1.245 Using Short Term CO/CO2 ratios to assess air mass differences over the Korean Peninsula during KORUS-AQ 2016.

Early Career Scientist

Presenting Author:
Hannah Halliday, NASA Langley Research Center, Chemistry and Dynamics, Hampton, VA, USA, hannah.s.halliday@nasa.gov

Co-Authors:
Josh DiGangi, NASA Langley Research Center, Chemistry and Dynamics, Hampton, VA, USA; USRA, Columbia, MD, USA
Glenn Diskin, NASA Langley Research Center, Chemistry and Dynamics, Hampton, VA, USA
John Nowak, NASA Langley Research Center, Chemistry and Dynamics, Hampton, VA, USA
Sally Pusede, University of Virginia, Department of Environmental Science, Charlottesville, VA, USA
Mario Rana, NASA Langley Research Center, Chemistry and Dynamics, Hampton, VA, USA; SSAI, Hampton VA, USA
Xinrong Ren, NOAA Air Resources Laboratory, Silver Springs, VA, USA; University of Maryland, Department of Atmospheric and Oceanic Science, College Park MD, USA
Hao He, University of Maryland, Department of Atmospheric and Oceanic Science, College Park MD, USA

Abstract:

The rapid industrial growth in East Asia over the past century has resulted in widespread prosperity, but has been accompanied by degraded air quality. These poor air quality can have both local and regional effects, and long range transport of pollution will increase the number of people affected. South Korea has a technologically oriented economy with vibrant urban regions, but suffers from poor air quality arising from both local emissions on the Korean peninsula and from the transport of pollution from mainland China. The KORUS-AQ field campaign was an international collaboration to measure the atmospheric composition over the Korean peninsula in the spring of 2016. We use the in situ data from the DC-8 aircraft to examine trace gas enhancement ratios over three major analysis regions: the Seoul metropolitan region, the South Korean peninsula, and the Yellow Sea. The ratios of the changes in CO and CO_2 abundance were calculated with a rolling correlation calculation, and the distributions of these calculated slopes were compared between different regions. These instantaneous slopes can be interpreted as a measurement overall combustion efficiency, and the distributions of the slopes show the ensemble of these combustion efficiency measurements. This technique allows us to compare the short term CO and CO_2 emissions signatures between different regions. Over Seoul, the surface layer shows a high efficiency signature in the $\Delta CO/\Delta CO_2$ ratios,

with 65% of the correlated shot term slopes falling below 1 % $\Delta CO/\Delta CO_2$. However, this ratio shifts to a lower efficiency signature at higher altitudes, indicating that transport of Chinese emissions becomes more important with altitude. Comparisons of measurements collected over the Yellow Sea and over China confirm that Chinese-type emissions show a shift to higher $\Delta CO/\Delta CO_2$ ratios (lower efficiency), with approximately 70% of the correlated slopes having a CO/CO_2 ratio between 1 and 4%.