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Nitrate during the APHH-Beijing winter campaign – influence of emission changes in GEOS-Chem

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APHH-Beijing is an extensive collaboration between UK and Chinese research groups to study air pollution sources and associated health impacts.

- Involves 30 institutions, 200 participants and nearly 200 instruments.
- Programme of intensive measurement campaigns, flux observations, personal exposure monitoring, remote sensing and chemical transport modelling.
- Measurement campaigns undertaken in autumn 2016 (7/11 - 9/12), and spring 2017 (16/5 – 30/6).
- Ground-based measurement at IAP site in central Beijing (39°58’28”N, 116°22’16”E), and on meteorological tower.
- Additional deployment at background site in Pinggu district, NE of Beijing.
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- GC v11-01
- 0.25x0.3125 nested China domain
- GEOS-FP
- SV-POA aerosol chemistry
- MEIC emissions
Model-measurement comparison
• Nitrate overestimated by a factor of 4 in GC
• Similar bias in nitrate NEMR with CO
Emission reductions

Avg NO$_3$ reduction = 19%

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Avg NO$_3$ reduction = 13%
Influence on model bias

0.5 x NO

\[ m = 3.338 \]
\[ R^2 = 0.276 \]

0.5 x NH\textsubscript{3}

\[ m = 1.921 \]
\[ R^2 = 0.332 \]

0.25 x NO, 0.25 x NH\textsubscript{3}

\[ m = 2.954 \]
\[ R^2 = 0.388 \]
Polluted and clean conditions

- Segregated using CO threshold of 600 ppb to define clean and polluted periods
Polluted and clean conditions

**GC**

- $m = 0.032$
- $R^2 = 0.312$
- $\text{Avg } NO_x/NO_y = 0.065$

**Obs**

- $m = 0.006$
- $R^2 = 0.236$
- $\text{Avg } NO_x/NO_y = 0.037$

- $m = 0.059$
- $R^2 = 0.635$
- $\text{Avg } NO_x/NO_y = 0.104$

- $m = 0.013$
- $R^2 = 0.426$
- $\text{Avg } NO_x/NO_y = 0.113$
Polluted and clean conditions

Avg NO₃ reduction: C = 19%, P = 20%

Avg NO₃ reduction: C = 10%, P = 27%

Avg NO₃ reduction: C = 10%, P = 15%