EMS Annual Meeting Abstracts
Vol. 21, EMS2024-716, 2024, updated on 21 Oct 2024
https://doi.org/10.5194/ems2024-716
EMS Annual Meeting 2024

Compound precipitation and wind extremes in the eastern part of the Baltic Sea region

Laurynas Klimavičius
Vilnius University, Institute of Geosciences, Department of Hydrology and Climatology, Lithuania
(laurynas.klimavicius@chgf.vu.lt)

Compound precipitation and wind extremes (CPWEs) are multivariate compound climate events that have received increasing attention recently. Such extremes can cause damage to buildings and infrastructure that results in extensive socio-economic losses. The main objective of this work is to assess the recurrence and intensity of CPWEs in the eastern part of the Baltic Sea region from 1950 to 2022.

This study investigated the region between 53.5° to 59.5° N and from 20° to 28.5° E. Daily precipitation and hourly maximum wind speed data with a grid size of 0.25 x 0.25° were obtained from the ERA-5 reanalysis database to identify CPWEs. Then, for the entire study period and each grid cell within the study area, the 98th percentile of daily maximum wind speed and precipitation were calculated. A CPWE was distinguished when precipitation and maximum wind speed values exceeded the 98th percentile values of the corresponding variable on the same day for at least one point in the study area.

Two different approaches were employed to evaluate the intensity of CPWEs. Firstly, terciles of maximum wind and precipitation were calculated, and the values of each variable were allocated into three categories, of which nine intensity classes of CPWEs were formed. While applying the other method, the number of CPWEs, when one or both of these variables exceeded the 99th percentile values in at least one grid cell of the study region, was computed.

A total of 797 CPWEs have been distinguished from 1950 to 2022. During the study period, the number of these events significantly increased (when $p < 0.05$). The highest number of CPWEs occurred in October. During the cold season (from October to March), most of these compound events were obtained in western Lithuania, while during the warm season (from April until September) – in the northeastern and south-eastern parts of the study region.

Evaluation of the intensity of CPWEs using the first approach revealed that all events characterized by extremely high amounts of precipitation (> 80 mm per day) occurred in June and September. Meanwhile, 88% of CPWEs, during which the wind speed was higher than 28 m/s, were obtained from October until March. The most severe CPWE occurred on August 7, 1987, in the northeastern part of the study region. However, using the other approach, the most intense CPWE was identified on October 28, 1998, when the values of both maximum wind speed and precipitation exceeded the 99th percentile values of the corresponding variable in 37.8% of the grid cells of the study area. The number of CPWEs when the values of both variables exceeded the 99th percentile

slightly increased over the study period.