Cascading uncertainties in flood models

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Living with global uncertainty

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Numerical models of loss from flood hazard lie at the base of an uncertainty cascade influenced by uncertainties in precipitation, transformation of precipitation into runoff and hydraulic routing of runoff over complex topography. The influence of uncertainties in hydraulic flood models has been extensively explored but generally in isolation from evaluation of uncertainties in loss methodologies. Abstractions caused by model resolution, digital elevation prescription and friction specification are evaluated for 1-in-100, 200 and 1000 year return period events Relative magnitude of uncertainties in depth/damage curves (and subsequent estimates of loss) are assessed compared to hydraulic modelling uncertainties.

Hydraulic modelling

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Figure #1: Maximum predicted water depth throughout the simulation for Δx = 2 m for the 1--in-100 year return period flood

Site description and data availability

Indicative tidal flood risk area of River Thames is 116 km^2 and Greenwich embayment is 11.5 km^2.

Embayment is characterised by densely clustered terraced housing, large industrial units and high asset value sites.

Embayment is well protected and defences are in good condition.

Inflow hydrographs obtained from RASP methodology for flows over embankments for 1-in-100, 200 and 1000 year return periods.

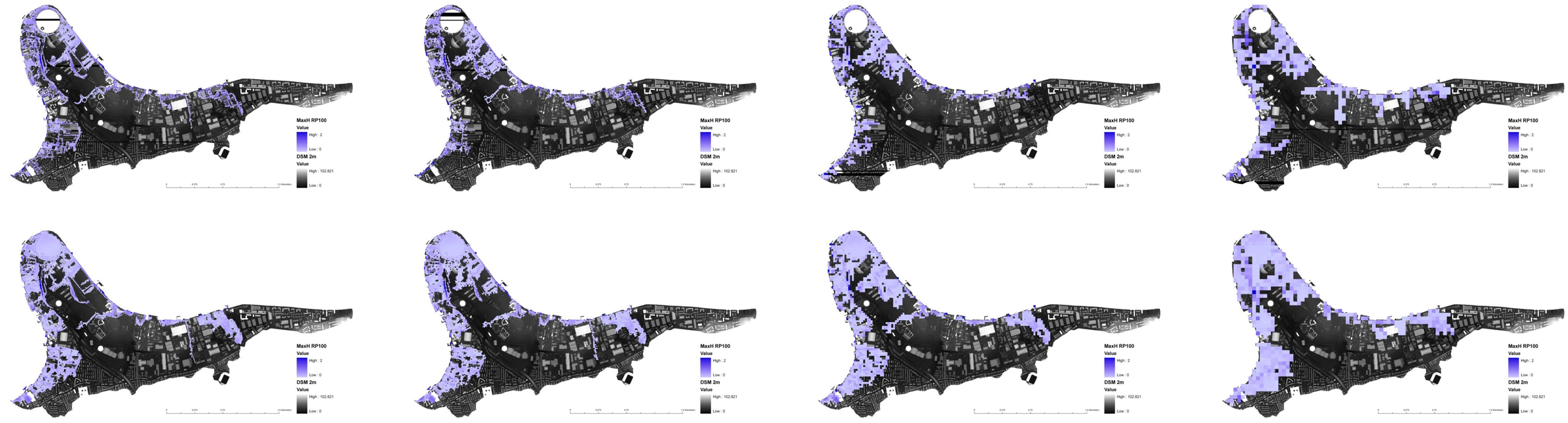
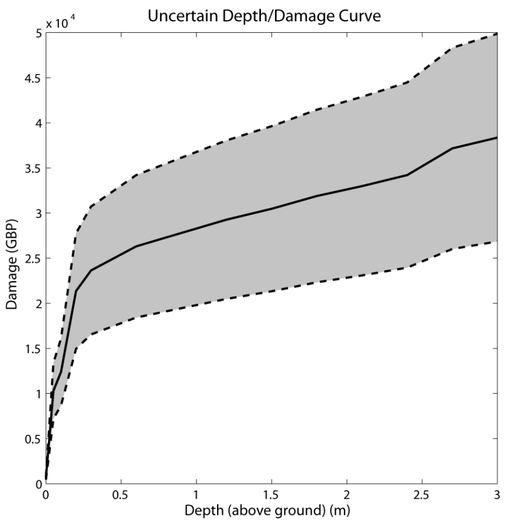


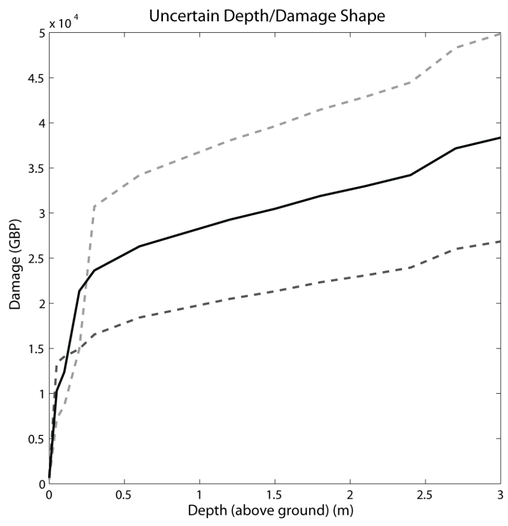
Figure #3: Maximum predicted water depth throughout the simulation at various resolutions for the 1-in-100 year return period flood

Uncertain depth/damage curves

Assumptions:

- flood duration < 12 hours
- maximum depth near building causes damage
- UK 2005 house prices
- 30% uncertainty range from Wind et al. (99)





Uncertain loss estimates

Coarse DTMs provide more consistent estimates of damage than coarse DSMs due to blockage effects but all underpredict.

Research and data effort should be concentrated on improving depth/damage curves rather than model resolution.

The key aspect is to get the **right answers for the right reasons** through correct process representation.