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Revisiting the Atmospheric Rivers in Europe: from impacts to moisture sources and future climate scenarios

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In recent years it was found that there is a strong relationship between Atmospheric Rivers (ARs) and extreme precipitation and floods across Western Europe. The relationship is especially strong along the western European with some areas having 8 of their top 10 annual maxima precipitation events related to ARs. In the particular case of the Iberian Peninsula, the association between ARs and extreme precipitation days in the western river basins is noteworthy, while for the eastern and southern basins the impact of ARs is reduced.
An automated (AR) detection algorithm is used for the North Atlantic Ocean Basin, allowing the identification of the major ARs affecting western European coasts in the present climate and to study them in future climate scenarios. To do so, we have used six global climate models under three climate scenarios (the control simulation, the RCP4.5 and RCP8.5 scenarios). The western coast of Europe was divided into five domains, namely the Iberian Peninsula, France, UK, Southern Scandinavia and the Netherlands, and Northern Scandinavia. It was found that there is an increase in the vertically integrated horizontal water transport which leads to an increase in the ARs frequency more visible in the high emission scenarios (RCP8.5) for the 2074-2099 period.
In addition, a Lagrangian analysis was applied in order to identify the main areas where the moisture uptake was anomalous and contributed to the ARs reaching each domain. The Lagrangian dataset used was obtained from a FLEXPART model simulation between 1979 and 2012.
The results show that, in general, for all regions considered, the major climatological areas for the anomalous moisture uptake extend along the subtropical North Atlantic, from the Florida Peninsula to each sink region, with the nearest coast to each sink region always appearing as a local maximum. In addition, during AR events the Atlantic subtropical source is reinforced and displaced southwards.

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