

### **3.099 Atmospheric CO, CH<sub>4</sub> and CO<sub>2</sub> observed over the Yellow Sea and the East China Sea in Spring 2017.**

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Abstract:

Accurate measurements of the mole fractions of carbon monoxide (CO), methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) were performed using a Cavity Ring-Down Spectrometer (CRDS) plus high pressure cylinder reference gas system during a cruise of the survey vessel Dongfanghong II on the Yellow Sea and the East China Sea in the spring of 2017. The spatial variations of the mole fraction of the three trace gases were very similar. The emission sources of these gases were divided into several regions by using the NOAA HYSPLIT model. Then we analyzed the variations of the ratios of the mole fraction enhancements between every pair of trace gases downwind of these source areas. The ratios showed that the distributions of these trace gases over the Yellow Sea and the East China Sea in the spring was mainly caused by the emissions from Eastern China. The much higher enhancement ratio of  $\Delta\text{CO}/\Delta\text{CO}_2$  and the lower ratio of  $\Delta\text{CH}_4/\Delta\text{CO}$  observed in the air parcels from big cities like Beijing and Shanghai indicated high CO emission from the cities during our time of observation. Compared with the values of NOAA's Marine Boundary Layer (MBL), the ratios of the averages in the air coming from the Northern sector (Russia) were on average closer to the MBL, and the air that stayed over the Yellow Sea and the East China Sea was a mixture of emissions from wide regional areas. The methods used to calculate the enhancement ratios and the uncertainties of the ratios of the enhancements of every pair of gases in this study can be used to compare with emissions inventories as a completely independent check. Moreover, the observation data and the results can be used for multi-species inverse estimates of the sources and sinks of greenhouse gases.