The Daisy Model Newsletter
Department of Plant and Environmental Sciences
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Daisy Newsletter no. 5

New homepage

We are happy to present our new homepage on **Daisy.ku.dk**.

It is now possible to download versions of Daisy for Mac OS X and MS Windows. The last release is numbered 5.23.

Information about new versions of the model will be published as "news" on the page. We also plan to provide information about our ongoing projects (MSc, PhD and other research projects, where Daisy has been used).

A new feature has been added to Daisy: The Drain parameter 'pipe_outlet'makes it possible to simulate the situation where the drain pipe outlet is permanently or temporarily under water. It is now supported for 2D simulations.

Recent projects where Daisy has been used

Matthias Ganghofner has submitted a MSc. Thesis on the subject "**Modelling nitrate leaching with Daisy over a time span of 24 years**" to be defended on *16th of March, 2016 at PLEN, KU*. The data used for modelling originates from the Danish monitoring programme and has kindly been made available by Gitte Blicher-Mathiesen, who is also co-supervising the thesis.

Kiril Manevski's PhD.-thesis has been added to the publication list below. The title is:
The influence of land use and management on nitrogen leaching in two agricultural catchments in China and Denmark. In this study, the Daisy model has been used to model water and nitrogen fluxes under different climatic zones, such as Denmark, China and Ghana, in various agro-ecosystems like intercropped maize, double-cropped maize and winter wheat, perennial monocultures with various grasses etc. Of special interest is the simulation of the nitrate leaching and the associated soil nitrate dynamics in the agro-ecosystem.

Hans Estrup Andersen et al. have published a study on **Identifying hot spots of agricultural nitrogen loss within the Baltic Sea drainage basin.**
The study focuses on identifying hotspots of agricultural nitrogen (N) loss in the Baltic Sea drainage basin (1,720,270 km2) with the aim of facilitating mitigation. They calculated rootzone N leaching for the entire drainage basin: A dataset of more than 4,000 agricultural fields with combinations of climate, soils and agricultural management which overall describes the variations found in the Baltic Sea drainage basin was constructed. The Daisy model was used to simulate N loss from the root-zone of all agricultural fields in the data set. From the data set of Daisy simulations we identified the most important drivers for N loss by multiple regression statistics and developed a statistical N loss model. By applying this model to a basin-wide data set on climate, soils and agricultural management at a 10 x 10 km scale they were able to calculate root-zone N losses from the entire Baltic Sea drainage basin and identify N loss hot spots in a consistent way and at a level of detail not hitherto seen for this area. Further, the root-zone N loss model was coupled to estimates of nitrogen retention in catchments separated into retention in groundwater and retention in surface waters allowing calculation of the coastal N loading.

Peltre et al. have concentrated on a more detailed quantification of effects of specific measures to control N-leaching in "**Straw export in continuous winter wheat and the ability of oil radish catch crops and early sowing of wheat to offset soil C and N losses: A simulation study"**. To be able to do so, they have parameterized an "oil radish" based on the existing autumn-sown oilseed rape, but with adjusted assimilation rate of photosynthesis (Fm), the effect of plant development stage on photosynthesis (DSeff), the temperature effect (TempEff) and the N-uptake effect of root and stem (CprN). They evaluate the effects on a Danish sandy loam soil over a period of 100 years. Early sowing of winter wheat comes out as a good option with respect to reducing leaching and it also seemed to reduce N_2O-production. Incorporation

of straw helps maintaining the carbon stock in the soil, and the expected increase in leaching due to higher mineralization after some time is visible, but it is rather small. The scenarios are also investigated with respect to sensitivity to higher precipitation, winter wheat and catch crop sowing date, winter-kill of early sown wheat and effects of the soil type.

Signe Rasmussen et al. have looked into effects of future climate on pesticide leaching in "**Pesticide leaching in the future**". The purpose of this modelling study was to contribute to an improved understanding of the mechanisms involved in pesticide leaching during a single rainfall event with temporal variability. Rainfall intensity of the first event after pesticide application has considerable effect on the amount of pesticide transported to groundwater and subsurface drains, especially in soils containing preferential flow pathways. Daisy was used to simulate pesticide leaching during and after single rainfall events of different durations and intensities. Designed temporally variable single rainfall events based on the Chicago Design Rain were inserted in the original weather file. A combination of different intensities (13- 39 mm h−1) and different event durations (1 - 9 h) were defined, resulting in 24 different design events were applied to a coarse sandy soil and a sandy loam containing macropores and subsurface drains. The fates of the herbicides bentazone and glyphosate were simulated. The leaching dynamics of both pesticides showed high variability at the hourly level, illustrating the importance of high model resolution when estimating pesticide leaching. For the coarse sandy soil different intensities did not appear to have an effect, as pesticide leaching was controlled by event volume. In contrast, results for the sandy loam showed an effect of intensity, especially for glyphosate, at initially wet soil conditions. Short intense events (1 h) resulted in high leaching to drains (1.7% of matrix infiltration) compared to events of longer duration (up to 0.4% of matrix infiltration). This indicates that it might be more prudent to view leaching as a risk that occurs under certain conditions, rather than something that can be averaged.

Recent articles and reports

Andersen, H.E., Blicher-Mathiesen, G., Thodsen, H., Andersen, P.M., Larsen, S.E., Stålnacke, P., Humborg, C., Mörth, C-.M. and Smedberg, E. (2016): Identifying hot spots of agricultural nitrogen loss within the Baltic Sea drainage basin. Water, Air & Soil Pollution. 227:38.

Manevski, K. (2015): The influence of land use and management on nitrogen leaching in two agricultural catchments in China and Denmark. PhD-Thesis, Aarhus University. http://www.forskningsdatabasen.dk/en/catalog/2279959954

Peltre, C., Nielsen, M., Christensen, B.T., Hansen, E.M., Thomsen, I.K. and Bruun, S. (2016). Straw export in continuous winter wheat and the ability of oil radish catch crops and early sowing of wheat to offset soil C and N losses: A simulation study. Agricultural Systems, 143: 195-202.

Rasmussen, S.B., Abrahamsen, P., Nielsen, M.H., Holm, P.E. and Hansen, S. (2015). Effects of Single Rainfall Events on Leaching of Glyphosate and Bentazone on Two Different Soil Types, using the Daisy Model. Vadose Zone Journal, 14 (11), http://dx.doi.org/10.2136/vzj2014.11.0164http://dx.doi.org/10.2136/vzj2014.11.0164

Salo, T. J., Palosuo, T., Kersebaum, K. C., Nendel, C., Angulo, C., Ewert, F., Bindi, M., Calanca, P. , Klein, T., Moriondo, M., Ferrise, R., Olesen, J. E., Patil, R. H., Ruget, F., Takáč, J., Hlavinka, P., Trnka, M. and Rötter, R. P. (2015). Comparing the performance of 11 crop simulation models in predicting yield response to nitrogen fertilization. The Journal of Agricultural Science, available on CJO2015. doi:10.1017/S0021859615001124.