PhD Project Proposal form for approval by the WIMEK Graduate School

Version date of this proposal (13/02/2020):

Main research group involved: WUR Soil physics and land management

Other research group(s) involved:
Deltares

Important:
Please read the **instructions** at the end of this form thoroughly before answering each question!
Please insert text electronically

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1. PhD CANDIDATE details

Full name of PhD candidate (as in passport): Pieter Cornelis Schaap
Gender (F / M): M
e-mail: peter1.schaap@wur.nl
Period of appointment / fellowship (dd/mm/yyyy): from 01-12-2019 to 01-12-2023
PhD category (Research Assistant, Sandwich PhD, Guest PhD, External PhD or staff; see explanation / instructions): Research Assistant

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2a. SUPERVISORS and TECHNICAL SUPPORT

List all staff members involved in the proposed research: provide name, initials, titles and type of involvement, e.g. promotor / main thesis supervisor, co-promotor, daily guidance, technician, advisor

Name and title	Specialization	Organisation / Institute	Involvement	Hours per week
Prof.Dr. Coen J. Ritsema	Soil physics, field instrumentation, erosion	WUR-SLM	Chair research group; Administration and finances	tba
Prof. dr. ir. Sjoerd E.A.T.M. van der Zee	Ecohydrology, flow & transport modelling	WUR-SLM	Project leader, Promotor PhD & daily supervisor, modelling	1
Dr. Perry G.B. de Louw	Hydrology, field experiments, stakeholder liaison	Deltares Research Institute	Co-supervisor PhD and field experiments	1
Dr. Willemijn Appels	Runoff/overland flow measurements & modelling	Lethbridge College, Canada	Co-supervisor PhD and vadose zone & runoff modelling	tba

2b. CO-OPERATION

With which other organisations outside your own university will co-operation take place?

Deltares Research Institute, Lethbridge Collega CA, Stowa, Waterboard Vechtstromen, Waterboard Aa en Maas, Mineral Valley, Lumbricus.

3a. PROJECT TITLE (English):

SURFLAT: Surface runoff in flat landscapes

3b. KEYWORDS (3 – 5):

Surface runoff, hydrological modelling, microtopography, contaminant transport, land management

3c. POPULAR SUMMARY of the proposal in English (max 100 words):

Although surface runoff plays an important role in contaminant transport, it remains poorly quantified. Because it is difficult to measure directly and computationally demanding to model at scales larger than the field-scale, there is a need for efficient upscaling methods. This research will explore the applicability of both high- and low-end models to calculate surface runoff at field scale and from there develop an effective upscaling procedure, enabling more accurate estimates of surface runoff at the regional scale. Because it is one of the most important controlling factors, the focus of upscaling efforts will lie on parameterizing microtopographic variability.

4a. CODE OF CONDUCT for RESEARCH INTEGRITY

I, Peter Schaap, declare and promise that I will adhere to the Netherlands Code of Conduct for Research Integrity and will faithfully act according its guiding principles regarding honesty, scrupulousness, transparency, independence and responsibility. Moreover, I will also adhere to the Research Integrity Code of Wageningen University and Research, focusing on the good behaviour of everyone at WUR: staff members, PhD candidates and students.

4b. LEGAL REQUIREMENTS

Does the proposed research comply with the law and legal requirements, such as 'DNA recombinant legislation', 'Code openness Animal Experiments' and/or 'Code of conduct for Biosecurity'?

Yes / No / not applicable

Not applicable

4c. ETHICAL DILEMMAS

Describe potential ethical dilemmas regarding this research project (see instructions):

In the light of recent protests in the agricultural sector in the Netherlands, caution should be applied in stakeholder management. Field measurements will most probably be executed in agricultural areas. Since our results might generate new insights regarding contaminant transport to river systems it is important to communicate clearly the potential consequences of this research. This will reduce the risk of emotionally driven conflict and secure measurement continuity.

Secondly, privacy issues need to be addressed as soon as information pertaining to individual farmers or persons are collected or used.

5a. FINANCING: How is the project financed? (more than one possible)

☐ University funds, percentage:
(First flow of funds)

☒ Externally financed by NWO/STW/WOTRO/KNAW, percentage:
(Second flow of funds)
Please specify:
NWO, 100%

☐ Externally financed by other parties (EU, government, industry, NGOs), percentage:
(Third flow of funds)
Please specify:

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6 RESEARCH CONTEXT

6a. Will the project be executed (partly) outside The Netherlands?
If Yes specify: in
No

6b. Affiliation with national or international research programmes (if applicable):
National program Lumbricus for a climate resilient soil- and water system; Mineral valley Twente;

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7. SCIENTIFIC SUMMARY OF THE RESEARCH PROJECT (max 250 words):

Surface runoff is widely recognized as playing an important and unique role in contaminant transport from agricultural fields to the river system. Its quantification however is still underdeveloped, especially in flat areas. Because micro-topography (< 10 cm) likely is an important controlling factor in such landscapes, accurate predictions of the occurrence and quantity of surface runoff are limited by a lack of high-resolution data and/or computational power. This project will explore the applicability of both conceptual (fill-and-spill) and state-of-the-art physically based models to estimate surface runoff at the field scale. Laser technology will provide high resolution surface topography data and direct measurements of surface runoff will aid in validating the hydrologic models. The goal of this research is to use the results of the field study to develop an efficient and accurate upscaling scheme, centred around a generic parameterization of microtopographic variability. This could support decision and policy making and contribute to improving the water quality of temperate lowland catchments.

8. DESCRIPTION OF THE RESEARCH PROJECT

(for question 8 a - f, use a maximum of 2500 words)

8a. Problem definition and research objectives

Surface runoff plays an important role in the transport of contaminants from agricultural fields to the river system (Heathwaite et al., 2000; Boxall et al., 2009; Rozemeijer et al., 2008; Dolph et al., 2019). Via a variety of pollutants, it may lead to reduced water quality, harmful algal blooms, decreased biodiversity in lakes and estuaries and increased risk of waterborne disease outbreaks (Curriero et al., 2001; Wurtsbaugh et al., 2019). The occurrence of surface runoff events is physically linked to extreme precipitation events, which frequency is expected to increase as a consequence of global warming (Boxall et al., 2009; Coumou et al., 2012). Accurate quantification of this process is therefore important in developing efficient policy aimed towards countering the adverse effects it could have on water quality, biodiversity and public health.

Apart from rainfall intensity and duration, soil infiltration characteristics and initial moisture conditions, recent studies have demonstrated the important role of microtopography in the onset and volume of surface runoff (Antoine et al., 2009; Frei et al., 2010; Appels et al., 2011). In lowland catchments, where slopes are typically gentle, the controlling effect of microtopographic variability is even more pronounced (Stolte et al., 2000; Yang and Chu, 2013; 2015). The complexity of the involved processes, its feedback mechanisms and data requirements make modelling studies at field- or larger scales computationally demanding. Consequently, there is a need for efficient and innovative upscaling methods.

This project will explore the applicability of both physically based and simplified conceptual models to predict surface runoff at the field scale. It will involve detailed measurements of surface microtopography, surface runoff, soil infiltration characteristics and moisture conditions. Using the results of the field study, an upscaling framework will be developed with a focus on parameterizing microtopographic variability. The goal is to develop a tool that is able to accurately quantify surface runoff in temperate lowland catchments, without being dependent on extreme computational power.

The project is divided into five main research objectives:

Objective 1: Develop the conceptual fill- and spill model FAST-R (Appels et al., 2011) to allow it to be used for microtopographic data at the field scale.

Objective 2: Assess temporal variability of the important surface runoff controlling factors microtopography, infiltration characteristics and soil moisture conditions.

Objective 3: Assess the differences between and applicability of the conceptual fill- and spill model (FAST-R) and the physically based model (D-Hydro model train) at the field scale for micro- and mesotopographic data using direct surface runoff measurements for validation.

Objective 4: Using 1-3, evaluate the feasibility of microtopographic parameterization as an upscaling method.

Objective 5: Using 1-4, develop a surface runoff tool and construct recommendations for surface runoff related land management.

8b. Scientific approach / methodological design

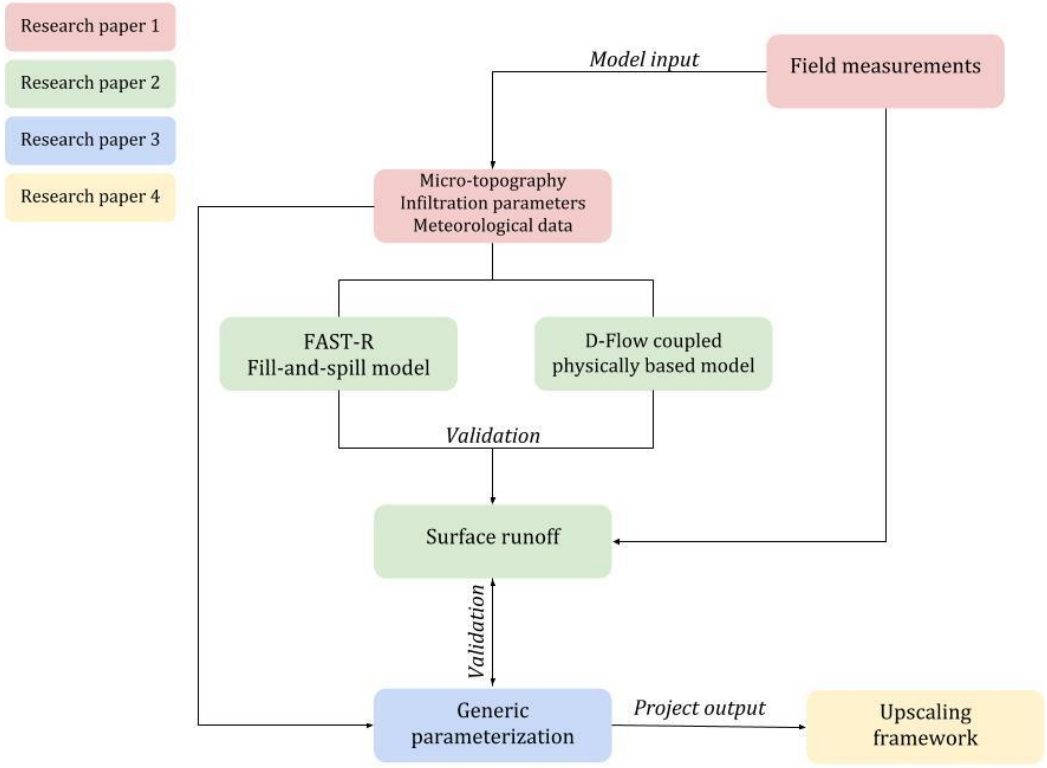


Figure 1: Flow chart of the research project SURFLAT

Objective 1: Develop the conceptual fill- and spill model FAST-R (Appels et al., 2011) to allow it to be used for microtopographic data at the field scale.

Appels et al. (2011) developed the hydrological model FAST-R, which uses the fill-and-spill concept and includes Philip's infiltration model and 2D groundwater flow. It assumes a hydrostatic equilibrium soil moisture profile, which allows a fast calculation of the storage capacity of the unsaturated zone. The original aim was to use it with microtopographic data input at the field scale, but this was computationally not feasible as a consequence of non-linearities introduced by the dynamic specific yield incorporated in the model (Appels, 2013). To overcome this problem, Appels suggests aggregating the groundwater level to a coarser 1m^2 resolution. Such an assumption is reasonable because groundwater tables tend to be smoother than the actual surface topography and would be better resembled by a coarser DEM (Sørensen and Seibert, 2007). With the goal of reducing the computational time of the FAST-R model at field scales, we will implement Appels' suggestion into the source code. Because the code is written in C++, this objective involves a training course in this programming language.

Objective 2: Assess the temporal variability of important surface runoff controlling factors microtopography, infiltration characteristics and soil moisture conditions.

As the aim of this project is to develop a tool to predict surface runoff using microtopographic parameterization, it is essential to understand its temporal variability. Apart from topography, infiltration characteristics and soil moisture conditions will be monitored throughout the year. In this part of the project we will answer the questions:

- Which natural and anthropogenic phenomena change the microtopography, infiltration characteristics and soil moisture conditions of the field sites significantly?
- When and how often do they occur?
- How do these phenomena affect the feasibility of our proposed upscaling framework?

To answer these questions, a combination of literature study, interviews with relevant stakeholders and field measurements will be conducted. Field measurements will consist of laser scanning (topography), lab analysis, double ring infiltrometer and permeameter measurements (infiltration) and precipitation, water table height and soil moisture (hydrologic conditions). To explore the temporal variability of these facets, measurements will be conducted on a quarterly basis. As we aim to encourage stakeholder involvement, we will cooperate with local water boards to conduct part of the measurements and/or monitoring.

Objective 3: Assess the differences between and applicability of the conceptual fill- and spill model (FAST-R) and the physically based model (D-Hydro model train) at the field scale for micro- and mesotopographic data using direct surface runoff measurements for validation.

Using the measurements of objective 2 as input for the selected models, similarities and differences in the outcomes will be evaluated and interpreted. We will analyse the results of the conceptual and the physically based model for both micro- and mesotopography. This objective will answer the following research questions:

- How do the modelled results of the conceptual and the physically based model differ and how can they be interpreted?
- How do the modelled results for finer and coarser DEM input data differ and how can they be interpreted?
- How do the modelled results compare to field measurements of surface runoff?

Apart from the field measurements of objective 2, in this part of the project surface runoff will be measured directly using a method previously applied by De Louw et al. (2015). It will involve a surface runoff collecting gulley (figure 2 left) and bin (figure 2 right), which enables quantification of the surface runoff flux.

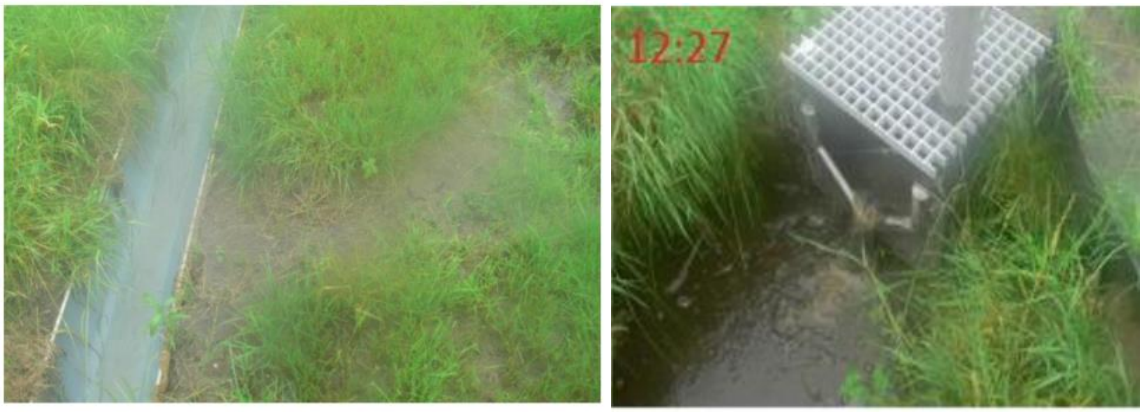


Figure 2: Surface runoff collecting gulley (left) and bin (right)

Objective 4: Using 1-3, evaluate the feasibility of microtopographic parameterization as an upscaling method.

The central focus of this objective is to develop an upscaling method based on microtopographic parameterization and place it in the broader context of hydrologic practices.
In this part of the project we will answer the following research questions:

- Can we establish a relationship between the shape of the surface and the shape of the surface runoff hydrograph?
- Based on this relationship, can we accurately predict surface runoff at the field scale?
- How does our proposed method differ from common practice methods such as the SCS-CN method or the TOPMODEL approach?
- Based on this newly gained knowledge, what is the feasibility of our proposed upscaling framework?

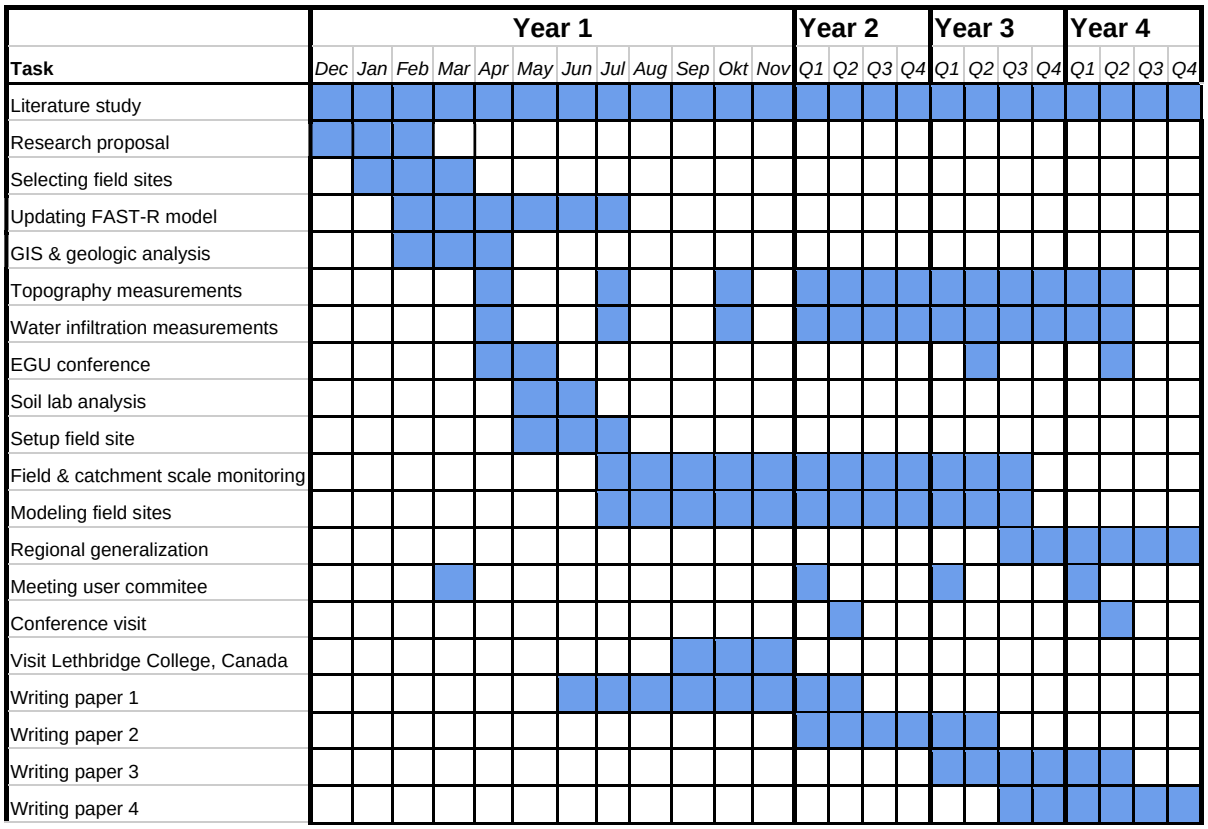
As recent studies suggest a connection between geostatistical topographic parameters (auto-correlation, variance) and surface runoff hydrograph shape, we will explore this correlation in the field (Antoine et al., 2009; Appels et al., 2011). Using the high-resolution DEM measured in objective 2, we will first define different geostatistical parameters for our field locations. They will be linked to both modelled and measured surface runoff hydrographs. The hydrographs will be fitted with a Gaussian function, from which descriptive parameters (height of peak, centre of peak, standard deviation) will be related to the geostatistical topography parameters. If they are correlated, this can form the basis of upscaling surface runoff predictions from the field to the regional scale.

In the last stage of objective 4, we will compare our method to common practice approaches such as SCS-CN, TOPMODEL and GSFLOW. Mapping the uncertainties, benefits and drawbacks of each approach will enable us to evaluate the feasibility of our proposed upscaling framework.

Objective 5: Using 1-4, develop a tool and construct recommendations for surface runoff related land management.

If our proposed upscaling framework proves feasible, we will develop it into a surface runoff prediction tool. As this is the last part of our research, the exact form of it depends on the knowledge we gain during the research project. The most likely setup is that we use precipitation (either historic, real time or design events), initial conditions (soil moisture/groundwater table) and soil characteristics (spatially and temporally characterized) as input to generate a surface runoff hydrograph specific to the event and location (parcel with specific land use/land cover). This means that in this objective, we will aim to generalize our results for the land use or land cover that characterises our field sites. It will involve extra field measurements of microtopography and infiltration characteristics.

8c. Work plan and time schedule (detailed work plan for the first year of the research project and a rough work plan for the second part of the project)



8d. Type of publications to be expected

We aim to publish four research papers on the following topics:

1. The temporal variability of relevant factors regarding surface runoff and how this relates to reference datasets and modelling exercises
2. The performance of different types of models in estimating surface runoff
3. The correlation between topographic shape and surface runoff hydrograph shape
4. An upscaling framework to estimate surface runoff at the regional scale

8e. Scientific significance / innovative aspects +
8f. Societal relevance (valorisation and dissemination of results)
(please mention the expected relevance for environmental and sustainability issues; the main stakeholders and the way you will disseminate the results to the stakeholders)

At this moment, overland flow and resulting floods, peak discharges and contaminant emissions into surface water (streams/ditches) cannot be predicted for relatively flat landscapes. This is a problem, in view of public perception, water board management, compliance with national and EU regulations, and liability for authorities at different levels. In this project, tools are developed, applied, and compared to better anticipate and predict these adverse effects, by developing generalizable understanding of the important role of micro/meso topography, and how to quantify this understanding with easily accessible measurements. As such understanding is yet lacking, it will become the reference for standards in the near future. This understanding will be released to the broader (consultancy/institute) community during its development, first by advertising new capabilities of the consortium (during the project), second by providing tools to the consultancy community (NL, EU, and beyond). By setting the new 2020 standard, and the transparency and plausibility of relationships that promote broad acceptance, the newly developed software and consultancy services are likely to land in the large and also internationally leading Dutch consultancy sector. Tests of project outcomes in in situ field scale situations will help convince the non-scientific stakeholders and compel them to embrace the results. Outcomes will be freeware, as far as software is concerned, but likely be best accessible to Dutch stakeholders. Costs due to damaging events, liabilities, and inproper management by stakeholders can be prevented or limited.

9. DATA MANAGEMENT

All collected data will be freely available through the open source platform *Hydroshare*. It is the responsibility of the AIO to manage this process. The data will also be stored on the SLM server and the personal computer of the AIO. After finishing the PhD project, the data can be downloaded from *Hydroshare* and the AIO remains available for questions via email.

10. FEASIBILITY

10a. Top 5 publications of the involved research groups, related to this proposal (other bibliographic references are listed in annex 1).

Appels, W. M., Bogaart, P. W., & **van der Zee, S. E. A. T. M**. (2016). Surface runoff in flat terrain: How field topography and runoff generating processes control hydrological connectivity. *Journal of Hydrology*, *534*, 493–504. https://doi.org/10.1016/j.jhydrol.2016.01.021

Appels, W. M., Bogaart, P. W., & **van der Zee, S. E. A. T. M.** (2017). Feedbacks Between Shallow Groundwater Dynamics and Surface Topography on Runoff Generation in Flat Fields. *Water Resources Research*, *53*(12), 10336–10353. https://doi.org/10.1002/2017WR020727

De Louw, P.G.B., Kuijper, M., Drost, R., Hendriks, D., Rozemeijer, J., & Stuyt, L. (2015). *Veldonderzoek oppervlakkige afstroming en regelbare drainage in het kader van DROP*. Utrecht.

Massop, H. T. L., Van Bakel, P. J. T., & **De Louw, P. G. B.** (2017). *Maatgevende afvoer en maaiveldafvoer in waterschap Vechtstromen*. Wageningen. https://doi.org/https://doi.org/10.18174/425042

Oosterwoud, M., van der Ploeg, M., van der Schaaf, S., & **van der Zee, S.** (2017). Variation in hydrologic connectivity as a result of microtopography explained by discharge to catchment size relationship. *Hydrological Processes*, *31*(15), 2683–2699. https://doi.org/10.1002/hyp.11164

10b. Data requirements and availability

1. *Topography data and measurements*
   - Microtopography: Terrestrial Laser Scanners (± 1cm); (Riegl-VZ200 ©)
     - Manual measurements at the selected field sites, quarterly
   - Mesotopography: AHN (0.5m)
   - Macrotopography: AHN (5m)

2. *Water infiltration data and measurements*
   - Soil characteristics
     - Staringreeks
       - Reference dataset / software tool (Wösten et al., 2001)
     - BOFEK 2012
       - Bodemfysische eenheden kaart
     - BRO Bodemkaart 2018
     - Single- or double ring infiltrometer
       - Manual measurements at the selected field sites, quarterly
     - Soil samples
       - Manual sampling at selected field sites for lab analysis, quarterly
   - Antecedent conditions
     - Groundwater level
       - Continuous measurement infrastructure at the selected field sites
     - Precipitation
       - Continuous measurement infrastructure at the selected field sites
     - Soil moisture vadose zone
       - Continuous measurement infrastructure at the selected field sites
       - VanderSat remote sensing data (100m) (optional, depending on available licenses)

3. *Discharge measurements*
   - Field discharge
     - Continuous measurement infrastructure at the selected field sites
   - Surface runoff
     - Continuous measurement infrastructure at the selected field sites

4. *Water quality measurements*
   - Phosphate, floating matter and other tracers and chemicals (tba)
     - Continuous measurement infrastructure at the selected field sites
     - Water samples for lab analysis

5. *Modelling field sites*
   - Models
     - FAST-R
     - D-Flow coupled with MetaSwap/Modflow (Deltares)
   - Input data
     - A selection of the data mentioned above
     - Additional input data
       - Historic/design event meteorological data (KNMI)

10c. Collaboration both national and international

National collaboration with water boards and technical staff of the SLM department will contribute to monitoring the selected field sites. The involvement of water boards Aa en Maas and Vechtstromen, Deltares and the Lumbricus project will help distributing the results to the involved stakeholders and translate the results into user friendly tools.

11. FINANCIAL ARRRANGEMENTS

As compiled in the funding agreement (NWO), there is a budget of €119.000,- for consumables, €19.000, for travel, €90.000,- for investment costs and the total budget involves co-financing by end-users that constitute the end-user committee.

12. ARE ALL REQUIREMENTS (FINANCIAL, PERSONNEL AND EQUIPMENT) AVAILABLE AND/OR ARRANGED? Yes

If not, please explain:

13. AGREED

Chair of main research group	Project leader
Name: Prof.Dr. Coen J. Ritsema	Name: Prof. dr. ir. Sjoerd E.A.T.M. van der Zee
Date: 13-02-2020	Date: 13-02-2020

14. NAMES, ADDRESSES AND EXPERTISE OF POSSIBLE REFEREES

Please name here at least five national and foreign referees *(name, affiliation, full address, including e-mail),* who will be able to give an independent judgement on the scientific quality and feasibility of the research project:

Referee 1:	Mathieu Javaux
Affiliation:	Université catholique de Louvain
Address:	ELIE Croix du Sud 2/L7.05.02 1348 Louvain-la-Neuve
Email:	mathieu.javaux@uclouvain.be
Referee 2:	Robert Barneveld
Affiliation:	Norwegian Institute of Bioeconomy Research NIBIO
Address:	Fredrik A. Dahls vei 20 1430 Ås
Email:	robert.barneveld@nibio.no

Referee 3: Prof. Dr. Jan Fleckenstein
Affiliation: Helmholtz Centre for Environmental Research UFZ
Address: Department of Hydrogeology
Helmholtz-Center for Environmental Research - UFZ
Permoserstr. 15
04318 Leipzig, Germany
Email: jan.fleckenstein@ufz.de

Referee 4: Dr. Xiaomei Yang
Affiliation: Wageningen University
Address: PO Box 47
6700AA Wageningen
Email: xiaomei.yang@wur.nl

Referee 5: Dr. ir. Ype van der Velde
Affiliation: Vrije Universiteit Amsterdam
Address: Department of Earth Sciences
VU University of Amsterdam
Amsterdam 1081 HV, Netherlands
Email: ype.vander.velde@vu.nl

Literature / References (bibliographic)

Antoine, M., Javaux, M., & Bielders, C. (2009). Advances in Water Resources What indicators can capture runoff-relevant connectivity properties of the micro-topography at the plot scale ? *Advances in Water Resources*, *32*(8), 1297–1310. https://doi.org/10.1016/j.advwatres.2009.05.006

Appels, W. M., Bogaart, P. W., & Zee, S. E. A. T. M. Van Der. (2011). Advances in Water Resources Influence of spatial variations of microtopography and infiltration on surface runoff and field scale hydrological connectivity. *Advances in Water Resources*, *34*(2), 303–313. https://doi.org/10.1016/j.advwatres.2010.12.003

Appels, W. M., Bogaart, P. W., & van der Zee, S. E. A. T. M. (2017). Feedbacks Between Shallow Groundwater Dynamics and Surface Topography on Runoff Generation in Flat Fields. *Water Resources Research*, *53*(12), 10336–10353. https://doi.org/10.1002/2017WR020727

Appels, W. M., Bogaart, P. W., & van der Zee, S. E. A. T. M. (2016). Surface runoff in flat terrain: How field topography and runoff generating processes control hydrological connectivity. *Journal of Hydrology*, *534*, 493–504. https://doi.org/10.1016/j.jhydrol.2016.01.021

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Coumou, D., & Rahmstorf, S. (2012). A decade of weather extremes. *Nature Climate Change*, *2*(7), 491–496. https://doi.org/10.1038/nclimate1452

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De Louw, P., Kuijper, M., Drost, R., Hendriks, D., Rozemeijer, J., & Stuyt, L. (2015). *Veldonderzoek oppervlakkige afstroming en regelbare drainage in het kader van DROP*.

Dolph, C. L., Boardman, E., Danesh-Yazdi, M., Finlay, J. C., Hansen, A. T., Baker, A. C., & Dalzell, B. (2019). Phosphorus Transport in Intensively Managed Watersheds. *Water Resources Research*, *55*(11), 9148–9172. https://doi.org/10.1029/2018WR024009

Frei, S., Lischeid, G., & Fleckenstein, J. H. (2010). Advances in Water Resources Effects of micro-topography on surface – subsurface exchange and runoff generation in a virtual

riparian wetland — A modeling study. *ADWR*, *33*(11), 1388–1401. https://doi.org/10.1016/j.advwatres.2010.07.006

Heathwaite, A. L., & Dils, R. M. (2000). Characterising phosphorus loss in surface and subsurface hydrological pathways. *Science of The Total Environment*, *251–252*, 523–538. https://doi.org/https://doi.org/10.1016/S0048-9697(00)00393-4

Massop, H. T. L., Van Bakel, P. J. T., & De Louw, P. G. B. (2017). *Maatgevende afvoer en maaiveldafvoer in waterschap Vechtstromen*. Wageningen. https://doi.org/https://doi.org/10.18174/425042

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Stolte, J., & Ritsema, C. (2000). Oppervla kte-afvoer : een combinatie van helling , bodem , gewas en regen. *Stromingen*, *6*(4).

Wösten, J. H. M., Veerman, G. J., De Groot, W. J. M., & Stolte, J. (2001). *Waterretentie- en doorlatendheidskarakteristieken van boven- en ondergronden in Nederland: de Staringreeks*. Wageningen.

Wurtsbaugh, W. A., Paerl, H. W., & Dodds, W. K. (2019). Nutrients, eutrophication and harmful algal blooms along the freshwater to marine continuum. *Wiley Interdisciplinary Reviews: Water*, *6*(5), 1–27. https://doi.org/10.1002/wat2.1373

Yang, J., & Chu, X. (2015). Advances in Water Resources A new modeling approach for simulating microtopography-dominated , discontinuous overland flow on infiltrating surfaces. *ADVANCES IN WATER RESOURCES*, *78*, 80–93. https://doi.org/10.1016/j.advwatres.2015.02.004

Yang, J., & Chu, X. (2013). Quantification of the spatio-temporal variations in hydrologic connectivity of small-scale topographic surfaces under various rainfall conditions. *Journal of Hydrology*, *505*, 65–77. https://doi.org/10.1016/j.jhydrol.2013.09.013

INSTRUCTIONS FOR COMPLETING THE SENSE APPLICATION FORM FOR REGISTRATION AND/OR APPROVAL OF A PhD PROJECT

Provide a clear description of your research project, which is understandable for non-specialists.

Send this project proposal by mail to the SENSE secretariat: Johan.Feenstra@wur.nl

Instructions for each question:

Research Group(s): please mention the chair group(s) responsible for the supervision of the PhD project

1. PhD candidate details

PhD category

Make here the appropriate choice between AIO or OIO (= Research Assistant) / Sandwich PhD / Guest PhD / External PhD:

- Research Assistant (AIO / OIO) = temporary employee appointed at a SENSE University;
- Sandwich PhD: fellowship student whose research is primarily conducted at the home institute or country of residence / origin
- Guest PhD: fellowship student whose research is primarily conducted at a SENSE University
- External PhD: PhD candidate not employed at a SENSE University who conducts research at an institute other than the SENSE University and whose only affiliation with the SENSE university is the promotor and supervisor(s).

Note: if you are not sure to which PhD category you belong, please ask your supervisor or the secretary of your research group.

2. Supervisors and technical support

List all staff members involved in the proposed research: provide name, initials, titles and type of involvement, e.g. promotor / main thesis supervisor, co-promotor, daily guidance, technician, advisor and the expected average number of hours per week they will spend on the project. For supervisors: the agreed average number of hours per week they will spend on supervision.

3. 3a Project title

Formulate the project title as concisely and specifically as possible (in English)

3b Keywords

Please mention the main 3 – 5 keywords, which are specific or characteristic for your PhD project. These keywords will be used at the SENSE website for search functions.

3c Popular summary

This summary will be used as description of your PhD proposal at the SENSE website. It should be inspiring and understandable for higher educated people outside your field of study.

4. Animal experiments / genetically modified organisms / ethical dilemmas

4a: Legal requirements

Animal experiments are regulated by the Law on Animal Experiments. If vertebrate animals are used within a new project, the Animal Experiments Committee (DEC) will send you a separate questionnaire. In case of genetically modified research an ethical check is compulsory. In that case you should contact the DEC too.

4b: Potential ethical dilemmas

Ethical dilemmas, considerations and decisions should play an important role in the programming of research proposals. Ethical dilemmas deal with potential harm to society, people, animals and ecosystems and with the potential use or misuse of research results.

Relevant aspects are:

- What are the funding organisations of the PhD research and what is their interest in the research results.
- Research methods: animal experiments; involving people in your experiments.
- Research location: research carried out in countries where human rights are violated.

Relevant questions may be:

- For whom is the research question relevant;
- Who can profit most of the research outcomes;
- Who could be harmed most by the research outcomes;
- Which development is supported by this research;
- Does the research support sustainable development; etc.

In general there are no good or wrong answers to ethical dilemmas, but it is very important to present your own considerations clearly and transparently.

See also The Netherlands Code of Conduct for Scientific Practice: http://www.vsnu.nl/files/documenten/Domeinen/Onderzoek/The_Netherlands_Code_of_Conduct_for_Scientific_Practice_2012.pdf.

5. Financing

Please tick the box to state how the project is financed. If more than one way of financing is used, tick more boxes and specify the most important ones and the proportion of the financial contributions.

6. Research context

Please specify where the research will be carried out and the affiliation with national or international research programmes. This text will be used for research summaries. A maximum of 250 words is applicable.

7. Scientific summary of the research project

This brief summary should explain the title of the research project and present a sound view of the main objectives, design and expected results of the PhD research

8. Description of the research project

(For the total of question 8a to 8f, a maximum of 2500 words is applicable)
This question constitutes the main core of the project application.

8a. Problem definition and research objectives

The problem definition provides a concise description of the problem setting. The problem definition has to be translated into one or more research objectives. Problem definition and objectives should be as specific as possible. The research objectives clearly state the different questions to which the results of the research should provide an answer.

8b. Methodological design

Here the question is addressed how the research objectives are met. The methodological design provides a clear description of the methods and research techniques that are going to be used to meet the different research objectives. So what methodology and methods are going to be used to answer the different research questions?

8c. Work plan and time schedule

Present a detailed work plan for the first year of the research project with smart objectives and a rough work plan for the overall PhD project.

8d. Type of publications to be expected

Mention here the outline of the expected scientific publications based on the research results.

8e. Scientific significance

Under scientific significance a description is given of the innovative aspects and motivated how the problem definition and research objectives follow from already available research results, knowledge and questions (the literature). What does the research add to the already existing scientific literature?

8f. Societal relevance (valorisation and dissemination of results)

What is the relevance of the research outcome(s) for current environmental and sustainability issues? What are the main stakeholders which may be interested in the results of your PhD research? How are these stakeholders involved during the PhD research? In what way will the dissemination of the results take place to stakeholders and society?

References

Include the references in the usual way for scientific reporting in a separate annex 1.

9. Data management

This section outlines the data management plan and must include:

- Where and how the data will be storaged (short term and long term storage),
- data ownership (please specify the ownership of data produced in this project or external data used for this project)
- data sharing (agreement on who will have access to and use your (un)published data)
- data management (who will be responsible for the data management after finalisation of your PhD)

This section may include references to a more comprehensive (i.e. 2 to 3 pages) data management plan in which elements are outlined in more detail and can also refer to a plan at the level of a research group. Note that the content of this document does not need to be included in this proposal; a citation is sufficient.

You can find more details here. Please note that data collection is also part of a data management plan but is specified in section 8 of this research proposal.

10. Feasibility

10a. Relevant publications of the research group and related projects

Mention the top five publications of the research group related to the problem definition and research objectives. This question addresses the feasibility of the research. Is the background of the research group such that the supervision can be adequate?

10b. Data availability

Is data availability guaranteed? Does the research make use of available data sources or will data be collected using surveys, interviews, etc. Is it feasible to collect the data within the timeframe of the PhD project? Are there challenges taken into account considering the data collection? How representative are these data?

10c. Collaboration both national and international

In what way does the national and/or international collaboration add to the feasibility of the research?
In case of Sandwich PhDs, is supervision in the country where the research will be performed adequate? Please specify which agreements have been made.

11. Financial arrangements

Please specify the budget for the PhD project: personnel costs, research costs, additional costs and the available budget for PhD training and education

12. Check: are all requirements arranged ?

This question is for your last check on the requirements. Are all the financial, personnel and equipment arrangements accounted for? Covering these requirements is the responsibility of the chair group. Before submitting the project proposal all requirements should be covered and arrangements finalised. If not, specify the situation and actions that will be taken to cover all requirements before the start of the project.

13. Agreed

Please verify that all mentioned research leaders have read and accepted the latest version of this project proposal. You may send this form by e-mail; a paper version with real signature is not required.

14. Names, addresses and expertise of possible referees

Provide here names and full addresses (preferably including e-mail) of at least five national and international referees with their expertise related to this research proposal. We will send the comments of two referees back to you anonymously – generally within four weeks - for a reply.