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# Investigating the co-evolution of semi-arid landscapes and vegetation under the influence of orographic precipitation

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Implications of orography on the precipitation patterns and vegetation establishment have long been documented in the literature. These observations are mostly focused on mountain chains along the oceans. However little attention is given to the inland areas where elevational gradient in precipitation regime is observed in semi-arid regions such as the Southwestern US. Hence, a numerical framework that integrates a range of ecohydrologic and geomorphic processes to explore the coupled ecohydro-geomorphic landscape response of catchments in semi-arid regions has been missing. In this study, our aim is to realistically represent the ecohydrologic dynamics driven by orography in a landscape evolution model (LEM). The LEM is used to investigate how surface hydrology and vegetation cover caused by differential precipitation patterns on the leeward and windward sides of low-relief terrains lead to differences in the organization of modelled topography, available soil moisture, and vegetation productivity. We use the CHILD LEM equipped with a vegetation dynamics component that explicitly tracks above- and below-ground biomass. The precipitation forcing of the LEM was generated by using the Weather Research and Forecasting Model (WRF) that simulates rainfall as a function of elevation and orientation. The preliminary results of the model show how the competition between an enhanced shear stress through runoff production and increased erosional resistance due to denser vegetation cover shape the landscape. Interestingly, simulations generate windward side steeper than leeward ones because of more erosional resistance. To ensure erosional equilibrium between sides, the divide migrates towards windward side. When the prevailing storm direction is from north (south), the orographic influence on divide migration increase (decrease) due to the role of solar radiation on available soil moisture. These outcomes highlight the strong coupling between landform evolution and climate processes.