The Daisy Model Newsletter
Department of Plant and Environmental Sciences
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Daisy Newsletter no. 21

1 The Daisy code, v. 5.88

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

2 Courses

We intend to carry out a PhD-course for new Daisy users from 24-28th of August 2020. Information about the course will be uploaded on our homepage soon. However, with the ongoing corona virus pandemics, plans may change.

3 Events

3.1 PhD's

Jacob G. Gyldengren, AU, Flakkebjerg successfully defended his PhD-Thesis with the title: "*A modelling approach to predict the effects of a targeted nitrogen (N) regulation on winter wheat yield and quality and on N losses to the environment*" on 19th of December.

David Nagy, AU, Foulum will defend 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

3.2 The Plant Congress, Herning, Denmark

The Plant Congress was held 13-14th January, 2020 in Herning, Denmark. Daisy related results were presented in a session on digital agriculture and precision application and another on pesticide spraying. For digital agriculture, the relevant presentations were: "*Evaluation of plant cover before N-fertilization in winter wheat*" by M. Styczen, and "*Effect of overlaps in fertilizer application on N-leaching*" by R. Gislum. With respect to pesticide application, M. Holbak talked about the "*Effect of weather and soil conditions on pesticide leaching*" while J. Vuaille's talk was called "*Choose the optimal spraying time*". The presentations can be found here under no. 77 and 80.

The first two talks were related to the Future Cropping project, which also held a final project conference with about 170 people present on 2nd March in Billund, Denmark on a conference called "Digital technologies for plant production in the future" (See https://futurecropping.dk/).

The last two talks relate to a project called "RAINPROOF" carried out in cooperation with Bayer AG, which finished recently. Below a photo of the participants in the final workshop.

3.3 The ICROPM2020 Conference

The ICROPM2020 conference was held in Montpellier, France, on Feb. 3-5, 2020. It was an excellent conference with a) a wide range of examples of model applications, b) some examples of new process descriptions and c) efforts to integrate process descriptions at different scales into complex modelling tools. Unfortunately, the book of abstracts does not seem to be available on the web.

3.3.1 Daisy-related presentations

Daisy was represented in two posters:

1) "*Modelling of drought stress in field crops by crop growth model DAISY*" by Pohanková E. (Eva.Pohankova@seznam.cz), Hlavinka, P., Takáč, J., Bednařík, M., Trnka, M.
2) "*Evaluating soil organic N balance under different crop rotations with grass-clover leys using Daisy simulation*" by Duan Y.-F. (duan@plen.ku.dk), Borgen, S., Bruun, S. and Jensen, L. S.

as well as one talk: "*Uncertainties in simulating N uptake, net N mineralization, soil mineral N and N leaching in European crop rotations*" by Yin X. (xiaogangyin@cau.edu.cn) et al. This talk related back to the article by Yin, X., et al. (2017), described in the Daisy Newsletter no. 9.

3.3.2 Examples of other talks at the conference of general interest:

i. "*Soil hydraulic properties matter: A physically comprehensive model for improving crop model simulations*" by Weber, T. (tobias.weber@uni-hohenheim.de), Gayler, S., Streck, T. and Diamantopoulos, E. described a method to improve the van Genuchten description of the retention curve in the dry range, providing much improved fits to data. See ref. below.
ii. "*A new efficient method for upscaling soil water flow to randomly dispersed or clustered roots*" by Graefe, J. (graefe@igzev.de) described a way to introduce inhomogeneous root distributions in models instead of the evenly spaced roots that we have in e.g. Daisy at the moment. See ref. below.

4 Recent articles where Daisy has been used

Nagy et al. (2020) investigated whether it was possible to describe 10-years of nitrate concentrations, measured in drainage from a tile-drained agricultural clay till field in Denmark, by applying the soil-plant-atmosphere model DAISY, capable of accounting for preferential transport and denitrification. A DAISY model concept, including macropores capable of capturing the water and bromide balance of the field within this specific timeframe, was able to predict the water transport to drainage, dry matter and N-yield of the harvested crops, while it was unable, with the standard default denitrification model, to predict dynamics and quantity of N-loss to drainage. This was caused by a fast saturation of the plow layer, where nitrate seemed to be denitrified almost instantly, and no surplus nitrate remained to be transported to the drainage. To circumvent this and describe the measured N-loss, modification to the water reduction function affecting denitrification was conducted. The denitrification had to be reduced by approximately 50% from a seasonal average of 75 kg N ha-1 to 35 kg N ha-1, while 48% to 80% of the total N-loss to drainage had to be preferentially transported from the plow layer. By not accounting for preferential transport and coherent denitrification, there is a high risk of underestimating leaching of nitrate to the aquatic environment.

5 References

5.1 Daisy

Nagy, D., Rosenbom, A.E., Iversen, B.V. and Plauborg, F. (2020) Effect of preferential transport and coherent denitrification on leaching of nitrate to drainage. Hydrology and Earth System Sciences – Discussions. https://doi.org/10.5194/hess-2019-666. Preprint.

5.2 Other articles of general interest

Graefe, J., Prüfert, U. and Bitterlich, M. (2019). Extension of the cylindrical root model for water uptake to Non-regular root distributions. Vadose Zone J. 18:180127. doi:10.2136/vzj2018.06.0127

Weber, T. K. D., Durner, W., Streck, T. and Diamantopoulos, E. (2019) A modular framework for modeling unsaturated soil hydraulic properties over the full moisture range. Water Resources Research, 55, 4994– 5011. doi: 10.1029/2018WR024584.