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Vorticity and geopotential height extreme values in ERA-Interim data during boreal winters

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The properties and dependences of lower tropospheric geopotential height (GPH) and relative vorticity extreme values are investigated in high spatial resolution ERA-Interim reanalysis data during the boreal winters from 1980–2014. A peak-over-threshold (POT) analysis is applied to determine the local generalized Pareto distribution (GPD) parameters with a 90th percentile threshold. In Northern Hemispheric storm tracks, the scale parameter decreases along the storm track axis for vorticity, whereas it increases for GPH. The shape parameters are weakly negative for both fields in the northern midlatitudes and over land, suggesting upper bounds for the extremes. The association of GPD parameters with the large-scale flow is assessed using monthly mean indices for the North Atlantic Oscillation (NAO), Pacific–North American (PNA) pattern and El Nino Southern Oscillation (Nino3.4 index) as covariates. While the GPH parameters are related to the covariates in the regions associated with the covariate loadings, the vorticity parameters are weakly related to all covariates. It is noteworthy that the NAO dominates all covariates in the central tropical Pacific. The probability for concurrent extreme events of vorticity and GPH is highest in storm tracks with values of about 0.3–0.5.