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Seasonality and weather-driven variability of transpacific transport

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We quantify transport from the industrialized regions of E Asia using the transit-time probability density function, $\mathcal{G}$, to isolate the role of transport from any other factors, such as chemistry and deposition. Using the offline transport model MATCH driven by NCEP reanalyses, we calculate $\mathcal{G}$, which is the mass fraction of air that had its last contact with the E-Asian source region during a given day, for each day of a three-year period. Ensemble means of $\mathcal{G}$ establish the climatological seasonal-mean transport from E Asia. Export from the source region is most efficient in spring, with nearly all E-Asian air involved in transpacific transport. In summer, E-Asian air is transported aloft across the Pacific and, in nearly equal measure, west over SE Asia to the Middle East. Winter transport is similar to that of spring, except winter has low-level transport to SE Asia. Fall transport is intermediate between that of summer and winter. For all seasons, the most probable transit times to N America are 6–8 days in the mid-to-upper troposphere and approximately one week (two for summer) longer at the surface. The surface signal of E-Asian air over N America is strongest in spring. Daily variability of transpacific transport is quantified in terms of the transit-time partitioned burden of E-Asian air over western N America. The standard deviation of the transit-time partitioned fluctuations has a nearly universal dependence on the corresponding seasonal-mean burden. The standard deviation peaks several days before the burden at a transit time of ~ 7 days. Lagged event and non-event composites, based on the western N-American burden of E-Asian air, reveal that transport events are associated with dipolar wind perturbations over the eastern Pacific that are positioned and phased to receive enhanced Asian outflow. Surface-pressure correlations are consistent with

an associated strengthened Pacific High and weakened Aleutian Low.