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# Compound variation in freeze-thaw index and wind climatic erosivity in the agro-pastoral ecotone in northern China

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Changes in wind speed and temperature significantly co-alter soil erosion climatic erosivity. However, knowledge on compound climatic elements of soil erosion to climate change is limited. Here, we quantify long-term climatic erosivity based on the wind erosion climatic erovisity and freeze-thaw climatic index, and analyze the contributions of single and compound factors using the slope change ratio of accumulative quantity methods. Our results show frequency of compound events is gradually decreasing as a result of climate change. Compound climatic erosivity exhibits large spatial variability and decreases with the wind erosion climatic erosivity and freeze-thaw climatic index. Moreover, a negative temporal trend of compound climatic erosivity is found in 61.28% of the study area from 1981 to 2020, which is largely attributed to declining wind speed. One unanticipated finding was that the frequency of compound erosion has shown a decreasing trend at some sites, but the intensity has shown an increasing trend. A possible explanation for this might be the extreme wind speeds and temperatures. Our findings highlight compounding effects of climatic conditions have a more severe impact on soil erosion.