Weekly periodicities of meteorological variables and their possible relations to aerosols in Korea

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Weekly periodicities of meteorological variables such as temperature (Tmax, Tmin, Tmean), DTR, cloud amount, insolation, precipitation, and precipitation frequency, as well as particle mass concentrations (PM10) have been examined to understand anthropogenic influence on the regional climate. We used surface meteorological data of 10 stations operated by Korea Meteorological Administration along with air pollution monitoring stations. The meteorological variables and their anomalies for each weekday have been analyzed as the departure from its weekly mean value, with the similar method to that of Bäumer and Vogel (2007). The negative anomaly of Tmin in the first-half of the week and the positive anomaly of Tmin in the second half were shown as significant different for 9 of 10 stations, except for one station. Accordingly, DTR averaged over all analyzed stations in Korea also showed a clear dependency on the weekday, but with the reverse pattern against Tmin. The weekly cycle of cloud amount was reverse to DTR and insolation (direct and diffuse radiation) such as more cloudiness (less radiation) from Wednesday to Saturday and less cloudiness (more radiation) from Monday to Tuesday. Meanwhile, the PM10 anomaly was positive for Tuesday through Thursday, and clearly negative on Sunday only. A remarkable decrease in PM10 anomaly on Sunday is thought to due to human-induced influence. It is interesting to see that weekly periodicities in meteorological variables were clearly significant especially in autumn, with their amplitudes almost $2 \sim 3$ times greater than those for the annual mean. However the regional scale of weekly cycles in meteorological variables and their phase shift of one or two days against PM10 cycles might imply the possibility of long-range transport of weekly cycles from the upstream region, China.