CROSS-COMPARISON OF SELECTED AVALANCHE OBSERVATIONS

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INTRODUCTION

In many mountainous regions, snow avalanches are severe threats to the population and their infrastructure. Delineation of avalanche endangered areas or the design of sufficient mitigation measures require in-depth understanding on the avalanche phenomenon. Measurements and observation constitute the basis for this understanding.

METHOD

NGI has been performing full-scale avalanche experiments and observations at the Ryggfonn test-site in western Norway for more than 40 years (Gauer and Kristensen, 2016). The acquired data constitute the basis for the presented cross-comparison with data originating from various other sites around the world, for example Vallée de la Sionne (Ammann, 1999) or Col du Lauteret (Eybert-Berard et al., 1978).

FINDINGS/RESULTS

Avalanche velocity is an important parameter to characterize the dynamic behavior. Observations imply that the maximum velocity of major avalanches scale with the total drop height H_{SC}, that is $U_{max} \sim \sqrt{g\,H_{SC}/2}$ (McClung and Gauer, 2018; Gauer, 2014). The observations are supported by a simple scaling analysis (Gauer, 2018). This scaling behavior has implications on the choice of the empirical parameters of the Voellmy-model that is used in most of the present day avalanche models. One factor that influences the avalanche dynamics is snowpack (Steinkogler et al., 2014).

Another important factor for the delineation of avalanche endangered areas or the design of objects subjected to avalanche impacts is the impact pressure. The pressure forces of dry- and wet-snow avalanches can be very different. Measurements give some indications about the order of magnitude of the force that might to be expected and show the difference between avalanche types.

CONCLUSION

Avalanche experiments provide valuable data. Measurements can, e.g., supply indications on forces to be expected or the efficiency of certain mitigation measures, like the catching dam at Ryggfonn. However, to obtain in-depth understanding in avalanche dynamics, cross-comparisons between different avalanche paths or test-sites are necessary to uncover, e.g., possible scaling relations. Full-scale avalanche tests are time consuming—only a limited number of experiments are possible in per year—and they are expensive. Therefore, small-scale granular- as well as for snow chute experiments seem to be appealing. In order to draw sustainable results from these, a cross-comparison with large scale experiments is needed. The same holds true for results of numerical models.

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