

## ***Interactive comment on “A coupled atmosphere and multi-layer land surface model for improving heavy rainfall simulation” by M. Haggag et al.***

### **Anonymous Referee #3**

Received and published: 1 July 2008

A coupled atmosphere and multi-layer land surface model for improving heavy rainfall simulation M. Haggag, T. Yamashita, H. Lee, and K. Kim Hydrol. Earth Syst. Sci. Discuss., 5, 1067-1100, 2008

General Comments: In this coupled land-atmosphere study, the SOLVEG model is used to represent the land surface in MM5 as an alternative to the slab model, or the Noah Land Surface Model. The authors present an application in which a heavy precipitation event in Japan is simulated, and discuss the mechanism by which they expect SOLVEG better reproduces the event. This is an interesting case study, but the manuscript should be substantially revised prior to acceptance by HESS-D.

The authors conclude that "improved simulation of soil moisture fields in conjunction

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with improved simulation of the surface temperature leads to better computation of energy fluxes, and precipitation". However, no temperature, soil moisture or energy flux data are presented to support this claim. The paper concludes that "MM5-SOLVEG coupling shows a clear image of the land surface-atmosphere interactions and the dynamic feedback on convection initiation, storm propagation and precipitation". The authors must present stronger evidence, notably observations other than precipitation, to convince the reader that this is the case. The authors refer to 'improved simulations' of soil moisture and ground temperature from MM5\_CPL in Figures 3 and 4, but these are not validated against observations. Surface wind and sea level pressure in Figure 9 should be validated against observations. For comparison, precipitation data should be included in Figures 8 and 10.

The paper would also benefit from a more detailed discussion of the differences between Noah LSM and SOLVEG physics, with particular regard to their energy, heat and moisture balances to explain how SOLVEG produces an 'improved' simulation. The discussion of the how MM5\_CPL reproduces the precipitation is the most interesting aspect of this paper and as such should be in its own section. At the moment, it is lost in the middle of the precipitation validation.

Specific comments:

The title suggests that a new coupled model is developed to improve heavy rainfall simulation. An alternative title should be proposed to reflect manuscript that two existing models are coupled and applied to case study.

Contour labels on Figures 6 and 7 are too small.

Axis, scale and title fonts on figures 2,3 and 5 are too small.

Colorbar on Figure 3 is too small

Page 1069, line 20: states, not parameters

Page 1072, line 13: Why is MM5 used rather than WRF?

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Page 1072, line 19: Noah is also multi-layered

Page 1074, line 3-5: This sentence is confusing, and unnecessary.

Page 1074, line 20: From Figure 1, these are not 'arbitrary' time intervals.

Page 1075, line 7: What time/date was the model initialized? Are the soil layers the same in the models and initial conditions data? Can a map be provided of initial conditions, e.g in Figures 3 and 4?

Page 1075, lines 9-14: This belongs in Section 4

Page 1075, line 11: Rainfall observations from ...

Page 1076, line 18-19: "By comparing the results of each case, the ground temperatures reveal patterns similar to the soil moistures". This is not obvious from Figures 3 and 4.

Page 1076, line 22-24: "This pattern of ground temperature can be seen as footprint of the produced rainfall by each model and its corresponding soil moisture variability". This is not obvious to me.

Page 1077, line 7: SOLVEG

Page 1078, line 9: "The plots show ... ". Please give figure numbers,

Page 1079, line 23: 'goal' or 'aim' rather than target?

Page 1082, lines 18 and 19. Where are these numbers in Table 2?

Page 1081, line 26: Provide some references for past studies ...

Section 5.4 belongs on page 1080, around line 15 as it demonstrates that MM5\_CPL performs best in terms of reproducing the precipitation.

Page 1083, lines 11 and 12: 'Improved simulation' implies that the quantity has been compared to observations ...

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Table 2: What observations are used as OBS here?

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 1067, 2008.

**HESSD**

5, S562–S565, 2008

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