HTAP2: Black Carbon and Ozone Results and Next Steps

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TF HTAP Leadership Team

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Task Force Goal:

- Foster international scientific cooperation to improve understanding of intercontinental transport of air pollution across the Northern Hemisphere
  - How do changes in emissions in one part of the world affect air quality in other parts of the world?
  - How do extra-regional emissions affect human and ecosystem health within a given region?

HTAP2: Suite of Cooperative Experiments to Assess Intercontinental Transport of Air Pollution

- 2010 Global Emissions Inventory
- 2010 meteorology
- ~15 global models
- Examined response of 20% reduction in anthropogenic emissions from one source region on air quality in the other source regions
HTAP2

- Of the ~15 models that participated in HTAP2, 10 included a treatment of aerosols
- Stjern et al., used these experiments to assess the impact of a 20% reduction in all anthropogenic emissions from one source region on levels of black carbon (BC), organic aerosols (OA) and sulphate (SO₄) everywhere else (including in the region where the emissions reduction was applied)
- From these BC, OA and SO₄ model outputs, they estimated the effect of reducing emissions on radiative forcing (RF) from the direct aerosol effect

Global and regional radiative forcing from 20% reductions in BC, OC and SO₄ – an HTAP2 multi-model study

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Source-Receptor Regions Analyzed

C.W. Stjern et al., 2016
Results

- In most cases, the local influence dominates
- But, emission reductions in south (SAS) and east Asia (EAS) have substantial impacts on the radiative budget of all investigated receptor regions, especially for black carbon (BC)
- For North America, BC emission controls on east Asia (EAS) sources are more important than domestic mitigation

HTAP2 also looked at intercontinental transport of ozone
Key Messages

- Intercontinental transport of ozone dominates over intercontinental transport of particulate matter (PM)
- Background ozone is very sensitive to methane concentration

Seasonal cycle of surface ozone: Europe

Next Steps: HTAP3

1) Updated Harmonized Global Emission Inventory
   - Global Emissions Mosaic Update (HTAPv3)
     - GEIA Meeting, Chile, November 2019

2) Improve our understanding of the relationship between global methane emissions, intercontinental transport of ozone and human and ecosystem health
   - Workshop, Edinburgh, April 2020, with TOAR, ICP Veg, AQMEII, MICS, ...

3) Continued Development of the openFASST Tool
   - For Global Scenario Analysis and Uncertainty Assessment

4) Foster discussion/scientific work on the following topics:
   - Extra-Regional Attribution of O3, PM Trends for Gothenburg Review
   - Impacts of Shipping
   - Taking Stock of Progress in Other Forums, Identifying Policy Relevant Needs
Conclusions

• Black carbon emissions are transported between source regions and continents; emission reductions from the major source regions in Asia would reduce the black carbon burden in the northern hemisphere

• Intercontinental transport of ozone makes a marked contribution to regional ozone levels; background ozone levels are sensitive to methane

• HTAP3 will develop an updated global emission inventory that will assess how intercontinental transport has changed since 2010