Plinius Conference Abstracts
Vol. 17, Plinius17-31, 2022
https://doi.org/10.5194/egusphere-plinius17-31
17th Plinius Conference on Mediterranean Risks

The role of Atmospheric Rivers in the Mediterranean in heavy precipitation events over the Alps

Silvio Davolio[1], Mario Marcello Miglietta[2], Marco Vercellino[3], Lucia Drago Pitura[4], Lorenzo Giovannini[5], Francesco Sioni[6], Federico Grazzini[7], Sante Laviola[1], and Vincenzo Levizzani[1]

[1]CNR - ISAC, Bologna, Italy (s.davolio@isac.cnr.it)
[2]CNR - ISAC, Padoa, Italy
[3]formerly Dep. of Physics, University of Bologna, Bologna, Italy
[4]3BMeteo S.r.l., Italy, formerly Dep. of Physics, University of Bologna
[5]Dep. of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy
[6]OSMER-ARPA FVG, Palmanova (UD), Italy; formerly Dep. of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy
[7]ARPAE, Bologna, Italy & LMU, Munich, Germany

Heavy precipitation events on the southern side of the Alps are typically associated with a favourable large-scale environment, characterized by an upper-level trough or cut-off cyclone over the western Mediterranean. This configuration induces, at the meso -scale, a meridional transport of large amount of moisture towards the orography, often organized in the form of a pre-frontal low-level jet. The thermodynamic characteristics of the impinging moist flow and its interaction with the orography determine the distribution and the intensity of the rainfall.

The present study shows that, besides the local contribution from the Mediterranean Sea, a relevant amount of moisture may move from the tropics towards the Mediterranean within long and narrow filament-shaped structures, known as atmospheric rivers (AR). To this aim, a detection algorithm, designed for the open oceans, has been adapted to the peculiar morphology of the Mediterranean and applied to identify ARs during some of the most severe weather events affecting the Alpine region in the last decades. Moreover, some diagnostic tools, such as an algorithm for the calculation of the atmospheric water budget, have been employed to compare and investigate such AR events.

The presence of ARs across the Mediterranean has been recently associated with heavy precipitation over southern Europe and Italy in particular. However, their role has not been fully assessed yet, in terms of contribution to the rainfall amount and of interaction with the cyclones driving their evolution. Therefore, high resolution numerical simulations are exploited to investigate how the transport of water vapour associated with the AR may have impacted on the severity and dynamics of a recent heavy precipitation event affecting the western Alps, and to disentangle how much rainfall can be attributed directly to the presence of the AR.