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Transpacific transport of anthropogenic aerosols and implications for North American air quality

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Recent observational evidence suggests that Asian aerosols can be transported across the Pacific to North America despite their short lifetimes. Dramatic reductions in visibility over the United States have been widely cited due to Asian dust events, whereas events of anthropogenic aerosol transport have not been documented as frequently. However the transport of these aerosols is pervasive and can therefore compromise air quality objectives in the United States. A recent modeling study by Park et al. [2004] showed that the amount of ammonium sulfate imported from Asia rivals the "natural" standard for 2064 as laid out by the U.S. Environmental Protection Agency Regional Haze Rule. We employ here a combination of satellite (MODIS and MOPITT) and ground station (IMPROVE and AERONET networks) to observationally-validate the GEOS-CHEM simulation of transpacific transport during 2001. Asian anthropogenic aerosols that are transported across the Pacific in the lower free troposphere consist primarily of sulfate, due in large part to oxidation of Asian SO_2 during transport. Carbonaceous aerosols are not effectively exported due to wet scavenging in the outflow. We find that MODIS systematically over-estimates both AERONET observations and GEOS-CHEM over the Pacific and North America. However, during events of transport we find good geographical correspondence between MODIS and the model simulation. For these events we simulate an Asian anthropogenic contribution of up to 1 ugm^{-3} of SO_4 at IMPROVE sites on the west coast of the United States. In order to reconcile recent high organic carbon observations on the west coast of the U.S. that have been associated with marine or Asian sources, we investigate the contribution of

a marine source of organic carbon and whether it can resolve these discrepancies. In addition we investigate the cause of the lack of correlation between carbon monoxide and aerosol optical depth in pollution export as observed between MOPITT and MODIS respectively.