

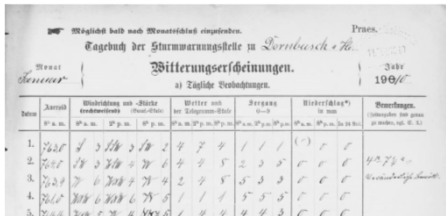
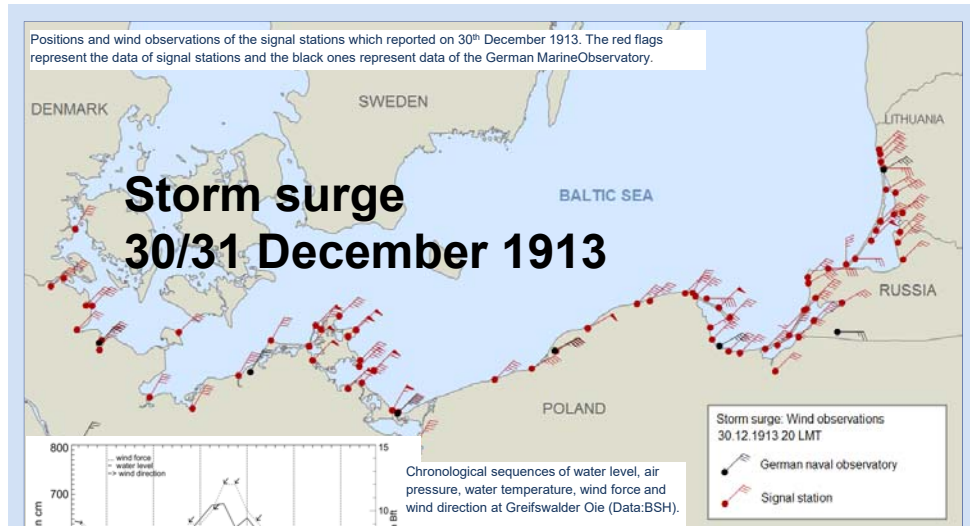
A new data set of historical coastal climatology: Signal Stations of the German Marine Observatory Hamburg

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A long overseen source of synoptic data collected along the coast of Germany has been detected, and is presently digitized. The data stem from warning posts in harbors along the coast, so called "Signalstationen", which recorded estimated wind-speed and direction, wave conditions, air pressure and some other variables. The first post began operating in 1877 and the last ceased operation in 1999. Signal Stations were positioned close to the shore to convey severe weather warning of the German Marine Observatory in Hamburg to ships and the coastal population. This was done by raising optical signals such as balloons, triangles, cylinders and flags. Reports were prepared 3 to 9 times per day. These observations did not enter the regular weather analysis process of the weather service, but were later archived: Now, about 800 handwritten journals are archived at the German Meteorological Service in Hamburg, and about 30% are now digitized and thus available for further analysis.

Signal station data

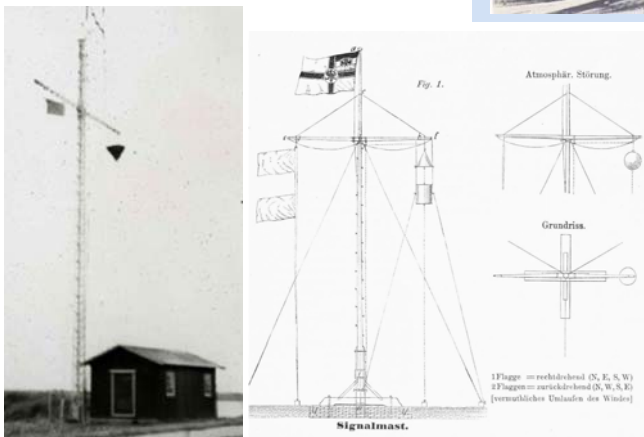
The Deutsche Seewarte in Hamburg sent wind and storm warnings to the signal stations for warning the coastal population about expected storm surges, and mariners about strong storms. For the verification of the storm warnings workmen were doing meteorological observations and measurements at the signal stations.

A signal station is a mast of about 20 m height with optical signals which is positioned close to the shore. About 160 signal stations were built by the *Deutsche Seewarte* in 1876 along the German Bight and southern Baltic Sea coast.



The storm surge on 29/30 December 1913 in the southwestern Baltic Sea Coast caused large damages of infrastructure. Wind and air pressure data of signal stations and the German Marine Observatory were used for the analysis. The distribution of the air pressure represents a passage of a depression on the 29th Dec. in the Rügen/Usedom region. The highest water level of 2.3 m was measured on 30th Dec.



Assessment

A first inspection of these data indicates a wealth of data, which are well suited for high-resolution description of historical coastal events such as the storm surge in the southern Baltic Sea on 30/31 December 1913. The temporal homogeneity is sometimes compromised and homogenization is required. Estimated wind conditions, available so far at two stations for more than 100 years, allow for an assessment of changing storm conditions based on wind data (instead of proxies such as percentiles of geostrophic wind distributions). The pressure data may be used to generating fine-scale synoptic analysis but also for calculating geostrophic wind statistics on spatial scales much shorter than what was possible so far.

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