The Daisy Model Newsletter
Department of Plant and Environmental Sciences
University of Copenhagen

Daisy Newsletter no. 36

Figure 1. Elves are an important part of Danish Christmas.

Merry Christmas and Happy New Year
from the Daisy-team

1 Special announcement

The agrohydrology group just got a special Christmas gift: The post as TT Assistant professor of Agrohydrology and Biophysical Modelling" in our group has just been announced. The deadline for application is 4th of February 2024. For details, look here. If you would like to work with us on Daisy development and interesting projects, please apply!

2 The Daisy code

I wrote last time that version 6.41 is the last version available at all platforms. However, we have realised that this version does not work on Mac-computers, where 6.32 is recommended. The Windows and Linux-versions have reached 6.44, which include a possibility to scale global radiation (for scenarios) and an improvement to the use of a table for hydraulic properties.

3 Courses

Two students finished their "projects outside curriculum", applying Daisy on different topics.

4 Events

At the Daisy lunch meeting on 30th November Aff. Prof. Merete Styczen presented a comparison of N_2O-related processes in Daisy and Daycent. The subject was selected because several project ar concerned with modelling N_2O at the moment. The presentation can be found here.

Progress on AgroEco-HPM

Silas Nyboe Ørting from DIKU has joined the team from Nov. 1st. Merete E. Styczen has changed status from affiliated Professor to Emerita.

With respect to databases, we have received deposition data that can be built into GEODaisy from the Danish Centre for Environment and Energy, and we have had a good dialogue with the Agency for Data Supply and Infrastructure and GEUS on how exactly to interpret the data in the Hydrological Information and Prognosis-system (HIP) for our use. Groundwater data (modelled and measured) are easily available in HIP while it is trickier to extract aquitard pressures to be used for simulations of drainage, but we are quite far with a tool to ease the process. We are waiting for corrected precipitation data from DMI and a new soil map from AU. We have asked several core collaborators for crop data for re-calibration of our crops, but this will need more attention in the coming period.

To ensure better quality assurance on Daisy, a test suite of model setups has been initiated. It is, however, still in its infancy. There is a long way before we have good coverage of all processes in the model. Tools will be built to compare

simulations before and after changes in the code are made and quantify changes.

ERDA has been selected as in-house teaching platform and the place to test "Daisy on the web" and teaching aids. Also, the ancient "ShowDaisy"-tool is on the way to be replaced with a more versatile phyton-tool.

Some work has been initiated on parameter optimization. When it is a bit further, it will be presented for the working group for discussion.

Two new chapters for the documentation is well underway: Chapter 7: Mineral N-processes and Chapter 5: Water flow in soils.

5 Recent articles where Daisy has been used

Gavasso-Rita et al. (2023) have published an overview of 10 crop models, including Daisy, and their applications in studies of crop growth and productivity, particularly with respect to maize, wheat and rice. It is quite a detailed assessment of conditions and experiments in which the models have been used and been shown to perform.

Murindangabo et al. (2023) have studied a wide range of measurement techniques for soil organic matter assessment as well as methods and model descriptions of soil organic matter dynamics. The article provides a comprehensive overview, particularly of process descriptions and a comparison between approaches. By the way, two other articles ((1), (2)) concern models that explicitly mention that they use the organic matter model from Daisy.

Vuaille et al. (pre-print) looked at no-till and mulching in conservation agriculture (CA), in combination with pesticide application, and compared it to a conventional tillage system (CT). They applied a new mulch module in Daisy, with a more comprehensive description of water dynamics and turn-over of the mulch, as well as co-metabolism of the pesticide. There was no systematic difference in pesticide leaching from the topsoil (to the subsoil and directly to drains via drain-connected biopores) between CA and CT, but pesticide degradation and sorption were significantly different; degradation in the mulch and soil surface layer was larger in CA.

Weckesser et al describes a DSS for termination of legume-rich leys, which give rise to large amounts of N in the soil when ploughed. Daisy is used for N-loss risk classification by estimating N mineralization based on management, soil type, N-accumulation in the field, and weather. In addition, the system applies "expert rules". The DSS is part of a larger expert system, where the same information is used for different queries.

In addition, Rashid, M.A., Larsen, L.W., Bruun, S. and Jensen, L.S. submitted a poster to the International Fertilizer Society's (IFS) annual meeting (2003) entitled, "Evaluating the performance of biobased nitrogen fertilizers using dynamic modelling,". The poster discusses the agronomic and environmental performance of biobased fertilizers in comparison to the reference (mineral fertilization), using Daisy for scenario simulations. The poster was among the top ten finalists for the 2023 Brian Chambers International Award.

6 Other articles

Grosz et al. (2023) argue that while biogeo-chemical models calculate the entire N balance to describe soil N turnover, published findings often focus solely on environmentally harmful N losses like N_2O fluxes and NO_3^- leaching. They state that it is crucial to publish and communicate the complete N cycle as calculated by the models. This practice is vital for advancing model development, ensuring quality control, facilitating model intercomparison, and generating new

hypotheses for empirical field studies. They therefore encourage ecosystem modelers to report all results, even those that cannot be fully validated due to a lack of measurements, including denitrification and modelled N_2 fluxes.

7 References

7.1 Daisy

Gavasso-Rita, Y.L., Papalexiou, S.M., Li, Y., Elshorbagy, A., Li, Z., Schuster-Wallace, C. (2023). Crop models and their use in assessing crop production and food security: A review. Food and Energy Security 2023; 00:e503. https://doi.org/10.1002/fes3.503 .

Murindangabo, Y.T., Kopecký, M., Konvalina, P., Ghorbani, M., Perná, K., Nguyen, T.G., Bernas, J., Baloch, S. B., Hoang, N.T., Eze, F. O., and Ali, S. (2023): Quantitative Approaches in Assessing Soil Organic Matter Dynamics for Sustainable Management. Agronomy **2023**, 13, 1776. https://doi.org/10.3390/agronomy13071776.

Vuaille, J., Abrahamsen, P., Jensen, S.M., Diamantopoulos, E., Wacker, T.S., Petersen, C.T. (pre-print). Modelling pesticide degradation and leaching in Conservation Agriculture: effect of no-till and mulching. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4601018 .

Weckesser, F., Albrecht, M., Hülsbergen, K-J., and Leßke, F. (2023). A DSS for the termination of legume-rich leys. Mitt. Ges. Pflantzenbauwiss. 33: 51-52. Conference paper: DIGITAL TOOLS, BIG DATA, MODELING AND SENSING METHODS FOR SUSTAINABLE AND CLIMATE SMART CROP AND GRASSLAND SYSTEMS 64. Tagung der Gesellschaft für Pflanzenbauwissenschaften e. V.

7.2 Other articles of general interest

Grosz, B., Matson, A., Butterbach-Bahl, K., Clough, T., Davidson, E.A., Dechow, R., DelGrosso, S., Diamantopoulos, E. Dörsch, P., Haas, E., He, H., Henri, C.V., Hui, D., Kleineidam, K., Kraus, D., Kuhnert, M., Léonard, J., Müller, C., Petersen, S.O., Sihi, D., Vogeler, I., Well, R., Yeluripati, J., Zhang, J., and Scheer, C. (2023). Modeling denitrification: Can we report what we don't know? AGU Advances, 4, e2023AV000990. https://doi.org/10.1029/2023AV000990.