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SIMULATION OF HEAVY PRECIPITATION WITH LONG DURATION OVER COMPLEX TERRAIN

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A diagnostic model for orographic precipitation that focuses on heavy rainfall with long duration during large-scale upslide motions is presented. It is used for the regionalisation of precipitation from rain gauge observations as well as for deriving rain fields for different statistical return periods.
Besides orographic parameters like elevation, slope or exposure it is found that orographic rain enhancement is also governed by atmospheric conditions. Particularly the Froude number, which describes the tendency of the air to flow over or around an obstacle, plays an important role. Analyses of different measurement data show that the strongest enhancement is associated with a high Froude number. This finding is a crucial point of the airflow model, which is based on linear theory for 3-D mountain overflow. Rain intensities at the ground are calculated from simulated vertical velocities using different parameterization schemes. The model has a small number of free parameters, a short computing time and a simple initialisation method, e.g. with single radiosonde data.
For Southwest Germany and Eastern France, with the low mountain ranges of the Vosges, Black Forest and Swabian Alb, model simulations are performed for individual heavy precipitation events. Mean rainfall distributions are derived from simulations of all extreme events with 24-h totals over 60 mm at selected rain gauge stations between 1971 and 2000. Furthermore the calculation of rain sums for different return periods is performed using extreme value statistics. So it is possible to quantify the hazard potential of heavy rainfall, which may cause flooding or landslides, with high spatial resolution (2.5 x 2.5 km).