3.050 Health and climate impacts in and from G-20 countries using realistic diesel emissions under present and future standards..

Early Career Scientist

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Abstract:

NO_X emissions have significant impacts on both climate and human health due to their contribution to [secondary] $PM_{2.5}$ and ozone formation. Emissions from many light- and heavy-duty diesel vehicles are currently underestimated by up to an order of magnitude and a factor of 3, respectively. Such underestimates hinder the development and monitoring of efficient air quality policy. In this work, we consider new inventories of real-world NO_X emissions developed by the International Council on Clean Transportation (ICCT) for 11 vehicle markets (which account for more than 90% of diesel vehicle sales in G-20 countries). In addition, emissions scenarios are developed to model the adoption of stringent diesel NO_X emissions standards (e.g. US Tier 3 or Euro 6/VI) in these 11 markets by 2040. The GEOS-Chem chemical transport model is used to estimate $PM_{2.5}$ and ozone concentrations for current baseline emissions estimates and for the alternative scenarios under improved emissions standards. We also evaluate the impact of these concentration changes on global mean surface temperature response and the number of avoided annual $PM_{2.5}$- and ozone-related premature deaths. Adjoint model calculations are then performed for each of the 11 regions, from which we assess the contribution of grid-scale changes in emissions to these multiple impacts. This allows us to evaluate the extent to which adopting more stringent diesel NO_X emissions standards in each of the 11 primary modeled vehicle markets influences ozone and $PM_{2.5}$ exposure burdens both within and outside of these regions. These findings highlight the potential health benefits while also addressing the potential change in global surface temperature due to the tightening of diesel NO_X emission standards around the world.