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Interrill soil erosion and its relation to soil properties along a climate gradient from arid to humid on hillslopes in Chile

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As soil erosion is an environmental problem in vast parts of the world and fundamental mechanisms of soil surface stabilization are still unclear, it is important to improve our understanding of basic erosion processes. In particular, comparative studies over different climate zones are scarce. A broad latitudinal climate gradient in Chile together with its typical natural vegetation allows to investigate climate specific soil properties, which may consequently imply a specific resistance against erosion. With increasing amounts of rainfall and concurrent decreasing temperatures, soil organic matter and the thereby related aggregate stability increase. Hence, differing sediment losses due to the climate gradient are expected. Furthermore, the topographic position along hillslopes is expected to play a role due to downslope relocation of clays and soil organic matter, both parameters influencing aggregate stability. The objectives of our study are to examine to which extend soil physico-chemical properties and aggregate stability control surface resistance against initial soil erosion and how this system is influenced by climate and topography.

The study took place in national parks on similar granitoid parent material within the Chilean Costal Cordillera from Pan de Azucar (26 °S) in the north to Nahuelbuta in the south (38 °S) to set the variables of lithology, human disturbances and relief as far as possible constant. At the same time, climate varies along the transect. The texture consists of loamy sands to sandy clay loams with increasing amounts of clay from semiarid to humid climate. The research plots were located on four different topographic slope positions at each site and analyses of bulk samples for soil properties, such as soil organic matter content, aggregation and soil moisture were carried out. We implemented an on-site rainfall simulation experiment with 0.4 $\times$ 0.4 m runoff plot sizes and a standardized rainfall intensity of 60 mm h-1 at every plot. Runoff and sediment delivery were measured in austral autumn 2017. The surrounding area was enclosed by a tent to ensure a wind-undisturbed rainfall event on each plot. Each measurement was replicated three times and consisted of 2 runs with 30 minutes duration. Additionally, aggregate stability was measured by wet-sieving. Linear mixed effects models to evaluate the impact of soil properties, soil organic matter, aggregate stability, topographic position and slope were compiled.

First results revealed a significantly lower sediment delivery in the humid study site compared to the arid to mediterranean study sites. The most humid site (Nahuelbuta) showed the highest aggregate stability and higher clay and oxide contents than the arid to mediterranean study sites, both major factors for aggregate stability. Topographic position and slope angle play a crucial role as the amount of sediment delivery increased in each site from the shallower south upper slope to the steeper south mid slope and south lower slope positions. We assume that the climate gradient along Chile has a major influence on soil stabilization. These preliminary findings will now undergo a more detailed analysis and further results will be presented at the EGU 2018.