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Observed and Modeled Variations of Carbon Monoxide over the western part of the Pacific Ocean

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Systematic observations of atmospheric carbon monoxide (CO) have been carried out in the western part of the Pacific Ocean since 1990. Air samples were collected at roughly 5° latitude intervals from 33°N to 38°S or 45°S, using commercial container ships which made a round trip between Japan and Australia (1990–1999) or New Zealand (1999–2010). The average CO concentration shows a clear north-to-south decreasing distribution, with especially high values in midnorthern latitudes, reflecting anthropogenic CO emitted mostly in the northern hemisphere. The maximum and minimum concentrations of the seasonal CO cycle appear in spring and summer, respectively. High concentration values of CO and its large seasonal cycle observed in midnorthern latitudes are caused by a long-range transport of anthropogenic CO emitted in East Asia and variation in the air mass associated with the Asian monsoon circulation. A large latitudinal gradient is observed in the tropics especially in winter, due to a suppression of meridional air exchange at the SPCZ. The CO concentration also showed a large interannual variability mainly in association with forest fires. In particular, the forest fires in Siberia in 1998 and Indonesia in 1997–1998 contributed to a remarkable increase in the regional CO concentration, followed by a recovery that took several months to a year.
A global chemical climate/transport model, CHASER [Sudo et al. 2002], reproduced the observed characteristics of the latitudinal distribution, seasonal cycle, and interannual variability reasonably well. Tagged CO experiments with the model revealed that CO emitted in China plays an important role in the distribution of the CO concentration at northern midlatitudes in the western Pacific, that CO originating in North America and Europe is transported over a long distance in winter and is clearly observable in the northwestern part of the Pacific, and that CO from South America and South Africa reaches the southwestern part of the Pacific.

Reference:
Sudo, K., M. Takahashi, J. Kurokawa, and H. Akimoto (2002b), CHASER: A global chemical model of the troposphere: 1. Model description, J. Geophys. Res., 107(D17), 4339, doi:10.1029/2001JD001113.