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Set-up and performance evaluation of a seismic rock fall observatory in the Alps

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Rock falls are important agents of erosion shaping the topography of bedrock slopes. Despite the considerable attention rock falls get when causing damage we still lack detailed information about the triggers, lag times, seasonal and elevation-dependent rock fall occurrence. This is due to the difficulty in observing rockfalls directly as the mobilisation of rock masses occurs rapidly, infrequently and distributed a priori unknown locations. To identify seasonal and elevation-dependent rock fall activities and characteristics and their environmental drivers and triggers in an alpine setting, we have operated a monitoring network to detect and classify rock falls in the Reintal valley, German Alps, since 2014. The Reintal is an Alpine valley in the Wetterstein massif close to the Zugspitze, Germany's highest mountain. The Reintal observatory produces nearly continuous datasets of seismic, meteorological and camera data. To our knowledge, these datasets are one of a few that permit a systematic study of rockfall patterns and their controls over a period of several years in an alpine setting.

In this contribution, we present the layout of the observatory and the instrumental network. Six seismometers record the motion of the ground; different types of seismic signals are shown and their sources discussed. This is done in combination with the meteorological data of the two weather stations in the valley and the images of the optical and infrared cameras of the observatory. We evaluate the performance, limitations and capabilities of the observatory. In addition, we discuss how we dealt with challenges such as power consumption of the instruments in the field, data storage and data loss. Our experience with the set-up and maintenance of the observatory can help guide the design and construction of other observatories in mountain environments.