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Transit-time and surface-origin partitioned intercontinental transport

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The intercontinental transport of pollution poses a growing threat to global air quality. We isolate the role of transport in determining pollutant concentrations by applying tracer-independent transport diagnostics to NCEP reanalysis data. At the heart of these diagnostics is the boundary propagator, G, which is a partitioning of any given air parcel according to location of last surface contact and transit time from that location. We use the MATCH model driven by NCEP reanalysis data to calculate G for a global tiling of the earth's surface consisting of 31 source patches concentrated in the Northern Hemisphere. One year of data is analyzed for the composition of the air over selected receptor regions and its variability. We focus on both the transit-time partitioned column burden and on the surface flux of air newly arriving from major pollution regions. Our analysis reveals receptor-source transport teleconnections which asymptote with long transit times to universal patterns set by the large-scale circulation. For North-American receptors, the burden of East-Asian air dominates the burden of European air for all transit times, while East-Asian air and European air arrive at comparable rates at the North-American surface.