The Daisy Model Newsletter
Department of Plant and Environmental Sciences
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Daisy Newsletter no. 12

We would like once again to thank you for taking an interest in the "Daisy" and to wish you a

Merry Christmas and a Happy New Year

The Daisy code

The official Daisy code is still 5.32.

Daisy panel

In order to strengthen the foundation of the Daisy code at PLEN, we have established an internal panel with members from different sections in order to improve the coordination of data collection, model development and model use. The first meeting was held at the end of November. We hope to be able to spread out the responsibility of keeping different parts of the Daisy code up to date and to ensure that modelers at PLEN learn from each other.

Modelling calcareous soils

Many soils in Eastern Denmark contain 10-15 % limestone in the subsoil. A recent BSc. and a MSc. study have investigated whether it is possible to use the HYPRES pedo-transfer function for these soils and whether the high content of lime influenced the measurement of the retention curve. Pressure plate measurements of a soil paste at pF 4.2 (standard procedure) turned out to retain too much water, while thin soil slices were able to drain off a lower water content. This is probably due to reallocation of the calcium carbonate when making the paste. The HYPRES pedo-transfer function produced good estimates of the retention curves whether it was based on the texture estimated without removing the limestone or with the limestone removed. Much of the limestone belonged to the silt and fine sand fractions.

Recent articles where Daisy has been used

Durand et al. have assessed the ability of 21 crop models (including Daisy with standard crop module) to capture the impact of elevated CO_2 concentration on maize yield and water use as measured in a 2-year Free Air Carbon dioxide Enrichment experiment conducted at the Thünen Institute of Braunsweigh. The study does not report details for the individual models, but they conclude that the maize models are not reducing transpiration sufficiently with elevated [CO_2]. Models with explicit impact of [CO_2] on stomatal conductance appeared to describe the seasonal water balance better, but they did, in general, not produce better yield estimates. They conclude that more efforts are required with respect to description of transpiration and kernel number set/sink strength in order to improve the models.

The study by Fan et al. concerns the development of ecosystem services over time in organic farming systems and how this compares to conditions in conventional systems. Daisy is used to set up 14 different conversion scenarios and evaluating these over a period of 65 years. The crop rotations and N-input in the conventional and organic system differ considerably, with more N-fixing crops and carbon incorporation in the organic scenarios. With respect to modelling they concluded that there is a need for more calibration and validation of the crop modules for organic farming conditions, including the ability to take into account a realistic weed pressure. The field measurements did not support the buildup of organic matter in the field simulated in the scenarios.

The article by Seidel et al. (2017) concerns irrigation strategies for white cabbage. Seidel et al. found that irrigation scheduling based on direct measurement of suction produced better results that obtained through Daisy modelling and water balance based approaches. They conclude that simulation-based irrigation may be efficient, if the plant and soil hydraulic parameters are estimated from experimental data, but that insufficient model calibration leads to

incorrect estimates of irrigation water demand and timing.

Zhou et al. (2017) tested a new methodology, where LAI and RVI measures are combined to produce an optimal curve for N-status. This curve, which appears to be independent of year and cultivar, was then used to guide fertigation in potato. The approach was tested against Daisy simulations of the experiment. Most of the time there was close correspondence between the two methods. While it may be possible to pick up N-stress earlier in the Daisy simulations than through measurements and thus optimize the application amount and timing, they also conclude that this requires a well calibrated model, which may not be available at farm level. The RVI/LAI-reference curve method provides the information to guide the timing of supplementary N, but the N-requirement is still undetermined.

Recent articles and reports

Durand, J.-L., Delusca, K., Boote, K., Lizaso, J., Manderscheid, R., Weigel, H.J., Ruane, A.C., Rosenzweig, C., Jones, J., Ahuja, L., Anapalli, S., Basso, B., Baron, C., Bertuzzi, P., Biernath, C., Deryng, D., Ewert, F., Gaiser, T., Gayler, S., Heinlein, F., Kersebaum, K.C., Kim, S.-H., Müller, C., Nendel, C., Olioso, A., Priesack, E., Villegas, J. R., Ripoche, D., Rötter, R.P., Seidel, S.J., Srivastava, A., Tao, F., Timlin, D., Twine, T., Wang, E., Webber, H., Zhao, Z. (2017). How accurately do maize crop models simulate the interactions of atmospheric CO_2concentration levels with limited water supply on water use and yield? European Journal of Agronomy (in press).

Fan F., Henriksen, C.B. and Porter, J. (2017). Long-term effects of conversion to organic farming on ecosystem services - a model simulation case study and on-farm case study in Denmark. Agroecology and Sustainable Food Systems.

Hertz, A.E. (2017). Estimering af hydrauliske egenskaber I kalkrig underjord syd for Kalundborg. BSc. report, PLEN, KU.

Holbak, M. (2017). Hydraulic properties of calcareous subsoil. An investigation of water retention, permeability and water table dynamics in a drained agricultural field on a young calcareous moraine soil. MSc. report, PLEN, KU.

https://doi.org/10.1080/21683565.2017.1372840

Seidel, S.J, Werisch, S., Schütze, N., and Laber, H. (2017). Impact of irrigation on plant growth and development of white cabbage. Agricultural Water Management 187 (2017) 99–111.

Zhou, Z., Plauborg, F., Thomsen, A.G. and Andersen, M.N. (2017). A RVI/LAI-reference curve to detect N stress and guide N fertigation using combined information from spectral reflectance and leaf area measurements in potato. European Journal of Agronomy 87 (2017) 1–7.