Geophysical Research Abstracts
Vol. 14, EGU2012-3444, 2012
EGU General Assembly 2012


# Inverse simulation of snowmelt runoff and snow cover area using the energy balance-based distributed snowmelt model (WEB-DHM-S) for the correction of basin-scale snowfall

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In this study, a method has been established that explicitly corrects the basin-scale snowfall amount through the inverse simulation of snowmelt runoff and snow cover area (SCA) with the use of the multilayer energy balance based distributed snowmelt model (WEB-DHM-S). The evaluation indices, obtained from the pixel-to-pixel analysis between the simulated SCA and the SCA derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the Terra Satellite, and from the statistical analysis between the simulated and observed snowmelt runoff, were used to define the threshold criteria for the minimization of bias/maximization of accuracy following the calibration of the orography-dependent snowfall correction factor (SCF). The method was applied at Yagisawa basin (167 km2) of the Upper Tone River of Japan. The model was run at hourly time step at 500 m grid from November 2000 to November 2004. Two types of precipitation (observed rain gauge, called AMeDAS and Radar data adjusted with rain gauge observations, called Radar-AMeDAS) inputs were corrected with this approach since both dataset highly underestimated the snowmelt runoff due to large underestimation of snowfall. The basin average SCF was estimated at 1.87 times for AMeDAS and at 3.77 times for Radar-AMeDAS precipitation, for which Nash Efficiency was greater than 0.80, and the overall accuracy of SCA simulation between the MODIS and the model was about 91%. The method established in this study is simple and robust, and can be applied to any snow-fed river basin to obtain a reliable SCF. Furthermore, this approach could be applicable in correcting the snowfall from reanalysis products and atmospheric model outputs which could be very supportive in the climate and land surface hydrological researches.