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The chaotic properties of western mediterranean climate

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The behaviour of rainfall in the Mediterranean region has been target of multiple studies because of its social economic and environmental implications. Mediterranean rainfalls are characterized by great variability between years combined whit recurrent drought periods and highly intense rain events. These circumstances favour the intensification of erosion processes and the incidence of landslides, floods, etc.

Western Mediterranean zones show these facts more acute, which could become more critical in a near future according to climate change scenarios. Within such environments, see facing lands of Spain present most contrasting rainfall regimes within the western Mediterranean climates.

Under such conditions, it is of paramount importance to determine rainfall behaviour according not only to general climate trends but also to specific microscale, or local, conditions -such as topograpy- that could be reflected in a random behaviour of rainfall.

The objective of this work is to establish rainfall characteristics due to local topographic conditions according to the possible existence of chaotic dynamics. The methodology applies the correlation dimension method to analyse the presence of chaotic dynamics to rainfall time serie. This technique allows calculating the necessary variables to explain the rain behaviour and to establish suitable models that assume their complexity.

The methodology have been applied to two monthly rainfall series (1950-1990) belonging to neighbouring stations with different topographic locations. Both rainfall stations, Elche and Novelda, are located in Alicante, eastern Spain, along the littoral mountain system. Elche with a SE orientation has a major marine influence, while Novelda, with a NW orientation, presents different local conditions with less Mediterranean sea influences.

Results show a chaotic trend of low dimensionality in the two series analysed, having a clear saturation of correlation exponent for Elche rainfall records, whereas for Novelda station this trend is not so clearly established. According to the specific local conditions represented by topographic orientation, the obtained results are related favourably to the particular characteristics of each station. For that reason, the differences obtained in both series could be attributed to certain specific local factors that are well represented by the correlation dimension method.