



Precipitation in Madeira island and atmospheric rivers in the winter seasons

Flavio T. Couto (1), Rui Salgado (2), Maria João Costa (2), and Victor Prior (3)

(1) Instituto de Ciências da Terra – Polo de Évora, Departamento de Física, IIFA, Universidade de Évora, Évora, Portugal. (couto.ft@gmail.com), (2) Instituto de Ciências da Terra – Polo de Évora, Departamento de Física, Escola de Ciências e Tecnologia, Universidade de Évora, Évora, Portugal., (3) Observatório Meteorológico do Funchal, Instituto Português do Mar e Atmosfera – IPMA, Funchal, Portugal.

This study aims to analyse the distribution of the daily accumulated precipitation in the Madeira's highlands over a 10-year period, as well as the main characteristics associated with atmospheric rivers (ARs) affecting the island during 10 winter seasons, and their impact in the rainfall amounts recorded near the mountain crest in the south-eastern part of the island. The period between September 2002 and November 2012 is considered for the analysis. The ARs have been identified from the total precipitable water vapour field extracted from the Atmospheric Infrared Sounder (AIRS). The AIRS observations were downloaded for a domain covering large part of the North Atlantic Ocean. The precipitable water vapour field from the European Centre for Medium-range Weather Forecasts (ECMWF) analysis was also used aiming to support the AIRS data when there was no satellite information over the island. The daily accumulated precipitation at surface showed generally drier summers, while the highest accumulated precipitation are recorded mainly during the winter, although some significant events may occur also in autumn and spring seasons. The patterns of the precipitable water vapour field when ARs reach the island were investigated, and even if great part of the atmospheric rivers reaches the island in a dissipation stage, some rivers are heavy enough to reach the Madeira Island. In this situation, the water vapour transport could be observed in two main configurations and transporting significant water vapour amounts toward the Madeira from the tropical region. This study lead to conclude that the atmospheric rivers, when associated to high values of precipitable water vapour over the island can provide favourable conditions to the development of precipitation, sometimes associated with high amounts. However, it was also found that many cases of high to extreme accumulated precipitation at the surface were not associated to this kind of moisture transport.