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Storms of the Future: Untangling the known unknown in climate change attribution using high resolution modelling

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In the early 2000s, a state-of-the-art CMIP5 medium resolution model was used to calculate climate change effects on storm characteristics for the future flood safety of the Netherlands. However, newly developed high-resolution models give more accurate results in terms of precipitation and storm track position. Here we look into the changes in storm characteristics over time for the Netherlands, comparing the medium (T159) and high-resolution (T799) EC-Earth model. Our data set encompassed the beginning and end of the 21st century, selecting the 95th percentile storms out of 30 years of climate simulations. The analysis was split up in storm (Oct-Mar) and non-storm (Apr-Sep) season. We found significant decrease in the number of future storms for storm season (-22%) and non-storm season (-27%). However, no changes in the wind direction was found. The future storm tracks leading to storm in the Netherlands do not shift position in storm season, but have a more northerly origin in the North Atlantic for the non-storm season. We found a significant increase in precipitation before and during storms in the future storm season. The expected future decrease in storm intensity but increase in precipitation before and during storms could lead to more compound events.
The high-resolution model gives almost equal results in wind speed and number of storms when compared to ERA-Interim for the present day climate. The medium-resolution, however, underestimates the number of storms. However clear the link between climate change and changes in extremes may seem, the processes involved in the climate change influence on extreme events is not well understood. Therefore, we apply the storyline method using the high-resolution (T225) ECHAM6 global atmospheric model to dive into these known unknowns, by spectrally nudging the dynamic variables in the model towards reanalysis data. This allows us to simulate a past extreme weather event anywhere on the globe, and compare its thermodynamic effects with the same storm in a preindustrial world, using a model with sufficiently high resolution to capture those effects realistically.