



## The peculiarities of Ianos among Mediterranean tropical-like cyclones

Daniele Nigro<sup>1</sup>, Simona Bordoni<sup>1</sup>, **Lorenzo Giovannini<sup>1</sup>**, and Mario Marcello Miglietta<sup>2</sup>

<sup>1</sup>University of Trento, Department of Civil, Environmental and Mechanical Engineering, Trento, Italy

<sup>2</sup>University of Bari, Department of Earth and Geo-environmental Sciences, Bari, Italy

Mediterranean tropical-like cyclones, also known as medicanes, are small cyclones observed in the Mediterranean region with an average frequency of 1-2 cases per year, mainly in autumn and winter. The tropical-like phase of these cyclones is characterized by the presence of a symmetric thermal structure and a deep warm core, which are features typical of tropical cyclones. Their mechanisms of formation and tropical transition have been investigated by many authors, but an official rigorous definition of medicane is still lacking, due to the significant case-by-case differences.

In this work, 17 Mediterranean cyclones, including three potential medicanes in 2023, have been first analyzed using the ERA5 reanalysis dataset to evaluate their similarities and dissimilarities, considering different features in the lower and upper troposphere. Results show that the development of a warm core is negatively correlated with potential vorticity (PV) in the upper troposphere, while PV increases in the low troposphere due to latent heat release. It has also been verified that during the tropical-like phase the wind shear presents lower values, the jet stream is weaker and farther from the cyclone center, and the cyclone is vertically aligned, even if some exceptions exist. Then, the presence of a dry intrusion has been investigated using back-trajectories, showing that all cyclones present descending dry air associated with a PV streamer, meaning that the upper-level dynamics are fundamental in the early stages. However, the threshold of 400 hPa of descent in 48 hours used in literature to define the dry intrusion is not appropriate for cyclogenesis in the Mediterranean, and, in some cases, a weaker PV streamer associated with a less pronounced descent is sufficient for cyclogenesis. In this regard, Ianos, one of the strongest medicanes ever recorded, presents two weak descending flows associated with PV streamers, one in the early stage and one before the strong deep warm core phase. This cyclone has also been analyzed through a simulation with the WRF model with a grid spacing of 3 km, with the main aim of evaluating the different terms of the pressure tendency equation (PTE), to quantify the role of upper-level dynamics and diabatic heating on the surface pressure tendency. The same procedure has been applied to analyze the recent cyclone Daniel that affected Libya in September 2023, and a comparison with Ianos has been performed.