Meteorological observations of signal stations - a data source for the analysis of extreme weather events?

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1. Signal Stations of the Naval Observatory Hamburg

The so called signal (or gale warning) stations were established at the coasts of the southern Baltic Sea to submit gale warnings of the German Naval Observatory (Deutsche Seewarte) Hamburg to sailors (Fig. 1).

Figure 1. Signal station in Leba (Poland). Optical signals are balloons, triangles, cylinders and flags (source: DWD, archive of the German Naval Observatory Hamburg).

The position of these stations ranged at the German Bight from Borkum to Sylt and at the southern Baltic Sea from Aarosund (Denmark) to Parlanga (Lithuania). Fig. 2 shows the positions of all 164 signal stations in the period from 1877 to 1999.

Figure 2. Positions of the 164 signal stations along the coasts of the North Sea and Baltic Sea (1877-1999).

Sub daily observations of wind force, wind direction and sea level pressure were collected at the signal stations to verify the warnings. About 800 handwritten journals, spanning a 123 years period, starting in 1877 and ending in 1999 are in the process of digitizing by Deutscher Wetterdienst Hamburg.

2. Case study storm surge 1913

Can the data provide a benefit for climate monitoring and climate research? First analyses show, that the wind observations are spatially homogeneous for case studies, e.g. of extreme events.

The storm surge at the end of 1913 caused serious damage of landscape and infrastructure in the region Rügen/Usedom (von Storch et al. 2014). This storm surge went along with the highest water level in this region, which was topped only by the storm surges in 1872 and 1904 (Rosenhagen and Bork 2009). The number of available data from weather stations increases by a factor of nearly 10, using the newly digitized data of the signal stations (Fig. 3).

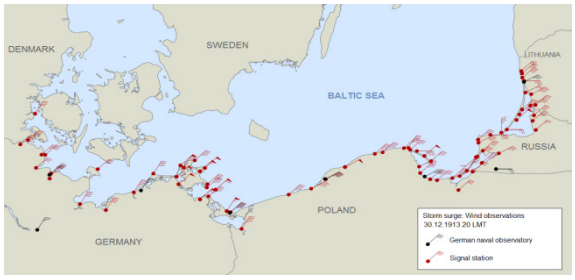

Figure 3. Wind direction and wind force at 30th December 1913. Black: 8 stations from daily weather report of Kaiserliche Marine – Deutsche Seewarte 1913, Red: 74 newly digitized data of signal stations of Deutsche Seewarte (data: DWD).

The data of the signal stations provide a further benefit. In case of a gale warning of the German Naval Observatory the temporal frequency of observations was increased, up to 10 additionally observations were made on stormy days.

3. Conclusions

The wind observations of the signal stations are spatially homogeneous for case studies, e.g. of extreme events. For long-term analyses of changes in wind force or geostrophic wind a homogenization of the time series is needed.

References

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