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Regional aspects of groundwater flooding in Chalk catchments

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Groundwater flooding can cause significant social and economic disruption and is a threat in many parts of NW Europe. For example, in the first assessment of its kind in England and Wales, Jacobs (2004) estimated that 380,000 properties are located on the most vulnerable formations, the exposed Chalk of southern England. However, to date, little attention has been given to groundwater flooding compared with surface water (fluvial) flooding.

The Chalk system is complex: the unsaturated zone of the Chalk drains slowly, acting as a leaky reservoir and contributing to recharge to the water table after recharge at the surface has stopped. During dry periods, a deficit builds up which then has to be satisfied before drainage can start through whole profile again. During wet periods, the unsaturated zone is very close to saturation, and additional input can result in a very rapid rise in the water table. Groundwater flooding typically follows intense rainfall events, but usually only when groundwater levels are above average levels. It may take two or three winters of above average rainfall for regional groundwater levels to reach these relatively high levels but it then requires a trigger event of intense rainfall to cause groundwater flooding

However, the importance of antecedent conditions appears to be different in different areas. Long-term (greater than a year) autocorrelation in Chalk groundwater levels has been noted in some regions of the Chalk, whereas water levels in other areas show a shorter-term autocorrelation. This is supported by observations of the length of groundwater flooding in different areas: in Brighton, flooding lasted for a few weeks, whereas the Hallue area of France had problems for several months. Initial results suggest that “flashy” catchments may maintain higher matric potentials at depth, and

thus be able to respond more rapidly to recharge at the surface when it occurs.

This paper aims to: Ţ describe autocorrelation and cross-correlations between rainfall and groundwater levels in three contrasting Chalk catchments, the Pang-Lambourn, the Brighton Block and the Allue in the Somme (France), to provide insights into the timing and nature of groundwater flooding events Ţ explore characteristics of the catchments, including rock mass properties, to provide an explanation for the regional variations that have been observed.