Can we identify the sources of the enhanced CO in Asian plumes?  
*fossil-fuel versus bio-fuel / biomass burning*

Acetonitrile (CH$_3$CN) as a marker compound  
*biomass burning source, ocean sink*
Strongly enhanced CO in plumes from Asia
Strongly enhanced CO in plumes from Asia

Most extensively sampled

Focus of this talk

Most extensively sampled
Focus of this talk
Biomass burning markers

CH$_3$CN (acetonitrile): clearly enhanced

CH$_3$Cl: has been observed in Asian biomass burning plumes but not enhanced here

BB$_{PALMS}$ = $\sqrt{(C \times K)}$\(^\dagger\): clearly enhanced

PALMS = particle analysis by laser mass spectrometry

\(^\dagger\) K corrected for sea-salt and mineral dust
# Biomass burning versus fossil fuel emission ratios

<table>
<thead>
<tr>
<th>Compound R</th>
<th>$\Delta R/\Delta CO$ in Utah fire (pptv ppbv$^{-1}$)</th>
<th>$\Delta R/\Delta CO$ in LA basin (pptv ppbv$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass burning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>acetonitrile</td>
<td>2.0</td>
<td>$&gt;&gt;$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Fossil fuel</td>
<td></td>
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</tr>
<tr>
<td>propane</td>
<td>1.9</td>
<td>12</td>
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<tr>
<td>iso-butane</td>
<td>0.07</td>
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<td>$&lt;&lt;$</td>
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<tr>
<td>n-pentane</td>
<td>0.15</td>
<td>3.5</td>
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<tr>
<td>iso-pentane</td>
<td>0.06</td>
<td>7.5</td>
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<tr>
<td>Fossil fuel</td>
<td></td>
<td></td>
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<tr>
<td>Both</td>
<td></td>
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<tr>
<td>acetylene</td>
<td>5.1</td>
<td>=</td>
</tr>
<tr>
<td>many others</td>
<td></td>
<td>5.1</td>
</tr>
</tbody>
</table>
Asian pollution observed on May 5th

High CO: correlated with fossil fuel tracers not correlated with biomass burning tracers
Asian pollution observed on May 5th

Different tracers for biomass burning place the BB emissions at the highest flight altitude
Asian pollution observed on May 5th

- >6.5 km: bio-fuel
- 5-6.5 km: fossil fuel
- 0-5 km: background

Altitude (km)

CH₃CN  CH₃Cl  CO  Butane  Pentane
Asian pollution observed on May 5th

Propane and acetylene:
OH lifetimes comparable
emission ratio for propane higher in urban pollution

ΔC₃H₈/ΔC₂H₂

May 5th:
5-6.5 km  1.5
>6.5 km   0.3

For comparison:
Los Angeles  2.4
Utah forest fire  0.4
Ocean uptake of acetonitrile

Acetonitrile consistently lower in the MBL than in the free troposphere

Measurements compared with GEOS-CHEM model:
1. biomass burning emissions
2. removal by OH
3. $v_d = 0.13 \text{ cm s}^{-1}$
Uptake enhanced off the U.S. west coast

Near-zero mixing ratios observed in the MBL west of Cheeka Peak Observatory (CPO)
Observation of a gradient in the MBL along the U.S. west coast.

CH$_3$CN anti-correlated with DMS in upwelling zone (see also Warneke, 2001):

Do biological processes play a role in CH$_3$CN uptake?

Uptake enhanced off the U.S. west coast.
Conclusions

1. Enhanced CO mostly attributed to fossil fuel use
2. Biomass burning influence at highest flight altitudes
3. Acetonitrile is a good indicator for biomass burning emissions
4. Acetonitrile is lost by ocean uptake
5. Uptake especially efficient off the U.S. west coast
Acknowledgements

PTR-MS  Carsten Warneke, Bill Kuster
CO      David Parrish, John Holloway
WAS     Elliot Atlas, Steve Donnelly, Sue Schaufller
PALMS   Dan Murphy, Dan Cziczo, Paula Hudson
GEOS-CHEM Qinbin Li, Daniel Jacob

Gerd Hübler, Michael Trainer, Fred Fehsenfeld

Crew of the NOAA WP-3