6b.5 Sensitivity of biogenic volatile organic compounds (BVOCs) to land surface processes and vegetation distributions in California

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Current climate models still have large uncertainties in estimating biogenic trace gases, which can significantly affect secondary organic aerosol (SOA) formation and ultimately aerosol radiative forcing. These uncertainties result from many factors, including uncertainties in land-surface processes and specification of vegetation types, both of which can affect the simulated near-surface fluxes of biogenic volatile organic compounds (BVOCs). In this study, sensitivity experiments are conducted using the Weather Research and Forecasting model with chemistry (WRF-Chem) to examine the sensitivity of simulated BVOCs to land surface processes and vegetation distributions in California. The measurements collected during the California Nexus of Air Quality and Climate Experiment (CalNex) and the Carbonaceous Aerosol and Radiative Effects Study (CARES) conducted during June of 2010 provide a good opportunity to evaluate the simulations. First, the BVOC emissions in the WRF-Chem simulations with the two land surface schemes, Noah and CLM4, are estimated by the Model of Emissions of Gases and Aerosols from Nature version one (MEGANv2.0), which has been publicly released and widely used with WRF-Chem. The impacts of land surface processes on estimating BVOC emissions and simulating VOCs are investigated. Second, in this study, a newer version of MEGAN (MEGANv2.1) is coupled with CLM4 as part of WRF-Chem to examine the sensitivity of BVOC emissions to land cover distributions. Specifically, MEGANv2.1 is embedded into the CLM4 scheme and shares a consistent vegetation map for estimating BVOC emissions. This is unlike MEGANv2.0 in WRF-Chem that uses a standalone vegetation map that differs from what is used in land surface schemes. Sensitivity experiments show that land surface processes significantly affect the simulated BVOCs, and the impact of land cover distributions on simulating BVOCs is larger than that of land surface processes. This study may imply that, in addition to improving details on land processes, effort is also needed to obtain appropriate land cover datasets for climate models in terms of simulating BVOCs and consequently SOA formation.