Plinius Conference Abstracts,
Vol. 11, PLINIUS11-0, 2009
11th Plinius Conference on Mediterranean Storms
© Author(s) 2009

An investigation of the large-scale environments associated with the genesis of mediterranean tropical-like storms

R. Romero (1), M. Tous (2), C. Ramis (1), and A. Genovés (2)

(1) Universitat de les Illes Balears, Departamento de Fisica, Palma de Mallorca, Spain (romu.romero@uib.es), (2) AEMET, Delegación Territorial en Illes Balears, Palma de Mallorca, Spain

Mediterranean tropical-like storms or medicanes are violent windstorms that, once developed over the sea, have the potential to affect the islands and coastal regions. Although the actual frequency and intensity of these extreme meteorological phenomena and the possible impacts of global warming have not been assessed, it is clear that the Mediterranean Sea and overlying atmosphere are only exceptionally conducive to medicane development and maintenance: the potential energy available for tropical-like cyclones is not ordinarily large, and the atmosphere above a thin boundary layer is usually far too dry to allow genesis. Synoptic analyses of a few well known cases indicate that medicanes are not isolated structures of the atmospheric circulation; they require a large scale baroclinic disturbance evolving over the Mediterranean and only during the mature or late stages of this primary cyclonic storm, a medicane might develop. They usually, and perhaps always, develop under deep, cut-off, cold-core cyclones present in the upper and middle troposphere, usually formed as a result of the “breaking” of a synoptic scale Rossby wave. As such a system approaches the Mediterranean, or develops in situ, the air through a deep layer of the troposphere is lifted through large vertical displacements, cooling it and increasing the relative humidity. Such an atmosphere is susceptible to tropical cyclone-like development. But the occurrence of cold upper lows over the Mediterranean is not uncommon whereas medicanes are rare phenomena, suggesting that very special meteorological conditions are necessary for medicanes to occur. These conditions are currently not well known and it would be difficult to find them from only a few case studies. Therefore, we propose to apply the kind of dynamically oriented climatologies designed in the framework of the MEDEX project with the aim of characterizing the meteorological factors conducive to medicanes development.

More precisely, MEDEX has developed a complete climatology of Mediterranean cyclones using the ERA-40 reanalyses which involves the three-dimensional characterization of the disturbances in terms of dynamical, thermal and humidity environmental variables. This approach is particularly beneficial for gaining insight on the processes involved in cyclone generation and intensification. The small size and maritime characteristics of medicanes implies that this special type of cyclone can not be captured in the above climatology. Only with very high resolution meteorological grid analyses and dense observational data over the Mediterranean a task like that would be possible. However, the larger scale nature of the precursor cyclones allows identifying and three-dimensionally characterizing the environments in which medicanes develop. We hypothesize that a comparison of these medicane environments against the generality of cyclonic situations should reveal useful discrimination variables among a large enough set of thermodynamical descriptors used. After compiling a new data base of medicane events going back to the beginning of the Meteosat satellite era, and locating this set of historical events and an independent set of MEDEX cyclones within the environmental parameter space, we could reach an answer to this important question.