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Identification of the atmospheric river drivers key on local flood generating mechanism and its sensitivity under the climate change

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Flooding is one of the natural hazard that causes the significant economic, ecosystem and human losses every year. Large percentage of floodings in the western of the US caused by heavy precipitation events are associated to atmospheric rivers (ARs). With the warmer climate is expected an increase of saturated water pressure which could increase the intensity and frequency of the ARs. In this work we attend to address two questions: 1) what are the large-scale drivers that promotes differences in ARs promoting heavy precipitation at different locations and 2) how climate change will influence on ARs and extreme precipitation.

The methods applied in our analysis consist on a dynamical downscaling using the Weather Research and Forecasting (WRF) model. The target region is the western coastline U.S. on a domain with 12-km grid spacing. Regional climate simulations (RCM) encompass a historical period (1970-2010) and future projections (2020-2060) using NNRP and ECHAM as initial and boundary conditions. Clustering methods are applied to the RCM to identify regions with similar precipitation variability. At each region, the extreme events of precipitation according to 99 percentile are identified and associated to integrated vapor transport (ITV).

Results show how heaviest precipitation in each region is associated to different AR patterns. When an AR impacts coastline, the direction and intensity of the IVT determine the areas affected by heavy precipitation. Coastal mountains play a key role intensifying the precipitation in the coastline and avoiding the inland penetration of the IVT. The shape of the atmospheric rivers is related to differences in 500 hPa geopotential between the mean and the extreme precipitation. Areas with heaviest precipitation are located in the interface of Z500 differences.