Daisy Newsletter no. 10

The Daisy code, v. 5.32

The present version 5.32 only differs from 5.31 by correction of an error introduced in 5.31.

PhD-course "Applied Agrohydrology 2"

A PhD-course on the use of Daisy will take place in the autumn, with an intensive week from 28th of August followed by project work with individual consultations. The deadline for applying for the course is 1st of August. The course description can be found on:

https://phdcourses.ku.dk/DetailKursus.aspx?id=103262&sitepath=NAT

Recent studies in which Daisy has been used

The report from the PESTPORE-study mentioned in Daisy News no. 4 (Jørgensen et al., 2017) has finally been released by the Danish Env. Protection Agency. As mentioned there, the study showed the presence of a relic macropore system below the active one, and measurements and Daisy simulations were carried out to determine the importance of this system for pesticide leaching. The report has a comprehensive English summary, and the study is presently being followed up by PESTPORE II, which attempts to clarify whether the observed pattern is a general occurrence.

Ozturk et al. (2017) compared the response of winter wheat modelled by FASSET, Daisy and SWAT under a changing climate. They concluded that the differences in crop models had had the largest effects on crop yield and grain N estimat-ions, despite the identical soil parameter and management inputs. Climate change projections provided by the RCMs were shown to be a minor source of uncertainty in yield predictions, though the period for which the simulation runs were carried out played a further important role. The results highlighted the need to improve crop models by incorporating recent knowledge from FACE experiments, e.g. down-regulation mechanism of photosynthesis and/or plant N metabolism under increased CO2.

The article by Zhou et al. (2017) is a very interesting study, where RVI- and LAI-measurements are combined, and the deviation from the optimal relationship is interpreted as N-stress and used to guide the application of additional N-fertilizer in potato. In addition, the different treatments were simulated using Daisy, and the occurrence of N-stress identified by the two methods were compared.

The Daisy model was able to simulate N stress and showed a close correspondence to the proposed RVI/LAI- reference curve method in most cases. N stress was usually simulated 0–6 days in advance of that measured with the RVI/LAI- reference curve method, and such deviations could be fully explained as they fell within the RVI/LAI measuring frequency of the seven days. However, the Daisy simulations failed to detect N-stress in some treatments. The authors recommend running Daisy for a particular field to alert for impendent N stress was recommended as a second management tool.

Yin et al. (2017) described a comparison of 12 process-based models for simulation of grain N in crop rotations across Europe. In regard to the Individual models, Daisy, FASSET, HERMES, MONICA and STICS were found suitable for predicting grain N of the main crops in typical European crop rotations, both in continuous simulation and single year simulations. The authors state that both model initialization and the cover crop effects in crop rotations should be considered in order to achieve good performance of continuous simulation. The study suggests that continuous simulation is required for simulating grain N in crop rotations, which may be even more important in organic farming systems or low input cropping systems, and the authors conclude that a detailed representation of the N cycle in the model and sound parameterizations of the crops are essential to achieve adequate model performance and yield predictions. Furthermore, the choice of either continuous simulation or single year simulation should be guided by the simulation objectives (e.g. grain yield, grain N content or N dynamics), the crop sequence (inclusion of legumes) and treatments (rate and type of N fertilizer) included in crop rotations and the model formalism.

Both the study by Ozturk et al.(2017) and Yin et al. (2017) conclude that the multi-model-means provide better predictions than single-models.

Furthermore, Daisy has been used to guide one of the applied irrigation strategies in white cabbage, but it is concluded that soil hydraulic parameters should be estimated for the site in question to provide good estimates (Seidel et al., 2017). Hansen et al. (2017) only use Daisy for water balance calculations for crop rotations on different soil types.

The article by Vanuytrecht and Thorburn (2017) is a review of how responses to atmospheric CO_2-concentrations are handled by different models. It is thus not a Daisy-article as such, but Daisy is one of the models figuring in the comparison and therefore mentioned here as an interesting article for people working with climate change. In the Daisy model implementation referred to, the minimum, maximum and critical N concentration of plant parts are decreased with increasing [CO_2] (-20% for an increase in [CO_2] from 350 to 700 ppm; (Olesen et al., 2004)" and a Specific Leaf Area response (-16% for a doubling of [CO_2] to 700 ppm (Olesen et al., 2004)" is included.

Olesen JE, Rubæk GH, Heidmann T, Hansen S, Børgensen CD (2004) Effect of climate change on greenhouse gas emissions from arable crop rotations. Nutrient Cycling in Agroecosystems, 70, 147–160.

Recent articles and reports

Hansen, A.L., Refsgaard, J.C., Olesen, J.E., Børgesen, C.D. 2017. Potential benefits of a spatially targeted regulation based on detailed N-reduction maps to decrease N-load from agriculture in a small groundwater dominated catchment. Science of the total Environment 595: 325-336.

Jørgensen, P.R., Krogh, P. H., Hansen, S., Petersen, C. T., Habekost-Nielsen, M., Rasmussen, S. B., Heinrichson, K. and Spliid, N. H., 2017. Dybe bioporers forekomst og betydning for pesticidudvaskning i moræneler. (The presence and importance of deep biopores for pesticide leaching in moraine till). BEKF nr. 171. Miljøstyrelsen (The Danish Environmental Protection Agency). http://www2.mst.dk/Udgiv/publikationer/2017/02/978-87-93529-71-7.pdf

Ozturk, I., Sharif, B., Baby, S., Jabloun, M. and Olesen, J.E., 2017. The long-term effect of climate change on productivity of winter wheat in Denmark: a scenario analysis using three crop models. Journal of Agricultural Science (2017), 155, 733–750.

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: 99-111.

Vanuytrecht, E. and Thorburn, P.J., 2017. Responses to atmospheric CO2 concentrations in crop simulation models: a review of current simple and semicomplex representations and options for model development. Global Change Biology (2017) 23, 1806–1820.

Yin, X., Kersebaum, K. C., Kollas, C., Manevski, K, Baby, S., Beaudoin, N., Öztürk, I., Gaiser, T., Wu, L., Hoffmann, M., Charfeddine, M., Conradt, T., Constantin, J., Ewert, F., de Cortazar-Atauri, I.

G., Giglio, L., Hlavinka, P., Hoffmann, H., Launay, M., Louarn, G., Manderscheid, R., Mary, B., Mirschel, W., Nendel, C., Pacholski, A., Palosuo, T., Ripoche-Wachter, D., Rötter, R. P., Ruget, F., Sharif, B., Trnka, M., Ventrella, D., Weigel, H.-J., Olesen, J. E. 2017. Performance of process-based models for simulation of grain N in crop rotations across Europe. Agricultural Systems 154: 63-77.

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: 1-7.