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Global water resources under pressure: the impact of climate change and socio-economic developments

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Freshwater is a limited resource on Earth but essential for life and human well-being as well as for economic development. Water is withdrawn for crop and energy production, industrial fabrication as well as human and ecosystem needs. Water resources are expected to change over the next decades due to climate and socio-economic impacts as well as political developments and land-use changes. Regarding climate change, the magnitude and direction of change differs between regions and seasons of the year and may have both positive and negative impacts (Bates et al. 2008). Many river basins of the world are seriously affected by an imbalance of water availability and water withdrawal. The number of people living in water-stressed basins (w.t.a. > 0.4) is currently 2.4 billion and is expected to increase in the future due to growing pressure put on freshwater resources. Total freshwater abstraction amounts 3856 km^3 of which 70% are withdrawn by the agricultural sector (FAO 2010), mainly used for irrigation purposes. Population growth and increasing prosperity along with consumption and dietary changes have contributed to a rising demand for water, energy and agricultural products. As global population projections range from 7.1 to 15 billion people by 2100 (IPCC 2000) meeting the demand for water in the future will be a regional challenge, particularly in the context of a urbanization and avoiding further expansion of agricultural land.

The global water model WaterGAP is used to simulate current and future water availability and sectoral water uses under different climate, socio-economic, and land-use conditions. Our model calculations are based on data generated by Integrated Assessment Models (IAMs), following different RCPs and SSPs, and provide information on future impacts on freshwater resources.

The objective of our study is to identify water stress hotspots and to further analyze its main causes and temporal occurrence. Since global water withdrawals decrease substantially under the assumptions of sustainable scenario conditions compared to conventional scenarios, the pressure on water resources decreases. Nevertheless, the area under water stress reduces only slightly and the number of people living in river basins suffering from water stress is expected to increase in 2050. In order to reduce water stress and to achieve water security the use of advanced technologies, increased efficiency and/or lifestyle changes is essential, but not sufficient to avoid water scarcity in many river basins around the world. The core issue is the amount of water used for irrigation, because the agricultural sector is and will continue to be the principal user of water in most water-scarce regions. However, water stress remains also high in densely populated areas driven by continuing urbanization.

References:
Bates, B.C., Kundzewicz, Z.W., Wu, S., and Palutikof, J.P. (ed.), 2008. Climate change and water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.
FAO (Food and Agriculture Organization of the United Nations), 2010. AQUASTAT. Available at: http://www.fao.org/nr/aquastat (Accessed 15 November 2010)
IPCC (Intergovernmental Panel on Climate Change), 2000. Special Report on Emissions Scenarios. Report of Working Group III of the IPCC (ed. by N. Nakicenovic & R. Swart), 599. Cambridge University Press, Cambridge, UK.