

Two decades of mountain climate monitoring and research: lessons learned and future challenges.

*Luis Duran^{1,2,3}, Irene Rodríguez-Muñoz¹

1. interMET Sistemas y Redes S.L.U. Madrid. Spain, 2. Centro de Investigación, Seguimiento y Evaluación del Parque Nacional Sierra de Guadarrama. Madrid. Spain, 3. Departamento de Física de la Tierra y Astrofísica. Facultad de Ciencias Físicas. Universidad Complutense de Madrid. Spain

During the last two decades several efforts have been made in order to have an accurate assessment of climatic conditions in a mountain area in Central Spain (Peñalara Massif). A combination of in-situ measurements, statistical analysis of historical data, use of re-analyses and high resolution modeling has been done in order to overcome the difficulties inherent in such a complex terrain. The first decade has been focused on the design and operation of a mountain observational network. After some efforts, the performance achieved was satisfactory. As a result, long and homogeneous records are now available for the first time. Also, valuable technical and operational information has been gained which helped in the re-design of the network which is now in operation. In the meantime, connections between mountain meteorological phenomena and synoptic forcing has been found using weather typing methods using total column water vapor flux fields from re-analyses. The interaction between regional scale advection of humidity and orography has been identified as the leading phenomena in terms of precipitation. This finally led to the application of an orographic precipitation model giving a high resolution assessment of precipitation at this mountain area which is coherent with in-situ observations. This database opens new horizons of research since it converts point measurements into spatial fields. This comprehensive approach for researching the climate of a mountain area has proven to be effective but also brings future challenges which will be discussed here.

Keywords: Mountain climate, Mountain meteorology, Mountain weather monitoring