Modelling at the Integrated Scale

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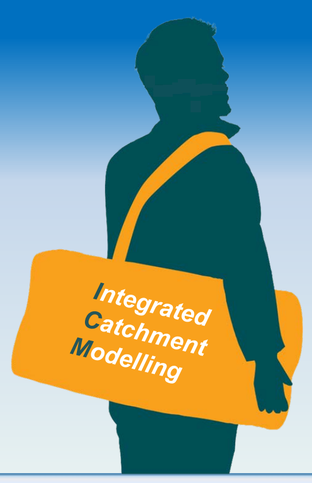
The Industrial Doctorate Centre for the Water Sector



Setting the scene

Effective and efficient modelling of the entire water system is of paramount importance if UK water companies are to better manage our impact on the environment.

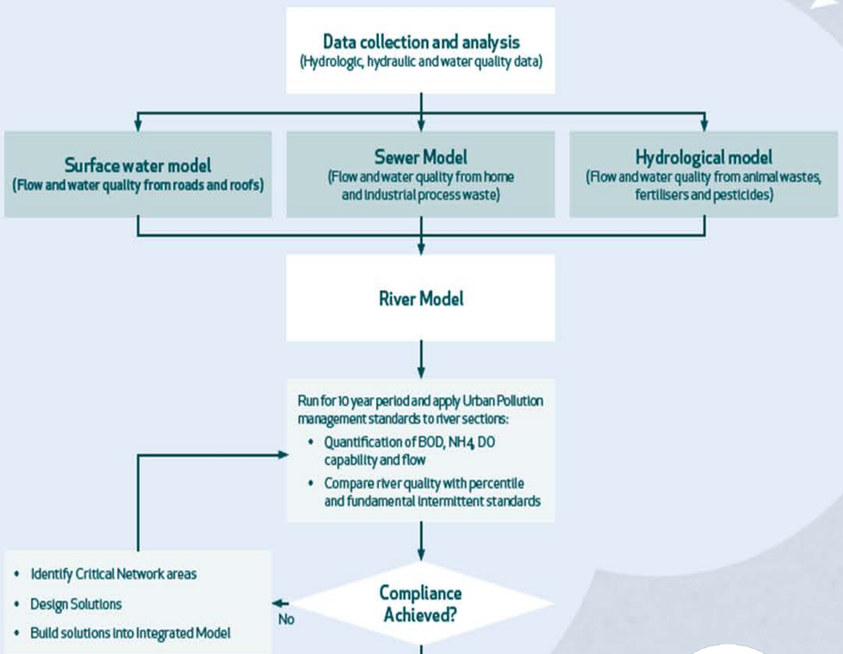
Current state of play

The Water Framework Directive stresses the need to manage land and water as one holistic system, therefor there is a need to model catchments at the integrated scale.

The problem

The ICM methodology is supported by a number of models used to describe individual components of the water cycle; surface water, sewer, hydrological and river. With so many models available from across a wide spectrum of complexity, an idealised model structure is yet to have been agreed.

Integrated Catchment Modelling Methodology:



- Replication
- Commercialisation
- Start Again

Benefits:

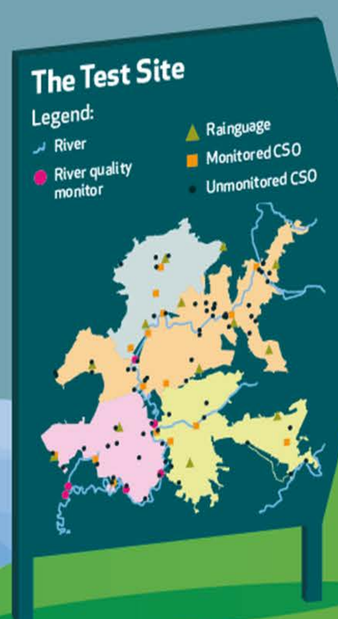
- Fast ICM run time
- Reduced cost of modelling
- Potential increase in modelling accuracy
- Better more cost effective solution

Next phase of work...

Reviewing the performance of event mean concentration models across varying catchments.

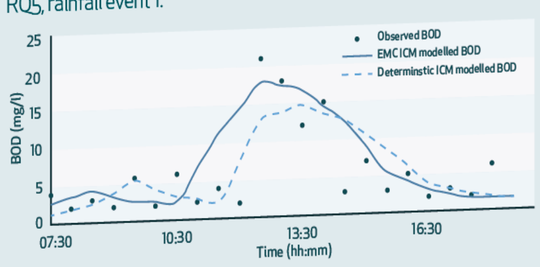
- Develop stochastic model using data collected and model review
- Test transferability of model from catchment to catchment

At which stage of the ICM modelling process are we getting things so wrong?



The results...

Figure 1. . Example of BOD measured within receiving waters after a spill event compared with associated ICM predictions using both mean concentration and deterministic Infoworks CS sewer model as inputs. Sampling details; start 7:30, end 15:00, water quality monitor RQ5, rainfall event 1.



Conclusions

Analysis of the river quality datasets showed that the variance between the observed and predicted water quality parameters is of a similar scale when both the mean concentrations and deterministic models are used to describe the CSO spill events

Why change the way we do it now?

The interdisciplinary nature of the methodology creates a lack synergy between models:

- Model complexity varies
- Input and output data resolutions vary

Many models, in particular sewer models generalise a wide range of parameters and fail to include the impact of randomness.

Whilst complexity can improve the realism of models, increases in model accuracy and certainty of model prediction are not guaranteed.

Research suggests that because certain physical process' and interactions are so complex (i.e sediment transport) and are so complex it may simply over ambitious or inappropriate to describe them in a physically deterministic model.

What can be done?

Getting going...

	Run time	Data Requirements	Accuracy & Error
Complex vs. Simple	↑ ↓	↑ ↓	? ?

Alternative: *Empirical multi regression event mean Concentration (EMC) models*

Why not yet: *Inherently sensitive to the strength of experimental data $$$ (Costly)*

Which Direction from here:
Test Sites, Data Collection, Analysis

What do we need to test the error between the two methods?

Is there scope to use EMC models to describe CSO's spills in a fully integrated study?

The test

- Obtain calibrated and validated ICM
- Collect in sewer water quality data:
  - BOD,NH4,TSS
- Raingauge Data:
  - 18 Raingauges across 4 catchments
- River Water Quality data:
  - 6 water Quality sampling sites
- Generate optimum EMC for monitored CSO's in individual catchments
- Replace sewer water quality modelling phase with simple optimum cathcment EMC's
- Run new ICM
- Compare magnitude of error in both ICM's using observed data

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