The Daisy Model Newsletter
Department of Plant and Environmental Sciences
University of Copenhagen

Daisy Newsletter no. 7

The Daisy code, v. 5.28

A new "Crop" log in log-std.dai with a subset of the content of the old "Crop Production" log has been made, but the subset should be easier to understand, and it is documented in the tutorial.

There are also some new facilities for logging specific parts of the crop development. See the NEWS file for more details.

Recent projects where Daisy has been used

Morten A. D. Larsen (The Technical University of Denmark) and co-authors has conducted work in the period of 2013-2016 involving Daisy model runs performed by Mikkel Mollerup. The work was part of the HYACINTS project (www.hyacints.dk). Daisy was used in the parameterization/calibration process of the MIKE SHE 3D distributed hydrology model over the Skjern river catchment (2500 km2). In the studies, Daisy simulated yearly variations in LAI, root depth, crop height and albedo for the crops of spring barley, winter wheat, grass and corn (for animal feed) as a function of soil type (JB classification). The crops and soil types were distributed according to their distribution within the catchment (app. 85% agriculture and grass, the remaining being mainly needle tree forest). The calibration was performed by maintaining the seasonal pattern of each variable but adjusting the amplitude by a single ratio for each variable in question. The upper and lower bounds of these were found in literature. The following five publications use a MIKE SHE setup calibrated in this manner: Larsen et al. (2016a and b) (b was already mentioned in Daisy Newsletter 6), Refsgaard et al. (2016), Butts et al. (2014) and Larsen et al. (2014).

Jacob Gyldengren finished his master thesis in which Daisy was applied to investigate the impact of different field drainage conditions on soil N turnover processes. Poor field drainage conditions have been shown decrease grain yield and grain N yield, and several causes for this has been suggested, including restricted root development, temperature effects, suboptimal timing of field operations and reduced availability of N. The purpose of the thesis was to focus on the latter, and to compare field measurements to model predictions of grain N yield in unfertilized experimental plots in two different drainage scenarios.

A well drained and a poorly drained plot/scenario was compared. The model was calibrated to fit the dynamically measured groundwater level and the grain N yield for four seasons (2012-2015) in the two drainage scenarios. The predicted winter wheat N yield in unfertilized plots in the 2015-16 season was satisfying.

In general, the model performed best in the well drained scenario. Based on Daisy simulations, the plant available N pr. season was estimated. The difference between plant available N in the two drainage scenarios correlated quite well to measured differences in grain N yield (winter wheat or spring barley) for four seasons (2013-2016). This indicates that the impact of drainage condition on the soil N turnover and N loss processes can explain much of the variation in observed yield- and N yield between different field drainage conditions. However, the results also suggest, that other drainage-related factors can "eclipse" the impact of differences in soil N dynamics in some situations.

The model generally overestimated the norm-fertilized grain N yield (wheat/barley), and mostly so in the poorly drained plot/scenario. This suggests that the fate of N fertilizer is not fully accounted for - especially so in the poorly drained scenario. In the light of this, the Daisy-simulated effects of poor drainage is discussed with an emphasis on the model description of soil N dynamics. The thesis will be available in the Library some time during October.

Daisy in “Terranimo”

Terranimo® (Terramechanical model) is a computer model that predicts the risk of soil compaction by farm machinery. The model estimates the risk of compaction for realistic operating conditions. It is available on http://www.terranimo.dk/. In the Danish version (versions exists called “global”, Norway, Finland, Switzerland, Belgium-Flanders), an option has been added that allows calculation of the matric potential using Daisy, when the soil texture has been specified.

Recent articles and reports

Butts M., Drews M., Larsen M.A.D., Lerer S., Rasmussen S.H., Groos J., Refsgaard J.C. and Christensen J.H. (2014): Embedding complex hydrology in the climate system – dynamic coupling across scales. Adv. Water Resour., 74, 166–184, doi:10.1016/j.advwatres.2014.09.004.

Larsen, M.A.D., Refsgaard, J.C., Jensen, K.H., Christensen, J.H., Butts, M., Drews, M. and Christensen O.B. (2014): Results from a full coupling of the HIRHAM regional climate model and the MIKE SHE hydrological model for a Danish catchment. Hydrol. Earth Syst. Sci., 11, 3005–3047, doi:10.5194/hessd-11-3005-2014.

Larsen, M. A. D, Christensen, J. H., Drews, M., Butts, M. and Refsgaard J. C. (2016a): Local control on precipitation in a fully coupled climate-hydrology model. Sci. Rep. 6:22927, DOI: 10.1038/srep22927.

Larsen M.A.D., Refsgaard J.C., Jensen K.H, Butts M., Stisen S. and Mollerup M. (2016b): Calibration of a distributed hydrology and land surface model using energy flux measurements. Agr. Forest. Meteorol. 217, 74-88, DOI: 10.1016/j.agrformet.2015.11.012.

Manevski, K, Børgesen, .C.D, Li, X., Andersen, M.N., Hu, C.,and Yanjun, S. (2016). Which soil dataset should I use? Simulation uncertainties for regional nitrogen management. 19th Nitrogen Workshop, Efficient use of different sources of nitrogen in agriculture – from theory to practice, Skara, Sweden 27 June – 29 June 2016. Proceedings, page 158-159.

Manevski, K, Børgesen, .C.D, Li, X., Andersen, M.N., Zhang, X., Abrahamsen, P, Hu, C. and Hansen, S. (2016). Optimising crop production and nitrate leaching in China: Measured and simulated effects of straw incorporation and nitrogen fertilization. Europ. J. Agronomy 80 (2016) 32–44.

Refsgaard, J. C., Sonnenborg, T. O., Butts, M. B., Christensen, J. H., Christensen, S., Drews, M., Jensen, K. H., Jørgensen, F., Jørgensen, L. F., Larsen, M. A. D., Rasmussen, S. H., Seaby, L. P., Seifert, D. and Vilhelmsen, T. N. (2016): Climate change impacts on groundwater hydrology – where are the main uncertainties and can they be reduced? Hydrol. Sci. J. DOI: 10.1080/02626667.2015.1131899.