SOIL Discuss., 1, C60–C61, 2014
www.soil-discuss.net/1/C60/2014/

Interactive comment on “Coupled cellular automata for frozen soil processes” *by* R. M. Nagare et al.

R. M. Nagare et al.

ranjeet.nagare@gmail.com

Received and published: 11 August 2014

SOILD 1, 119–150, 2014 Nagare et al. – “Coupled cellular automata for frozen soil processes”

RESPONSE TO REVIEWER COMMENTS: REVIEWER # 3 We thank Anonymous Reviewer # 3 for his/her comments. Following is our response to the reviewer comments. The reviewer comment is placed in italic and our response is in normal font. Reviewer Comments: 1. The complexity of the coupled CA-model is very high, with a lot of parameterisation. Is this level of complexity really necessary, and have the authors explored whether a simpler CA model would provide similar results?

2. There are underlying assumptions about the consistency in structure, bulk density

and hydraulic conductivity down the profile that do not seem realistic. What is being modelled is in effect an idealised, homogenous soil that is simpler than the reality.

Author Responses: 1. Our objective was to present ability of CA to model strongly coupled heat and water movement in frozen soils. The examples used to verify the code were chosen such that they have been used in the past by researchers to compare numerical solutions. Irrespective of the numerical method used, the physics of the problem will have to be simulated in order to represent the coupling. In addition, the profound effect of the processes on properties of porous media will also have to be considered. We did simply a few things like using SFC. Further, use of empirical laws itself is a major simplification. Except for simulation of perfectly idealized systems where parameters are known, we do not believe that a simpler approach than one presented here was possible. For example, if the objective was to simulate only freezing and thawing front movement while ignoring the freezing induced water movement, the parameterization could be reduced. But for a coupled nature, the additional parameterization is necessary. 2. The assumptions are based on the initial conditions of the verification examples used in this study. We believe our approach is able to handle heterogeneities with ease. In fact, as water moves from one zone to another, it results into changes in hydraulic and thermal properties making the system heterogeneous in transient simulations. And the code is able to handle these heterogeneities with ease as demonstrated by comparison with Mizoguchi (1990) data.

Interactive comment on SOIL Discuss., 1, 119, 2014.