Daisy Newsletter no. 35

1 The Daisy code, v. 6.41

A new version was officially released on all platforms in connection with the recent PhD-course conducted.

The most important additions since last release are:

- a new "hyprop" hydraulic model that uses parameters generated from the "hyprop" equipment from METER. However, it is quite slow, and you will get faster, but less accurate results by using the generated tables.
- Inclusion of two new programs to aid parallel simulations: "spawn" and "nwaps". The first program allocate Daisy runs to available cores in single computers, networks or supercom-puters until all required runs are done. The second program sums up result files and produces some basic statistics, making it easier to get an overview of main results. A presentation of this can be found on here.
- Some small improvements to the "table" hydraulic function, and
- A new "GlobradScale" weather parameter that can scale global radiation in the same way as "PrecipScale" does for precipitation.

Figure 1. Course participants (minus 1) and two of the teachers.

2 Courses

The Daisy PhD-course just finished. This year we had seven participants from Danish universities. Two participants are continuing with us, doing modelling projects.

3 Events

The AgroEco-HPM-project was presented to about 25 people at Foulum, Aarhus University on 15th August to create interest in participating in working groups on specific issues related to the project.

Figure 2. Presentation of AgroEco-HPM at Foulum.

4 Progress on AgroEco-HPM

The first meeting in the working group concerned with knowledge gaps was held on 21st of August, and a number of issues discussed. Some of these were improvements in the description of roots, parameter optimization, calibration of crops, not least cover crops, and N_2O-generation, but the wish-list is long. The wishes will have to be prioritized and we will see how we, in the short term, can cover the ones where data are available.

A steering committee meeting took place on 5th September. One of the important follow up-actions will be to define a range of crops for which calibration requires improvement and data required to perform such a calibration to be able to request such data from core collaborators.

We now have an agreement with Aarhus University to be allowed to use their defined "soil types" for Denmark and link it to a new soil map that is presently being prepared. The next step with respect to databases will be meetings with GEUS and the Agency for Data Supply and Infrastructure regarding the use of their "Hydrological Information and Prognosis System" and to continue talks with the Danish Centre for Environment and Energy regarding use of their N-deposition data.

The members of the team have changed slightly, as Maja Holbak has gone on maternity leave, but Muhammad Adil Rashid will help out in her absence and Silas Nyboe Ørting from DIKU will join the team during autumn.

5 Recent articles where Daisy has been used

Frederiksen et al. (2023a and b) only used Daisy-calculated percolation in connection with NLES-estimates of N-leaching. The main purpose of Frederiksen et al. (2023a) is development of a statistical model for drain flow ($Q = -242 + 0.48*P$, $R^2 = 0.57$), based on data from 38 Danish drain stations. The relationship was then tested in 14 smaller Danish catchments, where stream flow was partitioned into drain flow and base flow. Finally, transport was calculated based on an assigned drain flow concentration (based on pore water concentration calculations estimated from NLES and Daisy) and a base flow concentration based on measurements in a dry period. In Lillebæk catchment, the model overestimated transport by 4-9 kg N/ha but followed the observed pattern quite well. However, rather large differences could be observed on individual drains.

Frederiksen et al. (2023 b) combined nitrate leaching from the root zone and partitioning of nitrate transport between tile drains and groundwater in Lillebæk (as in the article above), with nitrate reduction in the groundwater simulated with a groundwater model (MODFLOW6) and particle tracking, assuming an aerobic zone, a zone with slow denitrification and a zone with fast denitrification. A distance-based generalized sensitivity of the response to the different inputs were evaluated. They found that partitioning of nitrate into tile drainage and groundwater flux was the most important component of a modeling environment to estimate N-retention while the geo-structure was secondary but also important. By increasing the resolution of N-retention map from catchment to pixel (25 x 25 m), the impacts of modeling components on the model estimation changed. Some model parameters that were insensitive on catchment scale were sensitive on pixel scale in distinct areas. For targeted regulation of agricultural N load to the stream, local findings can be more important than catchment scale findings to implement the most cost-effective mitigation measures on for example tile drained fields within the catchment.

6 References

6.1 Daisy

Frederiksen, R.R., Larsen, S.E., Blicher-Mathiesen, G. and Kronvang, B. (2023a): Development and application of a parsimonious statistical model to predict tile flow in minerogenic soils. Agricultural Water Management 281, 108244. https://doi.org/10.1016/j.agwat.2023.108244.

Frederiksen, R., Blicher-Mathiesen, G., Vilhelmsen, T.N., Christiansen, A.V. (Pre-print): Importance of different factors for modeling nitrate transport and retention in an agricultural catchment with distance-based generalized sensitivity analysis. Available at SSRN: https://ssrn.com/abstract=4514367 or http://dx.doi.org/10.2139/ssrn.4514367.