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Interannual variability of a precipitation gradient along the semi-arid catchment areas for the metropolitan region of Lima- Peru in relation to atmospheric circulation at the mesoscale

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The main moisture source for precipitation on the western slopes of the Central Andes is located east of the mountain range known as the Amazon basin. However, the Andean mountains, which reach up to 6000 m a.s.l., strongly influence climatic conditions along the Pacific coastline of South America as a climatic barrier for the low-level tropospheric flow and associated moisture transport from the Amazon basin. Additional, large scale subsidence caused by the South Pacific High inhabits convective rainfall at the Pacific coast where large metropolitan areas such as the Peruvian capital Lima are located. Two contrasts in precipitation can be found while crossing the Andean mountains from West to East. On the Pacific coast, at the location of the metropolitan area of Lima, no more than 10 mm mean annual rainfall occurs. In contrast, up to 1000 mm mean annual rainfall occur only 100 km east of Lima within the upper region (4000 m .a.s.l.) of the Western Cordillera. The transition takes place along the western slopes of the Western Cordillera and is characterised by a strong precipitation gradient. Here, catchment areas are located that provide most of the water resources needed to sustain an urban area of approximately 10 million people. This study investigates the interannual variability of the precipitation gradient between 1998 and 2012. The analysis is based on daily precipitation data of 22 rain gauge station, daily rainfall data of the Tropical Rainfall Mission (TRMM 3B42) at 0.25 degrees and reanalysis data at 36 km spatial resolution at the mesoscale. The reanalysis data was produced using the Weather Research and Forecasting Model. Station data was provided by the Peruvian weather service during the project “Sustainable Water and Wastewater Management in Urban Growth Centres Coping with Climate Change - Concepts for Lima Metropolitana (Peru) (LiWa)”, which is financed by the German Federal Ministry of Education and Research (BMBF). We are interested in the following questions. How is the interannual variability of the observed precipitation gradient related to atmospheric circulation east (Amazon basin) and west (south-east Pacific) of the study region? If those relations are quantifiable, are there any forecast potentials for the characteristics of the precipitation gradient during the raining season?
The results of the study provide valuable information needed to understand the generation of rainfall in the frame of a case study for the largest metropolitan area that is located at the arid Pacific coast of Peru. This information may also be useful for local managers in order to optimise water resource management and land use strategies.