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Analysis and classification of severe cyclogenesis events over the western Mediterranean Sea in the last 40 years

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The Mediterranean Sea is a mid-latitude fairly temperate marine basin, strongly influenced by the North-Atlantic atmospheric circulations. In this semi-enclosed basin, a wide variety of cyclogenesis mechanisms are known to develop, including baroclinic waves coming from the Atlantic, Mediterranean cyclogenesis originating from the cut-off of baroclinic waves, Tropical-Like Cyclones (TLC), Rapid-Cyclogenesis (RC) and Intense Mediterranean Cyclones (IMC). Depending on the cyclone type, the characteristic frequency of appearance can vary, ranging from tens per month to 1.5 per year, as in the TLC case. RCs are among the rarest and probably most intense and destructive cyclogenesis events that can develop within the Mediterranean basin; they usually originate at high latitudes, during wintertime, and mainly over the sea, preferring areas with high Sea Surface Temperature (SST) gradients. It is generally accepted that these events are determined by 12 different parameters, among which the most relevant one is the quick drop of pressure, close to 1hPa/hr for 24 hours, within the eye of the cyclone. RCs formation is an extremely complicated process, and in the Mediterranean basin it is mostly driven by air intrusions from the stratosphere and by the presence of Atmospheric Rivers. Using ERA5 dataset, we firstly conducted a physical and dynamical analysis of the most intense cyclogenesis events occurred in the Mediterranean basin in the period 1979-2020, identifying factors which triggered, generated cyclones and contributed to the intensification of such events. According also to Sanders' and Gyakum's definition of Bergeron, a parameter which describes RCs' deepening rate and varies from 28mb $(24h)^{-1}$ at the pole to 12 mb $(24h)^{-1}$ at latitude 25°N, we were able to classify them in the three aforementioned categories. Further analysis has been undertaken to determine the cyclones' phase and their main morphological characteristics, as well as their statistical distribution, seasonality and correlation with relevant indexes such as NAO, EA and SCAND, as well as SST anomalies exhibited by the Central Mediterranean Basin.