

EGU22-3057

<https://doi.org/10.5194/egusphere-egu22-3057>

EGU General Assembly 2022

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Forest damage caused by the impact of strong wind during extra-tropical cyclones – modelling and prediction

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Climate change will potentially modify wind characteristics related to the passage of extra-tropical cyclones over Europe, and the increasing frequency of strong winds will increase forest damage. Negative impacts will be significantly higher in managed forests. Analyzing data about past forest damage can provide a better understanding of the complex relationship between tree/forest features, wind climate properties, and the rate of forest damage. We present results of forest damage modelling and prediction using machine learning techniques. We applied five machine learning methods to data on the volume (m³) of damaged trees between 2007-2010. In a second step, logistic regression was applied to these data expressed as a rate of damaged forest area. We focus on two case studies: the Sudety Mountains region in SW Poland and the catastrophic damage caused by windstorm Klaus in SW France in 2009. We found that the best predictors of tree damage were tree age and volume, the distance from the windstorm track, the normalised difference vegetation index (NDVI) and wind exposure. For the second case study, we tested several combinations of data splitting cut-off levels and various definitions of the damage class during the training stage of the modeling. We obtained models' good predictive power (accuracy and AUC > 0.7) for training and test sets in both cases.

The study has been supported by the Polish National Science Centre (project no 2018/28/U/ST10/00075 and 2019/35/O/ST10/00032) and the ERC Advanced Grant (project no 694481).