

Interactive comment on “The simultaneous occurrence of surge and discharge extremes for the Rhine delta” by S. F. Kew et al.

Anonymous Referee #2

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General Comments

The authors present an analysis they designed to investigate whether the occurrence of high river discharges from the Rhine and North sea storm surges are independent. They use average areal precipitation within the Rhine aggregated over a number of days as a proxy variable for river discharge and average daily wind speed in a specific direction over the North sea as surrogate for sea surge. There are a number of interesting results their investigation has yielded. However, I feel that the way the authors have discussed their results and summed them up make drawing unambiguous conclusions relevant to the objective of the article difficult. Based on their results, I am not sure whether the conclusion they drew in the abstract is justified.

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Detailed comments

The analysis makes an assumption that the extremes of n-day (for n: 1-20) precipitation sum over the basin lead to high discharge and similarly the extremes of the daily average wind speed in a specific direction lead to surge. I would be cautious in making such an assumption, especially in relation to discharge. The consequences of aggregated basin average precipitation over different numbers of days depend very much on the size of the catchment, which make it difficult to use them all as proxies for extreme discharge. Instead of using all aggregated n-day extremes, why not identify the number of aggregation days whose extremes are strongly related to the extremes of the discharge (at least statistically) and base the investigation on those aggregation days only? Furthermore, how strongly are the extremes of the aggregated precipitation related to extreme discharge? This dependence can be influenced by the spatial and temporal patterns of the precipitation field over the days of aggregation.

To draw conclusion on whether extreme discharge and sea surge are dependent, the authors seem to focus on the 20-day precipitation sum as a proxy for discharge. Although their analysis shows an increase in the probability of directional wind speed they say is relevant to surge after an extreme 20-day precipitation, the authors mention that only 3% of all surges have occurred after a 20-day extreme precipitation. Does not this put in question the conclusion the authors make in the abstract that the probability of extreme surge following a 20-day precipitation extreme (a proxy for extreme discharge) is higher than the probability one would obtain if independence was assumed? Also, does not the result discussed on page 127, lines 18-20 enhance this contradiction? Under what discharge conditions did the other 97% of the surges occur? Do they have any relationship with the extremes of precipitation on other aggregation days? This might have to do with identifying an appropriate proxy for extreme discharge (see the first comment above)

What was the sampling strategy employed in drawing the 1000 samples to estimate the sampling error?

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Editorial comments

On pages 123 and 124, Figure 5a is mentioned, but there is just Figure 5.

Page 124, line 14: ‘...was found to be...’

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