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Impacts of topography and Land Use change on the air surface temperature and precipitation over the Central Andes of Peru

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This work focuses on the representation of the air surface temperature (T2m) and precipitation (PP) by modelling with WRF high resolution (3km) in the Peruvian Central Andes [14.5S-10.0S; 78.0W-73.0W] which considers from East to West: Pacific coast, Andes mountains and Amazon. Three experiments are considered: (1) using topography and land use from the United States Geological Survey (USGS) data base; (2) with a new SRTM topography (Shuttle Radar Topography Mission) and land use from the USGS, and (3) with SRTM and new land use based on satellite and in-situ measurements. Variations from (1) to (2), and (2) to (3) are considered to evaluate the effects of change in topography and land use respectively. Modelled hourly data of Januaries from 2004 to 2008 are considered. Observed hourly data of air temperature and precipitation from seven stations distributed on the domain are taken in account to assess the three experiments. In the experiments, T2 is mainly controlled by change in altitude with -6.2 and -5.6 degC/km during the daytime and nighttime respectively. These are noticeable when the topography is changed from USGS to SRTM with more differences in the Amazon and mountains where differences are 500m or more. Change in land use does not show significant differences in T2 in almost all area of study except when urban or ice appear. Changes in PP are also relatively larger, more than 50%, in the Amazon and mountains associated to changes in topography. These changes can be major in places near maximum variations in topography. PP also increases when new land use is considered. Analysis, in three sub-regions, in the coast, mountain and Amazon give an increase of precipitation associated to apparition or increment of grassland/forest, cropland/shurbland and forest respectively. About the performance of the experiments, substantial improvements in the bias of T2 and PP take place when the topography is set to SRTM. Reduction up to 5 degC can be observed and a better representation of the Diurnal temperature range. PP with SRTM also reduced its bias up to 50 % respect PP with USGS topography. PP modelling with new land use does not show significant differences from USGS. Finally, according the results modelling with SRTM topography is recommended to use instead the default USGS in the Peruvian central Andes.