The Daisy Model Newsletter
Department of Plant and Environmental Sciences
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Daisy Newsletter no. 30

1 The Daisy code, v. 6.22

The version 6.22 is still the latest official release on all platforms.

2 Courses

The Daisy PhD-course for 2022 will take place from 29th August to 2nd September, at UCPH. More information is available here. There is still room, so do not hesitate to join.

3 Change in staff

Associate Professor Efstathios Diamantopoulos has accepted a position as full Professor of Soil Physics at the University of Bayreuth. He will continue to be part of the Daisy group from his new position. Look out for a job opening at UCPH soon, for an overall strengthening of the Daisy group. We wish him all the best in his new position, where Daisy will become a part of the curriculum ☺.

4 Recent articles where Daisy has been used

Delhez and Longdoz (2022) have provided an abstract to EGU2020, describing a global sensitivity analysis carried out on Daisy according to the Morris method. The ultimate aim is to model a 4-year crop rotation. The methodology applied and the results will be presented at the conference, together with propositions to improve the experimental set-up at the site where field data are collected.

Groh et al. (2022) have carried out a model comparison on an unusual lysimeter study. Lysimeter soil columns from Dedelow (Germany) were transferred to a drier and warmer site (Bad Lauchstädt) and to a wetter and warmer site (Selhausen), and models calibrated on data from the first site have then been tested on the other sites. At one site, the crop models predicted agronomic and environmental components similarly well, but at the other site, model performance values indicate that the environmental components at were better predicted than agronomic ones. At that site, the crop models failed to predict site-specific crop development indicating that the climatic conditions (i.e., heat stress) were outside the range of variation in the data sets considered for model calibration. Daisy performed well with respect to actual evaporation, soil water content and drainage water flux at the bottom of the lysimeter. It did not perform equally well with respect to the biomass and yield simulations. Particularly the grain yields at Selhausen were severely overestimated, and the scatter for winter wheat grain yield was surprisingly large, considering the considerable calibration work done on this crop recently.

Seidenfaden et al. (2022) estimated nitrate fluxes and contributions of major uncertainty sources (variance decomposition analysis) affecting nitrate leaching from the root zone and river load from groundwater sources for an agricultural catchment in Denmark under future changes (2080–2099) in climate (four climate models) and land use (four land use scenarios). To investigate the uncertainty from impact model choice, two different agro-hydrological models (SWAT and DAISY-MIKE SHE) both traditionally used for nitrate impact assessments were applied.

On average, nitrate leaching from the root zone increased by 55%–123% due to different climate models, while the impact of land use scenarios showed changes between−9% and 88%, with similar projections for river loads, while the worst-case combination of the three factors yielded a fivefold increase in nitrate transport. Thus, in the future, major land use changes will be necessary to mitigate nitrate pollution likely in combination with other measures such as advanced management and farming technologies and differentiated regulation. The two agro-hydrological models showed substantially different reaction patterns and magnitude of nitrate fluxes, and while the largest uncertainty source was the land use scenarios for both models, DAISY-MIKE SHE was to a higher degree affected by climate model choice. The dominating uncertainty source was found to be the agro-hydrological model; however, both uncertainties related to land use scenario and climate model were important, thus highlighting the need to include all influential factors in future nitrate flux impact studies.

5 PhD-Thesis

Jorge Velez has published his thesis, covering three different studies. First he explored the limitations of the first-order kinetics approach frequently used in crop models for simulating organic matter and organic N-turnover in the soil. This included an incubation study of three temperature regimes, three cover crop types and two termination methods. The first-order approach could be improved by introduction of an initial lag phase. Work was done to improve the Daisy SOM-model by adding a process for microbial activation and deactivation. Secondly, he investigated aspects of the interaction between N leaching, tillage and cover crops. This resulted in a paper on the transport of added and native solutes by macropore flow as affected by tillage, with focus on N leaching reductions due to bypass effects in no-till system and a paper on interaction between tillage, cover crop N uptake and cover crop N re-mineralisation post-harvest. The third study concerned soil structure and macroporosity and the influence of tillage, cover crops and freeze-thaw cycles.

6 References

6.1 Daisy

Delhez, L. and Longdoz, B. (2022). Retrieving useful information from global sensitivity analysis performed on soil-plant-atmosphere model Daisy. EGU22-8481. https://doi.org/10.5194/egusphere-egu22-8481.

Groh, J., Diamantopoulos, E., Duan, X., Ewert, F., Heinlein, F., Herbst, M., Holbak, M., Kamali, B., Kersebaum, K-C., Kuhnert, M., Nedel, C., Priesack, E., Steidl, J., Sommer, M., Pütz, T., Vanderborght, J., Vereecken, H., Wallor, E., Weber, T.K.D., Wegehenkel, M., Weihermüller, L. and Gerke, H.H. (2022). Same soil, different climate: Croop model intercomparison on translocated lysimeters. Vadose Zone Journal 022;e20202. https://doi.org/10.1002/vzj2.20202.

Seidenfaden, I.K., Sonnenborg, T.O., Børgesen, C.D., Trolle, D., Olesen, J.E., and Refsgaard, J.C. (pre-print): Impacts of land use, climate change and hydrological model structure on nitrate fluxes: Magnitudes and uncertainties. Science of the Total Environment 830, 154671. http://dx.doi.org/10.1016/j.scitotenv.2022.154671

6.2 PhD-Thesis

Vélez, J.F.M (2022): Modelling nitrogen leaching in agriculture – Exploring interdependencies between cover crops, soil structure and organic matter turnover. Dept. of Agroecology, Faculty of Technical Sciences, Aarhus University. https://pure.au.dk/portal/files/266059907/Thesis.pdf.

6.3 Pre-prints available:

García-Jorgensen, D.B., Hansen, H.C.B; Abrahamsen, P. and Diamantopoulos, E. (pre-print): Modeling the environmental fate of the natural toxin ptaquiloside: production, release and leaching to groundwater.

Kjaersgaard, N.C., Ottosen, I.M., Diamantopoulos, E. and Andersen, B. (pre-print): An investigation of economic and environmental impacts from precision fertilization.