Hydrol. Earth Syst. Sci. Discuss., 3, S731–S733, 2006
www.hydrol-earth-syst-sci-discuss.net/3/S731/2006/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Simulation of spring snowmelt runoff by considering micro-topography and phase changes in soil layer" *by* T. Nakayama and M. Watanabe

Anonymous Referee #1

Received and published: 14 August 2006

The paper presents a modified version of NICE land-surface model and test results. The modification includes phase changes in soil moisture and multi-layer runoff that accounts for snow-frozen ground effects. This manuscript has a broad scientific and practical interest because the cold season runoff generation mechanism is not well understood in watershed modeling. While added a soil moisture phase change component follows available in literature approximations, a mixed two-layer runoff component is a novel concept that allows better representation of flood generation during transition periods. Presented results show reasonable agreement with available limited measurements. Unfortunately, the manuscript is difficult to read specifically the section on 'Model description of NICE-SNOW'. Results presentation section and discussion are also written poorly and they include a number of unclear statements. The manuscript requires significant editing to be helpful for broad scientific community.

Recommendations for paper improvement:

1. Section 3 should be rewritten to be understandable. Maybe it would be better to combine this section with appendix A to exclude inconsistencies in variable definitions, undefined variables, and equation discrepancies, e.g., Eq (15a) and (A12a), meaning of g and γ, etc. Numerous statements in Sections 4 and 5 should be edited, e.g., phrases 'the hydraulic conductivity increases temporarily in the thawing layer due to the macropores and desiccation cracks of the soil in the previous research at the end of winter' (page 2111), 'Ě can simulate the penetration of the frost front in the Sect. 3.4.' (page 2110) '. It is not easy to understand true meaning of the phrase in the Discussion section 'This model developed a multi-layer surface runoff submodel including the effect of micro-topography and meteorology, includes the phase change transitions in soil moisture, and also considered the effect of the snow layer and the frost/thaw soil layer on spring snowmelt runoff.' (page 2121). 2. The authors often refer to not well established assumptions that they use without clarification what and how exactly they use, e.g., 'So, we supposed that the hydraulic conductivity increases temporarily in the thawing layer due to the macropores and desiccation cracks of the soil in the previous research at the end of winter (Chamberlen Gow, 1979; Benoit et al., 1988)' (page 2112) but there is no approach itself. 3. It is not clear how a weighting factor of 1.1 was applied to divide 'the vertical dimension into 20 layers Ě' to get the upper layer at 2m depth and the 20th layer -250m from the sea surface. 4. While I can agree that the model simulations are compared reasonably well to limited measurement data, the author' statement 'reproduce excellently' (pages 2116-2122) is clear overestimation considering that the determination coefficient equals only 0.4 for ground water and 0.74 for runoff. This statement also contradicts to the author' statements in Discussion section 'Ě this discrepancy of runoff is due to an imperfectness of the heat-budget and hillslope surface-runoff submodel of the NICE-SNOW. While the simulation reproduces

HESSD
3, S731–S733, 2006
Interactive Comment

well the phase changes in the unsaturated layer in winter periods, the simulated soil temperature overestimates the observed value in winter season.' 5. There are no results to support the conclusion 'Ě the local effect of snow depth and the frost depth disappears in the snowmelt runoff discharge of catchment in the same way as some previous researches'. Fig. 8g that the authors refer to does not support this conclusion too. 6. There is no meaning referring to Fig. 3 in these contexts, pages 2107 and 2110. 7. Figures 7 and 8 need to be scaled up or redone to be helpful

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 2101, 2006.