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The 2022 Asian Summer Monsoon Transport and its Connection to the 2005-2021 Climatology as Illustrated by Carbon Monoxide

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The Asian Summer Monsoon (ASM) provides one of the most effective transport pathways to deliver surface pollution into the stratosphere and impact stratospheric composition and climate. To better understand the impact of ASM, the Asian summer monsoon Chemical and Climate Impact Project (ACCLIP) took place in South Korea from July 29 – Sep 2, 2022. During ACCLIP, in situ measurements of a wide range of trace gas, including carbon monoxide (CO), and aerosol species in the Upper Troposphere and Lower Stratosphere (UT/LS) were collected.

CO is a key pollutant emitted from anthropogenic emissions, as well as biogenic and biomass emissions, along with many other precursors for ozone and aerosol. In addition, its > 30-day atmospheric lifetime and linear chemical loss rate make it a key marker tracer for atmospheric pollution transport and ozone photochemistry. In this study, we use CO simulated by the NASA GEOS model to (1) analyze the ACCLIP-2022 observations, (2) examine surface-to-stratosphere transport in the Asian Summer Monsoon region during the summer of 2022, (3) assess how transport in 2022 is similar to or different from the 2005-2021 Climatology. In addition, we use idealized tagged CO tracers that are used track pollution transport from a suite of source regions, e.g., within East Asia, South Asia, and Southeast Asia, to quantify the contribution of these target regions to CO and air mass abundance in the lower stratosphere over Asia and downwind regions.