Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

ACG35-03 Room:301A Time:May 22 09:30-09:45

Effect of land surface process for simulating snow depth using WRF model over the mountainous area of central Japan

Masatoshi Kuribayashi[1*], NOH, Namjin[1], SAITOH M. Taku[1], WAKAZUKI, Yasutaka[2], TAMAGAWA, Ichiro[1], MURAOKA, Hiroyuki[1]

[1]River Basin Research Center, Gifu University, [2]Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba

The mountainous area of central Japan is one of the heaviest snow areas all over the world. The accumulated snow provides water resources, and also it is one of the important factors controlling phenology of forest ecosystem. The amount of snow might be reduced under the climate changed condition. Therefore, the accurate estimation of the amount of snow and the future prediction are quite important. The most precise method to measure the snow amount is in-situ observation, but there are few observation sites in the mountainous area over central Japan because of sever environment. Though the remote sensing is useful to check the special distribution of snow depth, it is not be able to observe continuously. There are researches about the spatial distribution and the future prediction of snowpack using regional climate model WRF (e.g., Kawase et al., 2012; Hara et al., 2008). These researches adopted the Noah-LSM as land surface process scheme. On the other hand, the Noah-MP, which is the renewed version of the Noah-LSM, was added to the land surface process option from WRF version 3.4 released in April 2012. According to Niu et al. (2011), the model reproducibility about snow depth, snow density, and snow water equivalent was improved at the mountainous area of Vermont in America by adopting the Noah-MP as land surface process.

In this study, we compared the reproducibility of snowpack simulated by WRF version 3.4.1 with the Noah-LSM and the Noah-MP in the mountainous area of central Japan from September 2006 to August 2008. First, we tried to validate the modeled data at the Tokamachi site (Elev. 200 m) of Forestry and Forest Products Research Institute, because the site only opens the observation data of snow density and snow water equivalent. The simulated snow depth, snow water equivalent, and snow depth by using the Noah-MP were more consistent with these observation data than the simulated data by using the Noah-LSM. We consider that the reason of better calculation by using the Noah-MP is multi-stratified structure of snowpack. Whereas the Noah-LSM treat snowpack as a bulk layer, the Noah-MP separate snowpack up to three layers, depending on the snow depth. The multi-stratified structure of the Noah-MP would be effective to separate new snow and old snow. As a result, it could reproduce the temporal variation of snow density at the time of snow fall and snow melt. Second, we tried to validate the modeled data at the Takayama site (Elev. 1324 m) of Gifu University, where located in the middle of Mt. Norikura. The calculated time series variation of snow depth by the Noah-MP was consistent with the observed value well. Both of the calculated snow depth by the Noah-MP and the Noah-LSM were consistent with the observation until the time of maximum snow depth. But, the Noah-LSM tends to estimate too fast snow melting speed during the beginning period of snow melt. As a result, it underestimated the snow depth during the snow melting period, and it estimated the end date of snow melt about two weeks faster than observation.

Keywords: snowpack, land surface process, mountanious area of central Japan, regional climate model