The Daisy Model Newsletter
Department of Plant and Environmental Sciences
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Daisy Newsletter no. 37

1 Special announcement

In the last newsletter, I wrote that the post as Tenure Track Assistant professor of Agrohydrology and Biophysical Modelling" in our group has been announced. Unfortunately, no women applied, which is a requirement at UCPH. The announcement has been re-posted, with the deadline for application 20th of March 2024. For details, look here. If you would like to work with us on Daisy development and interesting projects, MEN AND WOMEN, please apply!

2 The Daisy code 6.44/6.45

The situation described in Newsletter 36 has improved. The Linux version still exists in version 6.44, while the newest Windows- and Mac-versions are 6.45.

3 Courses

This year's Daisy PhD-course will be carried out at University of Bayreuth in Germany, hosted by Prof. Efstathios Diamantopoulos. The course will be held 9th-13th September 2024. The cost for one week is 600 € and 1350 € for the extended course with individual tuition. A flyer is available here, and registration and contact will be via email to bodenphysik@uni-bayreuth.dk.

4 Events

On 26th of January, a Daisy lunch meeting was dedicated to the use of the Danish database "HIP" (Hydrological Information and Prognosis system). Find the presentation and a guide on data extraction here.

Progress on AgroEco-HPM

Much work is being put into code re-organisation, new installers and developing a system of quality assurance of the code. We are ready to move Daisy to a new repository with an open structure and we are testing the first set of installers for windows Linux and Mac. In addition, we are now working on a generalised framework for parameter estimation, partially based on Bayesian optimisation and other sampling-based methodologies.

Also, video tutorials for new Daisy users are in the pipeline. When ready, they will be uploaded to a YouTube channel dedicated to Daisy.

We are still interested in good datasets for re-calibration of crops. If you have such datasets, please contact us, so we can improve the present crop models.

If there are any European partners out there interested in direct collaboration on projects, please reach out to darkner@di.ku.dk . There is an opportunity in the upcoming HE AgData partnership for potential funding.

5 Recent articles where Daisy has been used

Frederiksen et al. (2024) is the now published version of the article Frederiksen et al. (2023b) described in Newsletter 35.

García-Jorgensen et al. (2024) have made a very nice attempt to describe development of ptaquiloside (PTA) in bracken fern, followed by release to rainwater or from crop residues and calculation of fate. The required processes were added to Daisy and calibrated based on measured data. The calibrated model was used to simulate a 5-year period. Considering that the maximum tolerable concentration for PTA lies in the range of 0.5-16 ng l^{-1}, the average production of about 1.3 g m^{-2} is frightening. However, only 2.4 % of the production entered the soil and in average 99.7 % of this mass was degraded in the soil. However, macropores were responsible for 72% of the total mass of PTA leaching through

the rhizosphere. For the five years considered, maximum soil solution concentrations ranged from 1124 to 4330 ng l^{-1}. This concentration range for PTA indicates that pulse events are often exceeding the 16 ng l^{-1} threshold by 2 orders of magnitude, hence posing a considerable carcinogenic risk towards humans if shallow groundwater is used as drinking water.

Hansen et al. (2024) is not really a Daisy article, but NLES is used, which depends on flow calculations from Daisy. However, it is a very interesting concept for detailed mapping of groundwater retention of N (denitrification, actually) tested on the Danish monitoring catchments, and assessment of the economic gains in applying these detailed maps rather than general regulation of agriculture. Also, it includes recommendations concerning scaling up of the method and prioritization of the efforts.

You et al. (2024) have reviewed the use of crop models in combination with hydrological models over the last 20 years (thus starting 10 years later than the first Daisy-MIKE SHE-application). The article contains many nice overview tables and references for researchers involved in such model applications.

6 Other articles

For researchers with an interest in modelling N_2O-generation, the article by **Tang et al. (2024)** is of interest. Their study compared four widely used process models: APSIM, DNDC, DayCent, and STICS, analysing their mechanisms, input variables, and simulation results from different crops in simulating GHG emissions. A total of 94 relevant peer-reviewed literature papers were considered. The research identified strengths and limitations in the models when simulating GHG emissions from different crops. DNDC and DayCent performed better in simulating methane (CH_4) emissions from rice, while APSIM was more effective in simulating nitrous oxide (N_2O) emissions from maize and wheat. The simulation results were affected by model mechanisms, management practices, climate, and data availability.

7 References

7.1 Daisy

Frederiksen, R.R., Blicher-Mathiesen, G., Vilhelmsen, T.N., and Christiansen, A.V. (2024): Importance of different factors for modeling nitrate transport and retention in a tile-drained agricultural catchment with distance-based generalized sensitivity analysis. Science of the Total Environment 912 169614. https://doi.org/10.1016/j.scitotenv.2023.169614.

García-Jorgensen, D.B., Holbak, M., Hansen, H.C.B., Abrahamsen, P, Diamantopoulos, E. (2024): Modeling the environmental fate og bracken toxin ptaquiloside: Production, release and transport in the rhizosphere. Science of the total Environment, 921, 170658. https://doi.org/10.1016/j.scitotenv.2024.170658.

Hansen, B., Aamand, J., Blicher-Mathiesen, G., Christiansen, A.V., Claes, N., Dalgaard, T., Frederiksen, R.R., Jacobsen, B.H., Jakobsen, R., Kallesøe, A., Kim, H., Koch, J., Møller, I., Madsen, R.B., Schaper, S., Sandersen, P.B.E., Voutchkova, D.D. and Wiborg, I. (2024): Assessing groundwater denitrification spatially is the key to targeted agricultural nitrogen regulation. Scientific Reports 14: 5538. https://doi.org/10.1038/s41598-024-55984-9.

You, Y., Wang, Y., Fan, X., Dai, Q., Yang, G., Wang, W., Chen, D. and Hu, X. (2024): Progress in joint application of crop models and hydrological models. Agricultural Water Management 295, 108746. https://doi.org/10.1016/j.agwat.2024.108746.

7.2 Other articles of general interest

Tang, Y., Qiao, Y., Ma, Y., Huang, W., Komal, K., and Miao, S. (2024): Quantifying greenhouse gas emissions in agricultural systems: a comparative analysis of process models. Ecological Modelling 490, 110646. https://doi.org/10.1016/j.ecolmodel.2024.110646.