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Perspectives for the short-time prediction of hazardous rockfall events using radar-based storm cell forecast

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Small-scale rockfalls are one of the most important natural hazards in terms of casualties in densely populated mountain areas. During a four-year rockfall study in the Reintal, Bavarian Alps, more than 90 % of all small-scale rockfall activity were concentrated in two hours branded by the activity of intense rainstorms. The intensity and spatial distribution of the rainstorms were recorded by the adjacent precipitation radar station “Hohenpeißenberg” and match with the results of our rockfall measurements. Therefore, we combined rain gauge measurements and precipitation radar images to create a more accurate record of the spatial distribution of rainfall intensity especially during rainstorms. Logistic growth functions based on these combined precipitation values can model rockfall intensity with an R^2 of 0.89 to 0.99 for each of the eight rockfall collectors. The logistic growth function is adapted to the violent nonlinear response of rockfall intensity caused by gross secondary rockfall events that are triggered as soon as a threshold of 9-13 mm/h of rainfall is exceeded. Recent radar processing tools such as the storm cell tracking tool CONRAD (Convection in Radar) of the “Deutscher Wetterdienst” allow a short time forecast of intensity alterations and the movement of storm cells. A combination of the rockfall thresholds derived from our empirical measurements with radar-based storm cell forecast has the potential to create a short-term rockfall prediction for especially endangered areas e.g. those with a dense tourist infrastructure.