

# Future Directions of Global Hydrological Modelling and Water Resources Assessment Incorporating Human Activities

Petra Döll

*University of Frankfurt*

In my presentation, I will propose a number of research efforts (in the area of global-scale hydrological modelling and water resources assessments) that, in my opinion, should be undertaken to address important societal problems.

- 1) Assessing the impact of climate change, e.g.
  - Assessing the combined effect of atmospheric change and sea level rise on groundwater and surface water resources in coastal areas and on flooding
- 2) Assessing the impacts of agricultural land use change on water quantity and some water quality aspects (nutrients, pesticides)
  - Based on global data set of irrigated and rainfed cropping areas of most important crops (under development),
  - perform coupled modelling of land use, water use (irrigated and rainfed, blue and green agricultural water use, plus industrial and domestic water use) and water resources (includes economic modelling)
- 3) Assessing the impacts of water use (including water withdrawals, reservoirs, canals, other structural changes to rivers) on aqueous ecosystems (anthropogenic alteration of river flow regimes, environmental flow requirements, ...)
- 4) Assessing the role of groundwater
  - groundwater recharge
  - groundwater table
  - groundwater flow
  - groundwater withdrawals
  - use of fossil groundwater
- 5) Determining improved indicators of water scarcity for humans and nature based on case studies combined with improved global scale modelling, e.g. for
  - agricultural and hydrological drought risk
  - infringement on ecosystem requirements
- 6) Developing improved methods to show impacts of global-scale developments on river basin scale / urban water and land management, e.g. by
  - downscaling of climate change results
  - downscaling of other water-relevant global-scale driving forces to derive local scenarios of water resources, use and water quality
  - improving indicators that address consumers instead of water and land managers like the water footprint of Arjen Hoekstra
- 7) Developing new data products and promoting improved data collection, e.g.
  - water use data (see data for USA)
  - reservoir management
  - water quality
- 8) Assessing hot spots of water pollution (pesticides, heavy metals, arsenic, fluoride, organic waste)