Cartograms for use in forecasting weather driven natural hazards

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This study evaluates the potential of using cartograms to visualise, and aid interpretation of, forecasts of weather driven natural hazards in the context of global weather forecasting and early warning systems. The use of cartograms is intended to supplement traditional cartographic representations of the hazards in order to highlight the severity of an upcoming event. Cartogrammetric transformations are applied to forecasts of floods, heatwaves, windstorms and snowstorms taken from the European Centre for Medium-range Weather Forecasts (ECMWF) forecast archive. Key cartogram design principles of importance in standard weather forecast visualisation are tested in terms of the tasks needed to visualise and interpret the forecast maps. These design principles include the influence of spatial autocorrelation of the variable mapped, the minimum and maximum values of a variable, the value of the sea, the addition of geographic features and the geographic extent used. Results show that the utility of the cartograms is dependent on these design principles, but the optimal cartogram transformation is dependent on geographical features (such as coastlines) and forecast features (such as snowstorm intensity). The importance of forecaster familiarisation training is highlighted. It was found in particular that for highly spatially autocorrelated weather variables used in analysing several upcoming natural hazards such as 2m temperature anomaly, the visualisation of the distortion provides a promising addition to standard forecast visualisations for highlighting upcoming weather driven natural hazards.