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# Planetary and synoptic scale forcing associated with weather and climate regime in the Eastern Mediterranean

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**Abstract**

Teleconnection patterns appear as preferred modes of the natural variability of low-frequency atmospheric circulation with fixed centres of action. Their examination is of great interest in the field of atmospheric dynamics and climate variability, as they influence the regional climate and the occurrence of extreme weather events. An upper-level teleconnection pattern was identified in winter with its poles located over the eastern Mediterranean and Northeastern Atlantic, named Eastern Mediterranean Pattern (EMP), affecting the mean winter patterns of temperature and precipitation inversely between its two phases. On the planetary scale, the Rossby wave propagation was found to be responsible for the formation of the EMP, as stimulated by an intense latent heat source over the tropical oceans. On the synoptic scale, transients play an important role, as well as the interaction between stratosphere and troposphere.

Another form of teleconnection pattern was found in summer between the Indian summer monsoon (ISM) and the northeasterly winds over the Aegean Sea, the so-called etesians, through the extended Asian thermal low, which expands over the eastern Mediterranean with the form of the Persian trough. On the inter-annual scale, an equatorial Rossby wave pattern, extending westward from an ISM heat source to the eastern Mediterranean and North Africa, was identified which is associated with the northward displacement of the subtropical jet stream and, subsequently, with the subsidence over the eastern

Mediterranean and the formation of etesians. On the intra-seasonal time scale, the etesians' variability was attributed to the mid-latitude circulation rather to the monsoon forcing.

On the synoptic scale, the climate of the Mediterranean, and especially the precipitation regime, is strongly influenced by the sources and the preferred paths of the extratropical cyclones, namely the cyclonic tracks. The cyclone identification and tracking was performed with the scheme developed in the Melbourne University that has been appropriately modified to better capture the individual characteristics of cyclones in a closed basin with complex topography, such as the Mediterranean. It was found that the great majority of cyclones passing over Eastern Mediterranean generate within the basin rather than travelling from western Mediterranean as was expected. The analysis of their characteristics, such as frequency, intensity, movement, trends helps in weather forecasting. Furthermore, the study of explosive cyclones, being associated with extreme events near the coasts revealed that they are baroclinic disturbances that, are intensified by sea surface fluxes that form when cold intrusions from the north interact with the warm Mediterranean sea in winter.