Monte Carlo experiments for uncertainty investigation of glacier melt discharge predictions through surface energy balance analysis

FREDDY SORIA & SO KAZAMA

Civil Engineering Department, Tohoku University, Aoba Aramaki 6-6-06, PO Box 980-0871, Sendai, Japan
soria@kaigan.civil.tohoku.ac.jp

Abstract The spatial representativeness of point records is a concern in glacier discharge predictions. A Monte Carlo-based global sensitivity approach is used to investigate the predictive uncertainty in the net radiation ($R_n$) as the major component driving glacier melt in the Bolivian Andes. The $R_n$ is inferred through the Surface and Energy Balance Algorithm, calibrated with point dry-season records monitored on a glacier’s ablation area. High uncertainties are expected in the vicinity of the monitoring station (surface albedo ($\alpha$) between 0.81 and 0.79, specific melt discharge (SMD) between 72 and 88 L s$^{-1}$ km$^{-2}$); smaller uncertainties are expected on the glacier boundaries ($\alpha$ between 0.10 and 0.08, SMD between 128 and 143 L s$^{-1}$ km$^{-2}$). Thus, with the incoming long wave radiation ($R_{L\downarrow}$) as the most sensitive model parameter, the spatial variability in $\alpha$ determines the spatial variability in the SMD predictive uncertainties.

Key words tropical Andes; sensitivity analysis; remote sensing