Daisy Newsletter no. 23

1 The Daisy code, v. 5.88

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

2 Courses

The Daisy PhD-course for new Daisy users was held from 24-28th of August, 2020, with participation from three Danish (KU, AU and DTU) and one Spanish universities. Corona clearly limited peoples' travel plans.

On 1st September, a MSc-course on Modelling of Soil-Plant-Atmosphere Systems" started, including Daisy and HYDRUS. Ten students are participating this year.

3 Events

Two MSc students, Magdalena R. Guthey Schwartzkopff and Mathilde Huusmann Christensen defended their thesis "A model analysis of N leaching based on simulation results from the computer model Daisy against experimental data from marginal leaching field trials" on 11th Sept. 2020.

4 Recent articles where Daisy has been used

Garcia-Jorgensen et al. (2020) have worked with Daisy in a completely new way. They address the problem of phytotoxins formed in plants and leaching from plant material during growth or when the plant dies. They present a novel modelling approach for assessing the fate of plant toxins in the soil–plant–atmosphere continuum, developed for the specific case of ptaquiloside (PTA), a carcinogenic phytotoxin produced by Pteridium aquilinum. Daisy has been adapted for reproducing phytotoxin dynamics in plants, covering processes such as toxin generation in the canopy, wash off by precipitation and toxin recovery in the canopy after depletion events. Transport of the toxin in the soil was simulated by the advection–dispersion equation assuming weak sorption and degradation for two Danish soils. The model simulates realistic toxin contents in the plant during the growing season, where the actual PTA content is dynamic and a function of the biomass. An average of 48% of the PTA produced in the canopy is washed off by precipitation, with loads in the soil often in the order of mg m^{-2} and up to a maximum of 13 mg m^{-2} in a single rain event. Much of the toxin is degraded, but some scenarios result in very high environmental concentrations. The model is able to recreate data from literature, but work is ongoing to carry out further validation.

Gyldengren et al. (2020) tried to quantify leaching of N caused by uneven fertilizer distribution on irregular fields. By combining GIS and agroeco-system modelling (Daisy), they assess yield and environmental effects of two spreaders with different working widths (24 and 48 m) in four field polygons selected to represent a relevant span with regard to size and geometry for Danish conditions on two soils, a coarse sandy soil and a sandy loam. Both accuracy (average N input rate relative to target) and precision (evenness of distribution) decreased in small (4-6 ha) and geometrically irregular fields compared to large and regular fields. Increasing the working width from 24 to 48 m increased the variation in small fields, but not in large. Grain yields were negatively affected by distribution variation, while there was a poor correlation with average applied N rate. In contrast, grain N yields were insensitive to distribution variation, but showed strong correlation with average N input rate. N leaching was affected by both the amount and distribution of applied N. by up to 9 kg N/ha.

Groh et al. (2020) describes a model comparison carried out on lysimeters representing different truncated and colluvial soil profiles created by erosion. Twelve models/groups participated in the comparison, but neither a single crop model nor the multi-model mean was able to capture the observed differences between the four soil profiles in agronomic and environmental variables. The models´ sensitivity to soil related parameters was apparently limited and dependent on model structure and parameterization. Information on phenology alone seemed insufficient to calibrate crop models. *They conclude that soil processes need to receive greater attention in field-scale agroecosystem modelling and that high precision weighable lysimeters can provide valuable data for improving the description of soil-vegetation-atmosphere processes in the tested models*.

Yin et al. (2020) is also a model comparison study with focus on the N-transformations within the cropping system. Here, the uncertainties of six widely used process-based models (PBMs), including APSIM, CROPSYST, DAISY, FASSET, HERMES and STICS, were tested in simulating different N managements (catch crops (CC) and different N fertilizer rates) in 12-year rotations in Western Europe. Winter wheat, sugar beet and pea were the main crops, and radish was the main CC in the tested systems. The results showed that PBMs simulated yield, aboveground biomass, N export and N uptake well with low RMSE values, except for sugar beet, which was generally less well parameterized. Moreover, PBMs provided more accurate crop simulations (i.e. N export and N uptake) compared to simulations of soil (N mineralization and soil mineral N (SMN)) and environmental variables (N leaching). The use of multi-model ensemble mean or median of four PBMs significantly reduced the mean absolute percentage error (MAPE) between simulations and observations on most parameters. The performance and strengths of the different models are described in the article. *The results showed that better calibration for soil N variables is needed to improve model predictions of N cycling in order to optimize N management in crop rotations.*

We obviously still have some work to do ☺.

5 References

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