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Differentiating between local and remote pollution in Taiwan

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In our study, a new approach has been developed for differentiating between local and remote pollution in Taiwan. This is based on both AERONET measurements and NASA MERRA aerosol reanalysis (version 2, MERRA-2) over a 15-year period (2002 – 2017). The analysis of seasonal variations of the standard deviation of AERONET aerosol optical depth (AOD) measurements and MERRA AOD data in Taiwan showed that, in spring, aerosols from remote sources are predominant: by contrast, in autumn, aerosols from local sources dominate. In spring, when remote aerosols dominate, the standard deviation is almost three times lower than that in autumn. This finding was supported by MERRA AOD: total AOD data were used to differentiate between local and remote pollution over both Taiwan and the open ocean area in the vicinity of Taiwan. Over Taiwan, MERRA total AOD showed a primary maximum in spring and a secondary one in autumn. Over the open ocean area, where there are no local sources of anthropogenic aerosols, MERRA total AOD showed only one maximum in spring and no maximum in autumn. This suggests that, in Taiwan, the maximum in autumn is attributed to local air pollution, while the pronounced maximum in spring is mainly caused by air pollution from continental Asia. The analyses of spatial distribution of 15-year monthly mean MERRA winds confirmed the above-mentioned results. Furthermore, similar to total AOD, MERRA sulfate AOD peaked in autumn over Taiwan, but not over the oceanic area: this indicates the contribution of local emissions of anthropogenic aerosols from the industrial sector. The standard deviation of MERRA sulfate AOD in spring is two-three times lower than the standard deviation in autumn: this is additional evidence that, in spring, sulfate aerosols from remote sources are predominant; while in autumn sulfate aerosols from local sources dominate. AOD measurements at the high-elevated AERONET site in Lulin showed only the AOD maximum in spring and no noticeable maximum in autumn. This indicated that aerosols from remote sources were transported at altitudes above 2800 m in spring, while aerosols from local sources in autumn were vertically distributed below 2800 m.