Geophysical Research Abstracts
Vol. 16, EGU2014-70, 2014
EGU General Assembly 2014

Evaluation of NOAH LSM in predicting soil temperature and moisture at two tropical sites of India

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The soil temperature and moisture are important initial conditions to weather and climate models. Due to the sparsity of observations, surface and subsurface soil temperature and moisture are usually generated using land surface models (LSM). Hence it is important to test the performance of LSMs in predicting these parameters. The NOAH LSM has consistently performed well in studies which compared different land surface models [2, 3] and the performance of the model has been examined over different regions [1, 4]. However, performance of NOAH LSM over India has not been extensively investigated. In the present study, the simulation skill of 1-D NOAH LSM with respect to soil temperature and moisture has been evaluated at two sites in India namely Kharagpur and Ranchi, for a period of two years 2009-2010 in both cases. Model simulated soil temperature and soil moisture over Kharagpur have been validated against observation at three depths, namely 10 cm, 20 cm and 50 cm. For Ranchi, soil temperature has been validated at 10 cm, 20 cm and 40 cm and soil moisture at 15 cm, 30 cm and 45 cm. The parameters have been validated at observation frequency and at daily frequency. Soil moisture is well estimated by the model at all depths and over all time scales at these sites. It is suspected that the model has slower infiltration rate and higher evaporation rate or faster lateral run off than actual values. The model shows a dry bias in the monsoon period and a wet bias in other seasons with maximum over-prediction during spring and winter. The diurnal range of soil temperature is well simulated by the model in all seasons both at Ranchi and Kharagpur. Soil temperature is generally over predicted by the model with a maximum warm bias in spring and minimum in monsoon. Over Ranchi, the model over-prediction decreases with depth at all seasons hinting at possible inaccuracies in representation of land-atmosphere exchange coefficients at least over sites considered in this study.

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