Towards Improvement of the NCEP Noah LSM in the NLDAS during the Warm Season

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Abstract

The NCEP Noah land surface model (LSM) has been extensively evaluated with in situ observations over the southern Great Plains during the North American Land Data Assimilation System (NLDAS) Phase I simulation periods (May - September of 1998 and 1999). The model does a fairly good job but still some discrepancies in the surface energy partition between model and observations. The Bowen ratio is too low in the spring and too high in the summer. To improve the performance, we have further refined some parameters particularly those related to the calculation of canopy resistance such as the soil moisture stress function, vapor pressure deficit function, and minimum canopy resistance values. Varied LAI and root fraction have been applied as well to reflect its seasonal variation which has significant consequence on the temporal evolution of surface fluxes.

The new version of Noah LSM has been used to rerun NLDAS Phase I 3-year core period as well as some sensitivity tests. These results have been validated against some observation data. It is found that the high/low latent heat flux biases during the spring/summer have been reduced in the new version. Also the surface skin temperature and the surface water budget have been improved significantly.

Conclusions

> Seasonal LAI and root fraction have been implemented to Noah LSM.
> Some parameters have been retuned especially for those related to computing canopy resistance (vapor pressure deficit function, soil moisture function).
> The new version of Noah LSM has yielded better surface fluxes, particularly both the high LH bias during the spring and the low LH bias during the summer have been reduced.
> The warm bias of the surface skin temperature has been reduced.
> The new version of Noah LSM produces better surface water budget, i.e. surface runoff.