Geophysical Research Abstracts
Vol. 21, EGU2019-10414, 2019
EGU General Assembly 2019

Weather types over the Subtropical Southeast Pacific and their impact on moisture supply to the Atacama Desert

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One of the objectives of the Collaborative Research Center CRC32 “Earth – Evolution at the dry limit” is to study the impact of different moisture variables and precipitation extremes on landscape and biodiversity in the Atacama Desert. In recent studies evidence is found that these and other local variables are affected by mid-tropospheric synoptic systems over the subtropical Southeast Pacific. In this study we categorize these systems to weather types by using a methodology which combines EOF analysis and K-means clustering. Ten weather types are identified by the methodology, and their impact on the moisture supply to the Atacama Desert is analysed. Focus is given to integrated water vapor, specific humidity in different levels, extreme precipitation, and coastal low level clouds. Observational and reanalysis datasets as well as model output from a long-term WRF simulation are utilized to uncover the underlying mechanisms. Based on first results, we hypothesize that only a small subset of the weather types is relevant for moisture supply and extreme events, and that, depending on the weather types, different moisture sources can be identified. A weather typing approach as used in our study is useful for a broad range of applications: (i) For statistical-dynamical downscaling, where only a few representative weather types are dynamically downscaled. By utilizing the weather type frequencies and the simulated representatives, highly resolved climatologies of different parameters can be obtained, which is particularly useful for the study area of the CRC1211, where observations are rather rare. (ii) The methodology may easily be applied to different global model ensembles to gain insight into the moisture supply under paleo- and future climate conditions.