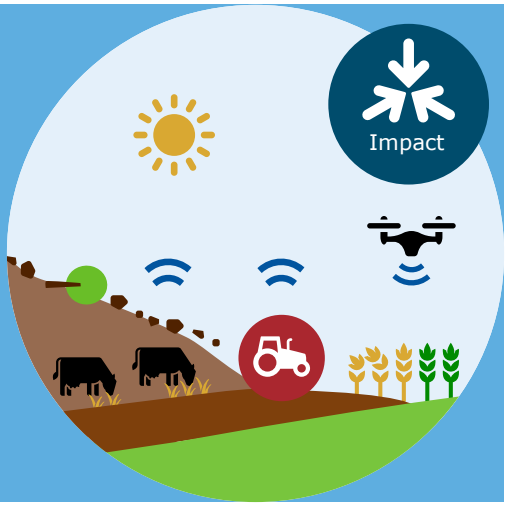
A digital twin of the global water and food system

Simulating risks for water and food security

Emerging DS/AI methods



WAGENINGEN
UNIVERSITY & RESEARCH

Data Driven Discoveries in a changing climate (D3C2)

Objective: This project aims to develop a prototype high-resoluton digital twin of the water and food system that is able to simulate real-time risks for the near and far future.

Activities

In this project, we have first improved a global hydrology and crop model to better reproduce interannual variability in crop yields and crop production. We did this by improving the representation of cropping areas, (from MAPSPAM), sowing dates and the length of the growing season. Subsequently, we ran the model with (near) real-time climate data from the Copernicus Data Store (ERA5 climate forcing), combined with seasonal forecasting (SEAS5). We are now linking our monthly crop production estimates with trade data. By doing this, we can estimate where the effect of climate variability in yields will have impact, directly and through trade.

Achievement

Building this test version of a digital twin for the global water and food system provides a good foundation on which we can build and maintain for clients. The project was very data-intensive and computationally demanding. We developed scripts for downloading and pre-processing daily climate data, running the model monthly to derive output indicators.
We have not managed yet to make this process automated. Still, there is a lot of handwork involved, which makes it a vulnerable process. In addition, we planned to incorporate machine learning for calibrating and postprocessing our data.

Outlook

We have two wildcards to document the results of this project in a scientific paper, and for the design of a dashboard. For the latter, we plan to discuss with potential end-users of our data what type of indicators are interesting. Next to this, we collaborate with a consultant in Australia to couple our biophysical model to a trade model, with the aim to provide monthly updated food security indicators. We acquired a project to further develop this for India and Australia. Lastly, we are in consultation with Heineken to provide this company with monthly updates of the water use and yield estimates of barley.

Deliverables

A prototype digital twin: a working model that is updated monthly and provides real-time simulation of the global water and food system.

Lessons learned

Setting up a model for generating monthly updates and improved representation of interannual variability in yield and water use, takes more time than expected. New team members had to learn a complex model. Getting them involved and getting everyone on the same page, proved to be quite complicated. Still, we are very proud of the

work we were able to do in a new collaboration between Wageningen Research and Wageningen University. We very much hope that we will be able to continue to further improve and disseminate what we did.

At this point, the product cannot yet maintain itself. Nevertheless, we are really convinced that it has a lot of potential to be further developed.

Contact

Hester Biemans
Water and Food Security Researcher
(project manager)
hester.biemans@wur.nl

Wageningen University & Research
P.O. Box 47
6700 AB Wageningen
The netherlands
T +31 317 48 07 00
www.wur.eu

Project members
Marijn Gülpen, *WEnR*
Ronald Hutjes, Jan Biermann, Samuel Sotanto & Lisanne Nauta, *WSG*