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A detailed record of sediment transfer and geomorphic work of small, medium and high-magnitude-rockfalls in an Alpine Catchment (Reintal, German Alps)

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Rockfalls play a crucial role in budgeting sediment flux and geomorphic work of steep environments. However, most rockfall studies only provide quantitative information on certain rockfall magnitudes and fail to give integral values that comprise small, medium and large rockfalls. This study compares the importance of debris falls ($<$10 m^3), boulder falls (10-10^2 m^3), block falls (10^2-10^4 m^3), cliff falls (10^4-10^6 m^3), bergsturz events ($>10^6$ m^3) in terms of sediment flux (m^3/a) and geomorphic work (J/a) in the glacially incised Reintal Catchment. The dataset in the 4 km^2 large Alpine catchment includes the direct measurement of 140,000 kg of small-scale rockfalls, a scientific record of mid-magnitude rockfalls for the 20^{th} century, a well-documented historical record that dates back to the 18^{th} century and carbon-dating of late medieval bergsturz activity. The total rockfall sediment yield of 6757 m^3/y ($\pm$1255) is dominated by bergsturz events (56%) and debris falls (23%), while mid-magnitude while mid-magnitude cliff falls (9 %), block falls (4 %) and boulder falls (8 %) are less important. The overall geomorphic work released by rockfalls per km^2 contributing rock face (13.3 ($\pm$1.9) GJ/km^2/y) exceeds values given by previous studies and geomorphic work done by other mass transport processes in the Reintal by one to three orders of magnitude.