

Mediterranean Cyclone Tracks in Regional Climate Models

The initiative of the COST-ACTION Working Group 2

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1. Introduction

Based on Flaounas et al. [1], nine cyclone detection and tracking methods (CDTM) were used to create Mediterranean cyclone tracks from 1979 to 2015 using ERA5 reanalysis and CMIP6 historical data. For the future period 2050-2100, CMIP6 data from regional climate models under SSP2-4.5 and SSP5-8.5 scenarios were used.

2. Methods

ERA5 and CMIP6 data have a temporal resolution of 6 hours and a spatial resolution of about 1°. All 10 CDTMs used are based on Flaounas et al. [1], employing mean sea level pressure or relative vorticity at 850 hPa and applying time, size, and length criteria to identify Mediterranean cyclones. The results undergo a 3-step IMILAST protocol [2], which includes searching for similar tracks occurring simultaneously within 300 km. Composite tracks are created at the average location of these points. Prioritizing composite track points with the highest confidence level.

3. Preliminary Results

The figures below show four of the ten CDTMs that detect Mediterranean cyclones using the CMIP6 Euro-Mediterranean Centre on Climate Change model (CMCC-CM2-SR5) with a 1° grid spacing under SSP585.

4. Next steps

We will create a complete dataset of Mediterranean cyclone tracks in regional circulation models that will be available to the Mediterranean Cyclones community. The final dataset is expected to enhance our understanding of future climate change impacts on Mediterranean cyclone characteristics.

References:

- [1] Flaounas et al. 2023. A composite approach to produce reference datasets for extratropical cyclone tracks: Application to Mediterranean cyclones. *Weather and Climate Dynamics Discussions*.
<https://doi.org/10.5194/wcd-2022-63>
- [2] Neu, U., Akperov, M. G., Bellenbaum, N., Benestad, R., Blender, R., Caballero, R., ... & Wernli, H. (2013). IMILAST: A community effort to intercompare extratropical cyclone detection and tracking algorithms. *Bulletin of the American Meteorological Society*, 94(4), 529-547.
<https://doi.org/10.1175/BAMS-D-11-00154.1>
- [3] Cherchi, A., Fogli, P. G., Lovato, T., Peano, D., Iovino, D., Gualdi, S., ... & Navarra, A. (2019). Global mean climate and main patterns of variability in the CMCC-CM2 coupled model. *Journal of Advances in Modeling Earth Systems*, 11(1), 185-209.
<https://doi.org/10.1029/2018MS001369>

