

FLOOD ESTIMATION AND IMPACTS IN URBAN AREAS

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Background

The area of Cranbrook U.K is modelled as a 1D2D semi-distributed model in Infoworks ICM. Modelling of infiltration and surface routing effects are calibrated with a Base Scenario using Fixed Runoff Coefficients for the infiltration model and Wallingford for surface routing model. The purpose of this project is to improve urban stormwater modelling by testing different infiltration and surface routing models and identifying the most representative combination for the Cranbrook Catchment.

FIGURE 1

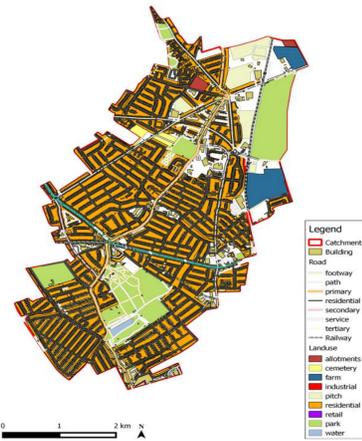
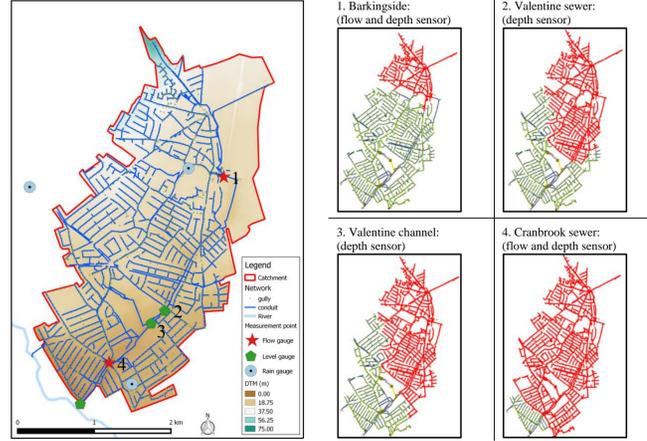


FIGURE 2



Methodology

Figures 1 and 2 show the land use in the Cranbrook Catchment and the areas that drain to the 4 monitoring stations respectively. The monitoring stations of interest are Barkingside, Cranbrook Sewer and Valentine Channel. Barkingside monitoring station is at the upstream location of the catchment, with mostly impervious upstream areas. The Cranbrook Sewer monitoring station, set at the downstream of the catchment drains the Valentine Park, which is a large open space in the catchment. The Valentine Channel drains mostly impervious areas and the A12. With the available observed data from the different monitoring stations, and 4 precipitation events, the following model combinations are tested to assess their suitability (Table 1).

TABLE 1

Combination	Infiltration Model	Surface routing Model	Sensitivity
1	Fixed Runoff Coefficients	Wallingford	
2	Fixed Runoff Coefficients	SWMM	
3	Horton	Wallingford	
4	Horton	Desbordes	Low Infiltration + Average Infiltration
5	SCS	Desbordes	Wet, Dry, Average Wetness
6	Green Ampt	Desbordes	
7	New UK	Wallingford	Average Fixed Coefficients, High Fixed Coefficients

Acknowledgments

I would like to express my truthful thanks to my supervisor Dr. Ana Mijic for the opportunity to be involved in such an exciting and challenging project and Rui Pina for his continuous help and support.

FIGURE 3

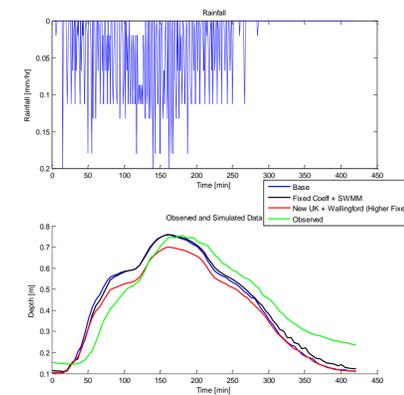


FIGURE 4

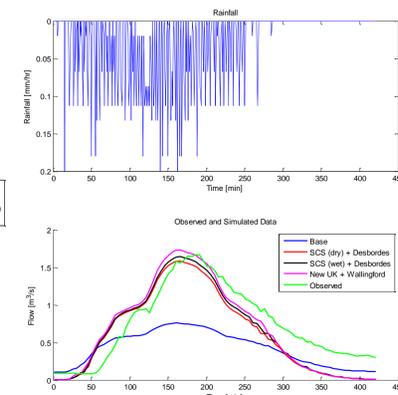


FIGURE 5

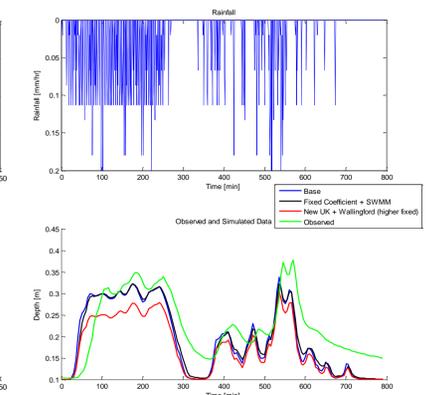


FIGURE 6

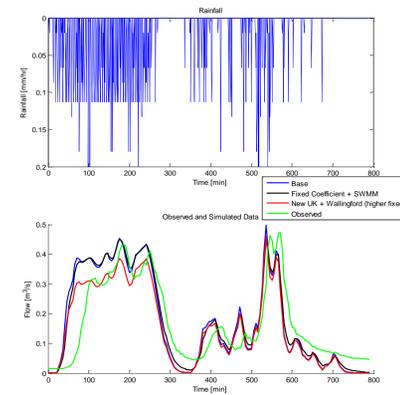


FIGURE 7

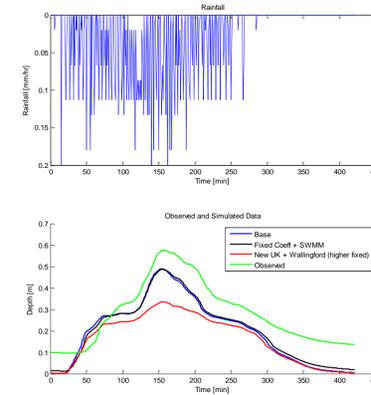
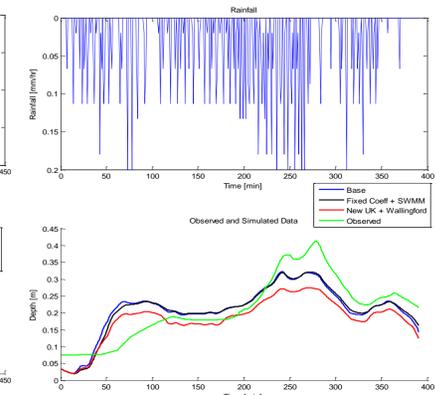


FIGURE 8



Results and Conclusions

The Base scenario is calibrated for depth simulations at Cranbrook Sewer monitoring station and flow simulations at Barkingside location. Figures 3 and 4 demonstrate the results for Cranbrook Sewer for depth and flow simulations respectively. Figures 5 and 6 demonstrate the results for Barkingside station for depth and flow simulations respectively. Figures 7 and 8 demonstrate the results for Valentine Channel for depth simulations for 2 rainfall events. It can be seen that the Base Scenario indeed performs well, with the Fixed Coefficients + SWMM model set up appropriate for locations with little or no pervious areas and the New UK + Wallingford for locations with higher percentage of pervious areas.

The SCS model has been tested with wet, average and dry conditions and indeed proved not suitable for modelling the Cranbrook Catchment. In most cases, dry and wet conditions in the SCS model produce identical results, indicating the model's insensitivity to parameter variation.

The combination modelling Horton as the infiltration model and Wallingford as the surface routing model consistently underperforms.

Horton + Desbordes combination generally performs well in the simulated results where infiltration effects are significant. This particular model combination performs well when infiltration effects are important in the catchment. Its reliability is based on the results of flow simulations at the Cranbrook Sewer.

As it is advised by InfoWorks ICM, Green Ampt infiltration model should be modelled with SWMM model in future research. Nevertheless, this work ensures the inapplicability of the Green-Ampt infiltration model combined with Desbordes surface routing model when infiltration effects are not significant at the modelled areas.

This project has improved urban water modelling by indicating which model combinations need to be further tested with sensitivity analysis and which model combinations need to be avoided in future work.