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## Factors leading to the formation of tornadoes: statistical links emerging from a large dataset

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The dynamics of tornadoes include large vorticity in the lower troposphere and an intense updraft, whose combination may result in their formation. In this study we investigate the possibility of using a statistical relation for their description. In fact, the nonlinearity, complexity and fine scale of these processes presently prevents their simulation in the atmospheric circulation models currently used for weather forecasts and climate projections. Here we use a large dataset of tornadoes observed in the USA and Europe and the data of ERA5 (ECMWF ReAnalysis 5) to establish a statistical link between the occurrence of tornadoes and factors whose values can be extracted from atmospheric circulation models. The values of CAPE (convective available potential energy), WS (wind shear in the lower troposphere), SRH (storm relative helicity) and LCL (lifting condensation level) of the high resolution (about 30km) ERA5 data have been considered. The analysis shows all these variables are significantly linked to the formation of tornadoes with WS and CAPE being the most relevant ones. The analysis is an extension of a former study (Inghrosso et al., 2020, **10.3390/atmos11030301**) based on a dataset of tornadoes events much larger than previously, on higher resolution atmospheric data, and more prognostic variables. The results provide a new expression for the probability of occurrence of tornadoes that can be used for forecasting their likelihood with potential applications to their predictions and future changes of their frequency.