Orography, shallow banded convection and rainfall climatology in the Mediterranean area

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Climatology shows that the mountainous areas surrounding the Mediterranean Sea collect up to two times more rainfall than associated coastal plains that are, in many places, massively populated. Plains are thus directly dependent on mountains in term of water resource. They are also prone to extremes of rainfall climatology like floods and droughts in which the role of the surrounding mountains is central.

A better understanding of the meteorological mechanisms behind rainfall climatology in these areas is necessary to deal with different questions, such as severe weather and flood forecast or impact of climate change.

This presentation explores a specific aspect of the role of mountains in triggering convection and rainfall. Considering that topography interacts with convection at related scales, we study how small topographic features trigger shallow convection and, in turn, banded rainfall.

Measurement of rainfall in mountainous areas is difficult. Different aspects of this question are examined, in particular in relation to shallow convection, the relatively moderate amounts of rainfall it brings and the limitations of radar and rain gage networks.

Statistics helps showing that, under stable meteorological conditions, bands of rainfall are generated by fast moving rain cells that are triggered by relief shoulders.

This evidence is confronted to a set of numerical atmospheric modeling exercises. The nature of the driving atmospheric conditions is analyzed using Meso-NH, a mesoscale non-hydrostatic model. Convergence is present within the topography below each rain triggering points. Increased vorticity in the mesoscale flux flowing on the mountain ridge is more effective in producing shallow convection and rain bands. The coexistence of shallow and deeper convection is illustrated.

Producing maximum intensities of the order of $15 mm h^{-1}$, but lasting up to one day, banded orographic rainfall is shown to contribute substantially to the mean annual rainfall collected by these areas and to related extreme rainfall accumulations.

Illustrations come from the Observatoire Hydrométéorologique Méditerranéen Cévennes Vivarais (France) that will be part of the HYMEX on-going experiment. The observation strategy specifically deployed for orographic precipitations during HYMEX is described.