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Floods and Flooding

Flooding

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Biography Chris Collier >> [1]

Flooding is the result of different processes, and therefore its impact is manifest in different ways. When the water table reaches the surface *groundwater* flooding may occur. However, the most familiar type of flooding occurs when there is too much water in a river such that it cannot be constrained within the river channel overwhelming defence structures. The result may cause severe damage to properties and endanger life. This is *fluvial flooding*, and the inundation may be very rapid over less than an hour if the river catchment is steep in which case this is referred to as *flash flooding*, or take place in large rivers slowly over many hours, but over large areas. Should a dam retaining a reservoir bursts the floods may develop very rapidly and cause great devastation.

Drainage systems in urban areas may pose significant problems in heavy rainfall situations. Some systems combine rainwater with wastewater including sewerage, and consequently when the water courses and drains are inadequate to cope with flows the resultant floods may not just endanger property and life, but also pose a health risk. Even when heavy rain is

separated from wastewater *urban floods* may cause significant damage. When the runoff from intense rainfall cannot drain away quickly enough through drainage systems or urban rivers, it may flow over the surface causing floods in areas not previously associated with flood events. This is referred to as *pluvial flooding*.

Arguably the flood events which have the largest potential for impacting people's lives is *coastal flooding* brought about by storm surges caused by high tides driven by winds from major weather events. Under water geological events may also result in enormous waves breaking on coastal areas known as tsunamis, such as that which occurred in the Indian Ocean on 26 December 2004 which resulted in the deaths of 275,000 people, and in north east Japan on 2 March 2011 in which 15,870 people were killed and the Fuhushima Daii nuclear power plant complex was severely damaged.

Flooding events occur worldwide occur worldwide on scales ranging from small steep rural catchments (e.g. Boscastle, UK area 20 km2, 16 August 2004) sometimes causing landslides (e.g. the Philippines 2012) to very large catchments associated with major rivers (e.g. Bangladesh affecting 75% of the total area of the country about 82,000 km2).

Forecasting the occurrence of flooding is a major scientific challenge involving numerical modelling of hydrological processes, or, in the case of large rivers, routing flood waves downstream. The impact of the type of weather events which may lead to flooding depends upon the intensity of the rainfall, the duration of the event and the catchment morphology (steepness and the type of surface i.e. concrete, vegetation etc).

Numerical lumped conceptual models in which a few parameters are related to catchment properties using regression or transfer function techniques may be developed. Whilst such approaches often provide a basis for practical forecasting techniques, they may not produce reliable results all the time. An alternative approach is the use of distributed formulations using spatial data sets such as terrain, soils, land cover and geology, and particularly rainfall derived from raingauge networks or weather radar.Such physically-based approaches may not produce more reliable forecasts than lumped models, although recent advances in distributed models employ runoff production schemes operating in individual grid squares producing runoffs which are routed from grid-to-grid squares are showing great promise. Indeed the UK Natural Environment Research Council (NERC) Centre for Ecology and Hydrology grid-to-grid model (Moore et al., 2012) forms the basis of nation-wide operational flood forecasts in the UK.

Reference

Moore, R. J., Cole, S. J. and Robson, A. J. (2012) "Weather radar and hydrology: a UK operational perspective", In Weather Radar and Hydrology (Proceedings of a symposium held at Exeter, UK, April 2011), *IAHS Publ*. *351*, 429-434

Image at the top of the page shows Boscastle in 2004 and above, shows the River Ouse in 2012

Links
[1] https://www.accsys.rmets.org/weather-and-climate/floods-and-flooding/professor-chris-collier