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Newly Digitized Historical Climate Data of the German Bight and the southern Baltic Sea Coasts

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The detection of historical climate information plays an important role with regard to the discussion on climate change, particularly on storminess. The German Meteorological Service (DWD) houses huge archives of historical handwritten journals of weather observations. A considerable number of original observation sheets exists which has been until recently almost unnoticed. These stations are called signal stations and are positioned close to the shore.

Data description

Meteorological observation data of about 160 signal stations exist from 1877 to 1999 (Fig.1). The number of the signal stations changed throughout the years. Between 1910 and 1940 is the maximum with more than 90 stations. Data of five stations exist for about 100 years. The report time of the meteorological data are 8, 14, 20 local mean time (LMT), see Tab.1. In stormy days, observation frequencies were often increased.

***Fig. 1**: Positions of the signal stations with weather observations in the time period from 1877 to 1999 of the Naval Observatory Hamburg.*

***Tab. 1**: List of available variables from signal station observations with units in varying time periods.*

	SLP	Wind direction	Wind force	Weather condition	Sea disturbance	Visibility	Precipitation height	Weather trend
Unit	mmHg	8-16 sections	Beaufort	0-9	0-9	0-9	mm	Significant events
Report Time LMT	8	8, 14, 20	8, 14, 20	8, 14, 20	8, 14, 20		8, 20; (24h)	
Time period	1877-1939	1877-1999	1877-1999	1877-1999	1877-1938	1838-1999	1877-1938	1877-1999

Data quality

The meteorological observation data of 15 Stations along the German Bight (three stations) and the southern Baltic Sea Coast from Emden (GER) to Leba (POL) are digitized and analyzed from 1877 to 1939 with a gap from 1887 to 1902. In regard to the evaluation of storm surges at these coasts, the sea level pressure (SLP), the wind force and the wind direction data were analyzed on homogeneity and quality.
The quality control of the observational data is performed by a new routine, developed by DWD. The data passes through formal, climatological, temporal and consistency checks.
Fig.2 shows the absolute frequency of the air pressure and wind force data measured at Ahlbeck station. It is shown that the observed data provide the expected distributions.
The homogeneity of the data is shown in Fig.3. The time series of SLP with year mean data (top) and the wind speed data (centre) indicates no significant trend. The wind direction plot (bottom) demonstrates the change of use of different wind rose distributions. The marked area (blue box) highlighted the observed wind direction in eight sections. Before and after this fraction of time the observation of the wind direction in 16 sections is obvious.

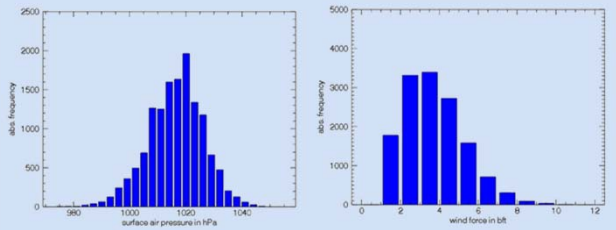

***Fig.2**: Absolute frequency of SLP(left) and wind force (right) from Ahlbeck station from 1878 to 1939.*

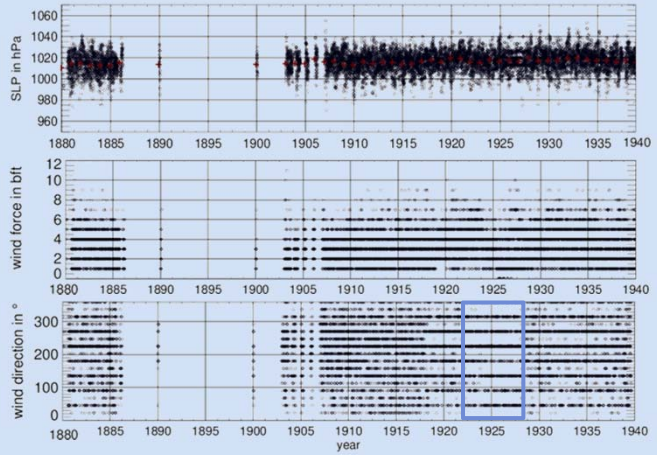

***Fig.3**: Time series from 1877 to 1939 of the sea level air pressure (top), the wind direction (centre) and wind force (bottom) from Ahlbeck station (see Fig.1). The data from 1887 to 1902 will be digitized in 2015.*

Conclusions and Outlook

The wind and SLP data of 15 signal stations along the German Bight and southern Baltic Sea coasts are proofed on quality and homogeneity and can be used for further analysis, particular on storm surge evaluations in this regions.
It is planned to digitize and quality check all handwritten journals. Until now 23 % of the data are digitized.
The signal station data will also be used to reconstruct the storm surge at the coast of the southern Baltic Sea in December 1913. For this case study data from 60 stations along the Baltic Sea Coast are available.

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