EGU2020-9465
https://doi.org/10.5194/egusphere-egu2020-9465
EGU General Assembly 2020

A New Approach to Quantify the Transport of Extreme Aerosol Events in Southeast Asia by Combining WRF-CHEM with Various Models and Remotely Sensed Measurements

Shuo Wang and Jason Blake Cohen
School of Atmospheric Sciences, Sun Yat-Sen University, Guangzhou, 519000, China(jasonbc@alum.mit.edu)

Southeast Asia has a far-reaching influence on the atmospheric distribution of aerosols and co-emitted trace gasses due to the high amount of emissions, the large contribution from co-emitted heat (i.e. biomass burning and urbanization), the highly variable topography, and intense and variable meteorology. We aim to quantify the pathways and constrain the impact of long-range transport on the measured increase in aerosol loading and variability. When the dry season comes in January through April, a large number of aerosols are discharged into the atmosphere from Myanmar, Thailand, Cambodia and Vietnam, which in theory, should transport them to the East under the influence of the Indian monsoon. What we observe is that first, this eastward transport is much larger in area than expected, with measurements clearly showing aerosols and long-lived trace gasses passing Taiwan and winding up in the Central Pacific, or passing around Taiwan and winding up in Northeastern China, Korea, and Japan. Secondly, we observe a significant although smaller transport of aerosols far to the south, breaching the equator, even though the climatology at this time of year indicates a Monsoon belt from 7^{o}N southward.

We first employ a new emissions spatial-temporal distribution, forced by remotely sensed measurements of trace gasses, and second we consider meteorology associated with both fire plumes and mountain slopes. The combination of these forcings we argue is essential to reconstruct the observations. We second use observations from dozens of AERONET sites located in Southeast Asia from 2010 to 2018, to obtain the distribution of extreme events of AOD and AAOD. In addition, we combine precipitation from TRMM. These are used in tandem to establish the structural observational relationship between emissions, rainfall, transport, and diffusion.

We run these new emissions in the WRF-CHEM framework and observe a strong improvement in comparison with the measured means and variability of aerosols from MODIS and MISR, gasses from MOPITT. Furthermore, we observe a change in the vertical distribution and location of the large-scale meteorology itself, indicating that there is a possible important two-way feedback at work. We specifically note that there are significant changes induced in the high rainfall days, and in the loadings of aerosols and wind in the region from 800 to 950 hPa, with different sized particles segregated into different height levels.