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# Interactions between sub grid-scale resolution, feature representation and grid-scale resolution in flood inundation modelling

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Numerical modelling of flood inundation over large and complex floodplains often requires mesh resolutions coarser than the structural features (e.g. buildings) that are known to influence the inundation process. Recent research has shown that this mismatch is not well represented by conventional roughness treatments but that finer scale features can be represented through porosity-based sub grid scale treatments. This paper develops this work by testing the interactions between feature representation, sub grid scale resolution and mesh resolution. It uses as the basis for this testing a 2D diffusion-based flood inundation model which is applied to a 2004 flood event in a topologically-complex upland floodplain in northern England. This application demonstrates the effects of topographically significant structural features on flood inundation at local scale and the importance of retaining these features in the model to account for their effects. Results showed serious degradation of model predictions without explicit representation of features like walls. Inclusion of such features through raising mesh cell elevations where intersected by a feature resulted in a major improvement in model predictions in terms of reduced inundation extent. To make such treatments physically realistic, and notably so that the full potential for floodplain storage is included, it was shown that a sub grid scale treatment also needed to be included. The effects of this combined treatment was the recovery of more plausible floodplain friction values as well as a sensitivity to friction that allows for more effective representation of floodplain friction effects such as vegetation.