

Quantifying the Relationship between Dust Emissions and Land Surface Heterogeneities Using CLM4 on the Arabian Peninsula

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Dust event significantly influences surface radiation and energy balance, and also results in a variety of environmental problems. Saudi Arabia (16°–33°N, 34°–56°E) is mainly covered by the Arabian Desert, and dust storm is a severe environmental problem in this region. Since dust emission is sensitive to land surface conditions, we used the Moderate Resolution Imaging Spectroradiometer (MODIS) obtained land cover type (LCT) data to investigate the surface vegetation distribution in the research area. In addition, the influences of surface vegetation distribution on dust emissions were inspected with hyperresolution modeling, which integrated MODIS-LCT product into the Community Land Model version 4 (CLM4). In order to quantify surface dust emission in Saudi Arabia, two topographic based soil erodibility datasets were incorporated into CLM4.

Our main conclusions are: 1) MODIS-LCT suggests higher shrubland fraction than the CLM surface dataset does; 2) experiments using MODIS-LCT reproduce lower dust emission than that of CLM4-CTL; 3) CLM4 simulated dust emission is sensitive to model resolutions; the higher the model resolution, the more the emission; 4) CLM4 simulated dust emission is much higher than other studies; 5) by integrating soil erodibility into CLM4, annual total dust emission in Saudi Arabian is reasonably reproduced.

Keywords: Dust Emission, Saudi Arabian, Surface heterogeneity