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Impacts of cloud-aerosols-radiation interactions on Atmospheric Rivers hitting European Atlantic coast as simulated by RCMs

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Atmospheric rivers (ARs) are considered a key meteorological phenomenon in the water cycle and they could be responsible for some extreme events like flooding or droughts. ARs are long filaments of high water vapor content that can travel hundreds of kilometers from the tropics to larger latitudes. During their trajectory, they can transport several aerosol spices such as sea salt or dust and, also anthropogenic aerosols. It is well known that aerosols can alter the precipitation intensity and variability, but it is still difficult to quantify these aerosol impacts.

In order to investigate how cloud-aerosols-radiation interactions affect to ARs three simulations are inspected with the same model configuration: control, ARI, and ACI. The only difference is the aerosols processing: in control, aerosol effects are parameterized, in ARI aerosol concentration interact with radiation and, in ACI aerosol concentration interact with clouds and radiation. These climatological simulations cover the period 1991-2010 and encompass the EURO-CORDEX domain with 0.44º spatial resolution. The AR's catalog developed by Guan et al. 2016 is used to identify the AR that impact to the Atlantic coast of Europe and they are grouped according to four different "detection barriers": 1) the Iberian Peninsula, 2) West France 3) the British Isles and 4) Norway.

Results show that ACI reduces the IVT due to a decrease in both water vapor and horizontal winds. Water vapor decreases over land but horizontal winds decrease offshore. As a consequence, there is precipitation reduction over the affected region. This result is clearer for AR approaching to the Iberian Peninsula but this signal is weakened as ARs affect to higher latitudes. The reason of this latitudinal change is the higher influence of dust transport over southern Europe. The analysis of the aerosol concentrations shows high concentrations of dust when ACI promotes the larger suppression of AR intensity.