Recent developments in and around Daisy

Adj.Prof. Merete Styczen,
Agrohydrology, PLEN, UCPH.
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KØBENHAVNS UNIVERSITET

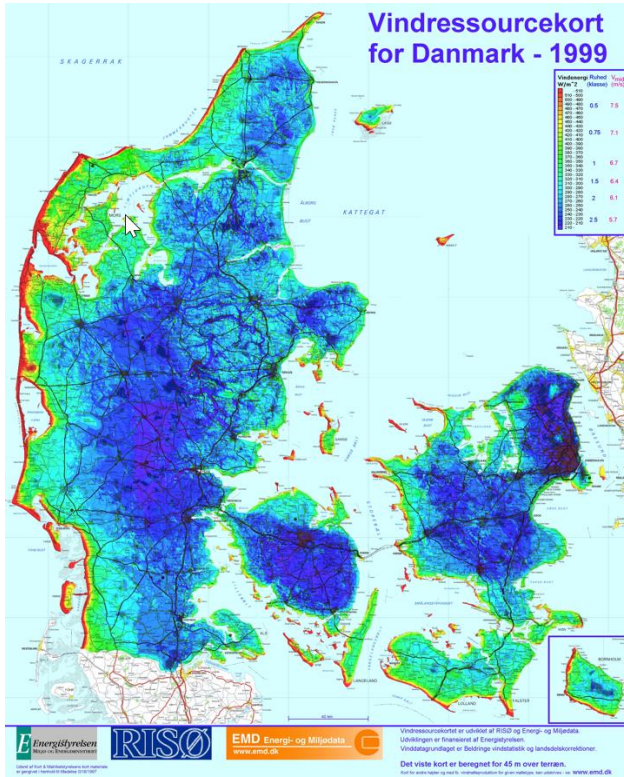
Updates to processes we thought we knew

Reference evapotranspiration

- Problem: Difference between FAO-PM_daily and hourly, the Aslyng-Hansen Makkink-implementation and calculations based on new measurements.
- Changes:
  - Optional description of clear sky radiation (ASCE) (hourly)
  - Optional description of cloudiness index (FAO and Kjaersgaard)
  - Several options of including ground heat flux in the calculation
  - Changed default-settings
  - Overhaul of the net longwave radiation calculation
  - Different options for Makkink parameterisation.

Make sure to consider this!

Simon Fiil Svane



Updates to processes we thought we knew

Equations describing soil hydraulic properties

- Biomodal van Genuchten retention curve with Mualem theory
- a van Genuchten retention curve model with Mualem and Tokunaga theory
- New pedotransfer-model (hypweb) for the above.

Maybe more to come!

WATER RESOURCES RESEARCH, VOL. 30, NO. 2, PAGES 211–223, FEBRUARY 1994

Hydraulic conductivity estimation for soils with heterogeneous pore structure

Wolfgang Durner
Institute of Terrestrial Ecology, Soil Physics, Federal Institute of Technology, Zürich, Switzerland

Water Resources Research

Research Article | Free Access

A Modular Framework for Modeling Unsaturated Soil Hydraulic Properties Over the Full Moisture Range

Tobias K. D. Weber, Wolfgang Durner, Thilo Streck, Efstathios Diamantopoulos,

First published: 03 April 2019 | https://doi.org/10.1029/2018WR024584 | Citations: 11

Water Resources Research

Research Article | Open Access

Pedotransfer Function for the Brunswick Soil Hydraulic Property Model and Comparison to the van Genuchten-Mualem Model

Tobias K. D. Weber, Michael Finkel, Maria da Conceição Gonçalves, Harry Vereecken, Efstathios Diamantopoulos,

First published: 20 June 2020 | https://doi.org/10.1029/2019WR026820 | Citations: 2

New processes: Mulch

Problem: Conservation agriculture challenges the model

Change: A dynamic mulch layer at the top of the soil that influences

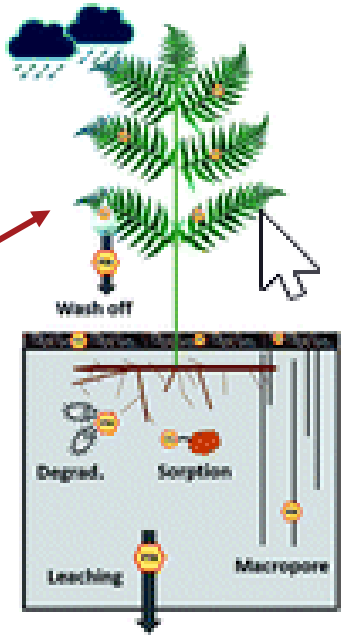
- Water dynamics
- Solute transport
- Carbon dynamics
- N-release (amount and form (DON))
- Protects against colloid release

Could be of interest for carbon sequestration and pesticide leaching, maybe for N too.

Jeanne Vuaille

New processes: Plant toxins (Natoxaq)

While the general leaching processes can be dealt with using existing chemistry processes, new processes are required for toxin formation in the plant and release through the plant surface.



This requires a model concept:

Issue 8, 2020

From the journal:
Environmental Science: Processes & Impacts

A novel model concept for modelling the leaching of natural toxins: results for the case of ptaquiloside

D. B. García-Jorgensen,*[a] H. C. B. Hansen,[a] P. Abrahamsen[a] and E. Diamantopoulos[a]

And measurements:

The final article combining the two is on the way

Bracken growth, toxin production and transfer from plant to soil: a 2-year monitoring study

Daniel B. García-Jorgensen, Efstathios Diamantopoulos, Vaidotas Kisielius, Mette Rosenfjeld, Lars H. Rasmussen, Bjarne W. Strobel & Hans Chr. B. Hansen

Environmental Sciences Europe **33**, Article number: 45 (2021) | Cite this article

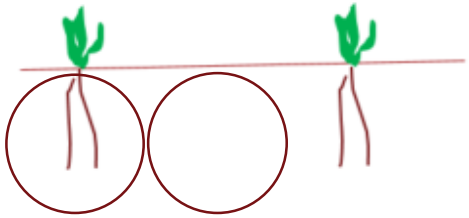
New (empirical) processes: roots

We assume "uniform" conditions in 1-D-simulations – or a 2-source process when it comes to evapotranspiration. Does that always work?

- Soil compaction: Assuming inhomogeneity in a horizon, slows down transport of water and N to roots – influence yields. Also possible to restrict root growth rate through a horizon.

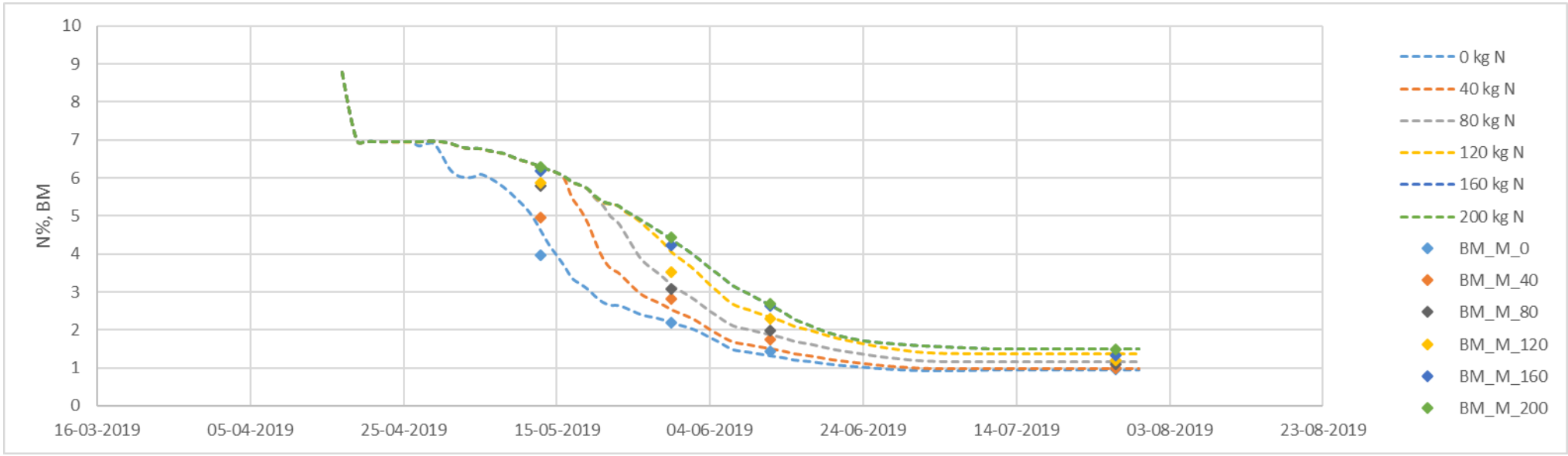
C.T. Petersen and P. Abrahamsen (2021): Predicting effects of soil compaction on crop yield and nitrogen dynamics. Report.

- Emerging plants (rows): Maybe the early roots do not explore the full rooting depth in the beginning.

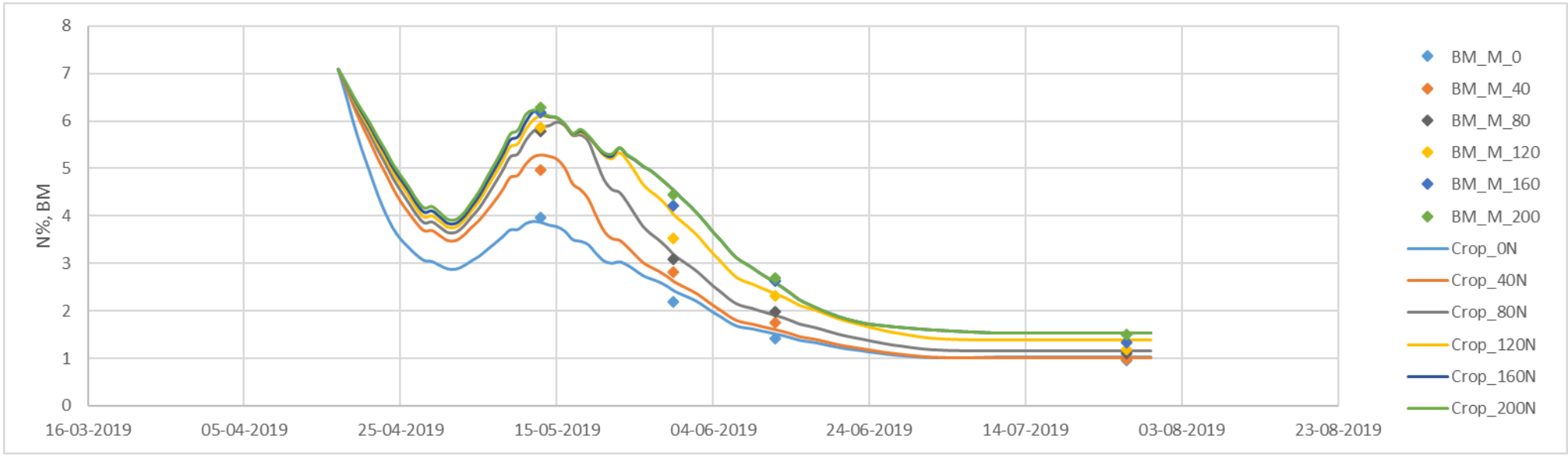


N-concentration in above-ground biomass

Uniform utilization



Area explored increase over time



Ongoing work, not published

Crop parameterisations

- Not so long ago- winter wheat, including a new process description making partitioning a function of N-content in the plant.

Effects of winter wheat N status on assimilate and N partitioning in the mechanistic agroecosystem model DAISY
Journal of Agronomy and crop science, 2020
Jacob Glerup Gyldengren[1] | Per Abrahamsen[2] | Jørgen E. Olesen[3] | Merete Styczen[2] | Søren Hansen[2] | René Gislum[1]

- Recently: Oil radish.

Celine R. Grønnings MSc. Thesis (2021): Oilseed Radish parameterization and crop model calibration in the computer model Daisy.

- On-going: Spring barley in Taastrup and Ringsted (2019 and 2020), Heinsvig in 2020. Three varieties at the last 2 sites.

Wrapping and accessories

- RDAISY toolbox
  - Running Daisy for sensitivity analyses and optimization.
- PyDaisy
  - Python-tools for running scenario simulation and data extraction.
- Java
  - Tool for model execution, presented in Session II and on posters.

ELSEVIER
Agricultural and Forest Meteorology
Volume 263, 15 December 2018, Pages 25-40

Sensitivity of simulated crop yield and nitrate leaching of the wheat-maize cropping system in the North China Plain to model parameters

Mohamed Jabloun [a, b, c], Xiaoxin Li [e], Xiying Zhang [e], Fulu Tao [d, f], Chunsheng Hu [e], Jørgen E. Olesen [b, c]

Not published, but used in projects

New tool: Weather data extraction from DMI's new free data ☺☺☺

Comparison with satellite data

Daisy Documentation

Updated A10:

DAISY
Soil Plant Atmosphere System Model

Technical Description

Editors: M.E. Styczen, P. Abrahamsen and E. Diamantopoulos

Method:
Main descriptions in the document, optional methods in appendices.

So far:

- **Overview of model**
- Description of Surface processes (not plant growth, but water, solute and heat)
- **Heat transport in the soil**

A.2.1: SSOC-model (not written)
A.2.2: Non-default evapotranspiration models.
A2.3: Available net radiation models.

A.4.1: Program deriving lower boundary conditions for heat calculations.

Daisy Documentation

Table 1.3. Related Parameter names in Daisy.

Name and explanation		Model (in Daisy)	Parameter name (Daisy reference manual)	Default	Default unit
S_i	Global radiation	weather	*GlobRad*	User input	[W m^{-21}]
T_a	Air temperature	weather	*AirTemp*	User input (hourly or daily)	[°C]
T_{min}	Minimum air temperature	weather	*T_min*	Optional input for daily records	[°C]
T_{max}	Maximum air temperature	weather	*T_max*	Optional input for daily records	[°C]
P	Precipitation	weather	*Precip*	User input (hourly or daily)	[mm h^{-1}]
E_r	Reference	weather	*RefEvap*	Optional input (hourly or daily)	[mm h^{-1}]

Original text from	A10	
Updated by	date	For Daisy version
Styczen, M	2021 04 30	6.08

1.8 References

Ahmadi, S.H., Andersen, M.N., Poulsen, R.T., Plauborg, F., Hansen, S., 2009. A quantitative approach to developing more mechanistic gas exchange models for field grown potato: A new insight into chemical and hydraulic signalling. Agricultural and Forest Meteorology 149, 1541–1551. https://doi.org/10.1016/j.agrformet.2009.04.009

Allen, R.G., Pereira, L.S., Raes, D., Smith, M., 1998. Crop evapotranspiration: guidelines for computing crop water requirements, FAO irrigation and drainage paper. Food and Agriculture Organization of the United Nations, Rome.

Allen, R.G., Pruitt, W.O., Wright, J.L., Howell, T.A., Ventura, F., Snyder, R., Itenfisu, D., Steduto, P., Berengena, J., Yrisarry, J.B., Smith, M., Pereira, L.S., Raes, D., Perrier, A., Alves, I., Walter, I., Elliott, R., 2006. A recommendation on standardized

Trying to keep track

Infra-structure proposal blue sky dreaming

Present structure

A wider-based steering committee

Work grp. n

Work grp. 3

Work grp. 2

Work grp. 1

Daisy Panel
at PLEN

Approx. twice per year

Daily management

Biweekly meetings
ED, PA and MES

Thank you for your attention

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