Session: C16 Poster: T159B

Soil moisture precipitation feedback in West Africa

Federico Fierli†; Orlandi Emiliano; Buzzi Andrea; Davolio Silvio; Drofa Oxana; Malguzzi Piero
† ISAC-CNR, Italy
Leading author: f.fierli@isac.cnr.it

Precipitation forecasts in the transition zones between wet and dry climates is closely dependent on soil moisture dynamics and latent heat fluxes between soil and atmosphere. In the Sahel, 90% of the precipitation is due to mesoscale convective systems, whose evolution and development are closely connected with the horizontal distribution of soil moisture. Furthermore, temperature and humidity gradients in the lower layers of the atmosphere determine the latitude, altitude and intensity of the African Easterly Jet, which in turn plays a key role in regulating the location and intensity of precipitation in the region. Because of feedback between latent heat fluxes, precipitation and atmospheric circulation, the climate of the West African region is particularly sensitive to changes in the spatial distribution of humidity and their fluxes. Using a regional climate model coupled with two different soil parameterizations, Steiner et al. (2009) showed that improving the parameterization of soil and soil-atmosphere coupling leads to substantial improvements in mean monthly precipitation and in the simulation of the main characteristics of West African dynamics. On daily time scales, Orlandi et al. (2010) demonstrated that the assimilation of satellite data of brightness temperature improves precipitation forecasts and the spatial and temporal evolution of deep convection. The improvements, however, are limited to the initial ~12 hour interval of the forecast. In the present work, using the BOLAM regional meteorological model, we investigate to which extent precipitation forecasts and the dynamics of the region are influenced by soil moisture distribution on seasonal timescales. Starting from a reference 30-day simulation that overestimates precipitation in the Sahel and shifts northward the rainy band and the African easterly jet, we modified the soil moisture initialization and the soil parameterization. It is observed that the average circulation and hence precipitation are largely modified, as the rainy band and tropospheric jets are shifted southward in the case of reduced soil humidity. Comparison with in situ measurements and satellite estimation shows that more realistic moisture simulations improve the spatial distribution of precipitation. The final aim is to assess the relative role of assimilation and latent heat fluxes tuning on the improvement of precipitation forecasting and analysis at regional scale.