

On air pressure and past storm activity - an assessment of the informational value of proxies for past storm activity

Oliver Krueger[†]; Hans von Storch

[†] Helmholtz-Zentrum Geesthacht, Germany

Leading author: oliver.krueger@hzg.de

Air pressure readings and their variations are commonly used to make inferences about storm activity. More precisely, it is assumed that the variation of annual and seasonal statistics of several pressure based proxies describes changes in the past storm climate qualitatively - an assumption that has yet to be proven. We present a systematic evaluation of the informational content of two classes of pressure-based proxies for storm activity. Firstly, we concentrate on the assessment of four proxies for storm activity that usually base on single-station observations of air pressure. We examine the annual (seasonal) number of deep lows, annual (seasonal) lower percentiles of pressure, the annual (seasonal) frequency of pressure tendencies above certain thresholds, as well as annual (seasonal) high percentiles of pressure tendencies. Secondly, we evaluate the informational content of the annual and seasonal variation of the statistics of geostrophic wind speeds that base on pressure readings from multiple stations. In this case pressure readings from three stations that form a triangle are used to derive statistics of geostrophic wind speeds. We gauge the proxies against annual (seasonal) 95th and 99th percentile time series of ground level wind speeds to quantify the relation between pressure based proxies and storminess. For that reason, we use the correlation as a measure of the informational content of the proxies. Moreover, we explore to what extent the proxy configuration and certain choices in the proxy definition affect the informational value. The analyses rely on bootstrap and binomial hypothesis testing, as well as on analysis of variance. Such an evaluation needs long and homogeneous records of wind speed. Something that is not available from observations. Consequently, we examine the proxies by using datasets of ground level wind speeds and air pressure from the NCEP-driven and spectrally nudged regional model REMO. Results from analyses of the multiple-station based proxy show that statistics of geostrophic wind speeds are a valuable proxy for describing past storm activity. On the contrary, results from analyses of single-station based proxies suggest that the informational value of the statistics of such proxies is inferior compared with the informational value of multi-station based proxies.