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Evaluating the impact of humidity bias on light precipitation estimates in Med-CORDEX/Hymex simulations using long term GPS network and ground-based datasets.

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This work uses a network of GPS stations from which a homogenised IWV dataset has been retrieved (IGS repro1), completed with colocated temperature and precipitation measurements over specific stations over France to i) estimate the biases of six regional climate models over Europe in terms of humidity ; ii) understand their origins ; iii) and finally assess the impact of these biases on the occurrence of precipitation. The evaluated simulations have been performed in the framework of HYMEX/Med-CORDEX programs and cover the Mediterranean area and part of Europe at horizontal resolutions of 50 to 12 km.

Results suggest that physics of models mostly explain the mean biases, while dynamics affects the variability. The use of nudging towards reanalyses thus improves the representation of the large scale advections of air masses and reduces the standard deviation of differences between GPS retrieved IWV and simulated ones. The land surface/atmosphere interactions are crucial in the estimation of IWV over most part of Europe, especially in summer, and explain part of mean biases. However, the relationship between IWV and temperature, that deviates from Clausius-Clapeyron law after a critical value of temperature, is generally well captured by models. This critical temperature presents a spatial variability since it corresponds to the value when relative humidity starts to decrease, and is thus strongly dependent on local processes which drive the local humidity sources (from evaporation and advection). This explains why the maximum values of IWV are not necessarely observed over warmer area, that are often dry area, where soil moisture limited regime is dominant.

Finally, it is shown that the biases in IWV and most importantly IWV's distributions as a function of temperature strongly impact the occurrence of light precipitation over France, and most generally over areas where convection is the main process of precipitation triggering: indeed, for each temperature, there exists a critical value of IWV over which a pickup in precipitation occurs. This is observed and simulated by models, but the critical values and the probability to exceed them vary between models and observations. Models which present too much light precipitation generally show lower critical values and higher probability to exceed them.