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## Wildfire risk in Madeira island and the potential impacts on tourism

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Drought conditions increase the likelihood of extreme wildfires which result in loss of life and property causing several damages to the society. The extensive study of different real cases is important to better understand the environmental conditions and their impacts on different sectors. The study aims to explore the atmospheric conditions associated with three forest fires occurring in Madeira island using convection-permitting simulations. In addition, the potential impacts on tourism sector is preliminary discussed using media data for one of the episodes when the fires affected the area surrounding the Funchal city, leaving several houses and a five-star hotel destroyed and 3 fatalities at least. Madeira is a Portuguese island located in the North Atlantic Ocean where the forest fires represent a risk for the ecosystems and for the local economy. The tourism is one of the main economic activities of the island. The numerical simulations were performed using the Meso-NH model. It was configured into two domains, the outer domain with 2.5 km resolution, and an inner domain with a resolution of 500 m and capable to better represent the complex terrain characteristic of the mountainous island. The vertical grid was calculated automatically by the model with a total of 50 levels following the terrain. The simulations were performed in a two-way interactive mode, initialized and forced using the European Centre for Medium-Range Weather Forecasts (ECMWF) analysis updated each 6 hours. The forest fires episodes were explored from the atmospheric circulation point of view, using meteorological variables as temperature, relative humidity and wind over the island. The Azores Anticyclone was the typical synoptic system inducing the north-easterly airflow towards the island. As it remains almost stationary, the fair weather is maintained over the region for several days and may lead to drought conditions during summertime. However, the downward motion created by the local orography at the southern slope was evident from the simulations. The combined effect of terrain and atmospheric condition was essential increasing the fire danger by leading the maximum temperatures above 35°C and relative humidity around 15%. Also, by creating the favourable conditions to the fire propagation after their ignition, namely due to the intense gust winds. One episode was marked by the cancellation of several international flights due to the high amount of smoke that affected Funchal, as well as the evacuation of more than 1,000 residents and tourists. The summer season is a critical fire weather period for the Madeira island, and the study contributes to identify fire risk and anticipate fire behaviour in some specific regions of the island. The use of high-resolution simulations is able to indicate the regions more propitious to

fires, namely those affected by the highest near surface temperatures and lowest values of relative humidity. Overall, the results also can help in the development of fire risk management practices, as well as promoting a sustainable development, namely of the tourism sector.