EMS Annual Meeting Abstracts
Vol. 10, EMS2013-137, 2013
13th EMS / 11th ECAM

The role of the nocturnal-coastal-front height in the occurrence of clouds and rain bands in the Mediterranean basin.

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It is already known that during nighttime in some coastal areas around the world cloud bands may appear near the coastline and sometimes producing rain cells or bands. The physical mechanisms that explain this phenomenon are well described for the tropical regions (e.g Yu et al., 2004; Frye, 2001; Oshawa et al., 2001; Mapes et al., 2003), and also for the Mediterranean basin (Callado and Pascual, 2002; Greich et al., 2004; Newman, 1951; Mazon and Pino, 2009, 2011, 2012, 2013). Due to nocturnal radiative cooling inland air moves offshore, forming a coastal front in arriving over the Mediterranean Sea. The relative warm and wet sea air is then lifted over the cold coastal front and clouds and precipitation may occur.

In this mechanism the height of the cold air mass (H) plays an important role to form clouds and precipitation (Miglietta et al, 2010; Wang et al., 2000). Stratiform clouds (and consequently the associated weak precipitation) are formed if H is higher than the Lifted Condensation Level (LCL), $H \geq LCL$. Moreover, if H is higher than the Level of Free Convection ($H \geq LFC$) convective clouds are formed.

Ten nocturnal events of precipitation are selected in the entire Mediterranean basin, and analyzed by using the version 3.3 of the WRF mesoscale model. Analyzing all the events, the height of the coastal fronts (H) is related to the land-sea potential temperature and wind speed differences.

Additionally, by using this relationship and the condition needed to form a cloud band over the coastal front ($H \geq LCL$), an index that allow us to evaluate whether stratiform clouds may be formed over the coastal front is proposed. This index could be used to forecast this type of nocturnal events near the coastline.