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Why do Atmospheric Rivers cause Different Floods?

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Atmospheric Rivers (ARs) are one of the main mechanisms of water vapour transport outside of the tropics. Defined as a region of strong horizontal water vapour flux typically located just ahead of the cold front of an extratropical cyclone, they can result in large quantities of precipitation when forced upward, for example by mountains or ascent in the Warm Conveyor Belt. Previous work has investigated the relationship between ARs and significant winter floods across a series of British river basins over the period 1979-2010, finding that between 40-80% of all landfalling AR events were followed by a subsequent flooding event. Two Welsh catchments $\sim$70 km apart demonstrated the strongest and weakest correlations respectively; a surprising result given the typical width of ARs to be on the order of 500 km. In this work we have used newly-available high resolution datasets to link the arrival of large-scale atmospheric features (in the form of ARs) to local hydrological observations. This has allowed us to analyse the driving processes behind the AR-flood correspondence at these two catchments. We believe we have identified initial evidence of a preferential orientation of landfalling ARs upon each catchment that generate the most significant response. Future work includes extending our analysis to nearby catchments as well as working on methods to increase the resilience, and ultimately effectiveness, of the chosen AR-detection algorithm when applied to such high-resolution datasets. In combination these ideas will hopefully increase our understanding of the extent to which ARs are responsible for winter flooding events across the UK as well as increase our possible flood forecasting potential.