Daisy Newsletter no. 22

1 Obituary: Prof. Søren Hansen

It is with great sadness that we hereby inform about the death of our colleague and friend, professor of agro-hydrology, Søren Hansen. Søren passed away on May 30th, after several years fighting cancer. Till the end, Søren participated in scientific discussions and his name is already on five published or accepted papers in 2020.

Søren was a driving force in creating the Daisy model system in 1990 and the centre for its further development and use over almost 30 years. His knowledge and understanding of the soil-plant-atmosphere system was impressive, and we are many who have benefitted from his knowledge as well as his kind and patient way of explaining and discussing theory and observ-ations covering all aspects water movement, nutrient dynamics and plant growth. Søren was a very modest person, who felt that his work would speak for itself. Daisy is certainly his legacy, and it will now be up to all of us to build on the strong foundation that he made.

We will miss him.

2 The Daisy code, v. 5.88

The version 5.88 is still the last official release on all platforms.

However, a new winter wheat will be distributed with the library. It has three features that are different from other crop descriptions: i. effect of N-status on stem/leaf partitioning (Gyldengren et al. 2020), ii. two-phase nitrate uptake through the roots (described in Newsletter no. 9) and iii. use of the the "seed" module for germination.

3 Courses

We still expect to run the **announced PhD-course** for new Daisy users from 24-28th of August 2020, as restrictions caused by Corona presently are being lifted.

4 Events

David Nagy, AU, Foulum defended his PHD-Theses with the title: "*Quantifying the transport and fate of dissolved nitrogen at different scales in drained agricultural landscapes*" on 6th of April in Foulum, Blicher Allé 20, Tjele. Links to the PhD an article can be found below.

5 Recent articles where Daisy has been used

Gyldengren et al. (2020) describes the implementation of a recent empirical model concerning the partitioning of assimilate in winter wheat according to N-status in the plant in Daisy. Implementation of the new N status response function improved model performance and ensured a more robust crop growth description, especially in scenarios with periods of low crop N status or N stress. The mechanism mimics an adaptation strategy, where the crop balances N stress and growth potential by dynamically adjusting the leaf-stem ratio and thereby N demand. This behaviour opens a discussion regarding the empirical concept of a biomass driven critical N curve. As a special treat for Daisy-nerds, the supplementary material contains a description of a new winter wheat parameterisation applying temperature responses by Wang et al. (2017) and other new parameterisations, as well as links between the DS and BBCH-scale. This parameterisation will be made available with new versions of Daisy, with reference to the article.

Liang et al. (2020) compares the ability of different crop simulation approaches of N-dilution (including M1: the one in Daisy, but not including the addition above, M2: CERES/RZWQM; M3 EPIC and M4: CROPSYST/STICS to reproduce observations. All four methods performed well, and M2 did so with the minimum input parameters.

The discussion paper "Nagy et al. (2020)" compared six different model concepts, using the dual-permeability module of the one-dimensional model DAISY, incorporating three different macropore settings and two different groundwater tables set as lower boundary conditions. The model study was based on ten years of coherent climate, drainage, and groundwater data from an agricultural clay till field. The estimated drainage obtained with the six model concepts was compared to the measured drainage. No significant discrepancies between the estimated and 10 measured drainage were identified. Bromide leaching tests were used to evaluate the mass balance of the model concepts. The estimated water balance of all six concepts revealed that 70% of the precipitation input to drainage was transported via macropores. According to the results of bromide leaching simulation, 54% of the drainage was estimated to be transported via vertical macropores being initiated in the plow layer.

The articles below by Styczen et al. (2020a&b) describes work also presented in Daisy Newsletter no. 11 on factors responsible for the drop in protein content observed from 1990 to 2015 in Danish grain crops. The (2020a)-article describes the initial data analysis of about 1000 fertilizer trials with winter wheat and 500 with spring barley. The (2020b)-article describes the model work based on the derived N-response curves, showing different causes to the development seen in the two crops.

Tenreiro et al. (2020) systematically reviewed seven crop simulation models (WOFOST, DSSAT, APSIM, DAISY, STICS, AquaCrop and MONICA) and five hydrologic models (HYDRUS-1D, HYDRUS-2D, SWAP, MIKE-SHE and SWIM) for comparison. According to the review, crop models rely mainly on 'discrete' and empirical approaches for modelling soil water movement while hydrologic models emphasize more 'continuous' and mechanistic ones. Hydrologic models pay more attention to spatially variable water processes than crop simulation models, although their focus is on scales higher than the field which is the relevant scale for assessing the influence of such variations on crop behaviour. Opportunities for progress in the spatial simulation of water processes at field level will probably come from two different directions. One implying a stronger synergism between both model families by using continuous-type approaches to simulate some mechanisms in existing crop models, and the other through the integration of lateral flows in the simulation of discrete water movement approaches. Daisy comes out of the comparison with the highest spatial score for a crop model.

6 Other articles

The article by Taghizadeh-Toosi et al. (2020) concerns parameterisation of the model "C-TOOL" for systems with different frequency of grass leys in the crop rotation or permanent grassland. The article was included because parameterisation of such systems may pose problems and these approaches, data and discussions may provide inspiration.

7 References

7.1 *Daisy*

Gyldengren, J.G., Abrahamsen, P., Olesen, J.E., Styczen, M., Hansen, S. and Gislum, R. (2020). Effects of winter wheat N status on assimilate and N-partitioning in the mechanistic agroecosystem mode DAISY. J Agro Crop Sci. 2020;00:1-22. DOI: 10.1111/jac.12412.

Liang, H., Gao, S., Hu, K. (2020). Global sensitivity and uncertainty analysis of the dynamic simulation of crop N uptake by using various N dilution curve approaches. European Journal of Agronomy 116: 126044. https://doi.org/10.1016/j.eja.2020.126044.

Nagy, D. (2020) Quantifying the transport and fate of dissolved nitrogen at different scales in drained agricultural landscapes. PhD Thesis. Available at: https://www.forskningsdatabasen.dk/en/catalog/2451997579.

Nagy, D., Rosenbom, A. E., Iversen, B. V., Jabloun, M., and Plauborg, F (2020): Estimating the degree of preferential flow to drainage in an agricultural clay till field for a 10-year period, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-665, in review, 2020.

Styczen, M.E., Abrahamsen, P., Hansen, S. and Knudsen, L. (2020b). Model analysis of the significant drop in protein content in Danish grain crops from 1990-2015. European Journal of Agronomy 118, 126068. https://doi.org/10.1016/j.eja.2020.126068.

Tenreiro, T.R. Vila, M.G., Gomez, J.A., Jimenez-Berni, J.A. and Fereres, E. (2020). Water modelling approaches and opportunities to simulate spatial water variations at crop field level. Agricultural Water Management 240, 106254. https://doi.org/10.1016/j.agwat.2020.106254.

7.2 *Other articles of general interest*

Styczen, M.E., Abrahamsen, P., Hansen, S. and Knudsen, L. (2020a). Analysis of the significant drop in protein content in Danish grain crops from 1990-2015 based on N-response in fertilizer trials. European Journal of Agronomy 115, 126013. https://doi.org/10.1016/j.eja.2020.126013.

Taghizadeh-Toosi, A., Cong, W.-F., Eriksen, J., Mayer, J., Olesen, J.E., Keel, S.G., Glendining, M., Kätterer, T. and Christensen, B.T. (2020). Visiting dark sides of model simulation of carbon stocks in European temperate agricultural soils: allometric function and model initialization. Plant Soil. https://doi.org/10.1007/s11104-020-04500-9.