

ENVIRONMENTAL PARAMETERS CONTROLLING THE GENESIS AND MAINTENANCE OF MEDITERRANEAN TROPICAL-LIKE STORMS

R. Romero¹, M. Tous², C. Ramis¹ and A. Genovés²

¹*Grup de Meteorologia, Departament de Física, Universitat de les Illes Balears, Palma de Mallorca, Spain*

²*Delegación Territorial en Illes Balears, Agencia Estatal de Meteorología, Palma de Mallorca, Spain*

Tropical-like storms occasionally develop over the Mediterranean Sea, sometimes attaining hurricane intensity and threatening the islands and coastal regions. These storms, often called medicanes, operate on the thermodynamic disequilibrium between the sea and the atmosphere and in this respect, as well as in their visual appearance in satellite images, are much like tropical cyclones. Synoptic analyses of a few studied cases show that a precursor of these violent windstorms is the presence of a deep, cut-off, cold-core cyclone in the upper and middle troposphere. However, the infrequent occurrence of medicanes suggests that additional and very special meteorological conditions are necessary for these storms to occur in comparison to ordinary cyclonic systems. These particular conditions are currently poorly known; this study is a first step towards the characterization of the meteorological environments conducive to medicanes development and maintenance.

The air-sea interaction theory developed by Emanuel allows one to determine the potential intensity of a tropical cyclone (idealized as a Carnot engine) from the environmental conditions. Real events from the tropical oceans demonstrate that the idealized model correctly predicts the maximum wind speed –or minimum central pressure– achievable in tropical cyclones. An empirical genesis index that combines the previous potential wind speed value with the low-tropospheric vorticity, mid-tropospheric relative humidity and deep-layer wind shear was formulated by the same author and successfully tested against the true space-time probability of tropical cyclone genesis. The previous parameters have been tested on a few well known mediterranean cases and the results are certainly encouraging. In particular, high values of the empirical genesis index are invariably obtained for the analysed events, indicating that such an index can be a good candidate to estimate the likelihood of medicane genesis in the present and future climate.

Although the record of medicanes is arguably too sparse to allow any kind of robust statistical analysis of real data, the significance of the above results has been expanded by means of a new data base of events going back to the beginning of the Meteosat satellite era. By locating this set of historical events and an independent set of ordinary Mediterranean cyclones within the environmental parameter space, it was possible to isolate thermodynamical factors that are distinctive of medicane producing environments.

Medicanes
Ingredients
Meteosat