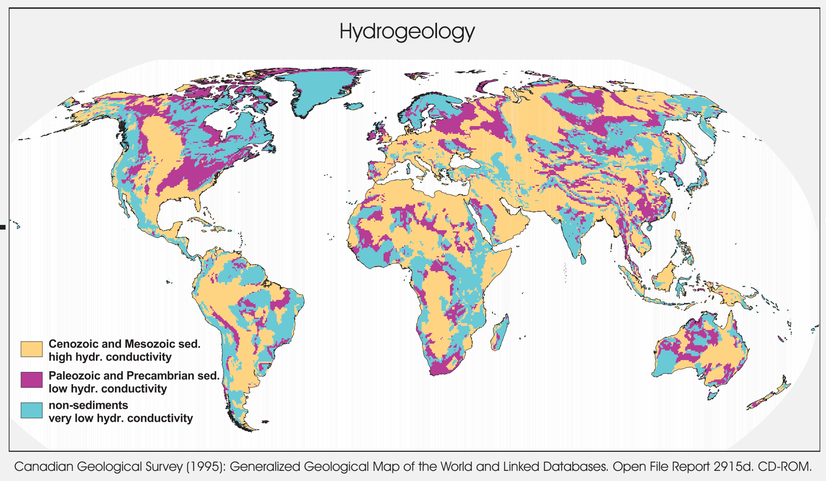
Fischer, G. (1999): Slope class distribution in 5' by 5' raster cells. Personal communication. Based on GTOPO30.

Soil texture



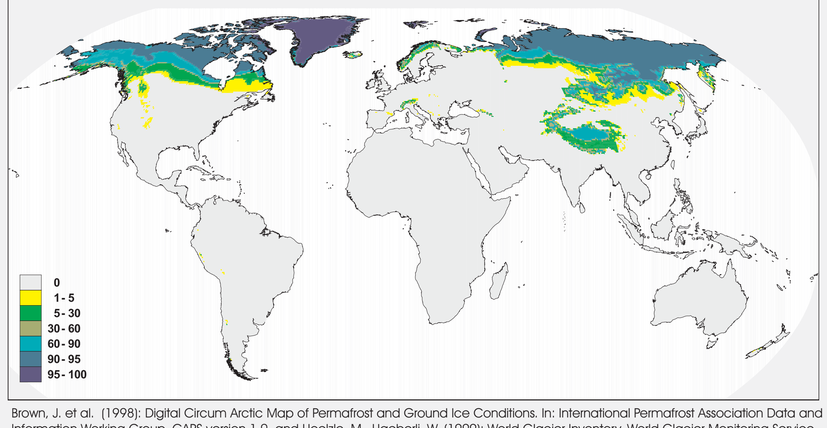
FAO (1995): Digital Soil Map of the World and Derived Soil Properties. CD-ROM version 3.5.

Hydrogeology



Canadian Geological Survey (1995): Generalized Geological Map of the World and Linked Databases. Open File Report 2915d. CD-ROM.

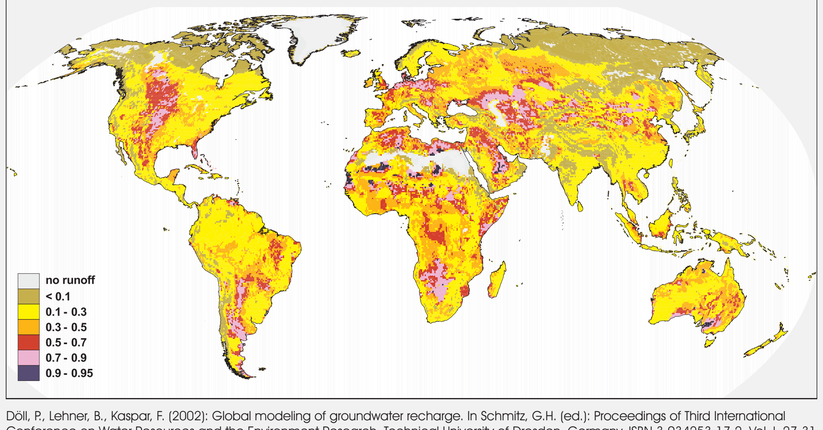
Percentage of permafrost or glacier cell area



Brown, J. et al. (1998): Digital Circum Arctic Map of Permafrost and Ground Ice Conditions. In: International Permafrost Association Data and Information Working Group, CAPS version 1.0, and Hoelzle, M., Haeberli, W. (1999): World Glacier Inventory. World Glacier Monitoring Service.

total runoff (from land fraction of cell)

Groundwater recharge as fraction of total runoff from land (average 1961-90)



Döll, P., Lehner, B., Kaspar, F. (2002): Global modeling of groundwater recharge. In Schmitz, G.H. (ed.): Proceedings of Third International Conference on Water Resources and the Environment Research, Technical University of Dresden, Germany, ISBN 3-934253-17-2, Vol. I, 27-31.