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Impacts of Fires on Convective Cloud Features in Southeast Asia: Variability with ENSO

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Located right in the middle of the tropical warm pool, convective activities over Southeast Asia are subject to interannual variability in sea surface temperature due primarily to varying phases of the El Niño-Southern Oscillation (ENSO). Observations often show a reduction in the amount of rainfall during El Niño and its increase during La Niña over Southeast Asia. Because of this interannual variability in rainfall and humidity, emissions of aerosol particles and their abundance in the atmosphere, often manifested in aerosol optical depths, are also subject to interannual variability; they increase during El Niño and are reduced during La Niña on average. Our previous study has shown an impact of biomass-burning aerosols on convective clouds, which enhanced rainfall and generally invigorated convection. Here we present the comparison of this aerosol effect among different years with different ENSO phases. We utilized month-long cloud-resolving simulations by the WRF-CHEM model that are capable of including both aerosol direct and indirect effects. The extensive simulation domain size and time period enabled the inclusion of a wide range of contributors to cloud development over the area, from aerosol activation to ENSO-affected meteorology. We show whether the invigoration effect that we found from the year of strong El Niño in 2015 still holds in years of weaker El Niño or even during La Niña.