Application of the land data assimilation system for a frozen soil in the permafrost region of Tibetan Plateau

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ABSTRACT

In the permafrost region of Tibetan Plateau, the snow depth is excessively estimated by the snow satellite retrieval algorithm. Therefore, it is important to estimate the thickness of an unfrozen layer on permafrost, in order to estimate an amount of snow cover in high accuracy based on satellite microwave data in permafrost region of the Tibetan Plateau. In this study, the thickness of an unfrozen layer on permafrost in the Naqu basin, Tibetan Plateau was estimated by using the data assimilation system for the permafrost which was developed by the Cold and Arid Regions Environmental and Engineering Research Institute from December 2003 to March 2004. In this result, the estimated soil temperature was in good agreement with the in-situ data at deep depth, and the estimated soil temperature was tracing the in-situ data, although the daily fluctuation was slightly overestimated at shallow depth. Furthermore, the estimated thickness of an unfrozen layer in this observation period was about 20cm. But, soil was frozen till a land surface in the in situ data. That is, the gap occurred in the result based on the land data assimilation system and the in-situ observation. On the other hand, the following characteristic was confirmed by the land surface observation at Naqu on March 2008. In Tibetan Plateau, the period when land surface is covered with snow is very short, and changes to a patch-like distribution immediately by the strong wind. In bare ground, a melting layer at about 20cm is formed by strong solar radiation. In ground surface covered with snow, soil freezes till a land surface in order that a strong solar radiation is cut off by snow. In addition, a snow in this observation site was observed as following when the thickness of a melting layer was estimated on the beginning of February 2004: Observation station was covered with snow for the fence, but about 90% of the surrounding area was the bare ground. We evaluated in view of these observation results that the estimated result was relatively suitable based on spacial heterogeneity between in situ observation and satellite.

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