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Statistical evaluations of vertical precipitation profiles obtained by the objective analysis tool VERA

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Especially in complex terrain, the distribution of precipitation sums is governed by different physical processes leading to horizontal as well as to vertical variations. Discriminating horizontal and vertical components is indispensable for a proper downscaling and enables conclusions regarding the processes modifying the precipitation intensities.

To derive height dependencies of precipitation sums, many different approaches have been carried out. Most of them do not distinguish explicitly between horizontal and vertical gradients because they are either based on measurements taken by installed rain gauges along slopes or on regressions that are computed only with respect to height without taking horizontal aspects into consideration. The objective analysis tool VERA (Vienna Enhanced Resolution Analysis) is able to decompose analysis fields into vertical and horizontal parts. With the aid of the so called Fingerprint technique, weighting factors are assigned to predefined patterns according to the degree of explaining the observed values. Horizontal patterns take into account luv-lee effects which can affect precipitation intensities up to great distances from mountain ridges, vertical patterns consider effects such as evaporation and seeder feeder effects.

The presentation introduces to the Fingerprint technique and focuses on different vertical Fingerprints ranging from simple mathematical functions to more sophisticated basis polynomials. The latter constitute pure vertical but horizontally varying precipitation profiles when composing them according to the computed (also horizontally varying) weighting factors. The so obtained vertical profiles are evaluated statistically for analyses based on daily, monthly and yearly precipitation sums. Differences in vertical precipitation gradients are investigated on the one hand for different regions of the Alpine domain (northern and southern foothills, main ridge, inner-alpine valleys) and on the other one for different seasons. Moreover, the effects of atmospheric stability resulting in convective or stratiform precipitation events and different atmospheric flow patterns on the profiles are studied.