

Groundwater flood prediction



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Key questions

- What geological and hydrogeological conditions make an area susceptible to groundwater flooding?
- Will the extreme rainfall events of the summer of 2007 cause groundwater flooding in 2008?

Groundwater floods

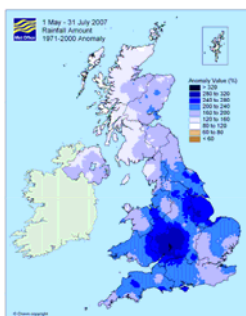
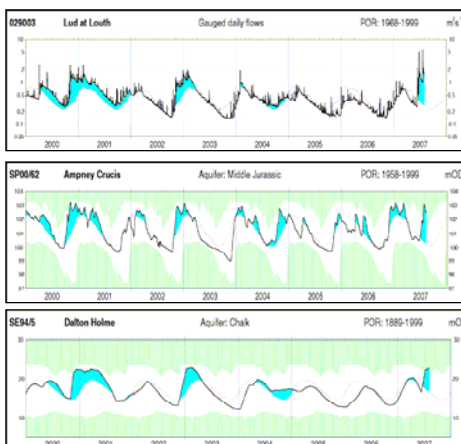
Groundwater flooding received relatively little attention in the UK until the winter of 2000/2001 when exceptional autumn and winter rainfall in the South East resulted in prolonged flooding and significant costs, both in disruption and restoration of infrastructure and buildings.

Since 2001 we have developed a better understanding of the mechanisms controlling groundwater floods, and of their spatial distribution through research funded by NERC, EA and the EU

By compiling existing geological and hydrogeological data into a single database, and applying a conceptual model for groundwater flood occurrence a national map of flood susceptibility has been developed that is already used by property developers and the insurance industry.

Rainfall - Summer 2007

In the summer of 2007, there were unprecedented May-July rainfall totals across much of southern Britain. The heavy storms in June and July resulted in significant recharge occurring in many areas. Groundwater levels responded to this recharge so that, in the Cotswolds and parts of the Chalk in Yorkshire and Lincolnshire, previous summer groundwater levels were exceeded. In the southern outcrop of the Chalk, the response in the water table was more subdued but rises were observed at a number of sites. Complementary evidence is provided by the increased flow in streams and rivers sustained primarily by outflows from springs and rivers.

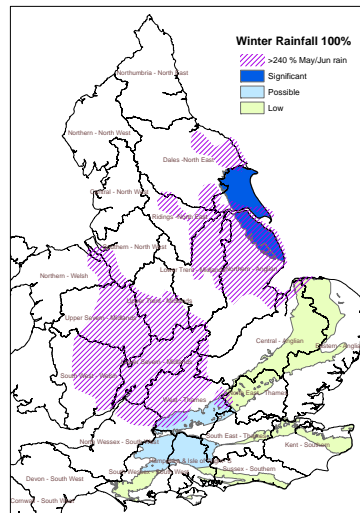


The rainfall anomaly (1971-2000) for 1 May - 31 July 2007 over the UK (reproduced courtesy of the Met. Office)

Predictions

Using data gathered by NERC alongside Met Office and EA monitoring data a prediction has been made of the probability of groundwater flooding in 2008 as a result of the intense summer rainfall.

- Long term monitoring data held by the National Water Archive give a hydrological context to the event.
- Soil moisture data and rainfall data are used to calculate the likely recharge, groundwater level monitoring showed the extent of rapid response in levels.
- As winter rainfall is the key controlling factor in flooding, long term catchment rainfall records were used to model three scenarios, a wet, average and a dry winter.



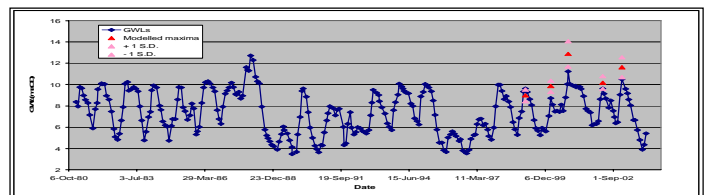
• The response of key indicator wells to similar winter rainfall episodes in the historic record was used to predict likely winter/spring levels, which were then compared to those from previous groundwater floods.

• Because groundwater responses are lagged with respect to rainfall, it's probably too early for a definitive forecast. - a review is under way using the latest water level observations

Future work

The challenge of accurate prediction is to establish robust but cost effective predictors.

A range of approaches to predicting groundwater levels are being trialed, ranging from the purely statistical, through neural networks to process based groundwater models.



Regression model prediction of groundwater maxima at St Peter's Church, Brighton

Future work is likely to concentrate on linking predictive models to telemetered water level data for near real time prediction in urban areas, and linking predictive models with climate change impact scenarios.

Find out more...

J. Finch, T. Marsh, A. McKenzie) A preliminary risk assessment of the potential for groundwater flooding during the winter of 2007/8, CEH Internal Report, August 2007

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