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Interannual variability of long-range transport as seen at the Mt. Bachelor observatory

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Abstract. Interannual variations in background tropospheric trace gases (such as carbon monoxide, CO) are largely driven by variations in emissions (especially wildfires) and transport pathways. Understanding this variability is essential to quantify the intercontinental contribution to US air quality. We investigate the interannual variability of long-range transport of Asian pollutants to the Northeast Pacific via measurements from the Mt. Bachelor Observatory (MBO: 43.98° N, 121.69° W; 2.7 km a.s.l.) and GEOS-Chem chemical transport model simulations in spring 2005 vs. the INTEX-B campaign during spring 2006. Measurements of CO at MBO were significantly enhanced during spring 2005 relative to the same time in 2006 (the INTEX-B study period); a decline in monthly mean CO of 41 ppbv was observed between April 2005 and April 2006. A backtrajectory-based meteorological index shows that long-range transport of CO from the heavily industrialized region of East Asia was significantly greater in early spring 2005 than in 2006. In addition, spring 2005 was an anomalously strong biomass burning season in Southeast Asia. Data presented by Yurganov et al. (2008) using MOPITT satellite retrievals from this area reveal an average CO burden anomaly (referenced to March 2000–February 2002 mean values) between October 2004 through April 2005 of 2.6 Tg CO vs. 0.6 Tg CO for the same period a year later. The Naval Research Laboratory's global aerosol transport model, as well as winds from NCEP reanalysis, show that emissions from these fires were efficiently transported to MBO throughout April 2005. Asian dust transport, however, was substantially greater in 2006 than 2005, particularly in May. Monthly mean aerosol light scattering coefficient at 532 nm (σ_{sp}) at MBO more than doubled from 2.7 Mm^{-1} in May 2005 to 6.2 Mm^{-1} in May 2006. We also evaluate CO interannual variability throughout the western US via Earth System Research Laboratory ground site data and throughout the Northern Hemisphere via MOPITT and TES satellite observations. Both in the Northeast Pacific and on larger scales, we reveal a significant decrease (from 2–21%) in springtime maximum CO between 2005 and 2006, evident in all platforms and the GEOS-Chem model. We attribute this to (a) anomalously strong biomass burning in Southeast Asia during winter 2004 through spring 2005, and (b) the transport pattern in March and April 2006 which limited the inflow of Asian pollution to the lower free troposphere

over western North America.

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