$\Delta CO/\Delta CO_2$ as a potential constraint on aerosol composition in the ACTIVATE dataset

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The $\Delta CO/\Delta CO_2$ Ratio

 $\Delta CO = [CO] - [CO]_{background}$

The $\Delta CO/\Delta CO_2$ Ratio

 $\Delta CO = [CO] - [CO]_{background}$

 $\Delta CO_2 = [CO_2] - [CO_2]_{background}$

Near a Combustion Source:

 $\Delta CO/\Delta CO_2$ is a tracer for efficiency – The amount of CO produced per molecule of CO_2

 $\Delta CO=[CO] - [CO]_{background}$

 $\Delta CO_2 = [CO_2] - [CO_2]_{background}$

ΔCO



 $\Delta CO = [CO] - [CO]_{background}$ $\Delta CO_2 = [CO_2] - [CO_2]_{background}$



 $\Delta CO=[CO] - [CO]_{background}$



 $\Delta \text{CO=[CO]} - [\text{CO}]_{\text{background}}$



 $\Delta \text{CO=[CO]} - [\text{CO}]_{\text{background}}$



 $\Delta CO=[CO] - [CO]_{background}$



The $\Delta CO/\Delta CO_2$ ratio can characterize airmass properties



Halliday et al. (2019, JGRA)

$\Delta CO/\Delta CO_2$ ratios are observable from space!



Silva et al. (2013, GRL)

$\Delta CO/\Delta CO_2$ ratios are observable from space!



Silva et al. (2013, GRL)

ACTIVATE flight legs particularly useful for quantifying $\Delta CO/\Delta CO_2$



ACTIVATE $\Delta CO/\Delta CO_2$ varies across all flight legs



ACTIVATE $\Delta CO/\Delta CO_2$ varies substantially across all flight legs



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ACTIVATE $\Delta CO/\Delta CO_2$ varies substantially across all flight legs



Hypothesis: The variability in $\Delta CO/\Delta CO_2$ is an indicator for variability in aerosol composition



Total aerosol varies with $\Delta CO/\Delta CO_2$



Organic aerosol follow the total variability



Sulfate aerosol decreases with $\Delta CO/\Delta CO_2$



Other aerosol chemical components vary with $\Delta CO/\Delta CO_2$





Aerosol composition varies with $\Delta CO/\Delta CO_2$



Summary & Next Steps

- Aerosol composition does vary with $\Delta CO/\Delta CO_2$
- Near-source approximations are imperfect (biogenic vs. industrial, etc.)
- Quantification of airmass source and mixing

