Plinius Conference Abstracts
Vol. 18, Plinius18-39, 2024, updated on 13 Dec 2024
https://doi.org/10.5194/egusphere-plinius18-39
18th Plinius Conference on Mediterranean Risks

Satellite-based characterization of Mediterranean tropical-like cyclones (Medicanes)

Giulia Panegrossi[1], Leo Pio D'Adderio[1], Paolo Sanò[1], Daniele Casella[1], Stefano Sebastianelli[1], Jean-François Rysman[2], Stavros Dafis[3,4], Mario Marcello Miglieta[1,5], Valentina Di Francesca[6], and Derrick Herndon[7]

[1]Institute of Atmospheric and Climatic Sciences (ISAC), National Research Council (CNR), Rome, Italy (g.panegrossi@isac.cnr.it)
[2]LMD & LadHyX, CNRS, ´Ecole Polytechnique, Institut Polytechnique de Paris, Palaiseau, France
[3]Institute of Environmental Research and Sustainable Development, National Observatory of Athens, Athens, Greece
[4]Data4Risk, Paris, France
[5]Department of Earth and Geoenvironmental Sciences, University of Bari, Bari, Italy
[6]CESBIO, Université de Toulouse, CNES/CNRS/INRAE/IRD/UT3
[7]Cooperative Institute of Meteorological Satellite Studies (CIMSS) - University of Wisconsin-Madison

Mediterranean cyclones are high-impact weather events that frequently result in devastating floods, storm surges, and windstorms, sometimes leading to casualties. They may exhibit characteristics typical of tropical (or sub-tropical) cyclones (e.g., a warm core, a cloud free eye surrounded by spiraling rain bands around the center, and a closed vortex associated with strong near-surface winds and heavy precipitation). Less frequently, these cyclones undergo transition into a tropical-like cyclone (TLC) during their mature phase, exhibiting at some point during their evolution a deep axisymmetric warm core of diabatic origin (i.e., latent heat release due to air-sea interaction and moist convection). The latter cyclones are generally referred to as Medicanes (Mediterranean Hurricanes). However, the term Medicane is often associated with other types of warm core cyclones, including warm seclusions present in the late stage of extra-tropical cyclones, where the warm core originates from baroclinic processes. The present work presents some recent advancements in the use of satellite passive microwave (PMW) measurements to monitor and to characterize warm core, deep convection and the presence of a closed eye during the cyclone evolution in order to identify the possible transition into TLC. Moreover, all the available scatterometers onboard LEO satellites (MetOp ASCAT and FY-3E WindRAD) are used to monitor the evolution of the surface wind field as the cyclone evolves to the mature stage and its relation to the cyclone intensification. The analysis is carried out for 15 Mediterranean cyclones that occurred in the last 21 years (2003-2023) and reveals that only 9 of them underwent a TLC transition during their mature phase. In particular, the study focuses on three cyclones (i.e., Helios, Juliette, and Daniel) that occurred between February and September 2023. The results indicate that the three cyclones show a very similar evolution during the initial phases, characterized by a dry stratospheric air intrusion followed by the development of a warm anomaly in the low/mid-troposphere around the cyclone center. This phenomenon is clearly driven by baroclinic processes. However, while for Helios the PMW diagnostics do not show deep convection in the warm core region, for both Juliette and Daniel deep convection is identified in the warm core region at the final stage of their mature phase, providing a strong indication that diabatic heating plays a key role in the warm core development. From the analysis, it can be concluded that, while Helios is a warm seclusion, Juliette and Daniel undergo a TLC transition at the final stage of their evolution. This research is an important contribution towards the use of Earth Observation for Medicanes' definition, within the activities of the ESA MEDICANES project and of the COST Action MedCyclones.