



## **Idealized study of Mediterranean quasi-stationary MCS: mesoscale mechanisms governing the location and intensity of the heavy rain**

V. Ducrocq, E. Bresson, O. Nuissier, C. De Saint- Aubin , and D. Ricard

CNRM/Météo-France, GMME/MICADO, Toulouse, France (veronique.ducrocq@meteo.fr)

Northwestern Mediterranean regions are frequently affected by torrential rainfall associated with mesoscale convective systems. These systems can stay at the same location during several hours, focusing high-rate precipitation in a specific and limited region. Ingredients favoring the triggering of these events are relatively well-known now. They include a slow-evolving synoptic environment, conditional convective instability, a low-level moist flow impinging the region, etc. But on the other hand, understanding how these ingredients combine and interact to produce more or less precipitation with different anchored locations is still an open question. The goal of the present study is to address this question based on idealized high-resolution modeling.

The effects of the mesoscale atmospheric conditions and of the terrain on the location and intensity of the quasi-stationary precipitating systems are investigated through 2.4-km MESO-NH simulations. Atmospheric conditions are idealized, but not the terrain as we wanted to keep in our simulations the strong topographic component of the region (e.g. sea surrounding by coastal mountain ranges). The idealized atmospheric conditions contain the main characteristics of the flow observed during heavy precipitation events over the Cévennes region (France). The control experiment successes in simulating a quasi-stationary mesoscale convective system with large accumulated rain amounts.

Then sensitivity experiments have been carried out. A first set of experiments aims at investigating the effects of the flow speed and wind direction by varying them. Then, the effects of the mountain ranges have been examined, by removing them alternatively. Finally, the sensitivity to the environment moisture distribution has been investigated by modulating the moisture apart the axis of maximum flow and humidity.

The synthesis of all these sensitivity experiments shows that the location and intensity of the Mediterranean quasi-stationary mesoscale convective systems depend not only on a unique combination of characteristics of the mesoscale environment in which the systems form and evolve (flow speed and direction, moisture distribution, terrain of the region). As instance, the same location of the system can be obtained by varying either the flow speed or the moisture. However, the MESO-NH experiments evidence four main low-level mesoscale forcings which combine or compete to explain the intensity and the location of the system: cold pool forcing, orographic lifting, low-level wind convergence and flow deflection. According to the characteristics of the environment, some of them could be dominant or absent.

This study is part of the pre-campaign studies of the HyMeX program (<http://www.hymex.org/>), helping to highlight the ingredients and mechanisms to sample during the HyMeX observation periods as it will be discussed during the presentation.