Federal Ministry
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An Initiative of the Federal Ministry of Education and Research
GRoW
WATER AS A GLOBAL RESOURCE

ViWA – Efficient and Sustainable Water Management in Agriculture

Water as a Global Resource (GRoW)

Agriculture is by far the largest consumer of the Earth's available freshwater. In many places, water extraction and use for agricultural purposes is neither efficient nor sustainable. When agricultural goods are traded worldwide, the water needed to produce them is embedded in the product itself with no regard for the water-related costs involved, whether direct or follow-up costs. The main aim of the joint research project ViWA is to examine, from the local to global level, water consumption in food production and develop incentives for sustainable water use.

Global Trade in Virtual Water

A large proportion of agricultural products produced worldwide are traded across international borders. The global competitiveness of these products depends very much on the local production costs. Up till now, however, local water availability has not entered into the equation, nor has the efficiency or sustainability of agricultural water use. This has now changed, with factors such as these becoming increasingly important, not least in light of the vast amounts of virtual water flowing between countries, virtual water being the volume of water needed to produce the commodity in question.

ViWA seeks to develop instruments that deliver more precise data on how efficient or, indeed, how wasteful water use in agriculture is. Further, for the first time, the project partners are conducting an economic analysis on global trade flows that factors in the actual water consumption from the producer to the consumer. These results are then used to develop incentives for more sustainable use of water in agriculture.

Determining Global Water Consumption in Agriculture

To measure water consumption and sustainability in food production at local and regional level, the joint project employs a combination of observational methods, combining data collected from environmental satellites with global weather and climate data. Using the resultant high resolution, up-to-date, location-specific data, the researchers are able to simulate crop water use efficiency, crop yield and virtual water flows for the primary products in agricultural trade, for the time being in pilot regions. This data forms the basis of a global economic analysis of virtual water flows which encompasses available data on volume, efficiency, scarcity and sustainability of the water resources used in agriculture.

These findings represent the baseline for the simulation of global agricultural trade and the development of model scenarios that demonstrate the impact of sustainable water use on regions with scant water supply and on those with plentiful water resources. Furthermore, the vulnerability of agriculture and ecosystems to climate variability can be analyzed.

Supercomputer at Leibniz Supercomputing Center (LRZ) in Garching, Germany. The SuperMUC is used to calculate global crop yield, water needs and other key parameters in high spatial resolution (1x1 km).

How Sustainable is Water Use?

Data on water consumption or water efficiency in agriculture, however, does not provide enough of a basis for conclusions to be drawn on the sustainability of agricultural water use. For this reason, the researchers' approach is to attempt to establish a correlation between natural water resources and the total consumption of all users in a specific geographical region. The amount of usable water for agriculture or industry, for example, is restricted by the water requirements of sensitive water-dependent ecosystems such as wetlands.

ViWA
Virtual Water Values

Intensive wet rice farming in paddy fields south of Moshi at the foot of Kilimanjaro in Tanzania

To ensure that water requirements are taken into full consideration, existing methods of analysis are adapted and combined to create new, innovative methods. One focus of the project partners' work is the identification of global hotspots, where water is not being used sustainably, as well as water surplus regions (referred to here as "cold spots").

There are many different reasons why available water resources are being overused, one possible reason being the existing mechanisms of spatial water management. By engaging in intensive dialogue with relevant industrial and public water users, the project thus seeks to identify both institutional obstacles and potential, and use this information to formulate recommendations for sustainable water management.

By gathering high resolution observational data, the researchers have the means to ensure that both global and local aspects are factored into the development and analysis of practical solutions for a more sustainable and more efficient use of water resources. This includes ensuring more sustainable virtual water trade.

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