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Influence of different meteorological datasets and emission inventories on modeled fire aerosol abundance

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Fires including peatland burning in Southeast Asia have become a major concern to the general public as well as governments in the region. This is because aerosols emitted from such fires can cause persistent haze events under certain weather conditions in downwind locations, degrading visibility and causing human health issues. In order to improve our understanding of the spatialtemporal coverage and influence of biomass burning aerosols in Southeast Asia, we have used surface visibility and particulate matter concentration observations, supplemented by decadal long (2003 to 2014) simulations using the Weather Research and Forecasting (WRF) model with a fire aerosol module, driven by high-resolution biomass burning emission inventories. We find that in the past decade, fire aerosols are responsible for nearly all the events with very low visibility (< 7km). Fire aerosols alone are also responsible for a substantial fraction of the low visibility events (visibility < 10 km) in the four selected cities of Southeast Asia: up to 39% in Bangkok, 36% in Kuala Lumpur, 34% in Singapore, and 33% in Kuching. By comparing the results from two modeled runs with the same FINNv1.5 fire emissions but driven by different meteorological inputs (FNL versus ERA-Interim), we have examined the sensitivity of modeled results to meteorological datasets. The discrepancy in modeled low visibility events arising from the use of different meteorological datasets is clearly evident, especially in the results of Bangkok and Kuching. We have also examined the sensitivity of modeled results to the use of different emission inventories (FINNV1.5 versus GFEDv4.1s). We find that significant discrepancies of fire emissions in mainland Southeast Asia and northern Australia between the two emission inventories used in our study have caused a substantial difference in modeled fire aerosol concentration and visibility, especially in Bangkok and Singapore. For instance, the contribution to fire aerosol in Singapore from northern Australia changes from nearly zero in the simulation driven by FINNv1.5 to about 22% in another simulation driven by GFEDv4.1s. Based on these results, we suggest further research is needed to improve the current estimate of the spatiotemporal distribution of fire emissions, in addition to total emitted quantities from the fire hotspots.