Daisy Newsletter no. 6

The Daisy code

We have now reached version 5.26. There have been a number of small changes since 5.23. The most important ones are

- you can now add details from the harvest log into normal log files,
- you can reset the organic matter pools. This is intended for use in long run scenarios to test short term effects of weather (or other changes) without long term effects of changes to SOM pools,
- you must specify atmospheric CO_2 in the weather file if you use the Farquhar photosynthesis model,
- Biopore leaching is now included in the Soil/Field Nitrogen/Chemical logs, the same way biopore percolation has been included in the Soil/Field water logs. You can now also separate drain flow from soil matrix or biopores, and separate input and output from biopores, rather than just the net exchange.
- You no longer need to include the bottom of the biopore zone in order to balance Field nitrogen and Field chemical. You still need to include the entire root zone though.

PhD-course

The course "Advanced Agrohydrology II" planned to start late August aim at teaching students to use Daisy. There will be one intensive week of lectures. During the rest of the semester, the students will work with their own data, if possible, or with data supplied by us. Look for the details at: https://phdcourses.ku.dk/Kursusliste.aspx?TermId=424&KatId=81&OCatID=4300220&sitepath=NAT. It should be announced shortly.

Recent projects where Daisy has been used

Sabine Seidel and coworkers have conducted five studies using Daisy (Seidel et al. 2016a and b., Kloss et al., 2014, Wagner et al., 2015 and Walser et a., 2011). **Daisy was applied in four field studies to predict the growth of wheat, barley, maize, field bean and white cabbage, and in one study on a regional scale to estimate the irrigation water demand of common bean under field conditions under varying climatic conditions.** One of the studies aimed at prediction of the whole soil-plant-atmosphere continuum including the leaf stomatal conductance and soil moisture dynamics (SVAT-modelling). The research group tested the transferability of winter wheat and barley plant parameters estimated from field data to greenhouse conditions. Furthermore, the research group has developed new plant parameters for field bean and adapted the ones of winter wheat, white cabbage, barley and maize. Daisy was used in the SAPHIR project link for estimation of the irrigation water demand of several crops in Saxony, Eastern Germany. The Daisy model was selected for the studies because of its balanced interconnection of all relevant processes at a consistent level of detail.

In order to support the work in a working group looking at interactions between the water level in streams and drainage conditions on the surrounding agricultural land, Daisy was used in 2D-mode to evaluate the **effects of high water level due to growth weeds in the stream on drained soils during summer**. The major effects take place on the land where the drainage pipe is flooded, but the moisture content is also higher in the upstream parts of the drained area. The report is only available in Danish, but can be found here: http://plen.ku.dk/raadgivning/rapporter/PLENrapport_teknisk_note.pdf.

Figure 1. Weeds in the stream "Vivede Mølleå" in February, 2016.

In the article by Ida B. Karlsson et al., Daisy was mainly used to generate **vegetation input** for the MIKE SHE model for present and future climate and land use changes.

Bjarke Stoltze Kaspersen et al (1) have published a study on **using a map-based assessment tool for the development of cost-effective WFD river basin action programmes in a changing climate**. In this study, the Daisy model was used to simulate the effects of climate change on nitrate leaching rates in the Isefjord and Roskilde Fjord River Basin. Results show that for the main soil types in the study area, future nitrate leaching rates increase by approx. 25% under current agricultural management practices. This impact outweighs the expected total N reduction effect of WFD Baseline 2015 and the first River Basin Management Plan in the Isefjord and Roskilde Fjord River Basin. The particular Programmes of Measures investigated in the study show that WFD N reduction targets can be achieved by targeted land use changes on approx. 4% of the agricultural area under current climate conditions and approx. 9% of the agricultural area, when projected climate change impacts on nitrate leaching rates are included in the assessment.

Bjarke Stoltze Kaspersen et al (2) have looked into the N effect of using degassed biomass from Solrød Biogas on agricultural fields in **Linking climate change mitigation and coastal eutrophication management through biogas technology: Evidence from a new Danish bioenergy concept**. Daisy model simulations were used to estimate the utilization requirements for the degassed biomass in order to reduce N losses from agricultural fields compared to the reference situation. The required N utilization rate of the degassed biomass determines the maximum applicable amount of N to the agricultural fields. The Daisy model simulations indicate that an N utilization requirement of 85% for the application of the specific degassed biomass to agricultural fields has the potential to reduce N runoff compared to the present application of both mineral fertilizers and pig manure without compromising crop yields.

Recent articles and reports

Three of the listed articles do not involve Daisy-modeling per se. Liang et al. (2016) and Specka et al. (2016) are using models, where the organic matter description stems from Daisy. Pettenati et al. (2016) describe a way to generate sorption values for metal ions usually not represented in agrochemical models, for use in Daisy. The work was done in connection with the EU Safir project.

The PhD work by Gareth Edwards, Marieke ten Hoeve and Kiril Manevski was presented earlier in the Newsletter. Some of their articles are now available.

Bruun, S., Yoshida, H., Nielsen, M.P., Jensen, L.S., Christensen, T.H., Scheutz, C.: Estimation of long-term environmental inventory factors associated with land application of sewage sludge. Journal of Cleaner Production 126 (2016) 440-450.

Edwards, G., White, D.R., Munkholm, L.J., Sørensen, C.G., and Lamandé, M.: Modelling the readiness of soil for different methods of tillage. Soil & Tillage Research 155 (2016) 339–350.

ten Hoeve, M., Nyord, Y., Peters, G.M., Hutchings, N.J., Jensen, L.S., and Bruun, S.: A life cycle perspective of slurry acidification strategies under different nitrogen regulations. Journal of Cleaner Production 127 (2016) 591-99.

Karlsson, I.B., Sonnenborg, T.O., Refsgaard, J.C., Trolle, D., Børgesen, C.D., Olesen, J.E., Jeppesen, E. and Jensen, K.H.: Combined effects of climate models, hydrological model structures and land use scenarios on hydrological impacts of climate change. Journal of Hydrology 535 (2016) 301–317.

Kaspersen, B.S., Christensen, T.B., Fredenslund, A.M., Møller, H.B., Butts, M.B., Jensen, N.H. and Kjaer, T.: Linking climate change mitigation and coastal eutrophication management through biogas technology: Evidence from a new Danish bioenergy concept. Science of the Total Environment 541 (2016) 1124–1131.

Kaspersen, B.S., Jacobsen, T.V., Butts, M.B., Jensen, N.H., Boegh, E., Seaby, L.P., Müller, H.G. and Kjaer, T.: Using a map-based assessment tool for the development of cost-effective WFD river basin action programmes in a changing climate. Journal of Environmental Management 178 (2016) 70-82.

Kloss, S., Grundmann, J., Seidel, S.J., Werisch, S., Trümmner, J., Schmidhalter, U. and Schütze, N. Investigation of deficit irrigation strategies combining SVAT-modeling, optimization and experiments. Environ. Earth Sci. 72 (12) (2014): 4901-4915.

Larsen, M.A.D., Refsgaard, J.C., Jensen, k.H., Butts, M.B., Stisen, S. and Mollerup, M.: Calibration of a distributed hydrology and land surface model using energy flux measurements. Agricultural and Forest Meteorology 217 (2016) 74–88.

Liang, H., Hu, K., Batchelor, W. D., Qi, Z. and Li, B. (2016).An integrated soil-crop system model for water and nitrogen management in North China.Scientific Reports | 6:25755 | DOI: 10.1038/srep25755. www.nature.com

Manevski, K., Børgesen, C.D., Xiaoxin Li, Andersen, M.N., Abrahamsen, P., Hu, C. and Hansen, S.: Integrated modelling of crop production and nitrate leaching with the Daisy model. MethodsX 3 (2016) 350–363.

Pettenati, M., Surdyk, N., Cary, L. and Kloppmann, W.: Revisiting the Kf-distribution coefficient concept through stringent geochemical modeling: Application to agronomical models under wastewater reclamation context. Geoderma, 268 (2016) 128–138.

Seidel, S.J. , Rachmilevitch, S., Schütze, N. and . Lazarovitch, N.: Modelling the impact of drought and heat stress on common bean with two different photosynthesis model approaches. Environmental Modelling & Software 81 (2016) 111-121.

Seidel, S.J., Werish, S., Barfus, K., Wagner, M., Schütze, N. and Laber, H.: Field Evaluation of irrigation scheduling strategies using a mechanistic crop growth model. Irrig. and Drain. 65: (2016)214–223.

Specka, X., Nedel, C., Hagemann, U., Pohl, M., Hoffmann, M. Barkusky, D., Augustin, J., Sommer, M., van Oost, K.: Reproducing CO_2 exchange rates of a crop rotation at contrasting terrain positions using two different modelling approaches. Soil & Tillage Research 156 (2016) 219–229.

Wagner, M., Sedel, S.J. and Schütze, N. Irrigation water demand of common bean on field and retional scale under varying climatic conditions. Meteorologische Zeitschrift, 2015. PrePub DOI 10.1127/metz/2015/0698.

Walser, S., Schütze, N., Marcus, G., Susanne, L., and Schmidhalter, U. Evaluation of the transferability of a SVAT model – results from field and greenhouse applications. Irrig. and Drain. 60 (Suppl. 1) (2011): 59‑70.