iCASP
Integrated Catchment Solutions Programme

The importance of good data for modelling

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Why do we want to model the hydrological cycle?

1 **Understand key physical processes**

We want to understand what impacts the flow of water through a catchment, and how we can influence or reduce those processes

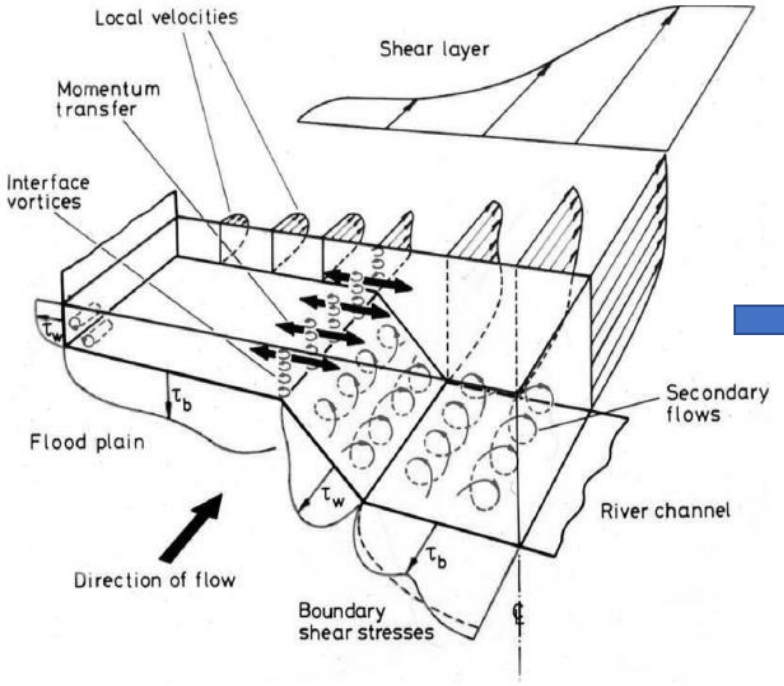
2 **Understanding of extreme events and associated risks**

What causes floods? Where is at risk from these events? Models can also help by giving us a different perspective of the event

3 **Predict the future!**

Historical data and events may not hold the key to future flood events…

How do models work?



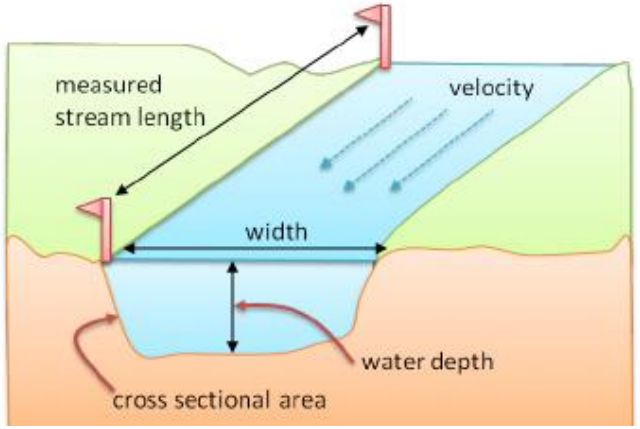


Figure 2.15 Flow structures in a straight two-stage channel (after Knight & Shiono, 1996).

Hydraulic processes are complex - to create a computational model that we can use, we need to simplify this down to a few, critical processes, that can be described in a few equations*

*These equations require us to provide it with parameters that characterise the topography and land form (**Manning's *n***)

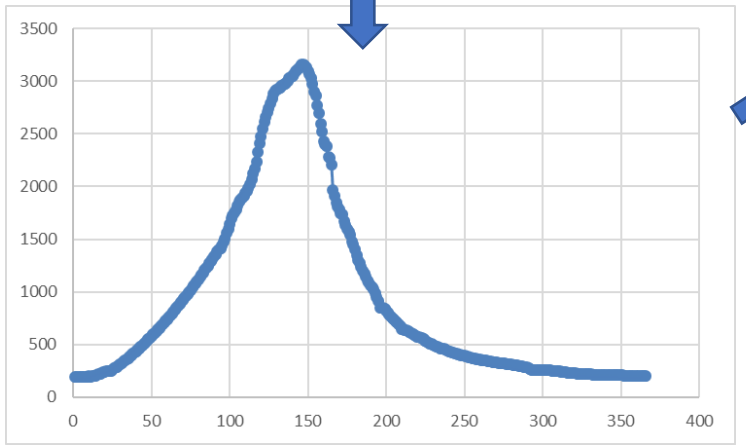
What data do we use in models and how do we use it?

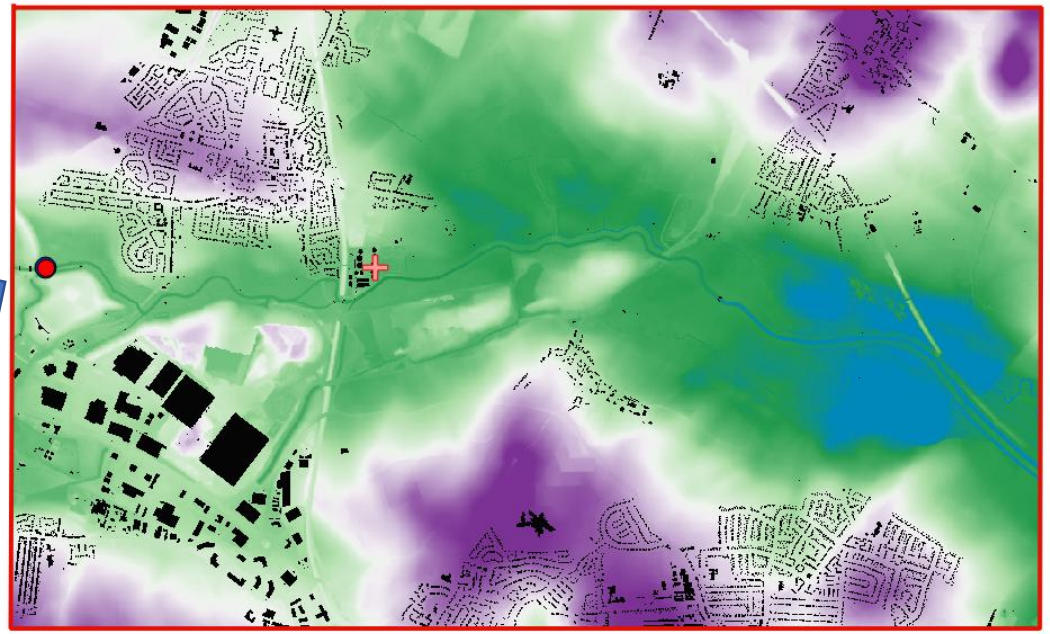
1 **Boundary conditions/Inputs**
We use river and rainfall gauge data as inputs to the model

2 **Calibrate and Validate the Model**
We can compare the outputs of our model to observed data and see the difference

3 **Using observations to reduce the uncertainty in models**
Using ‘soft’ observations to improve the model

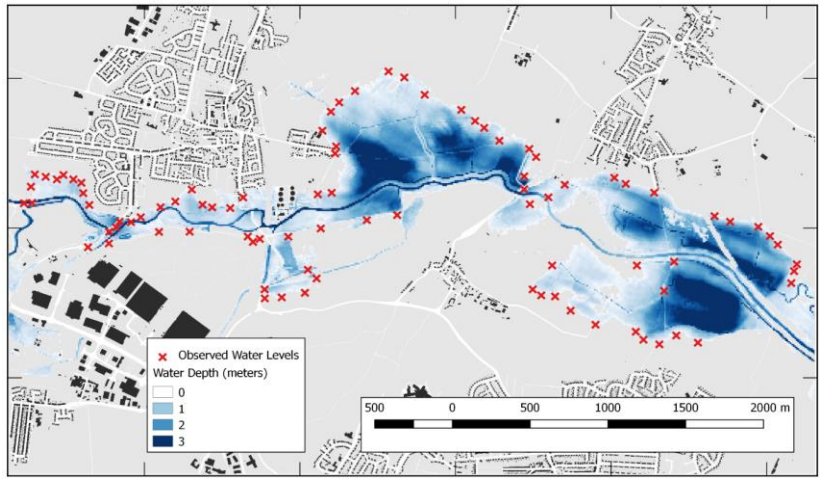
Boundary Conditions – Model Inputs

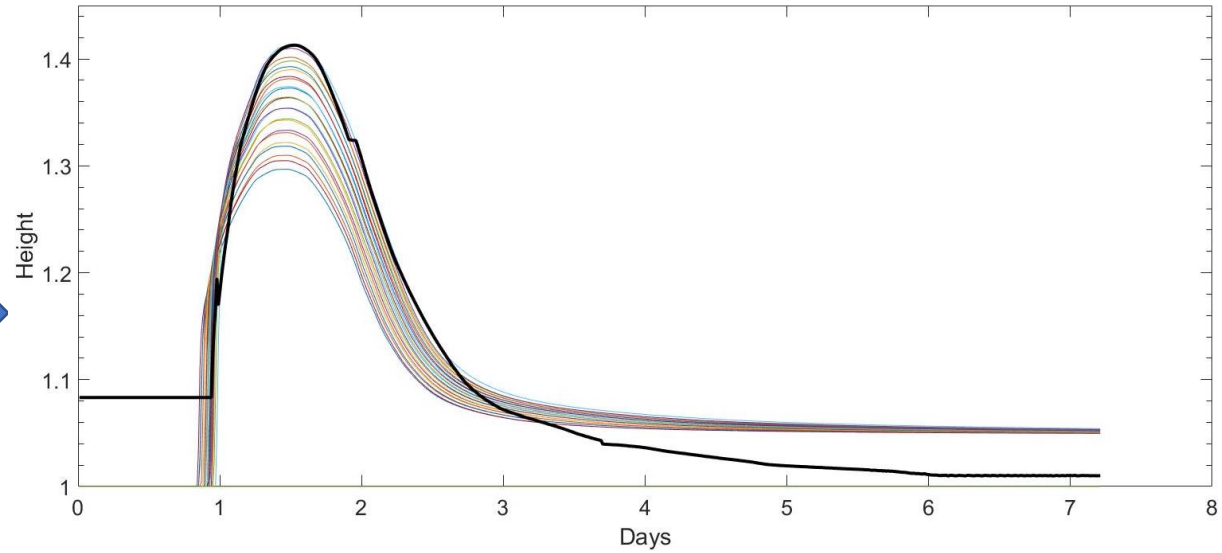




Calibration and Validation

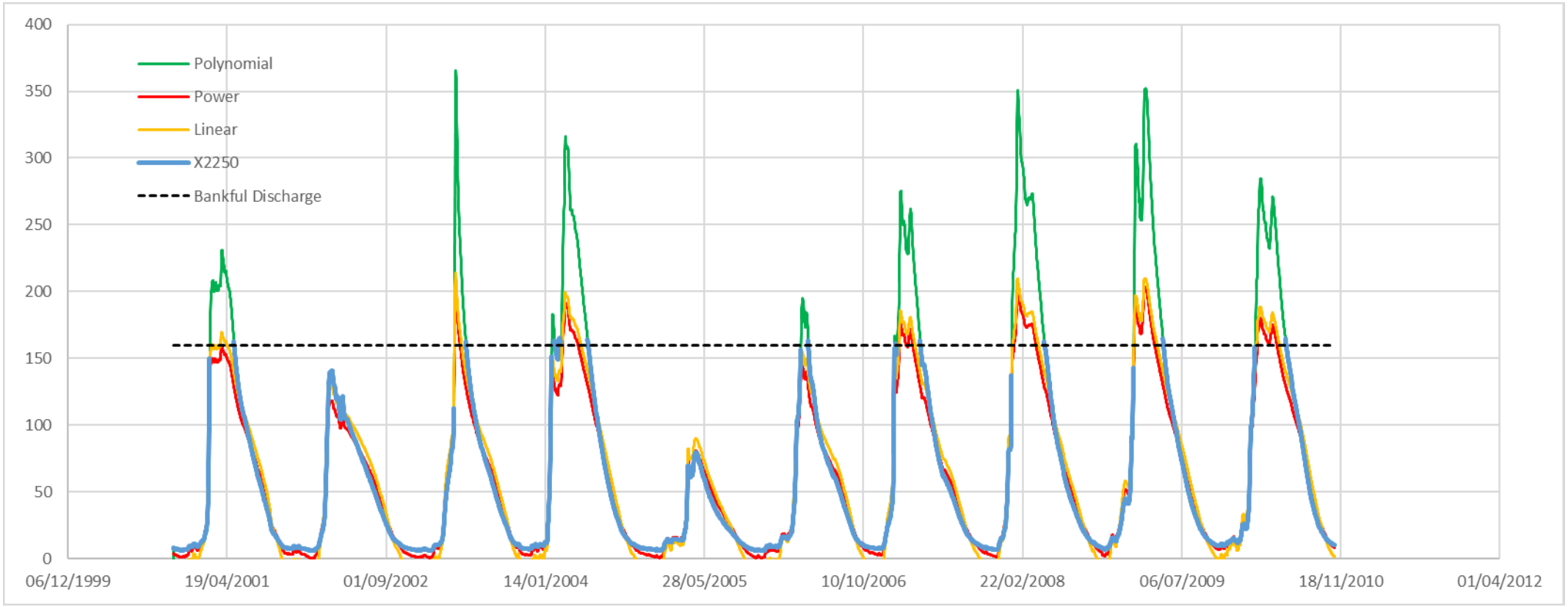
All models will have a level of **uncertainty** – model parameters can produce a range of possible results, all of which maybe plausible. Uncertainty impacts the confidence in the model results and ultimately how the model can be used.





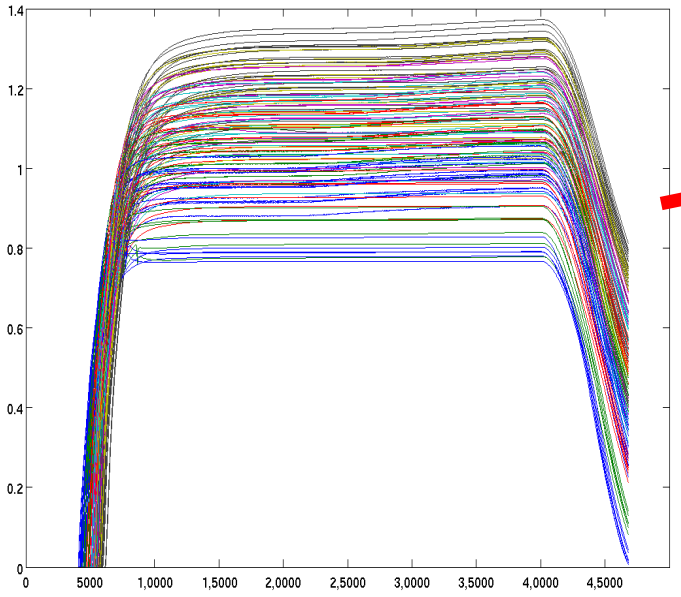
- Uncertainty is dealt with by **calibrating** the model - testing the model output against observed data, quantifying the difference, then picking the parameter set which produces a model that matches the observed data.
- The confidence in a model is further improved by **validating** the model; testing the calibrated model against an independent event
- This process relies on robust, quality data to ensure the calibration process works

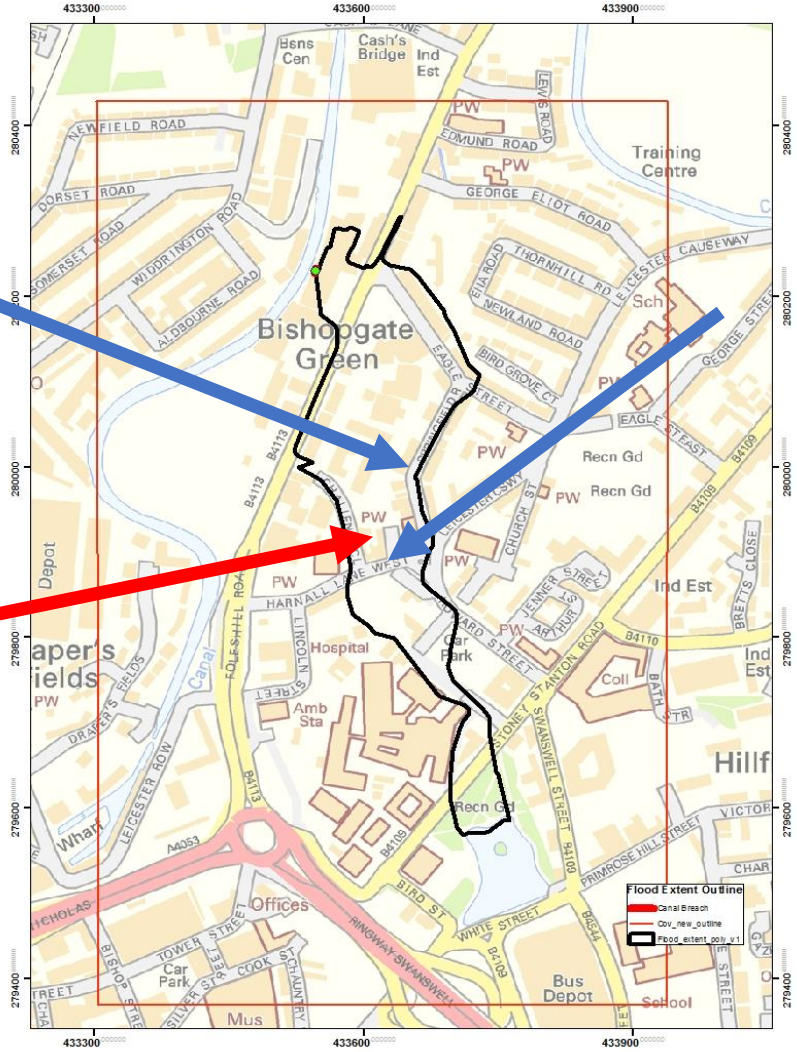
What can we do with data that is missing or incomplete?



What can we do with data that is missing or incomplete?

‘Houses along Eagle Street were flooded to a depth of 3ft (1m)’





‘The depth of water at the junction of Eagle Street and Hanwell Road was 4 feet’ (1.2m)

Some Comments

- **Data is really important to driving the modelling process**
  Hydrologists can make educated guesses about what the model should be doing, but having observed data justifies the modelling approach and the assumptions made.

- **Data should be organised and recorded in a logical fashion**
  The less time spent cleaning or modifying data, the more scenarios/model runs that can be completed

- **Good Data is critical to having confidence in models**
  Good data will reduce uncertainty and improve the robustness of the model. Conversely poor quality data will do the opposite - RUBBISH IN = RUBBISH OUT

- **It can be difficult to get good data, but all data is useful.**
  Not all data may be able to quantify the model, but we can still use the data to understand the key processes