

Using data assimilation and weather forecasts in irrigation scheduling (PhD scholarship)

Ref. BAP-2020-30

Research topics within the Division of Soil and Water Management cover physical, chemical and biological processes in the environment: measuring and modelling transport processes of water and solutes (nutrients - contaminants) in soils, expert systems for efficient crop water use, long-term trends in tropical soil fertility and soil chemistry, risk-analysis studies and speciation of metals and phosphorous species in soil and water, land surface modelling, remote sensing and data assimilation. The Division has 47 PhD students, 11 postdoctoral researchers and 8 professors.

About the Department of Earth and Environmental Sciences

The Division of Soil and Water Management is one of the 5 divisions in the Department of Earth and Environmental Sciences of KU Leuven. The main mission of the department is to carry out state-of-the-art scientific research with respect to the functioning of geo- and ecosystems at different spatial and temporal scales, including the interaction between humans and the environment and the sustainable management of natural resources.

About KU Leuven

KU Leuven is Belgium's largest and highest-ranked university as well as one of the oldest and most renowned universities in Europe. For the fourth year in a row, KU Leuven tops the Reuters ranking of Europe's most innovative universities. KU Leuven is home to a vibrant community of international students and staff members spread out over its various campuses. Sixteen % of the university's 56,000 students are international, representing 150 countries.

<https://ees.kuleuven.be/bwb/>

Project

With the development of cheap and autonomous soil sensors that transmit information about the soil directly and continuously to data servers, farmers may have now access to unprecedented real-time information about the state of their fields. An important challenge is to use this information effectively and improve the revenues while reducing the production costs and pressures on the environment. In irrigated agriculture, this challenge can be translated to a more effective water use to increase and improve yields and reduce water losses. A more effective water use comes down to applying the right amount of water at the right times.

In Flanders, the Bodemkundige Dienst van België (BDB) already offers irrigation scheduling for farmers as a paid service. The advice is based on simulations with a soil water balance model fed with weather data in real time, and the model is calibrated with monthly soil moisture data from (manual) soil sampling. This could be improved by also using weather forecasts and by using inexpensive soil moisture sensors that send their data via Internet-of-Things (IoT) technology to a server that runs model-based irrigation advisory system.

But, both weather forecasts and the properties of the soil and crop as used in the model are uncertain. These soil and crop properties are estimated from analysing previous information about how the soil moisture changed over time. This analysis and estimation of the soil and crop properties or model parameters corresponds with 'training' the model so that it can reproduce the observed soil water content dynamics (sensor data). Data assimilation is a technique that can be used to train a model. Since it also acknowledges uncertainties in the information that is used (the soil moisture and crop observations and the uncertainties in the weather forecasts), the uncertainty in the forecasts of the soil moisture, lost water from the root zone and crop water stress can also be evaluated. The technique is promising for improving irrigation scheduling, but to the best of our knowledge not yet used in irrigation advisory systems.

The PhD research will contribute to a VLAIO-funded 4-year research project on (supplementary) drip irrigation for vegetable crops in Flanders. The objective of the project is to develop an irrigation scheduling tool for vegetable production in Flanders, and to tackle a few technical constraints for drip irrigation in Flanders.

Profile

We seek a candidate with a master degree in Bioscience engineering, Water resources engineering, Agricultural Sciences or an equivalent master degree that is relevant for the above mentioned tasks. Master students who will graduate beginning of July 2020 can also apply, and will be considered if no candidate with the required profile can be found immediately.

The successful candidate will have the following profile:

- Creative with a strong interest in research
- Good academic performance at the MSc and BSc levels, with good performance on the master thesis in particular
- Strong background in soil science, crop science, biological systems analysis and/or agricultural water management
- Experience with simulation modelling and computer programming (e.g., Python, Fortran, C, Matlab, R, etc.).
- Demonstrated capacity to write (scientific writing) and communicate in English. Being fluent in Dutch is an added advantage but not a must (communication with farmers).
- Good interpersonal skills: able to work in a team and to communicate with both farmers and other researchers.

Offer

- Full-time doctoral scholarship for 2 years. After positive evaluation, the scholarship can be extended with 2 additional years (4 years in total).
- Multi-disciplinary and international professional environment in the Division Soil and Water Management.
- Leuven is a charming historical university town, with a central location in Western Europe.
- The PhD student will be embedded in a project team consisting of the two supervisors at KU Leuven (Jan Vanderborcht and Jan Diels), a supervisor at the Bodemkundige Dienst van België (Dr. Pieter Janssens) and colleague researchers at the Bodemkundige Dienst van België and several Flemish research centers for vegetable production (Herent, Sint-Katelijne-Waver and Kruishoutem).

At KU Leuven, PhD students are expected to obtain their PhD degree within 4 years. More information on the remuneration with a doctoral scholarship can be found at the following link:

<https://www.kuleuven.be/personeel/jobsite/en/phd/phd-information> (under heading 'working-conditions')

Interested?

Only persons strictly matching the above profile should apply. Submit your CV, along with a motivation letter, and two names for references on-line. For more information please contact Prof. dr. ir. Jan Diels, tel.: +32 16 32 97 44, mail: jan.diels@kuleuven.be or Prof. dr. ir. Jan Vanderborght, mail: jan.vanderborght@kuleuven.be.

Applications review and selection process will start on February 15th, 2020. The position will remain open until a suitable candidate is identified.

You can apply for this job no later than June 01, 2020 via the online application tool :

<http://www.kuleuven.be/eapplyingforjobs/light/55530961>

KU Leuven seeks to foster an environment where all talents can flourish, regardless of gender, age, cultural background, nationality or impairments. If you have any questions relating to accessibility or support, please contact us at diversiteit.HR@kuleuven.be.