Mapping Return Values of Extreme Wind Gusts

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Abstract
Buildings, especially tall ones, are subjected to wind stresses. In particular, high velocity gusts can impart a large amount of stress. Thus, a building’s design must take into account the wind velocities it must endure. A particular quantity of interest to engineers is the estimated n-year return value for an extreme wind gust at the necessary geographical coordinate. A two-stage approach to creating maps of n-year return values is considered in this talk. The available data are a single irregular time series of wind velocities at multiple wind reporting stations spread throughout the contiguous United States. The first stage of the analysis involves estimation of the n-year return value at each station using a non-homogeneous Poisson process. In the second stage, local regression based on the estimated n-year return values at the stations is used to create an interpolant so that the n-year return value may be estimated at a geographic coordinate of interest. Standard errors and confidence bounds for the estimates are calculated using a non-parametric bootstrap algorithm. Results are presented for a region within Kansas.

Keywords: n-year return value; Irregular time series; Non-homogeneous Poisson process; Local regression; Non-parametric bootstrap.

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