EMS Annual Meeting Abstracts
Vol. 21, EMS2024-760, 2024, updated on 09 Sep 2024
https://doi.org/10.5194/ems2024-760
EMS Annual Meeting 2024

On the automated detection of the rotational center for the characterization of Mediterranean cyclones

Stefano Sebastianelli[1], Leo Pio D'Adderio[1], Paolo Sanò[1], Daniele Casella[1], Giulia Panegrossi[1], and Derrick Herndon[2]
[1]National Research Council of Italy, Institute of Atmospheric Sciences and Climate, CNR-ISAC, Rome, Italy (s.sebastianelli@isac.cnr.it)
[2]Cooperative Institute of Meteorological Satellite Studies (CIMSS) - University of Wisconsin-Madison

Recent studies exploiting satellite observations characterized both the thermodynamic and the microphysical structure of Mediterranean cyclones supposed to go through a tropical transition (Medicanes) with particular reference to the role of deep convection in the development of the warm core. In analogy with what happens in tropical cyclones (TC), the surface wind field is useful to characterize Medicanes, as it could give additional information on their evolution.

The purpose of our work is the characterization of the surface wind field of Medicanes by means of the correct identification of Medicane's rotational center. The methodology we developed exploits the computation of the standard deviation of the horizontal surface wind direction also taking into account the wind speed field. This methodology is based on the observation that very close to the center the wind direction is highly variable in space due to the formation of the cyclonic vortex.

The Automated Rotational Center Hurricane Eye Retrieval (ARCHER) algorithm, developed by the TC group at CIMSS/University of Wisconsin-Madison, is widely used for the correct identification of a TC's center of rotation. Since Mediterranean cyclones often exhibit satellite-based phenomenological features typical of TCs we will also try to investigate the applicability of ARCHER algorithm to these cases.

To retrieve the surface wind field over the sea, data provided by the Advanced SCATterometer (ASCAT) real-aperture radar onboard MetOp satellites and by the Wind Radar (WindRAD) onboard of Feng Yun FY-3E satellite series are used. For both sensors the surface winds field estimation is related to the roughness of the sea surface through the back-scattered electromagnetic signal. We exploit all the available ASCAT and WindRAD overpasses for the Medicanes occurred in the last decade.

A key feature that characterizes the surface wind field of a Medicane is the radius of maximum wind (RMW). Following the definition provided for TCs, the RMW is defined as the distance between the location where the maximum wind speed occurs and the Medicane's center of rotation. A further objective will be to show how the different methodologies used for the determination of the Medicanes' rotational center influence the RMW computation as the cyclones evolves to its mature phase and to what extent the RMW can be used as a proxy for the cyclone's

intensification.

Preliminary results show that our methodology is more reliable during the mature phase when the Medicane is more organized showing a closed cyclonic structure associated to strong near-surface winds with a quasi-calm area in its center, and that the RMW decreases as the medicanes intensify. This work is part of the ESA project “Earth Observations as a cornerstone to the understanding and prediction of tropical-like cyclone risk in the Mediterranean (MEDICANES)”.