IMPERIAL

A Flexible Modelling Framework for Model Creation Based on Perceptual Understanding in Integrated Human-Water Systems

Robin Maes-Prior,
Dr Barnaby Dobson,
Dr Ana Mijic

This presentation participates in OSPP

EGU

Outstanding Student & PhD candidate Presentation contest

Beginning

Motivation

Initially wanted to create an **integrated water systems model** for the purpose of long-term **wastewater (WW) management**. The WSIMOD modelling framework was selected (Dobson, Liu & Mijic, 2023).

WSIMOD

WSIMOD is a highly flexible whole-water system model using well-documented, open-source software, which enables analysis of water management and long-term planning from a physically based, systems-level perspective using flow and water quality indicators.

WSIMOD IMPERIAL

WSIMOD was selected for its:

- **Systems approach** (allows for a high-level approach linking up the different systems)
- **Modular format** (easy to apply changes)
- **Reduced complexity** (lower run-times)

However, the simple conceptualisation of the groundwater (GW) as a tank filled by percolation from land should be noted.

Default WSIMOD Setup

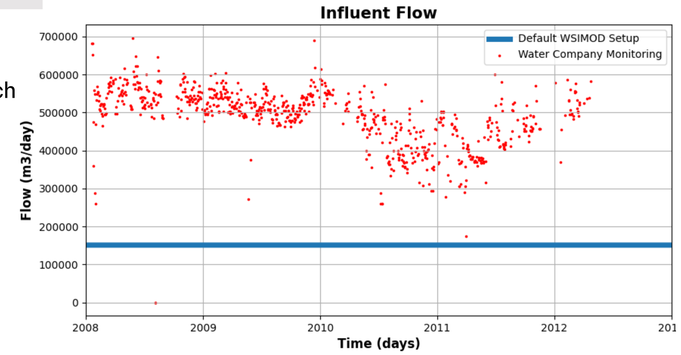
Using **open-source data** (HadUK, hydrological_features, ONS, CBED, UWWTD, WIMS, CSO, land_cover, soil_zhang, outline) to develop an initial integrated model of the Mogden WW catchment.

Problem

Visually it is clear that despite changes improving on the baseline, the simulated influent is still incorrect.

Water company data shows **43% of the dry weather flow** into Mogden is made up of **unaccounted for flows**.

These unaccounted flows have a lot of **systemic uncertainty**, for example, are they due to GW infiltration or sewer misconnections, or both.



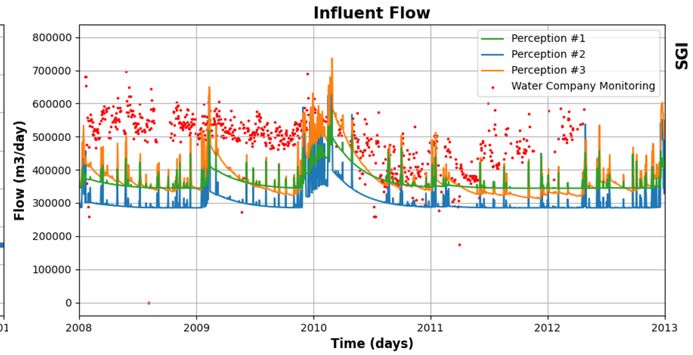
Present

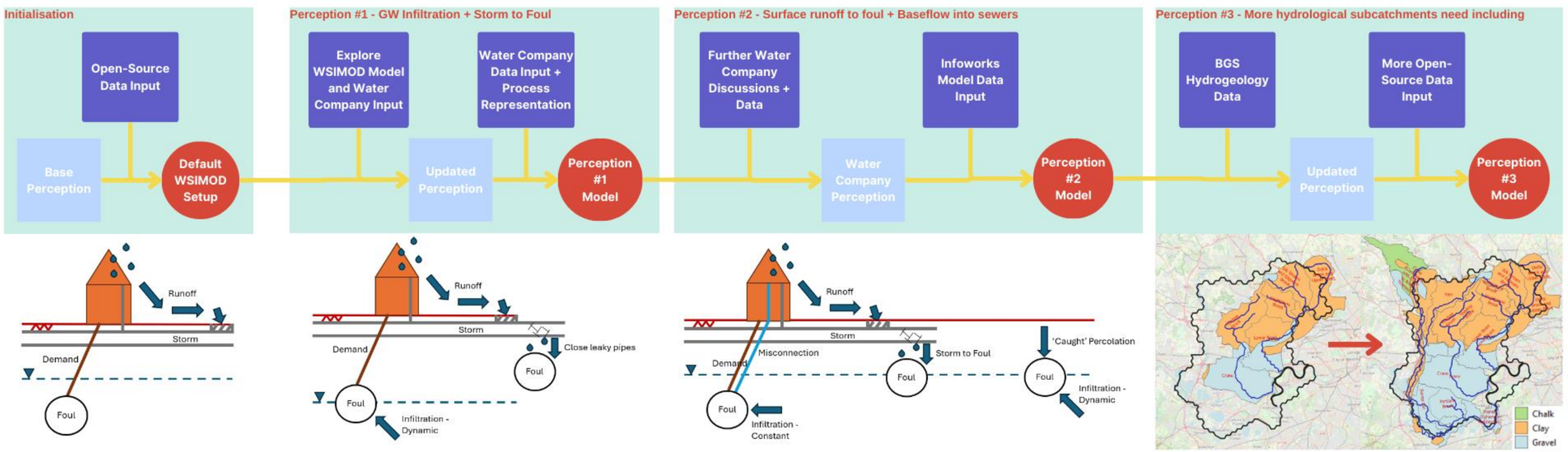
Method

To deal with this uncertainty and make sure **results are being produced for the right reasons**, a perception-based framework was developed, building on perceptual modelling in hydrology (Beven, 2001; Wagener et al., 2021) to incorporate relevant WW infrastructure. Changes were applied globally, and the models were left uncalibrated. The flow chart at the bottom shows the framework.

Performance

Comparing the results of the different perceptions:



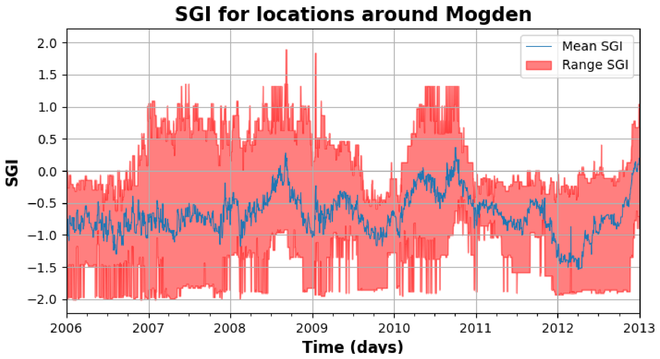


Moving Forward

The results are clearly still not capturing the desired behaviour and further work will need to be done.

Next Perception/Conception

The SGI (Bloomfield & Marchant, 2013) was calculated for a selection of EA borehole data as shown below. A lag between the behaviour of this and water company influent data indicates a timearea method for GW may help match the data and will be trialled next.



Sensitivity Analysis

To further understand these results and whether the model is responsive to the parameters controlling the different sources of influent (in the correct parts of the model) a sensitivity analysis will be undertaken. If the model is not sensitive to these parameters, then a more complex GW model will need to be coupled to the model.

What would you do?

We would love to hear from you! If you have any comments or feedback, please do stay and chat!

If you would like to leave feedback online or vote for my poster in the OSPP contest, scan the following QR codes:

FEEDBACK

OSPP

References: Beven, K. (2001). *Rainfall-Runoff Modelling: The primer.* Wiley.; Dobson, B., Liu, L. & Mijic, A. (2023). Water Systems Integrated Modelling framework, WSIMOD: A Python package for integrated modelling of water quality and quantity across the water cycle. *Journal of Open Source Software, 8,* ***4996.***; Wagener, T., Gleeson, T., Coxon, G., Hartmann, A., Howden, N., Pianosi, F., Rahman, M., Rosolem, R., Stein, L. & Woods, R. (2021). On doing hydrology with dragons: Realizing the value of perceptual models and knowledge accumulation. *WIREs Water, 8.*