



Stochastic model for the inter-annual dynamics of the snow storage-melting process

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The inter-annual dynamics of snow storage and melting have key importance for several environments. For instance, fluctuations of the snow mantle and related variations in the End-Of-Summer Snowline (EOSS) are fundamental for the recharging process of glaciers and for both the base and surface flows. Classic approaches, e.g. temperature index and energy-mass balance models for melting, have shown to be useful for short-term predictions. For the long-term, however, the increasing of uncertainty in the variables intrinsically introduces stochastic effects in the dynamics underlying the process. Our purpose is to formulate and investigate a simple stochastic model to describe the inter-annual dynamic of the probability density function (pdf) of the snow height at a point. The model has only two components which allow us to retain the basic structure of the dynamics i.e., stochastic winter accumulation (due to a poissonian process of solid precipitation) and deterministic summer melting. We show that under stationary conditions, the process has a pdf that obeys to an integral-difference equation. However, despite some similarities with the Takács process, the solution of this equation in closed form seems not to be straightforward. Therefore, in order to study the relative importance of each component, we numerically simulate the process by means of a MonteCarlo scheme. The results show the role of the parameters that assure a statistically stationary behaviour and, in turn, the related significance of the latter for the inter-annual dynamic of the EOSS.