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Orographic enhancement of rainfalls in the Rio San Francisco valley in southern Ecuador

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In a tropical mountain rain forest in southern Ecuador diurnal dynamics of cloud development and precipitation behavior is investigated in the framework of the DFG research unit 816. With automatic climate stations and rain radar rainfalls in the Rio San Francisco valley are recorded. The observations showed the typical tropical late afternoon convective precipitation as well as local events such as mountain valley breezes and luv-lee effects. Additionally, the data revealed an unusually early morning peak that could be recognized as convective rainfalls. On the basis of GOES-E satellite imagery these rainfalls could be traced back to nocturnal convective clouds at the eastern Andes Mountains.
There are some explanations for the occurrence of the clouds: One already examined mechanism is a katabatic induced cold front at the foothills of the Andes in the Peruvian Amazon basin. In this region the mountains form a quasi-concave configuration that contributes to a convergence of cold air drainage with subsequent convective activities. Another explanation for the events is the orographic enhancement by a local seeder-feeder mechanism. Mesoscale convective systems from the Amazon basin are transported to the west via the trade winds. At the Andes Mountains the complex and massive orography acts like a barrier to the clouds. The result is a disconnection of the upper part of the cloud from the lower part. The latter rains out at the eastern slopes and the upper cloud is transported further to the west. There it acts like a seeder to lower level clouds, i. e. the feeder.
With the numerical model ARPS (Advanced Regional Prediction System) this procedure is investigated on the basis of two case studies. The events are detected and selected through the analysis of GOES-E brightness temperatures. They are also used to compare and validate the results of the model. Finally, the orographic enhancement of the clouds is examined. By using a vertically pointing radar the development of the resulting precipitation is analyzed and discussed in the context of a seeder-feeder mechanism.