German Bight storms analysed

SIR — In the debate concerning climate change due to increasing emissions of radiatively active gases into the atmosphere, many people are concerned about the possibility of an intensification of extratropical storms. Even though the International Panel on Climate Change[1] took a cautious stand in this matter because of lack of evidence, a mixture of indirect evidence and misleading scientific statements has created substantial unease in the public.

Reports have been presented to the North Sea offshore oil industry about extreme waves, higher than ever previously observed. Two workshops "Climate Trends and Future Offshore Design and Operation Criteria" in Reykjavik (29–30 March 1993) and Bergen (30 November–1 December 1992) were held in which the Norwegian Weather Service brought together people from the oil industry , certifying agencies and scientists to discuss whether the wave and storm climate is in fact worsening. No definitive answers emerged — it is not possible to tell whether the extremes had become worse or if reporting systems have improved. The insurance industry has organized meetings with scientists because of the increased number of claims for storm-related damage. Newspapers in northern Europe were full of speculation about the enhanced threat of extratropical storms in the early part of 1993.

To ascertain whether the storminess really had worsened, a systematic analysis was begun at the Seewetteramt Hamburg. Identification of a trend in climatic data requires long and homogeneous time series , but homogeneous daily time series of wind for studying extreme events are rarely available because of changing procedures in observing, reporting or analysing the wind. The geostrophic wind (blowing parallel to isobars and representing the first-order approximation of the real wind) computed from pressure readings from a few stations can he regarded as a proxy for the real wind. From this model, annual frequency distributions of daily wind can he obtained for periods of 100 and more years. Any trend in the wind statistics will he reflected in these geostrophic wind statistics.

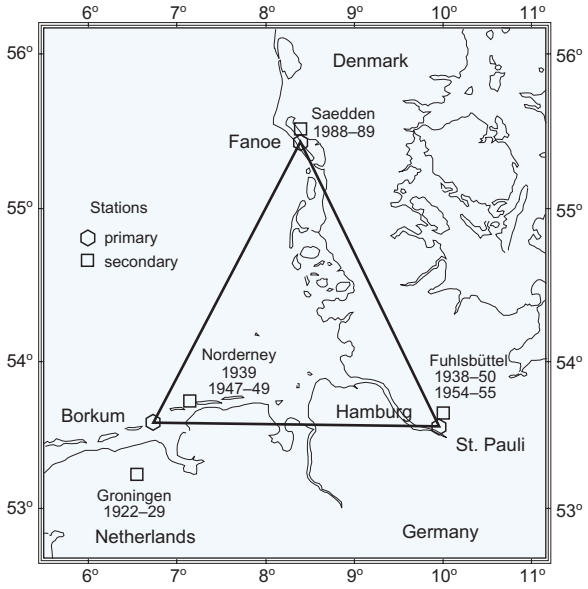

FIG. 1. Location of the meteorological stations from which pressure readings have been used to estimate geostrophic wind speed in the German Bight from 1876 to 1989.

We applied this approach to the German Bight, in the southeast part of the North Sea, where three stations have reported air pressure since 1876 (Fig. 1). The resulting time series of the 1 10 and 50% percentiles of the annual distributions of geostrophic wind speeds (Fig. 2) stayed remarkably stationary, showing that this storm statistic has not changed in the German Bight in the past 100 years.

An alternative, and potentially more convincing, analysis would be to examine the historical weather maps and count the number of storms with a core pressure below certain thresholds. Such an analysis has been done, revealing a substantial increase in the number of severe storms in the North Atlantic area 2. The problem with this approach is that it cannot distinguish whether changes are 'real' or whether they result from the ever-increasing quality of the operational analyses arising from more and better observations, more powerful diagnostic tools and other improvements in the monitoring of the state of the troposphere. A more detailed mapping of the pressure distribution, however, automatically yields deeper lows. On the other hand, the long time-series of pressure readings suffers from no substantial inhomogeneities because the measuring instruments (mercury barometers) and reading methods have remained unchanged for more than 100 years.

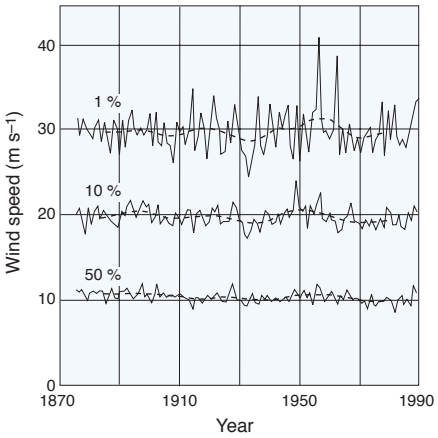

FIG. 2 Time series of the 1, 10 and 50% percentiles derived from annual distributions of daily geostrophic wind speeds in the German Bight. (The p 'percentile' of a distribution X is the number x, such that the probability of observing $X > x$ is p. Thus, the 1% percentile, derived from an annual ensemble of 365 samples, represents the minimum of the 3–4 largest observations.) Solid lines, annual average; broken lines, 30-year low pass.

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2. Schinke,H. *Wiss. Z. Humboldt-Univ. Berl.* **41**, 17–28 (1992).