4.095 Decadal-scale attribution of ozone and methane radiative forcing.

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Abstract:

Methane and ozone are the 2nd and 3rd most important greenhouse gas in terms of radiative forcing (RF). Mitigation policies directed at controlling these short-lived climate pollutants (SLCP) as a means of avoiding "dangerous" climate change while simultaneously improving air quality have been proposed. In order to assess the effectiveness of these strategies at the scales in which they would be enacted, the complex interaction between emissions, transport, transformation, and radiation must be characterized. Concurrently, the last decade has seen a dramatic change in the landscape of emissions with Asian regions playing an increasingly prominent role. Here, we quantify and attribute the global impacts of these changes on climate forcing at unprecedented spatial scales using satellite observations from TES, OMI, and MOPITT in conjunction with advanced assimilation and adjoint modeling techniques from 2005-2015. The trajectories of satellite-constrained NOx and CO emissions have divergent time rates of change leading to a net RF that changes in sign within country boundaries. The impact of the intra-continental variations in emissions along with the top 10% of sub-national drivers of decadal climate forcing is quantified revealing opposing regional balances between India and China. These results show the potential of an SLCP monitoring and attribution system as part of a broader effort to mitigate against climate change.