Comparison of Asian Emissions Inventories

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Increasing Emissions in Asia

PM$_{2.5}$ Emissions in Asia

![Graph showing PM$_{2.5}$ emissions in Asia from 2000 to 2008 for China, India, and Japan. The emissions have increased over time, with China showing the highest emissions.]

Source Kurokawa et al., 2013
Countries with Lowest Air Quality Score

1. **India** - 23.24
2. **Pakistan** - 23.02
3. **China** - 18.81
4. **Nepal** - 16.23
5. **Bangladesh** - 13.83

Source: Yale University, 2014 Environmental Performance Index
Importance of Emissions Inventories
Difference in Global Emissions Inventories

Source: Granier et al., 2011
Impacts on Modeling

Source Ma and van Aardene, 2004
Research Questions

- How much differences are there among emissions inventories in Asia?

- Which sector/species do we see the largest difference and why?
Emissions Inventories

- Emissions Database for Global Atmospheric Research (EDGAR) v4.2 - Global
- Regional Emissions in ASia (REAS) v2 - Asia
- Multi-resolution Emission Inventory for China (MEIC) - China
- Zhao Yu’s - China
- Ajay Nagpure’s - India
- Pandey et al. (2014) and Sadaverte and Venkatakrishnan (2014) - India
Analysis

- Years: 2000 - 2008 (2011 for India)
- Pollutants: CO, SO$_2$, NO$_x$, PM$_{10}$, CO$_2$
- Sectors: industry, transport, power, and residential
- Countries: China, India, Pakistan, and Nepal
China Total Emissions

Solid: EDGAR, Dash: REAS
Blue: CO, Red: SO$_2$, Yellow: NO$_x$, Green: PM$_{10}$, Brown: CO$_2$
China South Central Region
China CO Emissions in South Central Region

Solid: EDGAR, Dash: REAS
Red: industrial, Purple: transport, Green: power, Blue: residential
China CO Emissions in East Region

Solid: EDGAR, Dash: REAS, Square: Zhao Yu, Triangle: MEIC
Red: industry, Purple: transport, Green: power, Blue: residential

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Comparison of Asian Emissions Inventories
China CO Road Emissions in East Region

Solid: EDGAR, Dash: REAS, Circle: Zhao Yu
Red: On-road, Blue: Off-road
India Total Emissions

Solid: EDGAR, Dash: REAS, Diamond: Pandey et al.
Blue: CO, Red: SO₂, Yellow: NOₓ, Green: PM₁₀, Brown: CO₂
India Regional PM$_{10}$ Emissions

Left: EDGAR, Right: REAS

Red: industry, Purple: transport, Green: power, Blue: residential
Pakistan Total Emissions

**Solid: EDGAR, Dash: REAS**
Blue: CO, Red: SO$_2$, Yellow: NO$_x$, Green: PM$_{10}$, Brown: CO$_2$
Pakistan Regions

- Baluchistan
- Sind
- Punjab
- F.A.T.A.
- N.W.F.P.
- Azad Kashmir
- F.C.T.
- Northern Areas
Pakistan Regional SO$_2$ Emissions

Comparison of Asian Emissions Inventories

Left: EDGAR, Right: REAS
Red: industry, Purple: transport, Green: power, Blue: residential
Nepal Total Emissions

Solid: EDGAR, Dash: REAS
Blue: CO, Red: SO₂, Yellow: NOₓ, Green: PM₁₀, Brown: CO₂
Nepal Sectoral NO$_x$ Emissions

Solid: EDGAR, Dash: REAS, Circle: MALÉ
Red: industry, Purple: transport, Green: power, Blue: residential
Comparison of Asian Emissions Inventories
Nepal Regional NO$_x$ Emissions

Comparison of Asian Emissions Inventories

Left: EDGAR, Right: REAS
Red: industry, Purple: transport, Green: power, Blue: residential
Spatial Distribution: REAS - EDGAR PM\textsubscript{10} and CO

PM\textsubscript{10} \hspace{1cm} kg km\textsuperscript{-2} month\textsuperscript{-1}

CO \hspace{1cm} kg km\textsuperscript{-2} month\textsuperscript{-1}
Impacts on Modeling: REAS - EDGAR $O_3$
Impacts on Modeling: REAS - EDGAR PM$_{10}$
Large discrepancies exist among inventories both in magnitude and spatial distributions.
Conclusion

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- Sectors responsible for the discrepancy varies based on species and location.
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- Model results are influenced significantly by the difference in emissions used as inputs.
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Questions?