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How far can we have a detailed understanding of catchment hydrological function?

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With contributions from

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BHS 2014
Water resources management within an uncertain climate

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- Increasing pressure is being place on global water resources. Providing the necessary water for homes and business whilst limiting impacts on the wider catchment under a changing climate requires a **detailed understanding of catchment hydrological function**, its future response to a changing climate and innovative approaches to maximise water extraction.

So how far do we understand?

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- Models are a means of formulating understanding but require calibration because of issues of uniqueness of place
- Disinformation in data available for calibration - does this compromise representation of understanding?
- Do we know enough about space-time variability of fluxes – example of incremental discharges?
- And what about when we have models of everywhere?

Disinformation in data available for calibration

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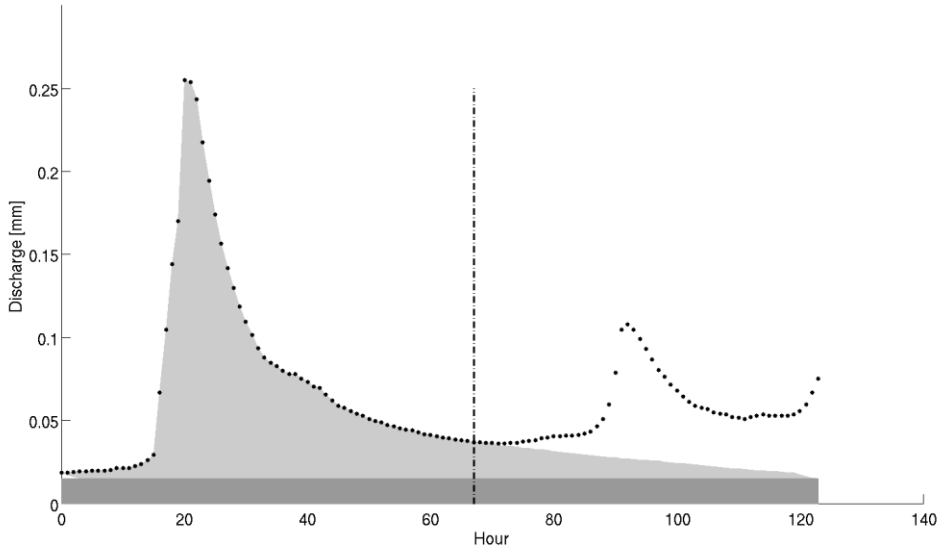
- How far have model calibrations been affected by lack of understanding of the available data?
- Storm based mass balance



Beven et al., HESS 2011; Beven and Smith, JHE 2014

Disinformation in available data

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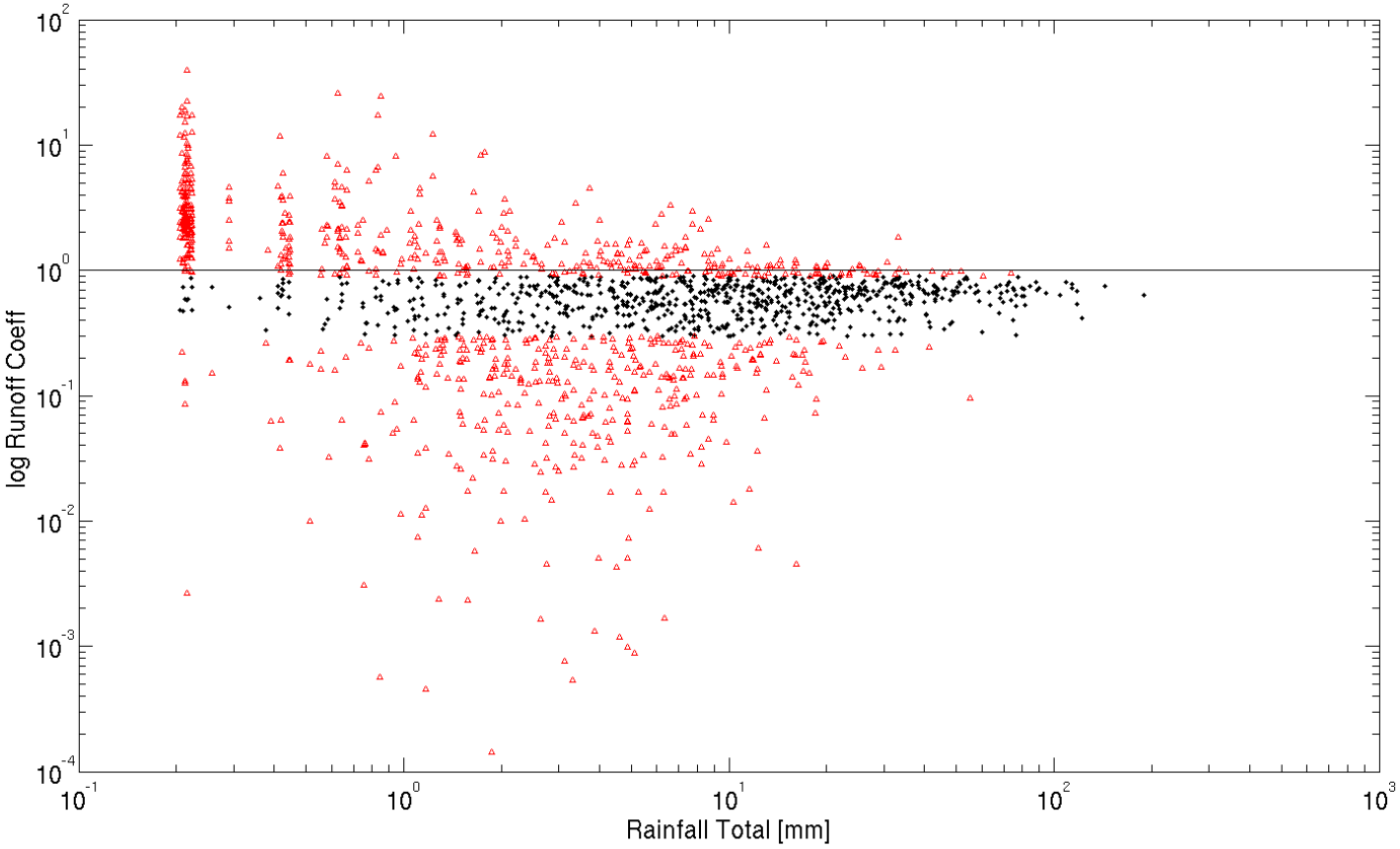
- Analysis of Runoff Coefficients- Tyne at 23006

  (red > 0.95 or <0.05)



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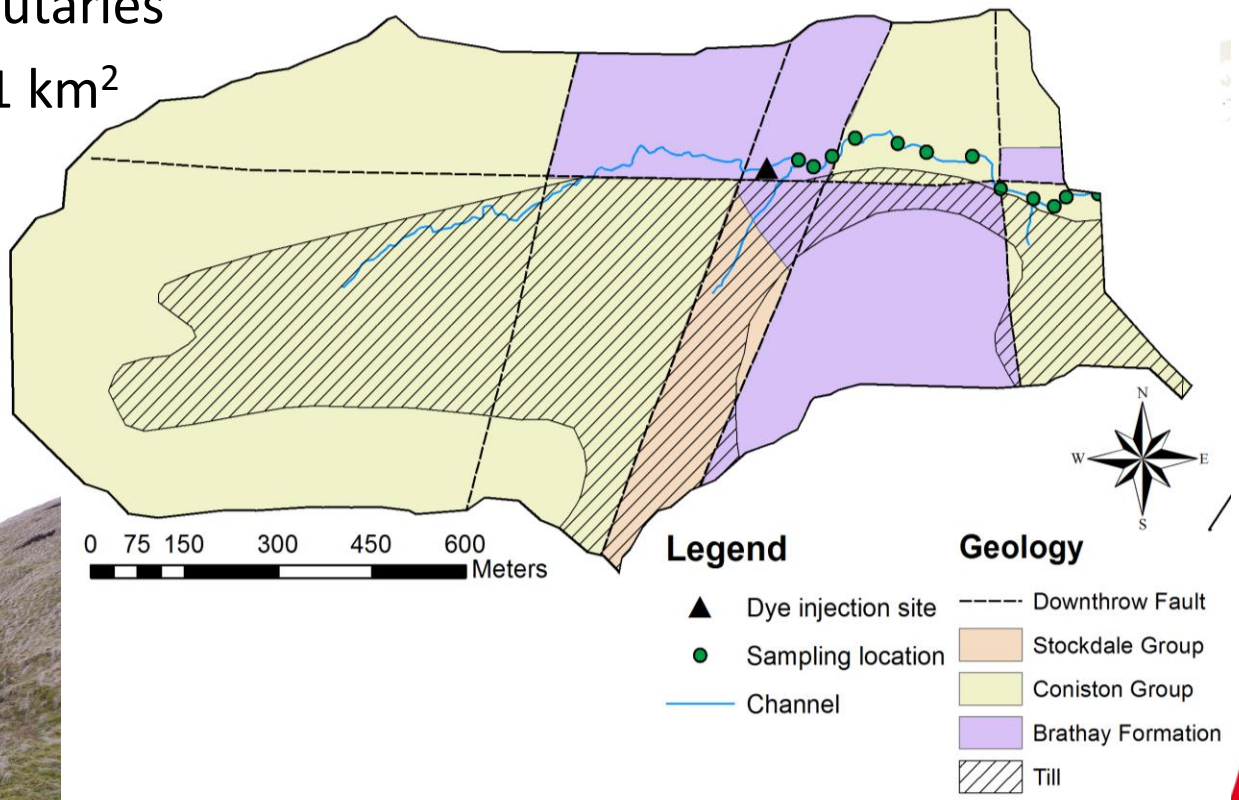
- Exploration of incremental discharges in catchment downstream of junction of main tributaries
- Lower catchment 1.1 km^2
- 12 sites, 11 reaches



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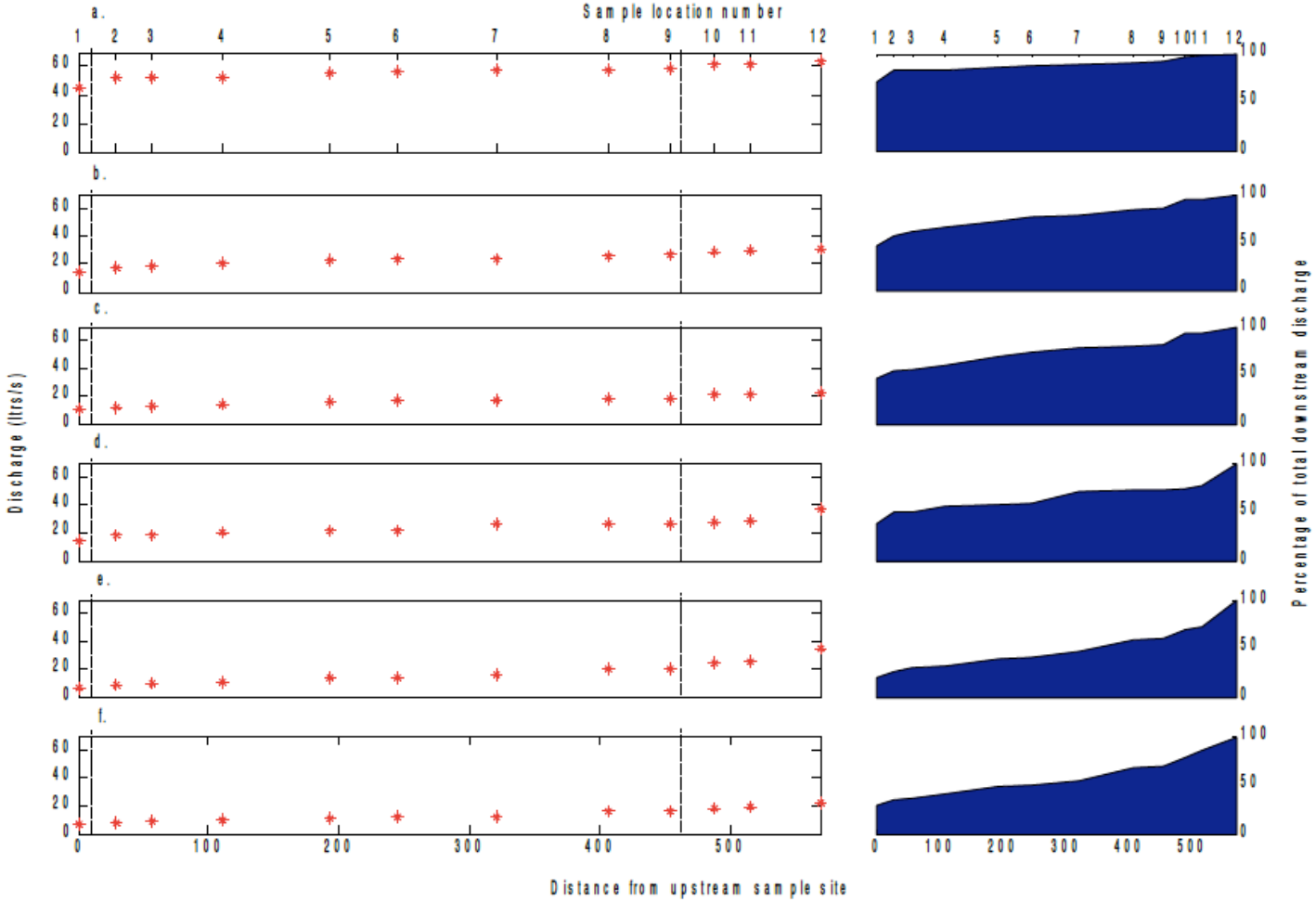
- Rhodamine continuous injection tracing – discharges from dilution at steady state



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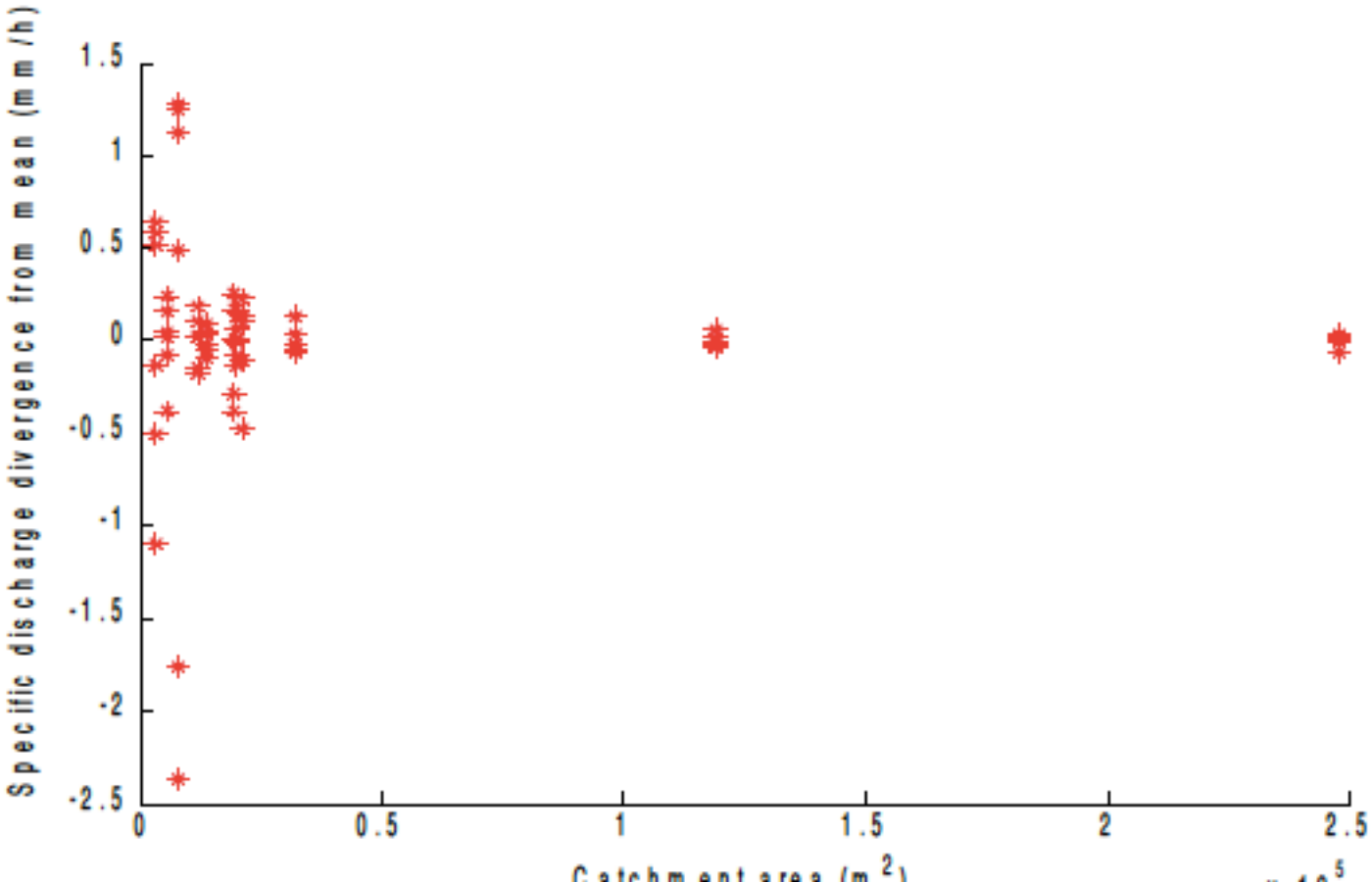
Specific discharges by catchment area for reaches and cumulative reaches (as determined from raster DTM)



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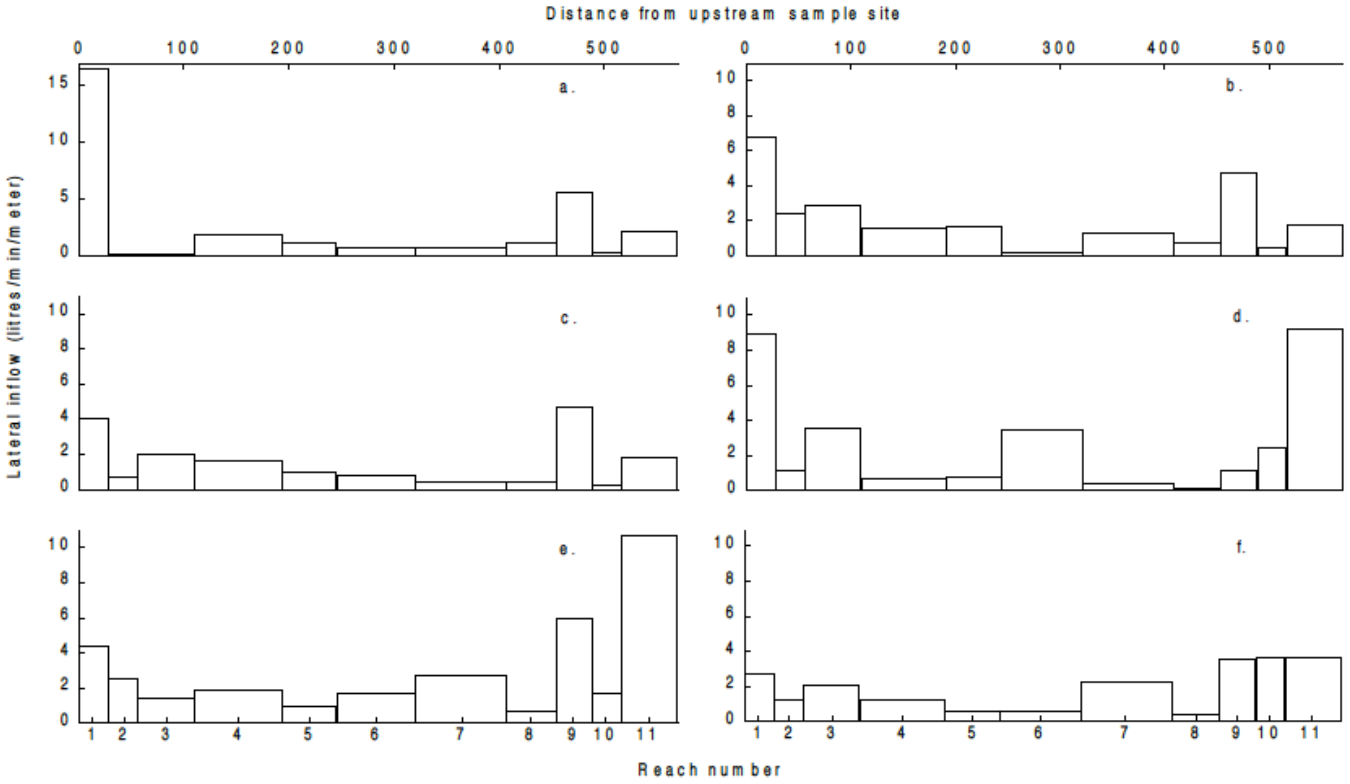
Incremental discharges for different catchment discharges



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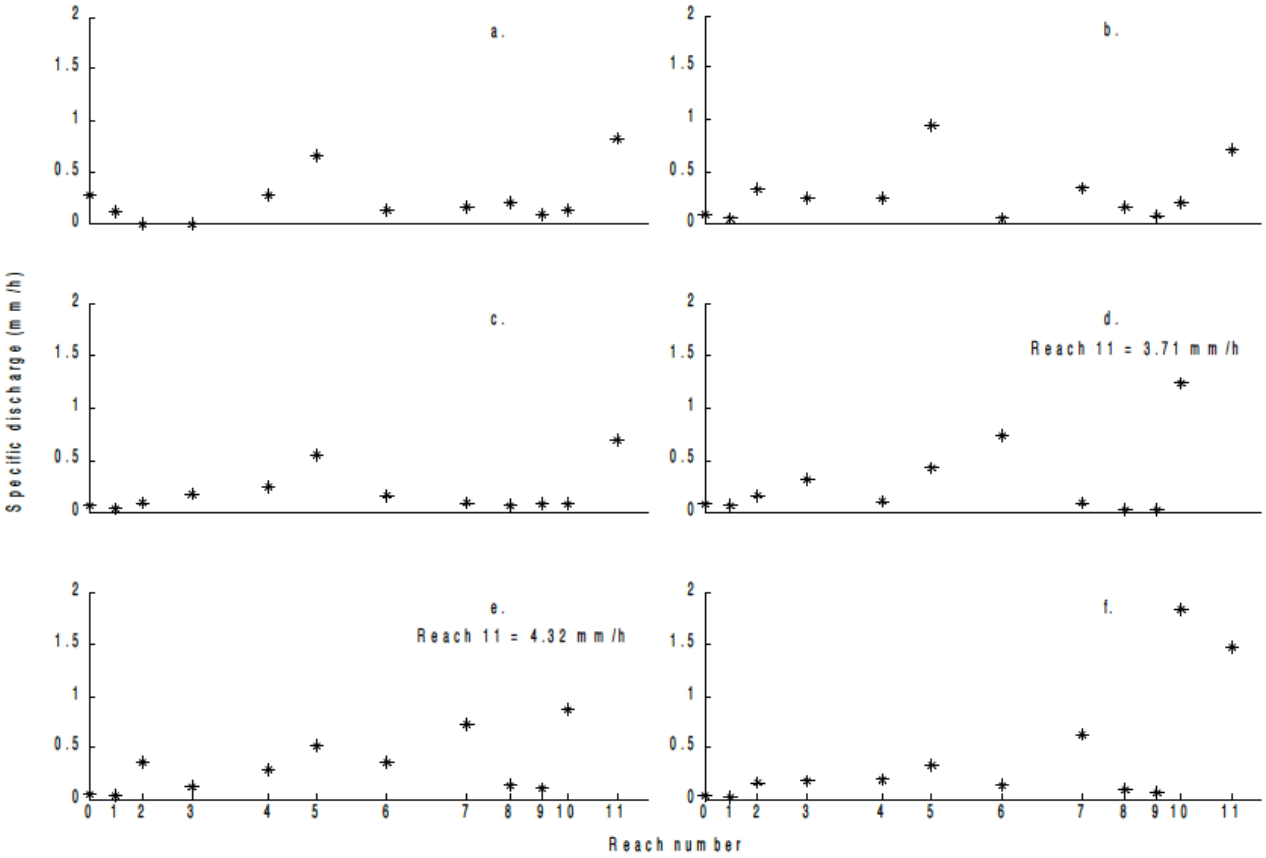
Specific discharges at different total discharges



What about when we have "models of everywhere"

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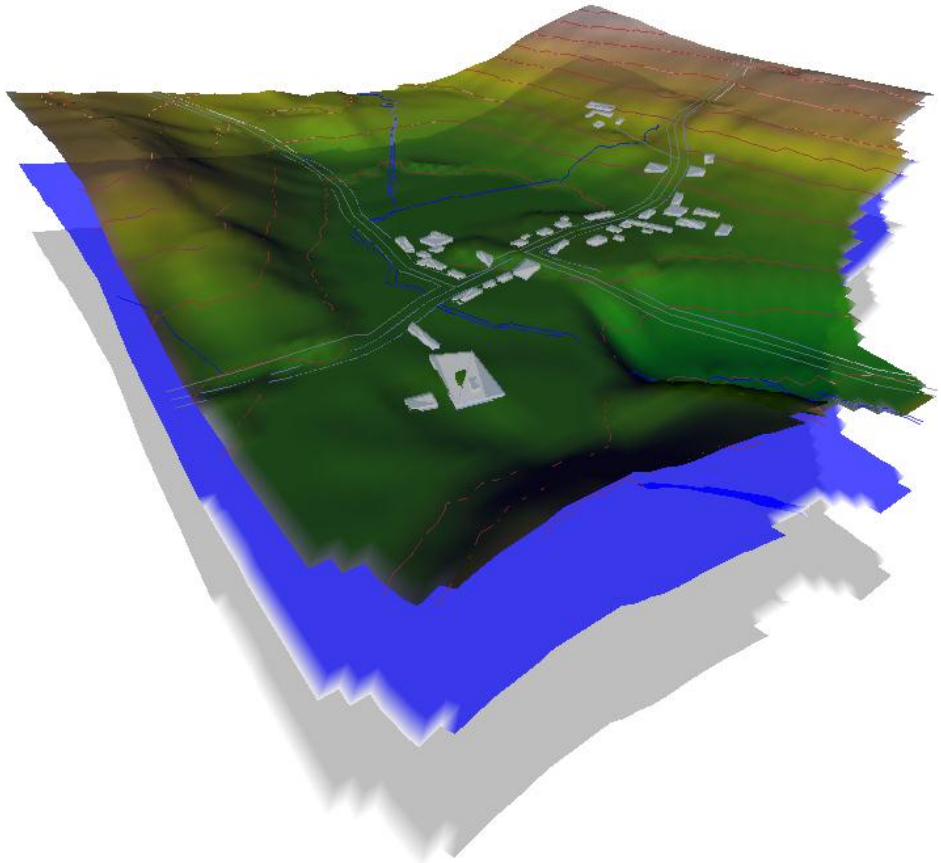
- Moves towards hyperresolution models and on-line visualisation of model outputs



Peter Metcalfe poster 4-5P

What about when we have "models of everywhere"

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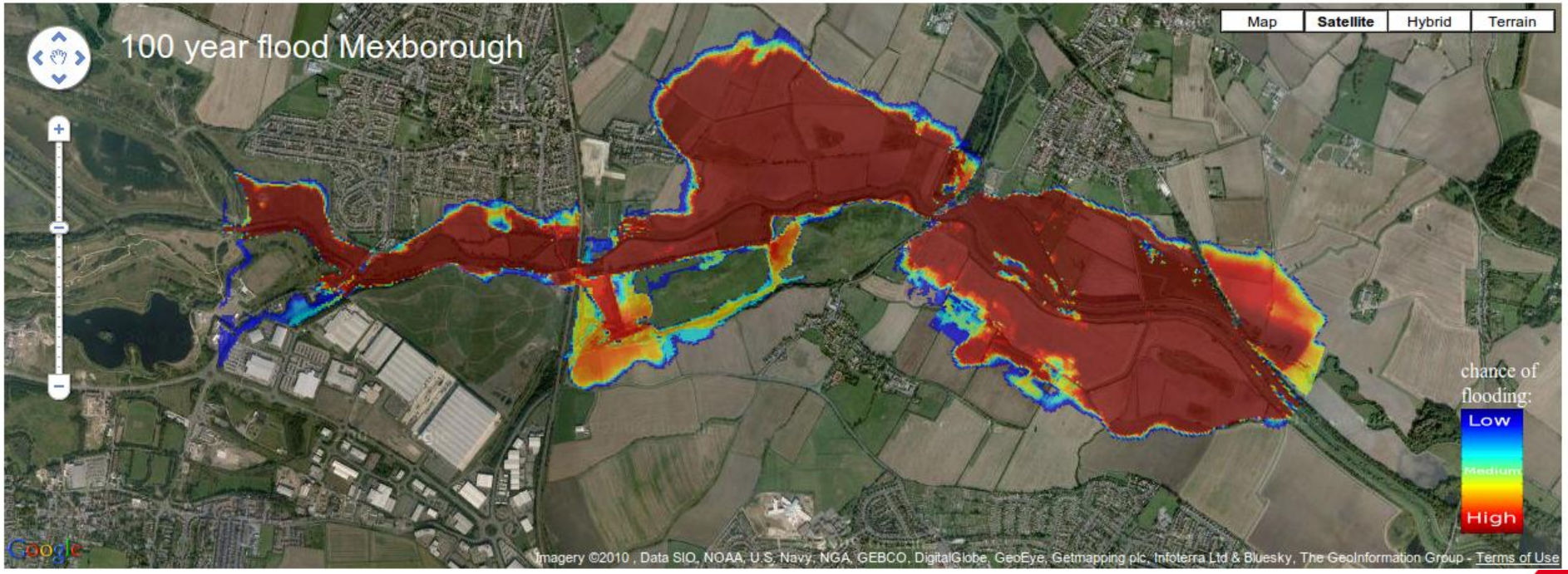
- ……. sometimes even with uncertainty



What about when we have "models of everywhere"

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- Space-time variability suggests it might be difficult to be right everywhere because of inherent (epistemic) uncertainties about inputs, processes and characteristics
- Visualisations of distributed predictions mean that local stakeholders and users can relate strongly to local model outputs
- ….. And will react particularly where the model appears not to give correct results, requiring action
- Modeller is less likely to wrong if proper account of uncertainties are made
- But should also as

Summary

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- Still more to learn about how calibrated models might properly reflect understanding of catchment processes in places with unique characteristics
- “Models of everywhere” concept will change way in which modellers interact with users in future
- Issues about whether readily available data are sufficient to support strong conclusions about understanding and impacts of future change
- Space-time variability of responses will condition such impacts but as yet we know little about it.
- Some good reasons for evaluating uncertainty in predictions of local impacts of change

Informative and disinformative prediction bounds in prediction

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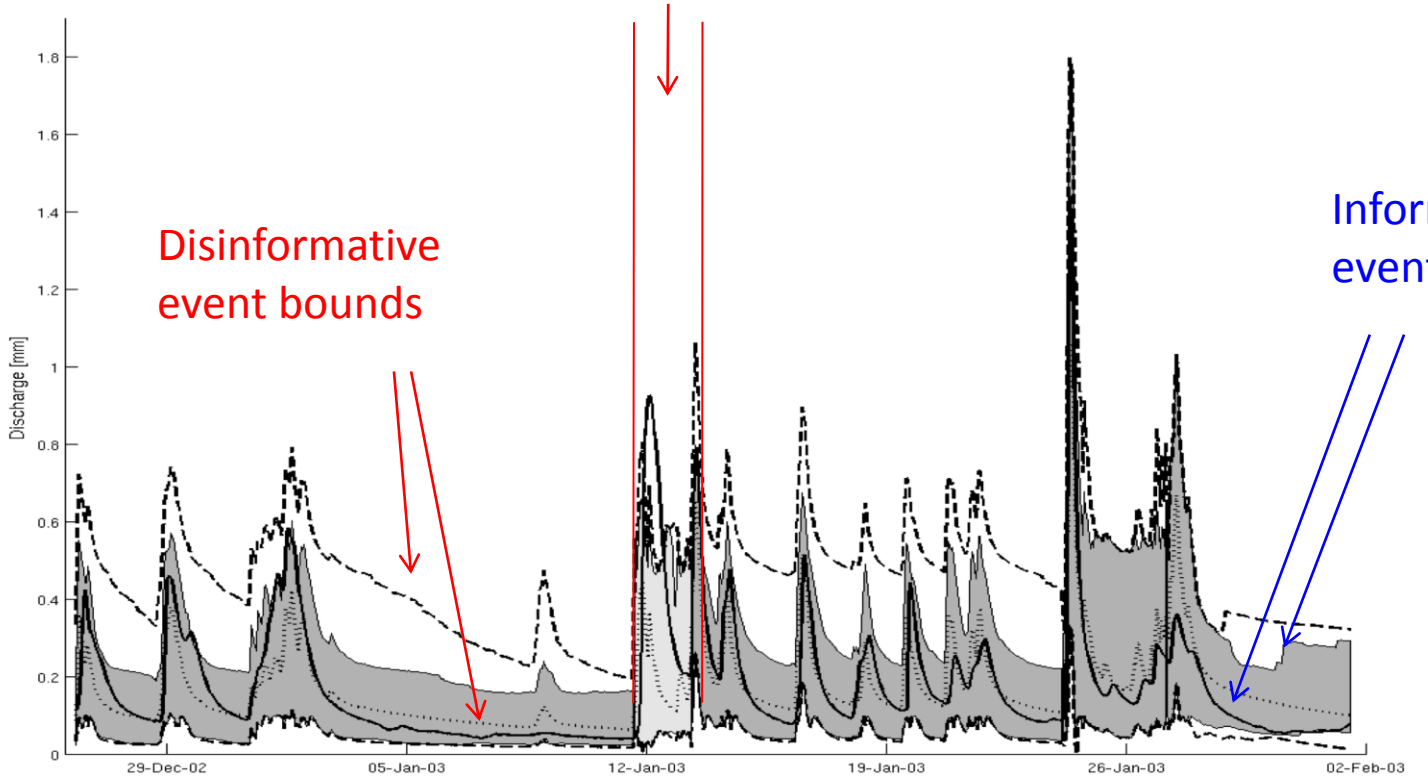
Disinformative event (post hoc)



See Beven & Smith, JHE 2014