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ARTICLE

Evaluating a New Deposition Velocity Module in the Noah Land-Surface Model

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Abstract The community Noah land-surface model (Noah LSM) has been modified to couple with a photosynthesis-transpiration scheme (GEM) to estimate the deposition velocity (V_d) for air quality studies. This new capability of the Noah-GEM model was tested in a point version of the National Center for Atmospheric Research-High Resolution Land Data Assimilation System (HRLDAS). Ozone V_d observations from June 1–30, 2002 over the AmeriFlux forested site located at Niwot Ridge, Colorado, USA (40°1′58″N; 105°32′47″W) were used. The model reasonably captures V_d variations for both dry and wet conditions but has problems at nighttime. Experiments were performed to assess the sensitivity of V_d calculations to surface characteristics related to vegetation and soil parameters. The results indicated that V_d values are sensitive to accurate specifications of the leaf area index (LAI) and a lesser extent to vegetation type, maximum stomatal resistance (R_{smax}) and soil texture prescription. The model sensitivity to canopy resistance was noted for both daytime and nighttime. For this forest site, neither soil textures nor soil moisture appeared to affect V_d calculations significantly, though they affected the surface heat-flux estimation particularly under low soil moisture conditions. Therefore, the V_d estimation in the Noah model can be enhanced by either site-specific LAI or assimilating regional normal difference vegetation index information for specific time periods. Results also highlighted the need to lower the current constant R_{smax} value used in Noah and other land-surface models.

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