Evaluation of NICAM-TM CO data using MOPITT CO data

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Carbon monoxide (CO) in the atmosphere is produced by incomplete combustion of carbonaceous materials and oxidation of hydrocarbons; biomass burning is one of the major sources of CO in the atmosphere. The main sink of atmospheric CO is a reaction with hydroxyl radical (OH). The lifetime of tropospheric CO is around two months, which results in its longer transport in hemispheric scale.

This study has compared CO concentrations simulated by Nonhydrostatic Icosahedral Atmospheric Model-based Transport Model (NICAM-TM) with CO concentrations observed by Measurement of Pollution In the Troposphere (MOPITT) on board the Terra satellite. Here, we have compared MOPITT CO data with NICAM-TM CO data with and without applying MOPITT CO averaging kernel functions (AK).

In the lower troposphere (850 hPa), NICAM-TM CO was lower than MOPITT CO in most regions except active biomass burning areas. NICAM-TM CO was significantly lower in the middle latitudes (30º–60ºN) where there are large anthropogenic CO emissions; the negative bias of NICAM-TM CO data against MOPITT CO data was about 30%. This implies the possibility of the underestimation of anthropogenic emissions in the NICAM-TM CO simulations. In the upper troposphere (250 hPa), NICAM-TM CO was lower than MOPITT CO in almost all regions; the negative bias of upper tropospheric NICAM-TM CO data was about 30% in low and mid-latitudes in both hemispheres in spring season.

In addition, seasonal variations in NICAM-TM CO data were much lower than those in MOPITT CO data in the upper troposphere. MOPITT CO there was largest in mid-latitude in spring and the differences between MOPITT and NICAM-TM CO was also largest in spring of all the season; these differences were also evident after applying MOPITT CO AK to NICAM-TM CO data. Comparisons with MOPITT CO data suggest that the negative bias in NICAM-TM CO data in the upper troposphere can be partly attributed to the underestimation of anthropogenic emissions and transport process from the surface to the upper troposphere in the NICAM-TM CO simulations.

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