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Microbial mediated soil structure formation under wetting and drying cycles along a climate gradient (arid to humid) on hillslopes in Chile

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It is well-known that the land surface resistance against erosion is largely controlled by the structure stability of the soil given by its inherent properties. Microbial activity plays a vital role in soil structure development, and thus affecting soil physical parameters. Accordingly the influence of biota shaping the earth's surface has been described through mechanisms such as mineral weathering, formation of ions and biofilms controlling land surface resistance against erosion. However the role of microorganisms for the development of soil stabilizing properties is still unclear and a precise quantitative understanding of the mechanisms under different climate conditions is widely missing.
The objectives of our study are to examine to which extend microbiological processes control soil structure formation and stability and whether this is influenced by climate and topographic position.
Soil samples were taken along a climate gradient and from different topographic positions of hillslopes in the Chilean Coastal Cordillera in austral autumn 2016. The variables of lithology, human disturbances and relief were held as far as possible constant whereas climate varies along the transect.
We implemented 10 wet-dry cycles on air dried and sieved natural and sterile samples to enhance particle aggregation and increase structure stability. Throughout the entire experiment temperature is held constant at 20 °C to avoid changes in microbial activity. Samples are moistened and dried and each kept at the same respective pF-values for the same duration to add the same stress to each sample. Aggregate stability will be measured using wet sieving, ultrasonic dispersion and simulated rainfall. The results will be compared with on-site rainfall simulation experiments on hillslopes in the Chilean Coastal Cordillera to link laboratory results with natural field conditions.
The experiment gives first insight into the aggregate formation process over time with and without microorganisms (sterilized samples). Furthermore it allows to qualify and quantify the contribution of biota to soil structure formation and stability.