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More intense Mediterranean wind storms in a changing climate?

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This study examines cyclones causing extreme wind storms affecting the Mediterranean region under present-day and future climate conditions. An ensemble of 7 coupled ocean atmosphere simulations using the ECHAM5-OM1 model is analysed: 3 present-day climate integrations, 3 integrations driven by the SRES A1B greenhouse gas scenario and 1 integration driven by the SRES A2 forcing scenario.

Extreme wind events are defined based on the identification of wind clusters featuring wind speeds exceeding the local 98th percentile and tracked using a nearest neighbour approach. The wind tracks are then matched to the associated cyclone based on a) the distance between the wind track and the cyclone core and b) the cyclone's strength. The intensity of an extreme wind event is expressed by a storm severity index, which takes both area and duration of its extreme wind speeds into account.

All four climate change integrations show a significant decrease in the total number of cyclones over the Mediterranean region. Accordingly, the number of extreme wind tracks also decreases over most of the Mediterranean Basin. Only some simulations show a small increase in the number of extreme wind events over northern Italy, as part of a positive trend over Central Europe which extends southwards.

In spite of the reduction in total numbers, the intensity of the wind storm events in the future scenario integrations is higher than for the 20th century simulations, particularly in terms of the standard deviation of the storm severity index. All 4 future scenario integrations feature several individual events with intensities exceeding the most extreme event in any of the present-day climate integrations. Case studies are presented to examine the characteristics of the cyclones associated with these extraordinary storms, and the factors favouring their development in the scenario integrations.