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Statistical modelling of extreme temperatures on the Greenland Ice Sheet

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The Greenland ice sheet has experienced significant melt over the past 6 decades, with extreme melt events covering large areas of the ice sheet. Melt events are typically analysed using summary statistics, but the nature and characteristics of the events themselves are less frequently analysed. Our work aims to examine melt events from a statistical perspective by modelling 20 years of MODIS surface temperature data with a Spatial Conditional Extremes model. We use a Gaussian mixture model for the distribution of temperatures at each location with separate model components for ice and meltwater temperatures. This is used as a marginal model in the full spatial model and gives a more location-specific threshold to define melt at each location. The fitted model allows us to simulate melt events given that we observe an extreme temperature at a particular location, allowing us to analyse the size and magnitude of melt events across the ice sheet.