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The role of large sea-land temperature, the coastline shape and the SST in the nocturnal offshore convection in the Mediterranean basin

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Offshore precipitation cells and lines are usually detected during the night near the coastline in the whole Mediterranean basin. The precipitation events are mainly located in areas where coastal mountain ranges and mouth rivers enhance convergence by the interaction of nocturnal mesoscale and local flows (land breeze, katabatic winds, drainages winds) with a prevailing synoptic wind.

The methodology used to study this phenomenon consisted in three stages. First, NASA's TRMM radar satellite database is used to detect nocturnal precipitation near the coastline, from 18 to 21 UTC. An event will included in the study if the precipitation spot detected by using TRMM is stationary near the coast, or moved offshore, lasted no more than 6 consecutives hours, and appeared and disappeared suddenly during the night. Secondly NCEP reanalysis database has been used to describe the synoptic conditions and to discard precipitation events associated to low pressure areas, a dynamic (polar) fronts, or a through. Finally the version 3 of the Weather Research Forecast model (WRF-ARW) has been used to simulate and analyze some selected events.

Three precipitation events are used to analyze the role of the three most important physic factors that determines the nocturnal offshore convection: the land-sea temperature difference (Heiblum et al., 2011; Khain et al., 1993), the curvature of the coastline which favors convergence at low levels (Houze et al. 1981; Negri et al. 1994; Ohsawa et al. 2001) and the sea surface temperature (Malda et al., 2007; Britten and Simpson, 1980). Three different events in which these features play an important role has been simulated. Respectively the Israel and Lebanon event on 5th and 6th January 2011, the Libyan event occurred the night from 28th to 31st January 2008), and the event occurred in some areas of the coastline in the Adriatic, Ionian and Tyrrhenian Seas the night of 27th September 2004.
The simulations show the large influence of these factors in nocturnal convection. The analysis of these simulation has been a good tool to determinate several features like the depth of cold mass, temperature and wind pattern, and how the horizontal convergence by several kind of winds produce upward vertical transport of mass, heat and moisture at upper levels in the boundary layer.