



Aerosol optical depth and its relation to regional-scale circulations over Korea during MAPS-Seoul (May-June, 2015) and KORUS-AQ campaigns (May-June, 2016)

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We investigate aerosol optical depth (AOD) and its relation to regional-scale circulations over Korea during the two recent field campaigns conducted in May-June of 2015 (MAPS-Seoul experiment) and May-June of 2016 (KORUS-AQ campaign), using satellite MODIS and AERONET measurement data. The monthly averaged MODIS AOD at 550 nm was estimated to about 0.35 in May and 0.50 in June during the MAPS-Seoul experiment, which was about 33% and 17% lower than that of 13-year averaged MODIS AOD. MODIS AOD during KORUS-AQ 2016 campaign was similarly about 8~23% lower than those of 13-year averages, but slightly higher than those in 2015. The monthly averaged MODIS AOD was 0.40 in May and 0.56 in June, 2016. Consistently, ground-based AERONET sky radiometer measurements at Seoul showed AODs of about 0.35 (May) and 0.60 (June) at 500 nm during MAPS-Seoul experiment, which was approximately 32% and 20% lower than the averaged AODs (May – 0.51; June – 0.76) from 4-year measurements (2012, 2013, 2015, and 2016). Also, AOD during KORUS-AQ campaign in 2016 was about 0.43 in May and 0.71 in June, which was about 16% and 6% lower than 4-year mean AOD. This year-to-year variation of AOD in May-June over East Asia, including Korea, was closely linked with synoptic atmospheric circulations. Generally, aerosol optical depth (AOD) is high in May and June due to stagnant synoptic meteorological systems, as previously reported by Kim et al. (Atmospheric Environment, 2007). For example, in 2012, MODIS AOD over the Korean Peninsula was observed to be about 0.71 in May and 0.72 in June. This can be explained by the frequent occurrences of stagnant atmospheric conditions. However, the regional-scale circulations during MAPS-Seoul and KORUS-AQ campaigns were characterized by the fast-moving confluent flows over the Korean peninsula, formed between Siberian high pressure system located in North China and North Pacific high in South China. These results suggest that atmospheric circulations play a crucial role in atmospheric aerosol loadings in East Asia, especially over the Korean Peninsula during pre-monsoon period (May-June), before the onset of summer rainy monsoon.