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Precipitation diurnal cycle and associated valley wind circulations over an Andean glacier region (Antizana, Ecuador)

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In the tropical Andes, the evolution of the mass balance of glaciers is strongly controlled by the variability of precipitation and humidity transport. It is therefore crucial to better understand the main patterns of precipitation in terms of spatio-temporal distribution at the local scale. In this study, we focus on the region of the Antizana ice cap, located in the Equatorial Andes about 50 km east of the city of Quito (Ecuador). In addition, the Antizana region is located in a very complex zonal climate gradient, with the Pacific Ocean to the west and the humid Amazonian plains to the east, including an area of maximum precipitation on the Amazonian slope, also called "Precipitation hotspot".

In this study, we perform dynamical downscaling using a Regional Climate Model (RCM) to improve the understanding of the atmospheric processes controlling the spatio-temporal variability of precipitation. The WRF (Weather Research and Forecasting) model is used to perform a set of ten experiments with four one-way nesting domains (27km, 9km, 3km, 1km), with the highest resolution domain centered on the Antizana mountain, for the year 2005. For the model validation, we use the 3B42 satellite product of the Tropical Rainfall Measuring Mission (TRMM) at 3-hourly time step, the ORE Antizana meteorological station (SNO GLACIOCLIM, LMI GREATICE) at hourly time step, and 2 meteorological in-situ stations, installed by the Instituto Nacional de Metereología e Hidrologia (INAMHI) in the Antizana region, with a complete chronology of daily precipitation (mm/day) during the 2005 year.

We test different forcings of DEM (Digital Elevation Model), microphysic schemes, Cumulus schemes and convection-permitting simulation, and radiation/slope dependent options. The analysis focuses in particular on how the different representation of thermally driven valley wind circulation can affect the diurnal cycle of precipitation at the ORE Antizana in-situ station. The influence of the diurnal cycle of the regional humidity flux on the mountain precipitation is also analyzed.