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Integrating spatial patterns into a snow avalanche cellular automata model

ABSTRACT. Snow avalanches are a major mountain hazard that kills hundreds of people and causes millions of dollars in damage worldwide annually. Yet, the relationship between the well-documented spatial variability of the snowpack and the avalanche release process is not well understood. We utilize a cellular automata model to show that the spatial structure of shear strength may be critically important for avalanche fracture propagation. Fractures through weak layers with large-scale spatial structure are much more likely to propagate over large areas than fractures through weak layers with smaller-scale spatial structure. Our technique of integrating spatial structure into the model can improve many cellular automata models that aim to explain and predict other natural hazards, such as forest fires, landslides and earthquakes. *INDEX TERMS:* 0742 Avalanches; 0736 Snow; 0515 Cellular automata; 4430 Complex systems