Scavenging of PM$_{2.5}$ by precipitation and the effects of precipitation pattern changes on health risks related to PM$_{2.5}$ in Tokyo, Japan

SUPPLEMENTARY MATERIAL

S1. CHARACTERISTICS OF PRECIPITATION PATTERN IN TOKYO

In this section we introduce characteristics of hourly observed precipitation data in Tokyo in 2012 (the period when PM$_{2.5}$ data were missing was excluded). Figures S1 and S2 show the scatter plots for average precipitation intensity/total precipitation amount per event against precipitation duration for each event.

In all precipitation events (191 in total), the number of events whose duration is 1 or 2 hours is 118 and the total amount of precipitation for these events is 194.5 mm/h, which is comparable to 12.5% of the total precipitation in 2012 (1561 mm/h). Total number of hours of precipitation duration for these events (159) are 22.5% of those of all precipitation events (707).

Figure S3 shows the relationship between precipitation duration and change in [PM$_{2.5}$] before and after all precipitation events. The negative value of changes in [PM$_{2.5}$] indicates that the precipitation event contributes to decreasing [PM$_{2.5}$]. The results show that long precipitation duration significantly removes [PM$_{2.5}$] more than short precipitation duration (Spearman’s rank test, $\rho = -0.469$, $P < 0.001$).

S2. OPTIMIZATION OF PARAMETER $k$ FOR ALL PRECIPITATION EVENTS

In addition to the optimization of $k$ in modeling the decrease in PM$_{2.5}$, we optimized $k$ for all precipitation
events. Optimized $k$ was 0.0147 for model 1 and 0.0607 for model 2, and these results are in accordance with the medians of $k$ optimized per event (0.0308 for model 1 and 0.0777 for model 2 as shown in Figure 4). Figure S4 is the same as Figure 4 in the main text but for estimation with $k$ optimized among all precipitation events. Correlation coefficients for model 1 and 2 are 0.803 and 0.842 respectively and this result indicates that model 2 performs better than model 1 in terms of the reproducibility of [PM$_{2.5}$]. This result is in accordance with the results mentioned in the main text.