



Evaluating the changing Andean hydrology under land-use and land-cover change using the JULES land-surface model

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Our research geographically focused on the tropical Andes, which is a hotspot of land-use and land-cover change (LUCC) and hydrological risks. The region provides headwaters for the major largest rivers of the Amazon basin, which supplies water resources for the major Andean cities and towns. Currently, the highland hydrology is threatened by the increasing human intervention such as cattle grazing, cultivation, and pine planting. These impacts require systematically assessment to support the decision making on watershed management. Hydrological models are commonly used for this propose. However, the model development could be hinder, given the intensive data requirement to parameterise the complex environment with its complexity of meteorological and geographical conditions combined with extremely heterogeneous land-use. In this study, the tropical Andean hydrology has been explored using the JULES land surface model. The model simulates the fluxes of carbon, water, energy and momentum between the land surface and the atmosphere with a large dataset of hydrometeorological variables by using a physically-based approach. It could be coupled to an atmospheric global circulation model, but also used as a standalone land surface model for hydrological assessment. The physically-based model has the advantage to detect and attribute change in hydrological observations, thus identifying the potential factors affecting change. Thus, the potential hydrological impact under anthropogenic interventions could be identified by changing the model structure or parameter values which represents in the catchment properties. The dominated land cover classes are parameterised to the parameter “libraries” within small-scale catchments. Then the large-scale hydrological changes under the impacts of LUCC are simulated with the calibrated land cover parameters accordingly. The effects of LUCC on the Andean hydrology are evaluated during the period from 2001 to 2017.