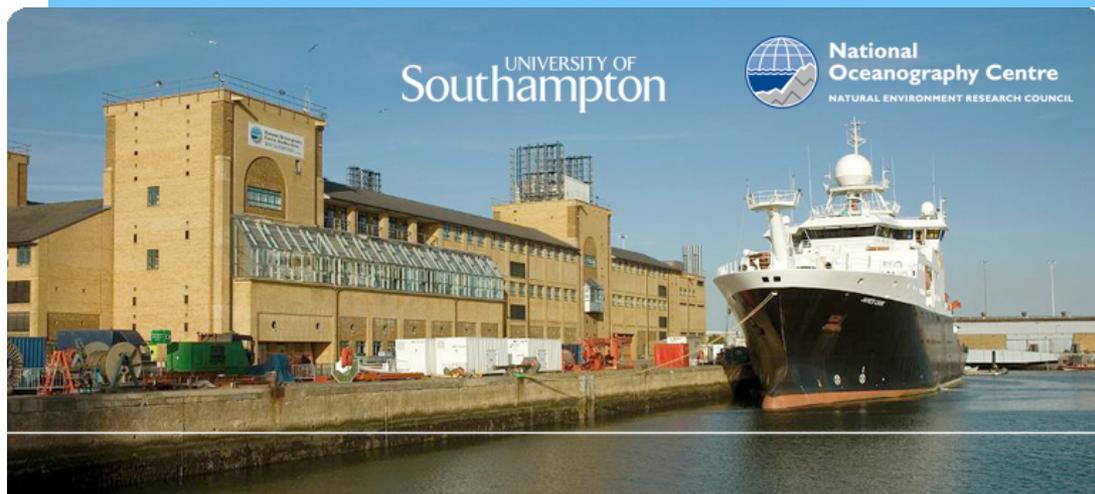


Coastal flooding: research examples from the UK

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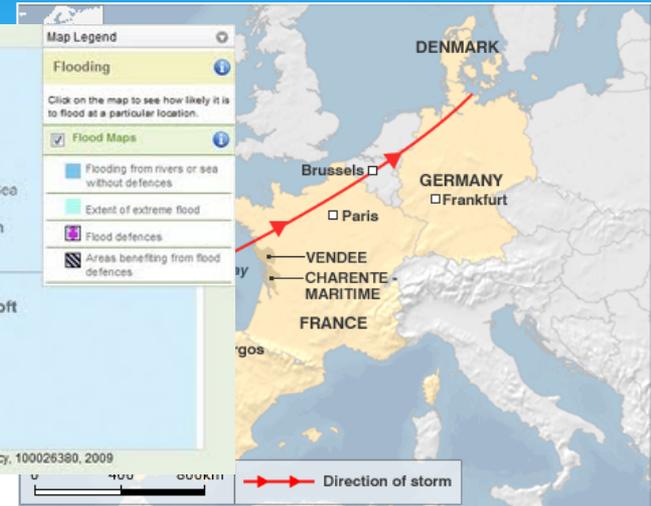
Background: coastal flooding in the UK



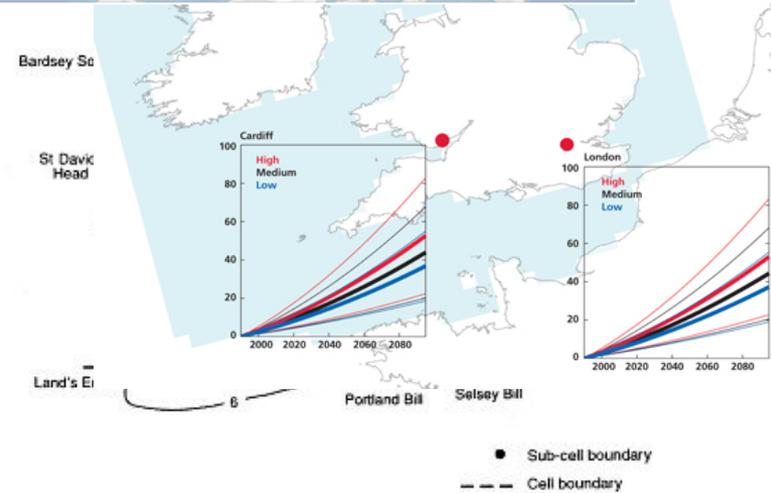
ScreenCast-O-Matic.com



UK coastal flood research & management



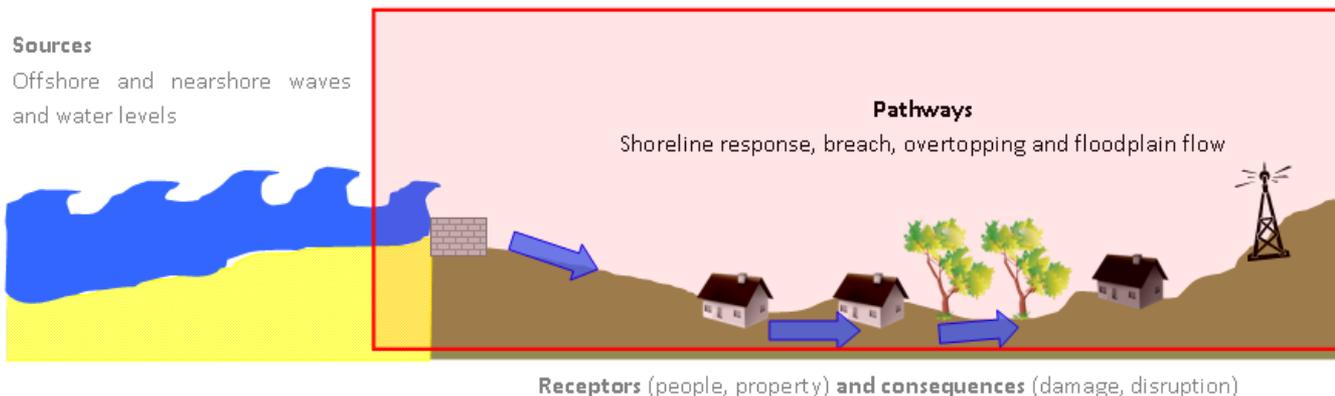
- Some regions very susceptible, adaptation methods needed
- Areas where flooding not well understood
- Existing approaches do not cope with individual events
- 2010: Storm Xynthia (Atlantic France, 60 killed)



Ph.D. research

Aims & objectives

- * Develop a flood simulation method
 - * Defence failures & dynamics of flood events
 - * Practical (fast run-time, easily understood outputs)
- * Apply to a case study
 - * Consequences of coastal flood events not well understood
 - * Validation
 - * Assess detail/resolution



The Solent: a south coast case study

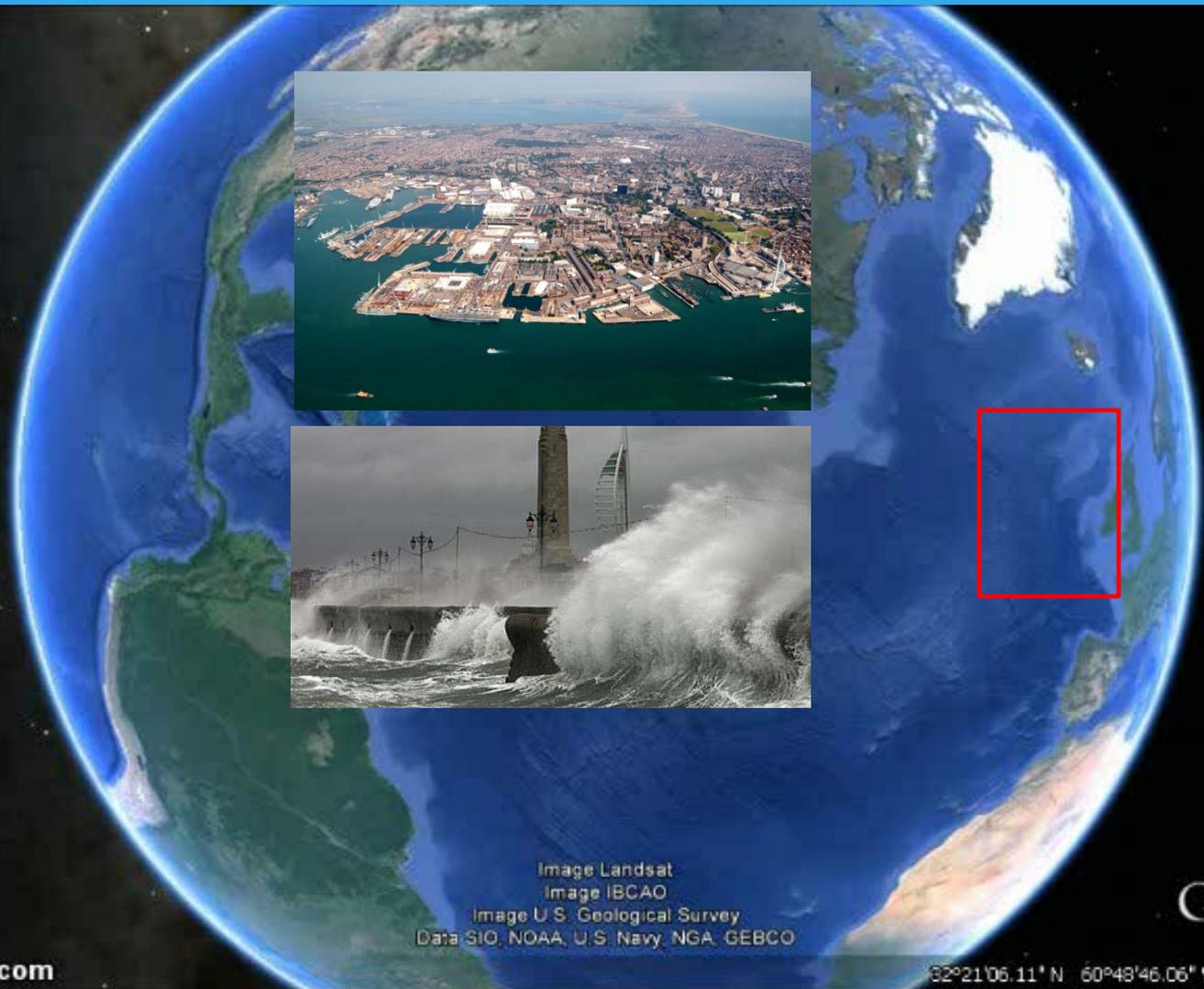
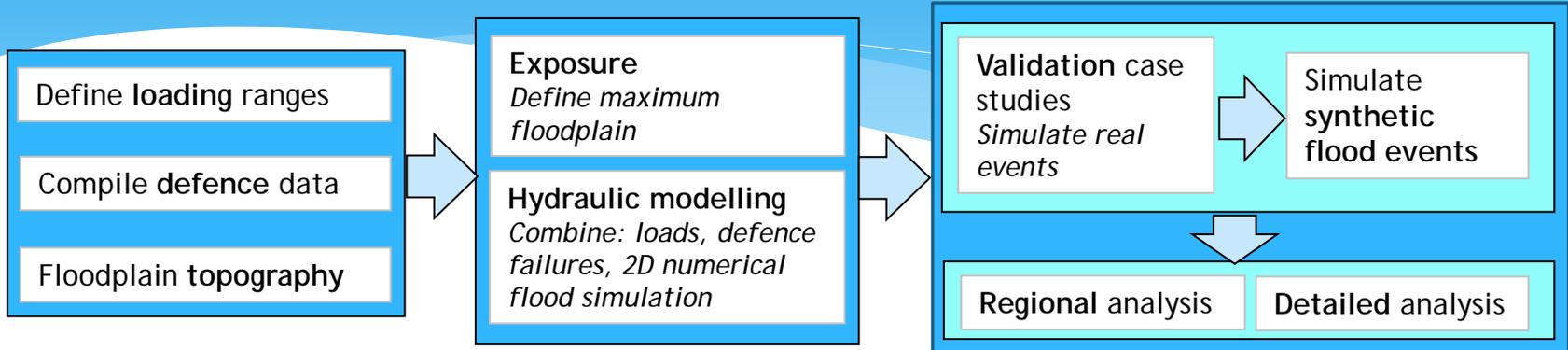


Image Landsat
Image IBCAO
Image U.S. Geological Survey
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

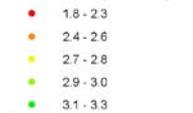
Google earth

32°21'06.11" N 60°48'46.06" W eye alt 11001.00 km

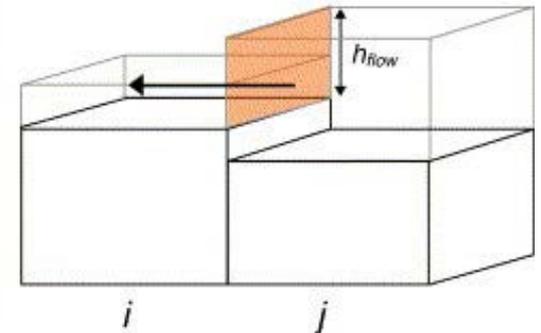
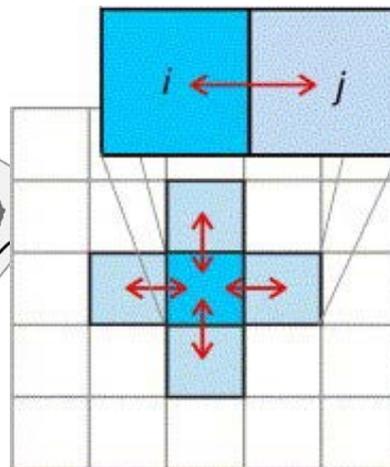
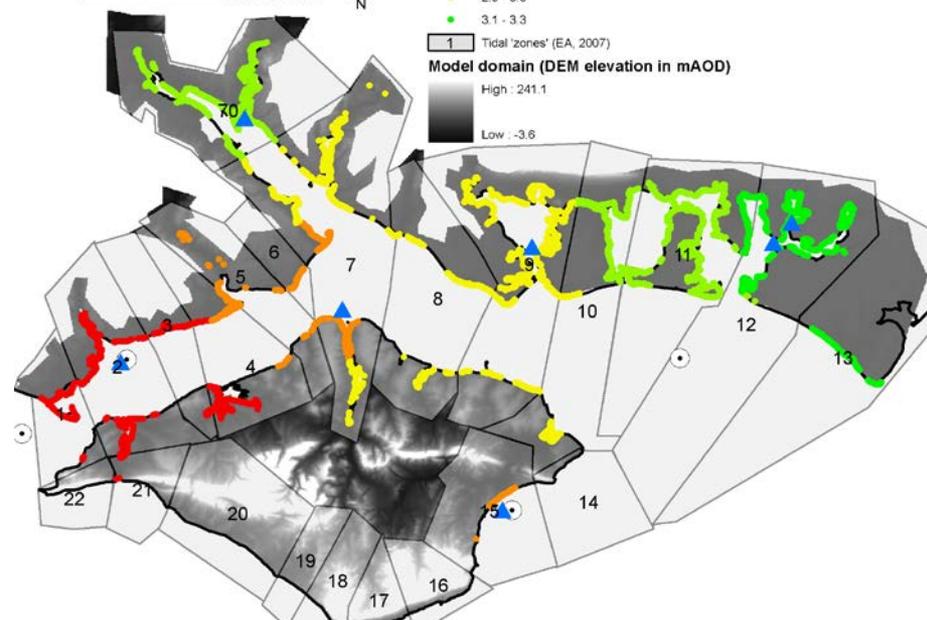
Methodology



Model inflow points & peak SWL for 10 March 2008 flood simulation

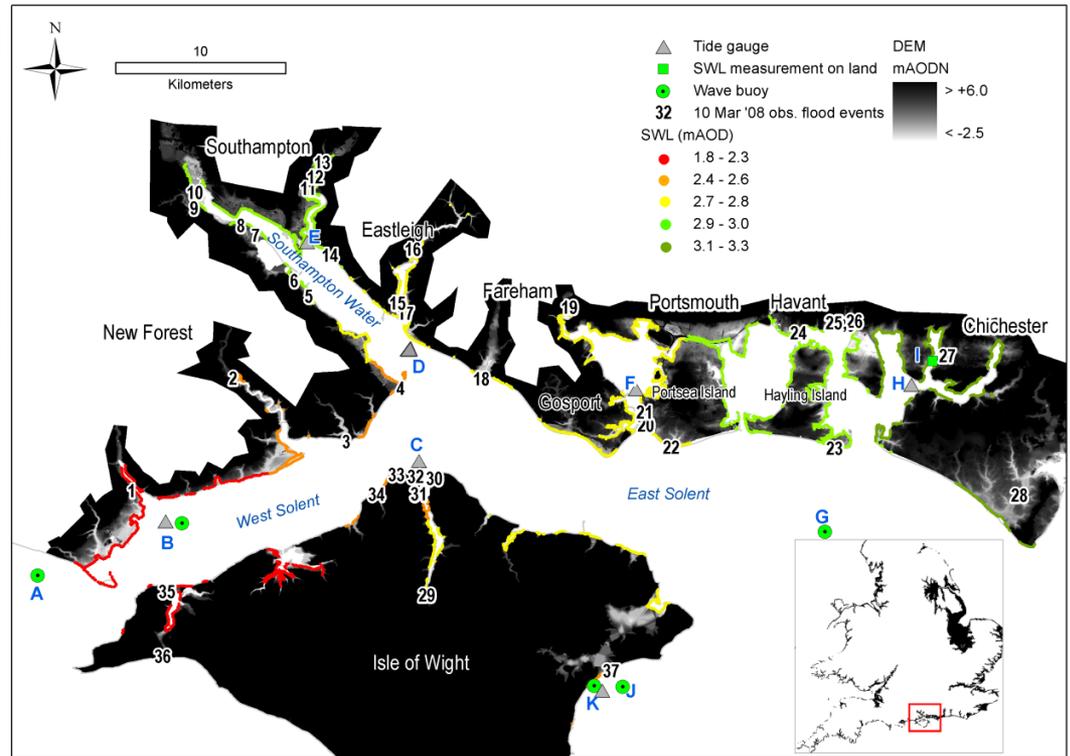
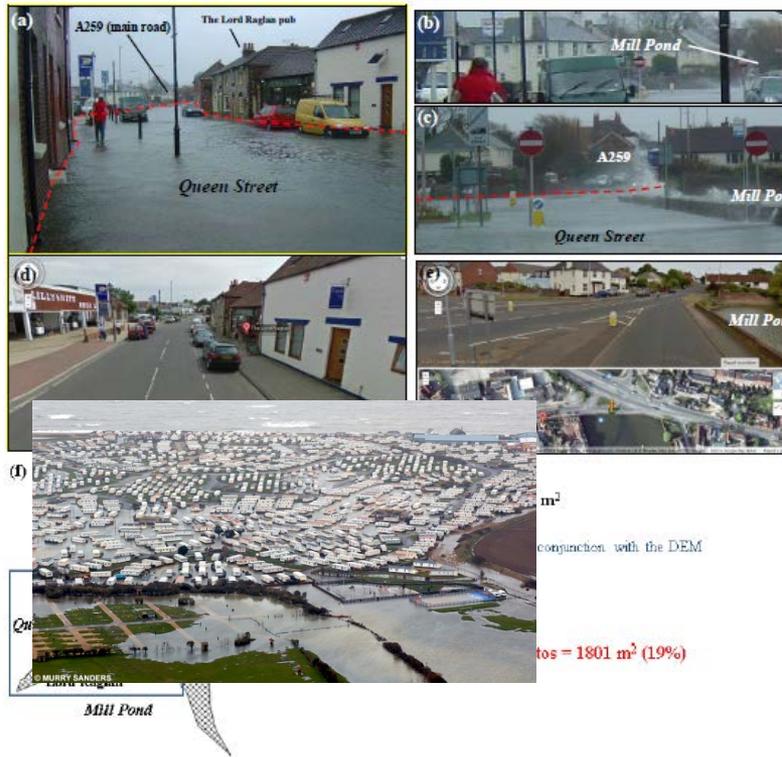


10 Kilometers

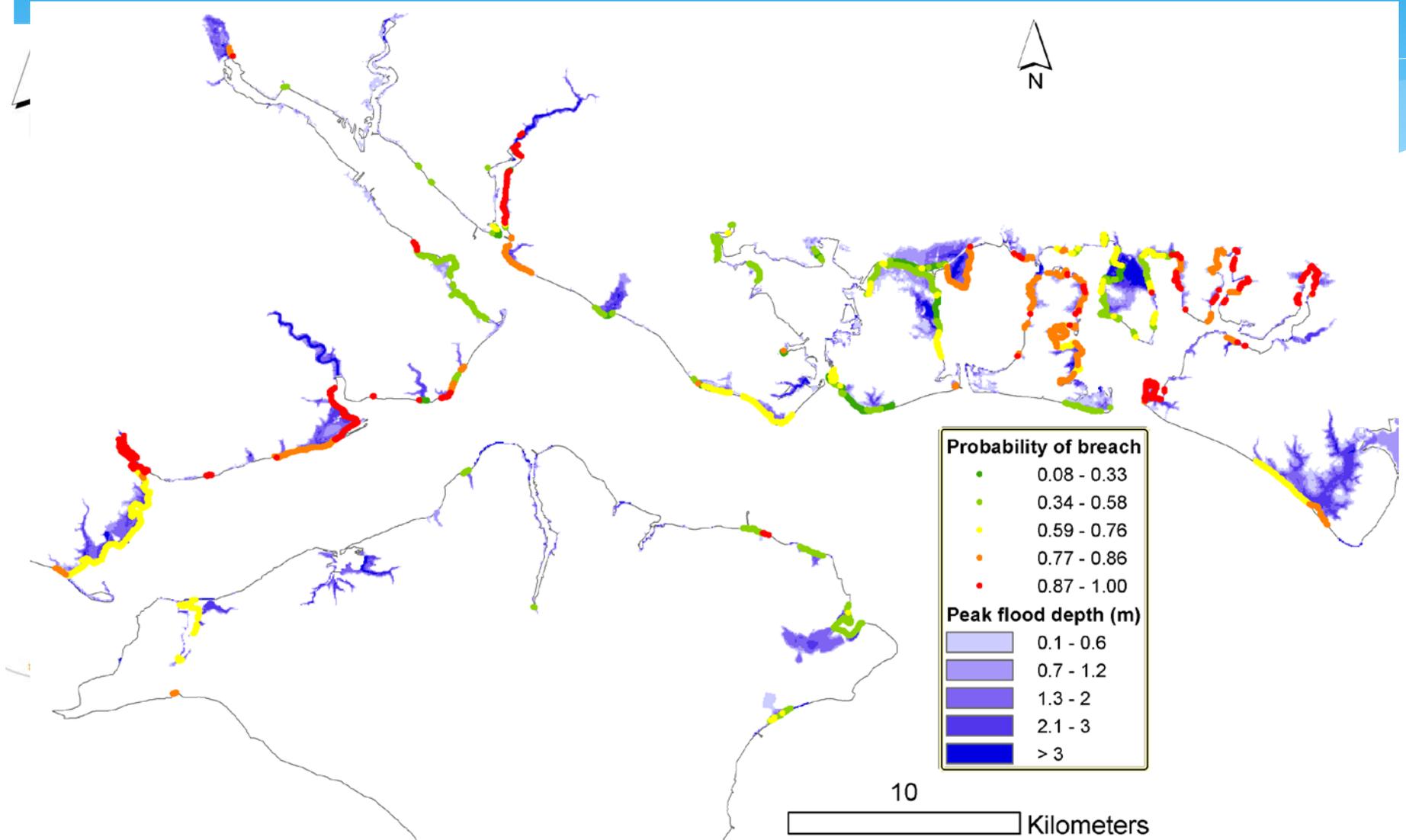


Validation

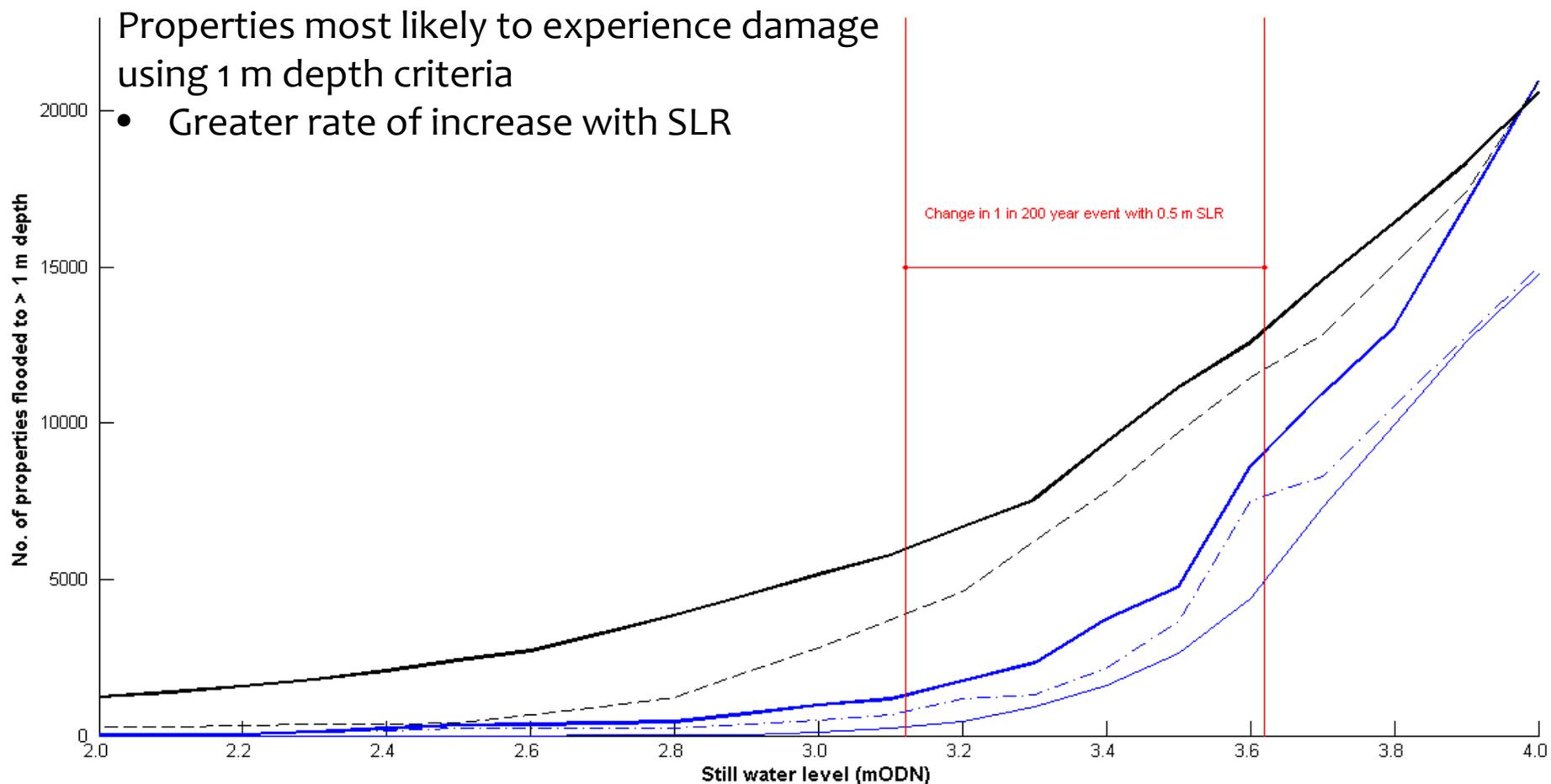
- * Events simulated using historic boundary conditions, defence data etc.
 - * 10 March 2008: regional 1 in 10 - 1 in 50 event - mainly small floods & near misses
- * Photos (>300), media reports etc. observed vs. modelled
- * Good spatial match; verified defence failures, DEM etc.
- * Depth threshold for entry to properties ~0.5 m



Regional-Scale Coastal Flood Modelling



Regional-Scale Coastal Flood Modelling



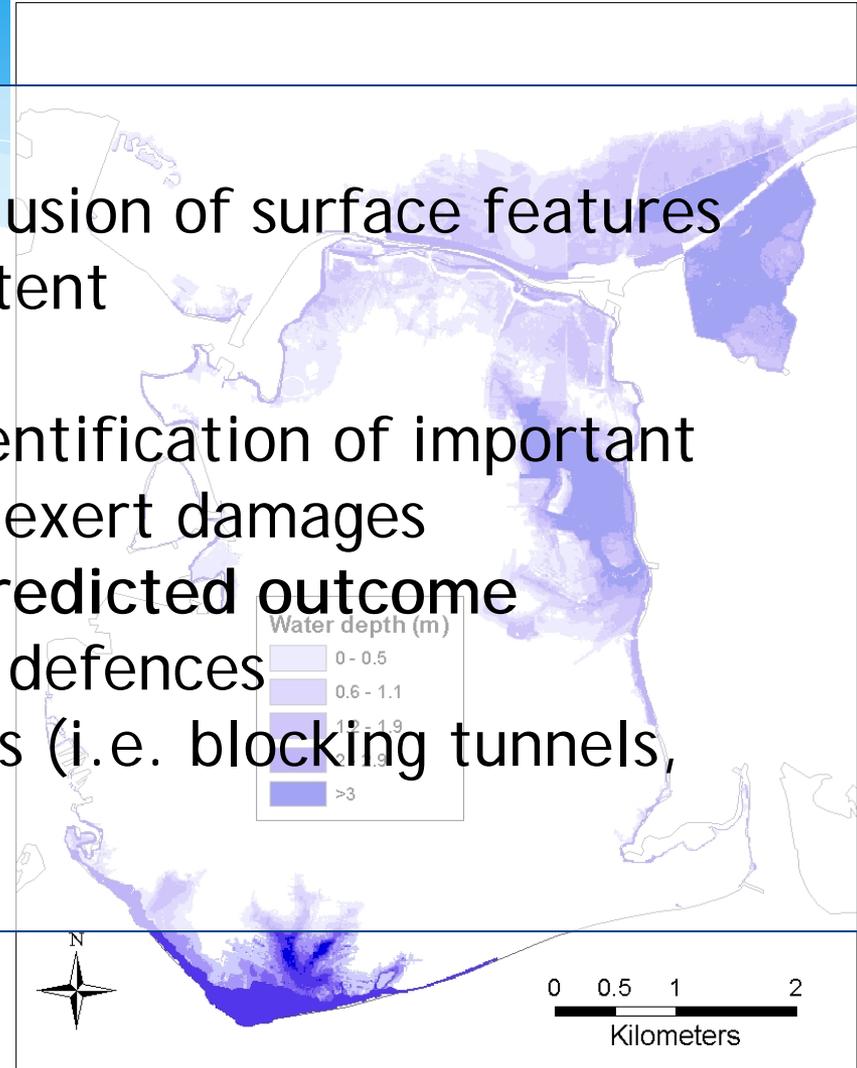
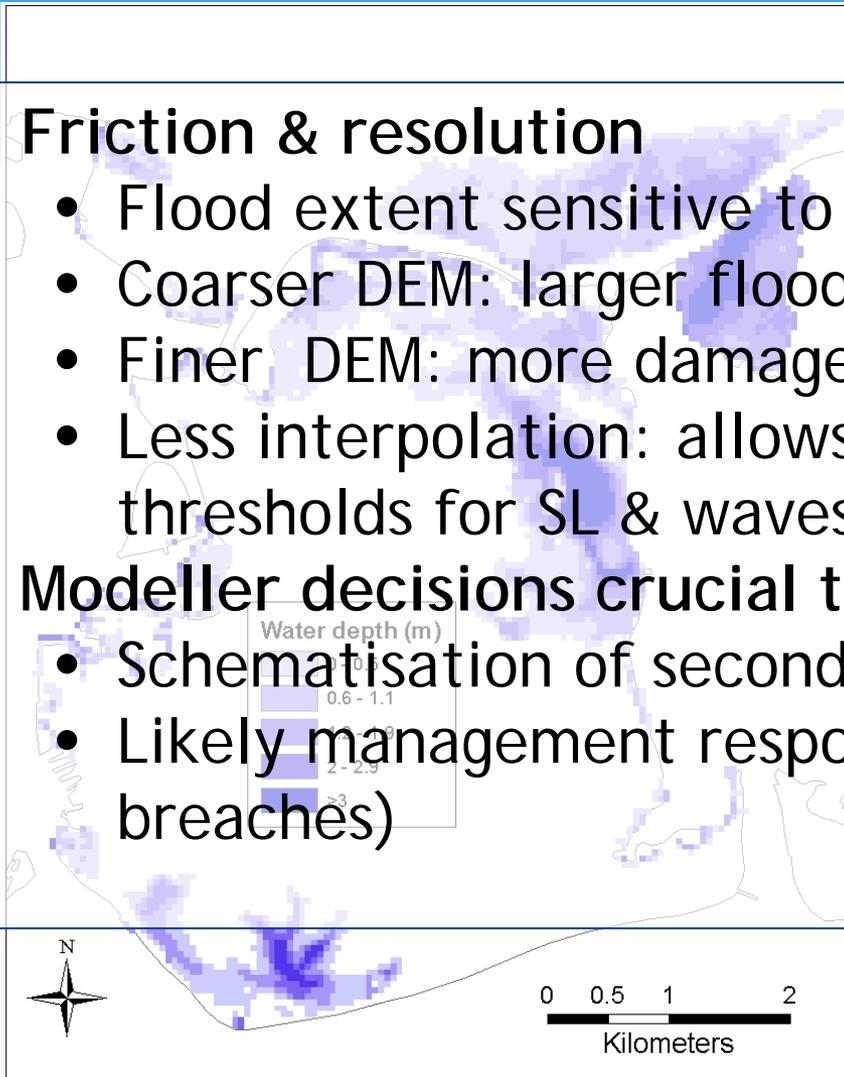
Increased detail – city of Portsmouth

- **Friction & resolution**

- Flood extent sensitive to inclusion of surface features
- Coarser DEM: larger flood extent
- Finer DEM: more damages
- Less interpolation: allows identification of important thresholds for SL & waves to exert damages

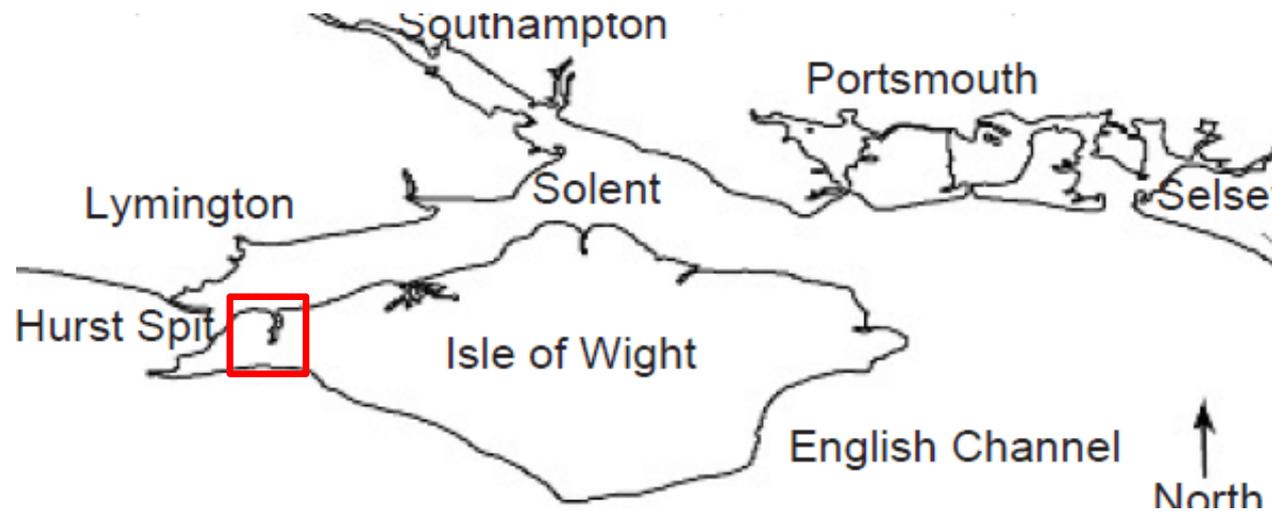
- **Modeller decisions crucial to predicted outcome**

- Schematisation of secondary defences
- Likely management responses (i.e. blocking tunnels, breaches)



Applications – flood visualisations

- CCATCH - project to educate coastal communities about impacts of climate change
- Schools, local residents
- Model simulations applied to visualisations



3D output – ‘flythrough’ visualisation

Discussion – flood event analysis

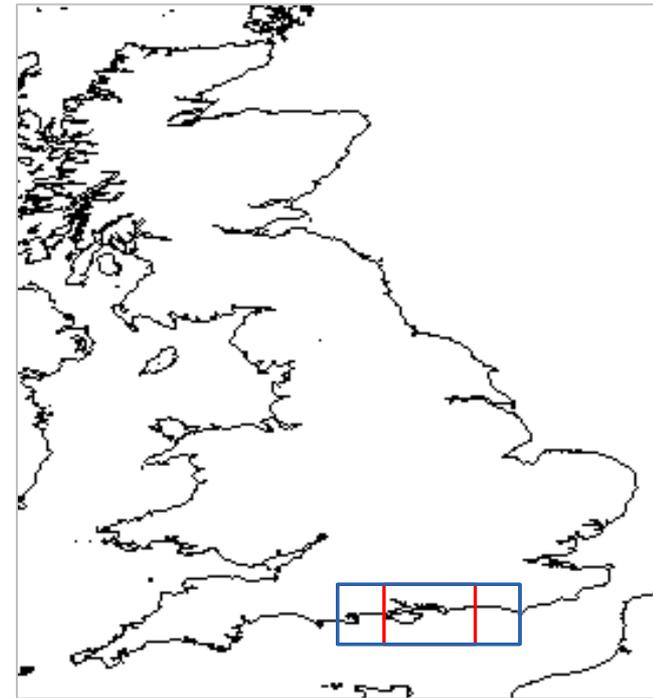
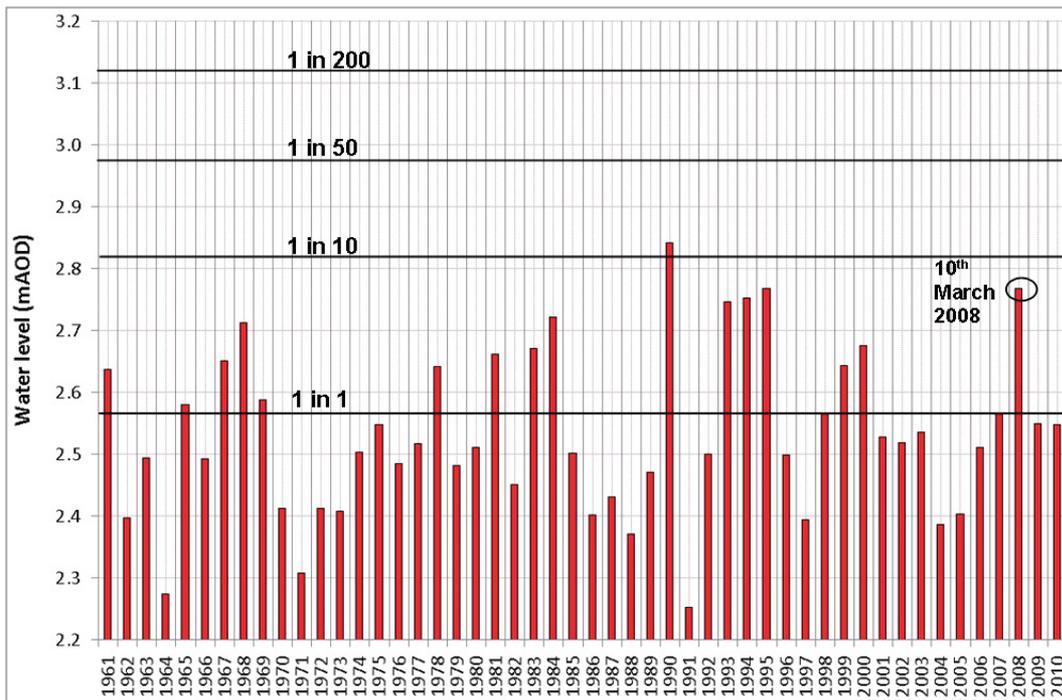
- Simulations suggest 1 in 200 year SL could cause significant damage e.g. 10,237 properties = £1 Bn damages (reduced to £23 Mn at >1m)
- Mid-prob SLR (UKCP09 2050: 18-26 cm south UK):
 - 10 March 2008 becomes 1 in 1 year event
 - or: event with the same probability (~1 in 10) exerts >fourfold increase in impact's (*assuming existing defences maintained, but not upgraded*)

Flood event monitoring is important

- * Needs to be undertaken more systematically
- * Historical perspective on events & planning decisions
- * Helps to understand modelling uncertainties & data gaps
- * Engages public

Future work / applications

- Increase model extent, resolution & analysis of past events
- Improve understanding of flood mechanisms
- Assess health & economic impacts



Conclusions

- * **Validated coastal flood simulation method: improves understanding of coastal flooding**
 - * Defence failures, inundation events, 'forensic' flood event assessment
 - * View consequences across range of loadings & defence responses
 - * Shows flooding as a present-day threat & will grow with SLR
- * **Different adaptation required for the region's two cities**
 - * Southampton - no existing defences
 - * Portsmouth - long defended coastline, landfills, greater hazard
- * **Applications**
 - * Scenario assessment tool - inform adaptation options
 - * Flood forecasting & warning, coastal management
 - * Flexible tool, platform for further research...

Current work – storm & flood clustering

- * **Seriality of storms:** cumulative insurance losses comparable to a catastrophic hurricane

- * 8 storms Dec 1989 - Jan 1990, €10.5 bn

- * 2 storms Christmas 1999, €18.5 bn



Source: Mailier et al, 2006

- * **'Flood MEMORY' Project**

Analyse situations where 2nd flood strikes before defences reinstated / householders & businesses vulnerable ('memory period')



<http://www.kentonline.co.uk/>

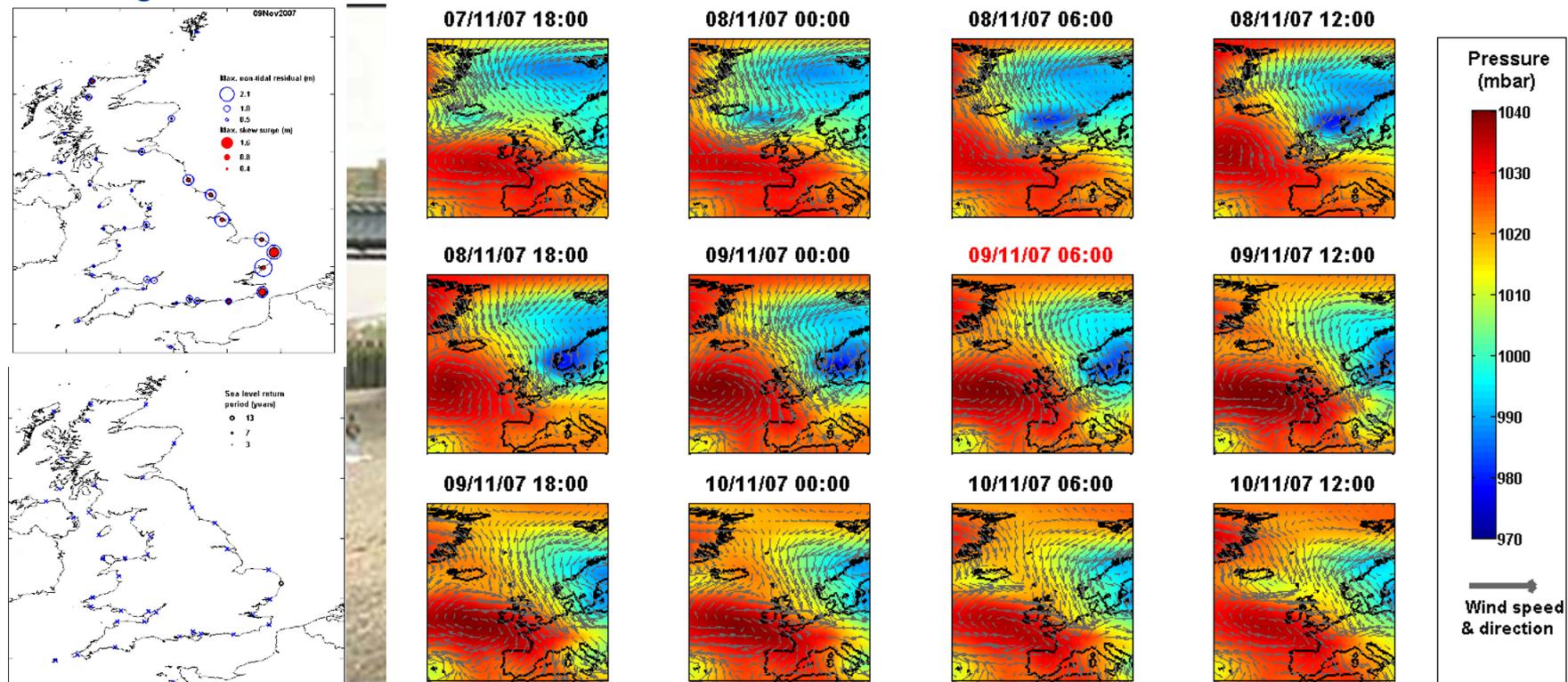
Coastal flooding & extreme sea levels

Usually characterised by return period

- Sea level = tide + surge + MSL
- Applications: e.g. inundation modelling, risk management

But...individual events are complex spatially & temporally

- * Prolonged storms, high tides & smaller successive events important
- * Spatial 'footprint' of surges & extreme sea levels
- * Surge event database & website



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- The University of Newcastle (Coordinator)
- The University of Nottingham
- Queen Mary, University of London
- Swansea University
- Herriot-Watt University
- University of the West of England
- Cranfield University
- National Oceanography Centre / University of Liverpool
- National Oceanography Centre / University of Southampton.

Thanks for listening!
Questions?

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