Vrije Universiteit Brussel

Process-based spatially-distributed hydrological modelling: the open source WetSpa-Python model

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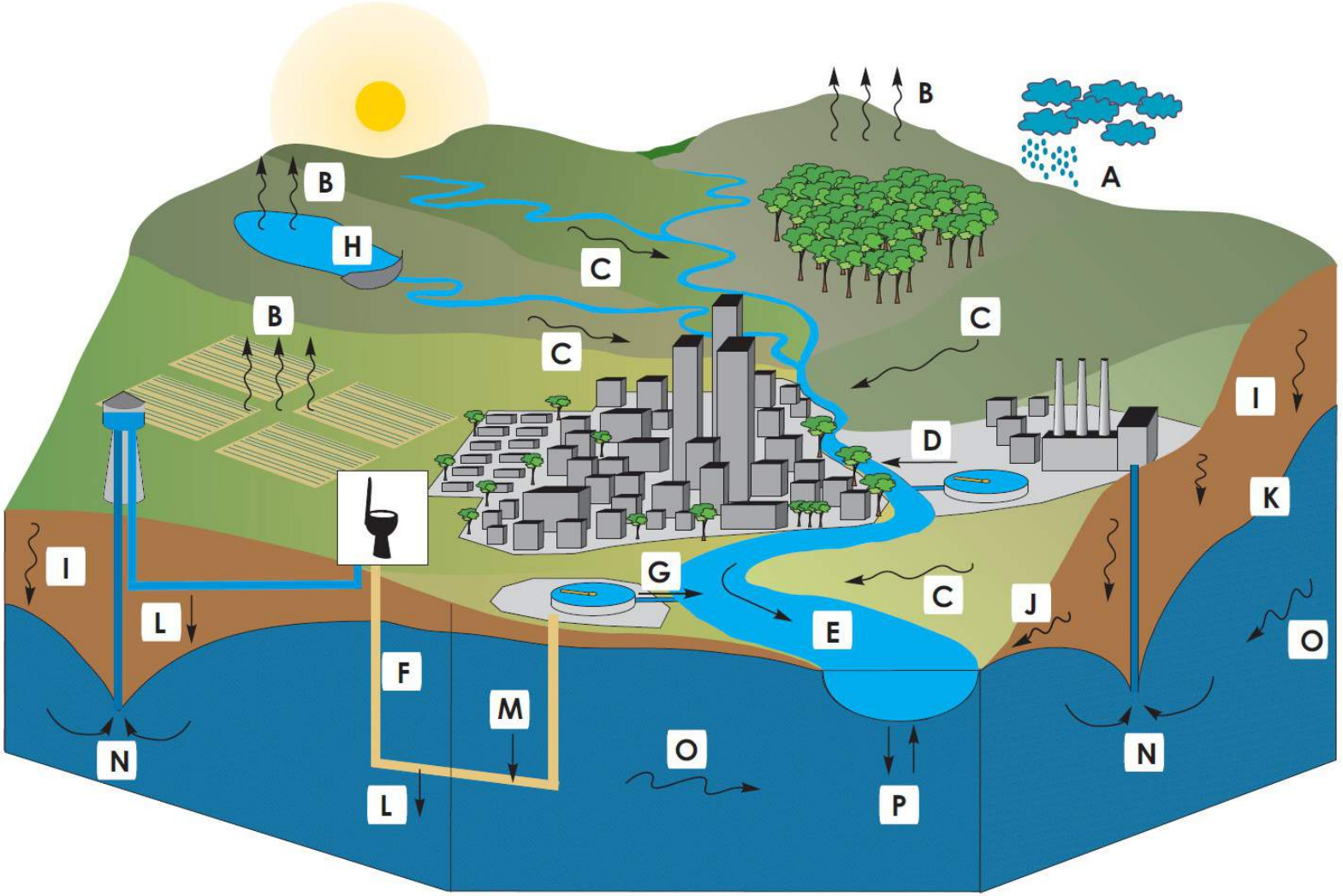
FOSS4G

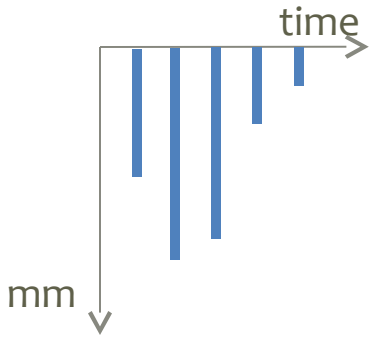
Hydrological modelling aims at understanding and predict water movement



Hydrological models:

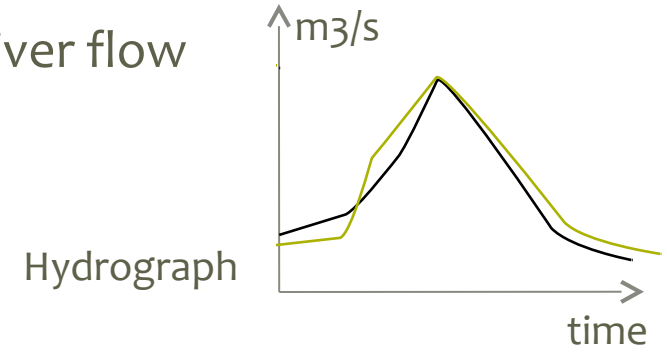
from precipitation to river flow

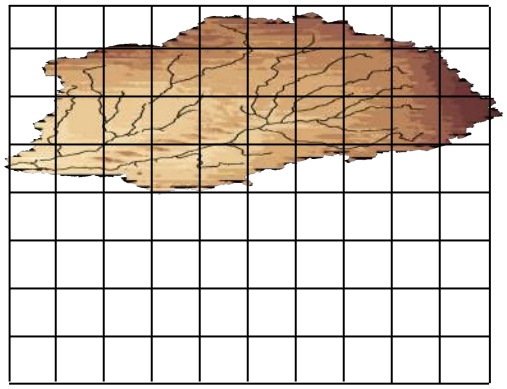
Lumped, black-box....



Rain → *f(x)* → River flow

Parameters





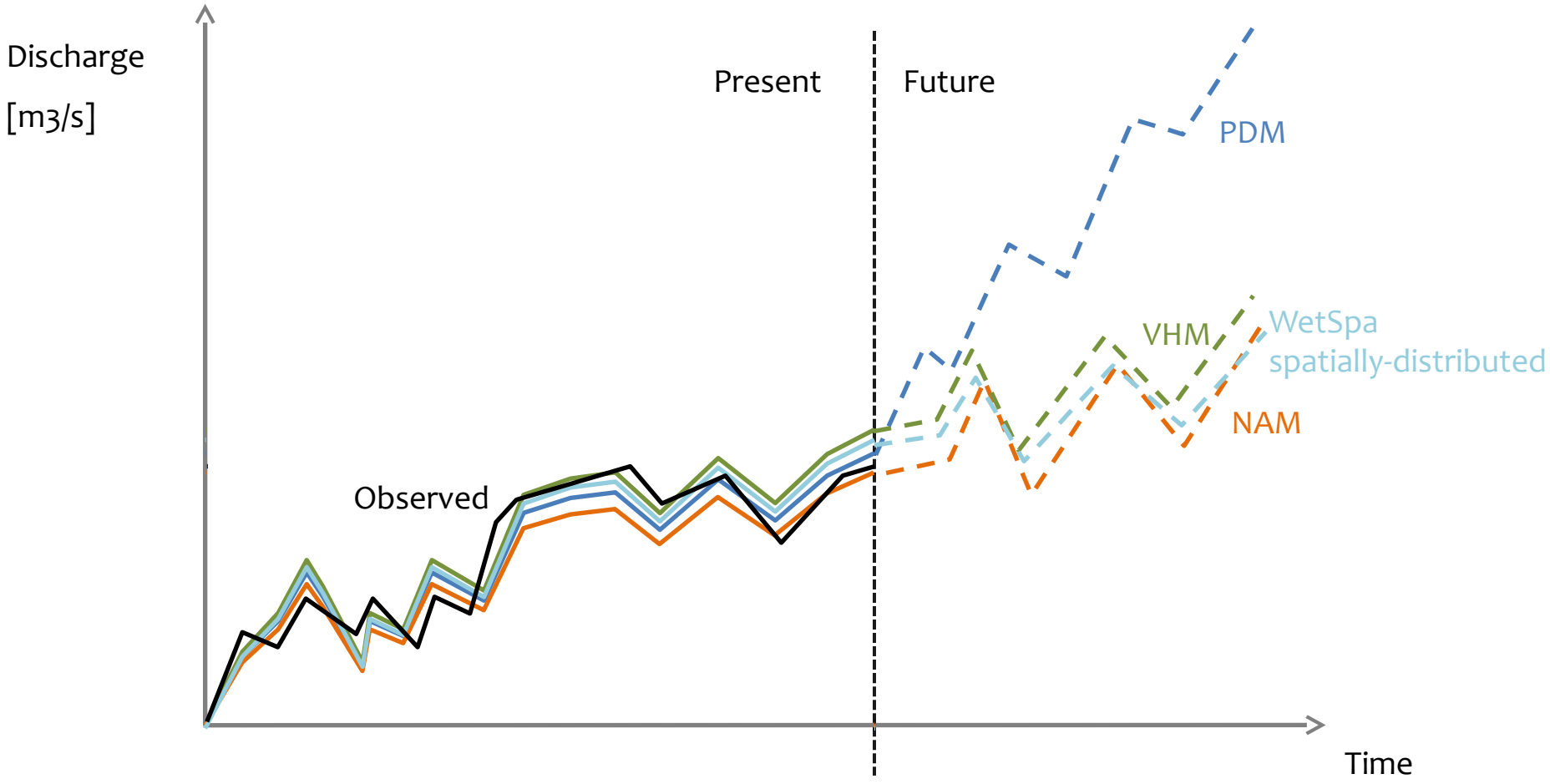
Spatially-distributed

Spatial-temporal resolution

Spatially-distributed outputs

One model fits all is no longer applicable

Ensemble of model structures → assessment of model structure uncertainty



Restructuring-rethinking a model can

increase model flexibility

help process understanding

allow model coupling

allow model development

Process-based spatially-distributed hydrological modelling: the open source WetSpa-Python model

The WetSpa-Python model has enhanced flexibility

- It is as reliable as its predecessor
- It has a wider range of applications
- It is open-source

The WetSpa-Python model can be applied to regions and not just catchments

- Example of the Gaza region

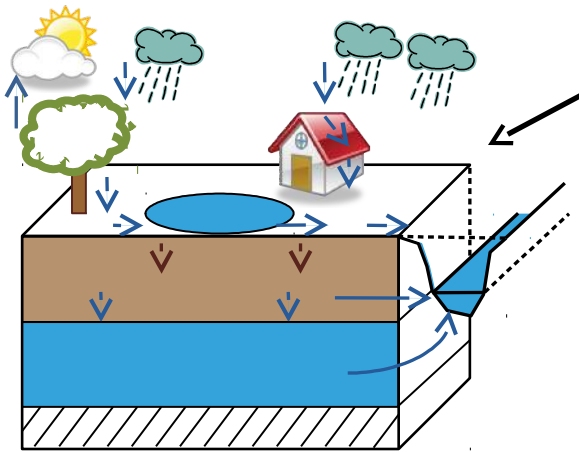
What more?

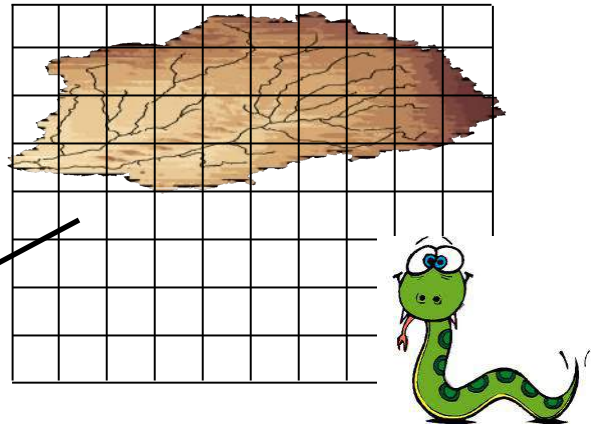
- Model coupling
- Model extensions
- Web-based applications

The WetSpa-Python model is a flexible hydrological model

obtained by re-implementing the WetSpa model in a new environment

The WetSpa model...





python

PCRaster

Modelling framework

is a spatially-distributed dynamic hydrological model

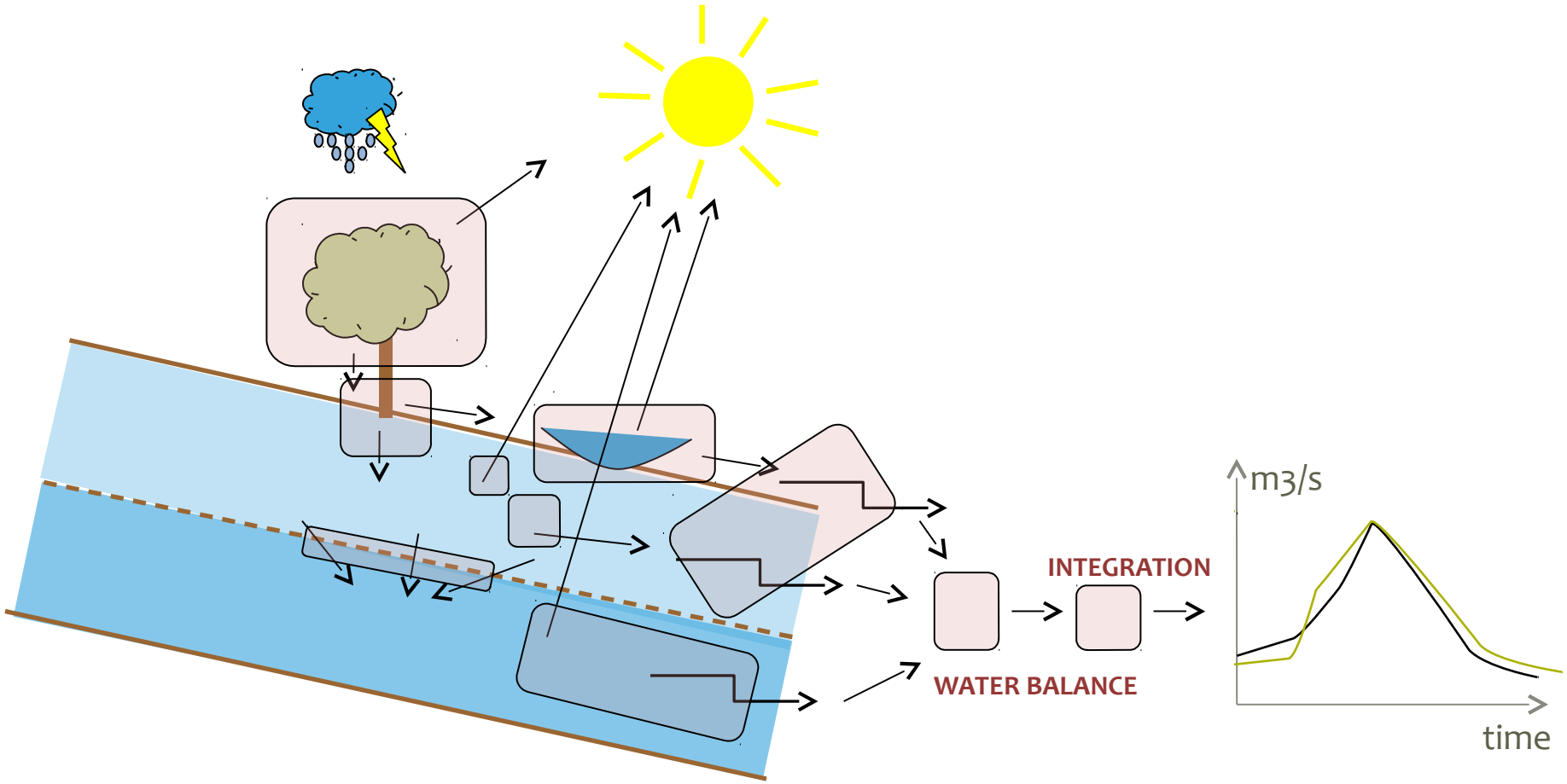
has been extensively validated

is computationally efficient

The WetSpa-Python model

The structure of the WetSpa-Python model is process-based

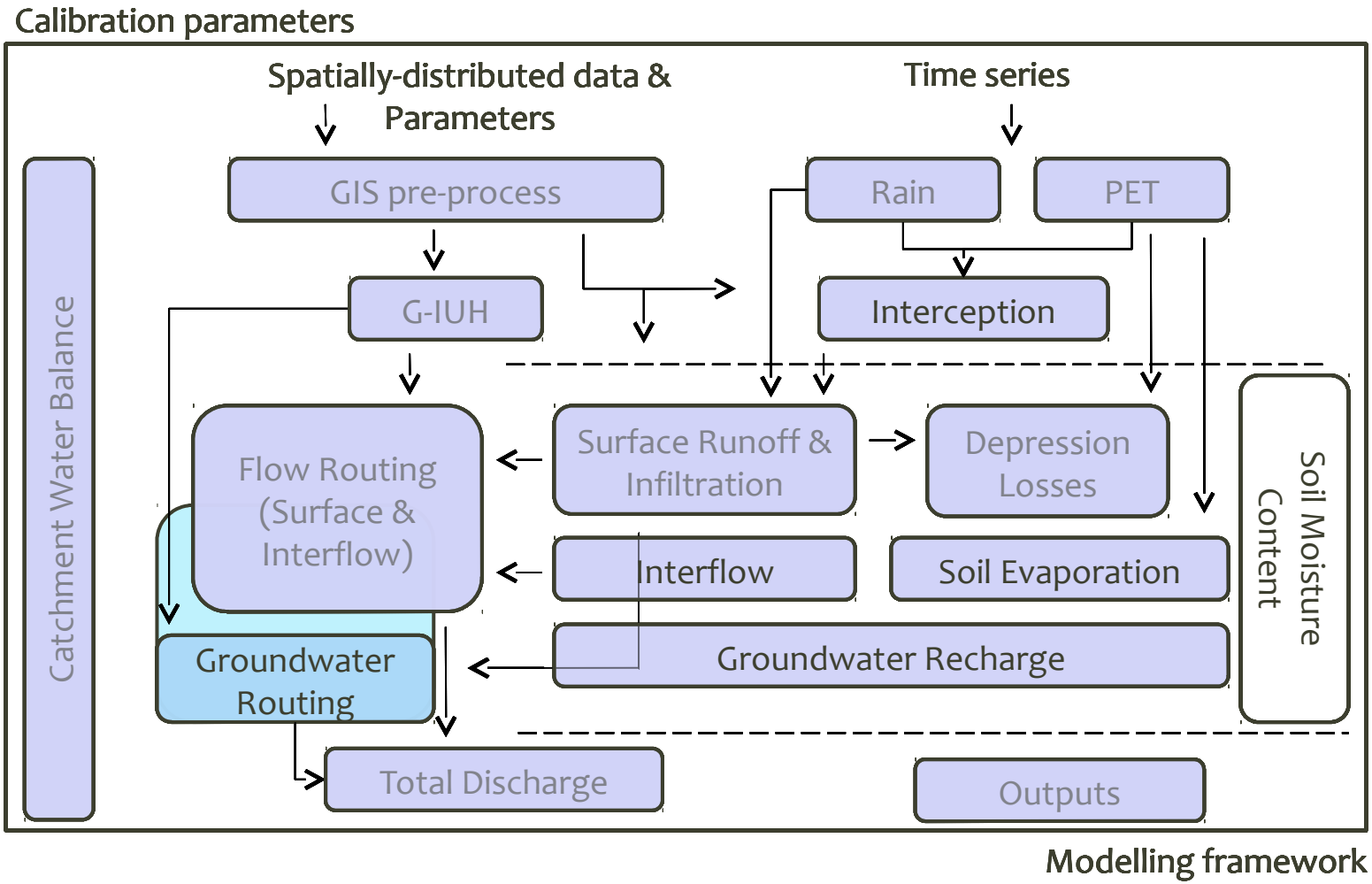
created by disassembling the original WetSpa model



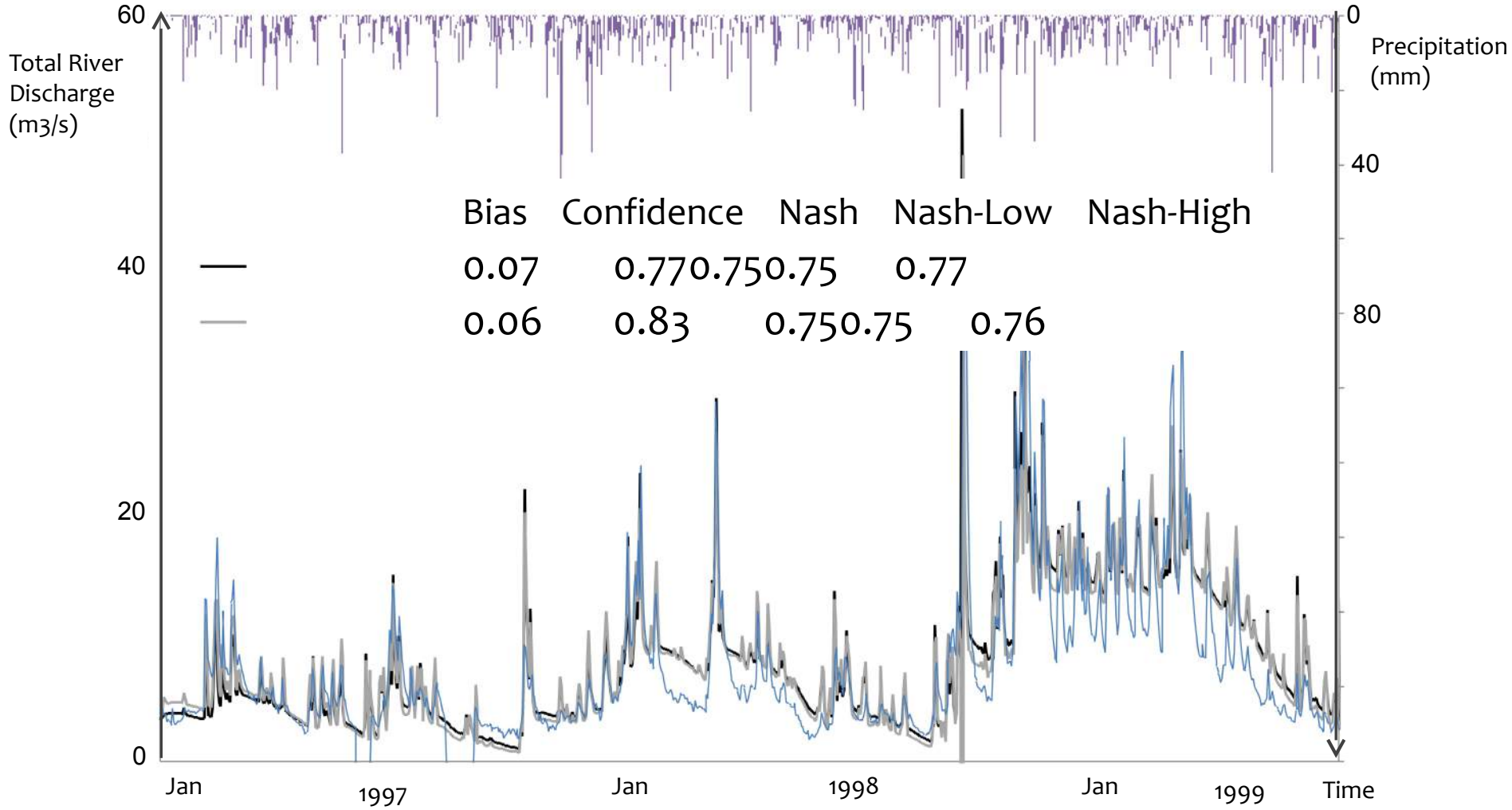
The structure of the WetSpa-Python model is process-based

Independent component exchange variables at run time

Components can have different spatial and temporal resolution



The WetSpa-Python model perform as good as the original WetSpa model for natural catchments



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→ The WetSpa-Python model can be applied to regions and not just catchments

- Example of the Gaza region

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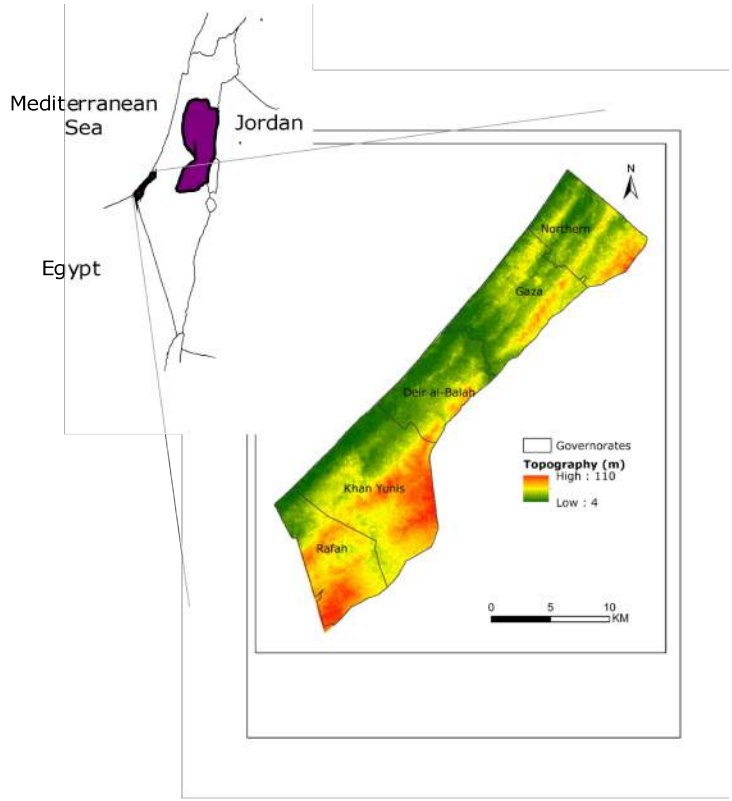
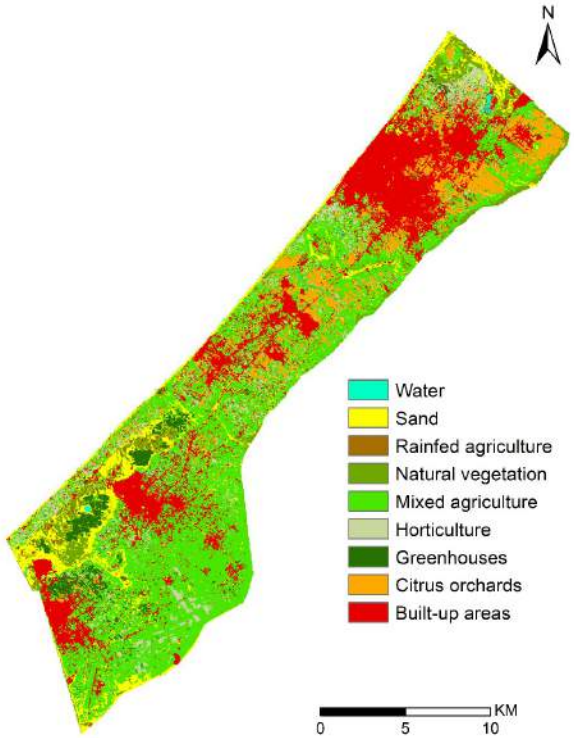
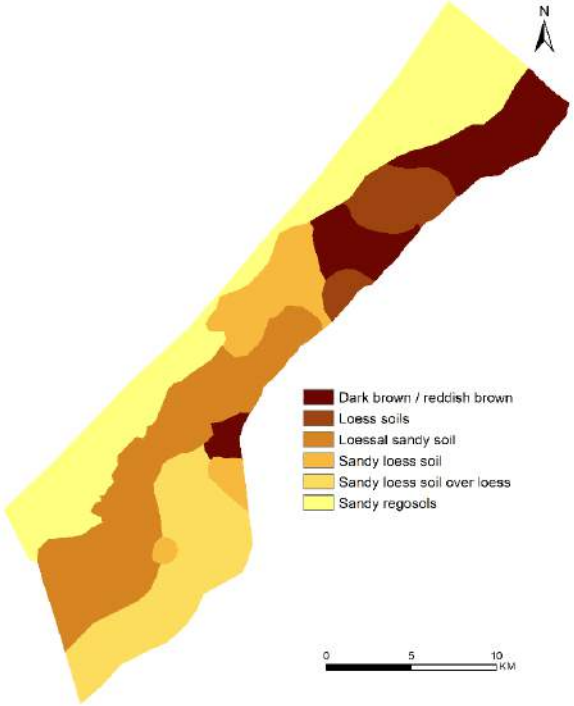
The WetSpa-Python model is more flexible than the original WetSpa model

Tailor-made structures can easily be developed:

Dynamic water balance, Gaza region



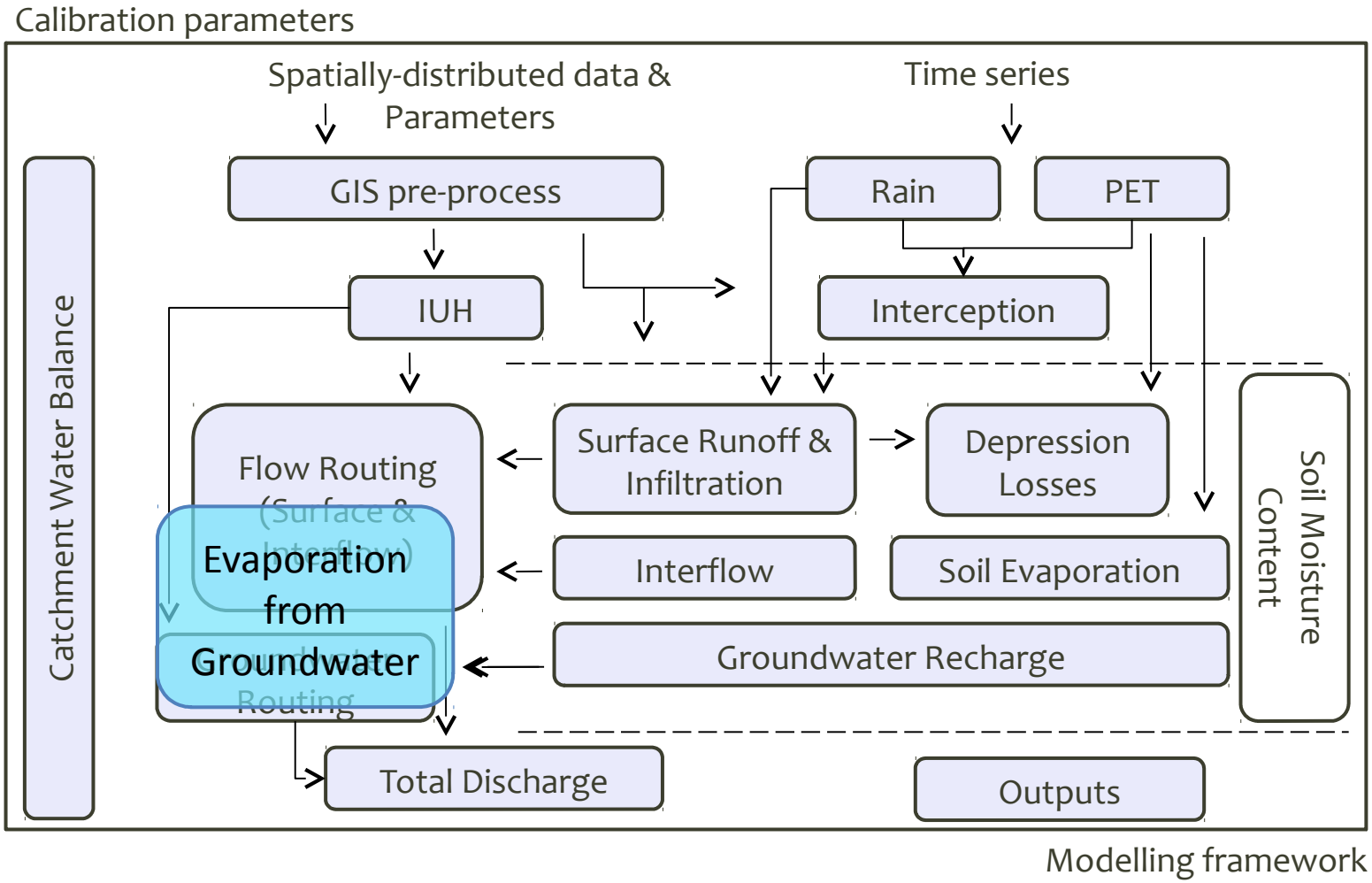




Zainab, Z., 2015. Spatial and temporal estimation of groundwater recharge: Identifying controlling factors and impact assessment, PhD dissertation thesis, Vrije Universiteit Brussel, Belgium

We adapted the structure of the WetSpa-Python model

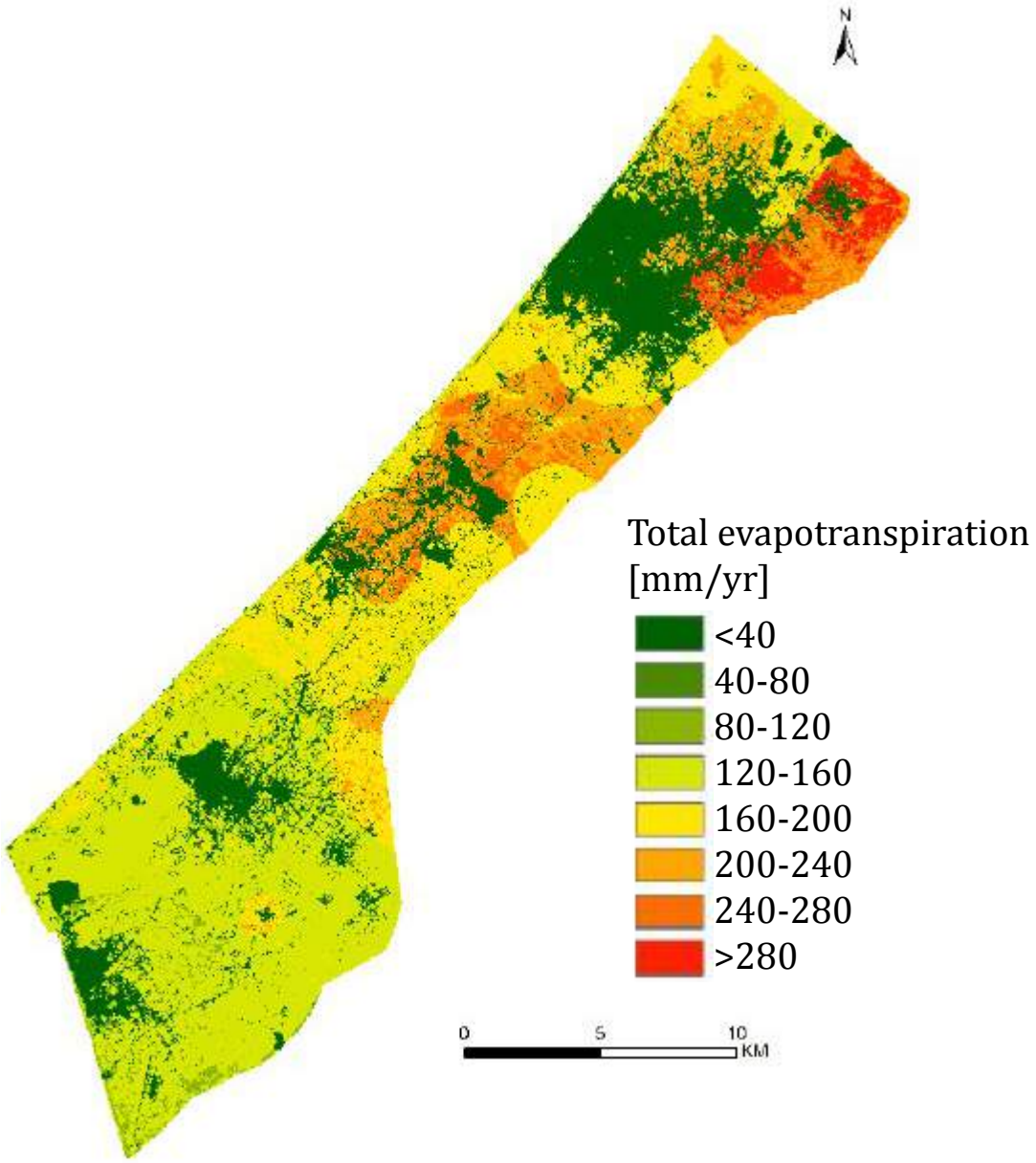
for the Gaza case study



We calibrated the WetSpa-Python model using spatially-distributed ET

Spatial variation is consistent with previous studies

Total ET is underestimated due to the lack of irrigation



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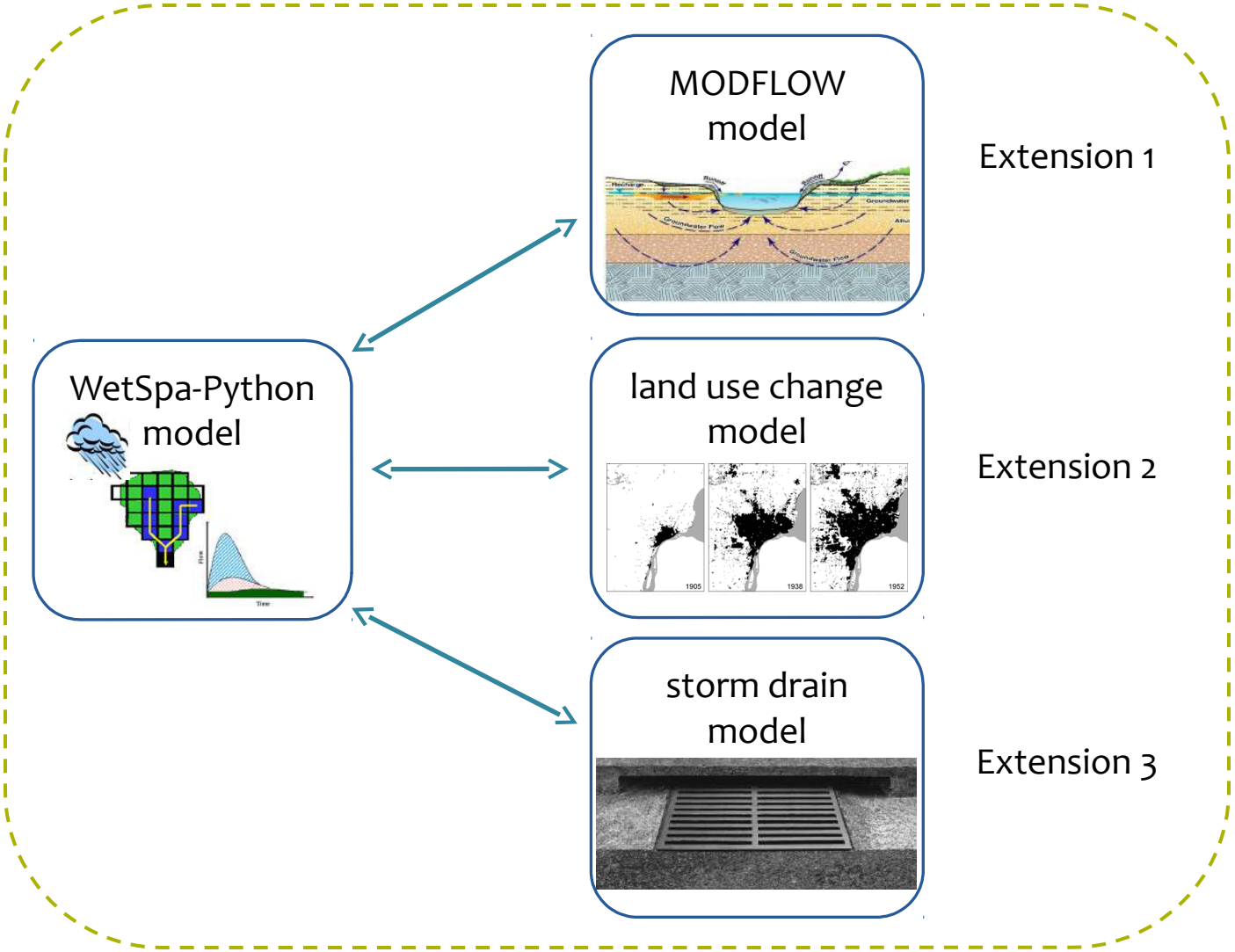
The WetSpa-Python model integrates several component software for studying urban catchments



The WetSpa-Python model is a state-of-the-art integrated system for the hydrological analysis at catchment scale

Independent components represent physical processes

Spatial and temporal resolutions can be freely selected

The work required for model integration is sensibly reduced

Adaptations to case-specific requirements are straightforward

Model complexity is partially compensated by modularity and flexibility

Improvements of the WetSpa-Python extensions are easy to achieve

The WetSpa-Python model supports the transition

One model fits all

One flexible open-source model

= many different models

HydrOSService

Web-services platform for integrated hydrological models

using Free and Open Source Software

and cloud computing infrastructure

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Salvadore, E., Bronders, J., Batelaan, O., 2015. Hydrological modelling of urbanized catchments: A review and future directions. Journal of Hydrology, 529(1), 62-82.

Salvadore, E., Bronders, J., Schmitz, O. Batelaan, O., in review. Flexible process-based hydrological modelling: the WetSpa-Python model. Journal of Environmental Modelling and Software.

Schmitz, O., Salvadore, E., Poelmans, L., van der Kwast, J., Karssenberg, D., 2014. A framework to resolve spatio-temporal misalignment in component-based modeling. Journal of Hydroinformatics, 16(4), 850-871.

Salvadore, E., 2015. Development of a flexible process-based spatially-distributed hydrological model for urban catchments. PhD thesis, Vrije Universiteit Brussel

FWO VLAANDEREN

vito vision on technology