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Development of a Distribution-Independent Storm Severity Index (DISSI)

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Wind Storms are among the most dangerous natural hazards on the planet, causing very large socio-economic losses every year. These losses, i.e. the severity of the storm, however are not solely dependent on the wind speed. Duration and size of a storm event are the leading factors in connection with observed losses. The Storm Severity Index (SSI) introduced by Leckebusch et al. (2008) represents an important quantification of the severity of a storm event, as it takes into account both the complete lifetime and the entire affected area of a storm.

This study, however, shows that the values of the SSI are dependent on the location where they were calculated. More specifically this means that the SSI is dependent on the tail of the wind speed distribution at a given site. This leads to a systematic overestimation of SSI values in regions with little storm activity, thus outside the main storm tracks. Consequently, this entails to a latitudinal dependency of the SSI. The goal of this study is to create an index that is independent of the wind speed distribution. This means that wind speeds of the same extremeness, e.g. wind speeds at the 99th percentile, are assigned the same severity value. Due to the fact that the index is independent of the distribution it is named Distribution-Independent Storm Severity Index (DISSI).

The DISSI is created with the help of the Extreme Value Theory (EVT). Wind speed exceedances of a high threshold (e.g. 98th percentile) are modeled using a Generalized Pareto Distribution (GPD). Subsequently these modeled values are transformed into an exponential distribution using an equiprobability transformation. The DISSI avoids the overestimation in areas with little storm activity: Every percentile is assigned the same value. Thus, the DISSI is more comparable when assessing the severity of storms, especially when comparing storms in different latitudes.