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Friction coefficient sensitivity analysis : a Bayesian approach using runout distance posterior predictive distribution

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Friction coefficient sensitivity is a critical point for avalanche modelling, especially for reference hazard characterisation. For a few years, methods inspired by hydrological rainfall runoff modelling associated with Monte Carlo simulations have been proposed to address this issue : a propagation model is calibrated using recorded avalanches and probability distributions are proposed for friction coefficients. Enough fictitious events are then generated in order to compute output variables probability distribution. A most questionable assumption is then friction coefficient distribution specification, which generally comes rather from practical reasons than from physical considerations.

Bayesian inference is an interesting option to try to overcome the difficulty : all model parameter posterior distributions can be computed simultaneously using historical data and simulation algorithms, the so called Markov Chains Monte Carlo techniques. This study deepens an approach of Ancey using a very well documented site and a Coulomb based propagation operator : several model structures are implemented and simulations are carried out up to yield runout distance posterior predictive distributions.

Model comparisons based both on Bayes factors and on runout distance predictive distributions give converging results. Sensitivity to friction coefficient likelihood model is found to be low, especially with respect to observed runout distance reliability. This is presumably an outcome of Bayes formula for predictive distributions that allows mixing as many distributions (i-e likelihood with a given value for the param-

eters) as necessary to capture data structure. It though also appears that for extreme avalanches modelling friction coefficient dependence with other variables through a mixture model approach is likely to make a significant difference in terms of reference hazard.