

1.238 The global network of import and export of air-pollution related premature mortalities.

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Abstract:

Quantifying the extent to which air pollution in any particular country is a consequence of that country's emissions is key to developing effective domestic air quality control policies. Further, understanding how much pollution emanating from any single country is affecting neighboring nations through long-range transport is critical for formulating international strategies to improve human health. Here we present first-ever calculations of national-scale source-receptor relationships for every country in the world for exposure to PM_{2.5} and O₃, quantifying the impact of each emitted precursor species and sector from each country on exposure in every other country. These calculations are possible through application of a global adjoint chemical transport model (GEOS-Chem) using satellite constraints to resolve PM_{2.5} exposures at ~10 km. Results are evaluated against source-receptor relationships calculated for large aggregate regions (i.e., Europe, South-East Asia) performed as part of the HTAP2 multi-model project. We then estimate the import and export of premature mortalities associated with long-term exposure to PM_{2.5} and O₃, identifying sectors in each country around the world that make the greatest contributions to premature deaths internationally and highlighting countries that are most subject to the influence of internationally transported pollution. Additionally, we

consider recent epidemiological evidence for O₃ health impacts being substantially (x2 - 4) greater than considered in previous assessments of long-range pollution health impacts; these revised estimates change our conclusions regarding the roles of PM_{2.5} vs O₃ in contributing to long-range health impacts in many cases. Lastly, we show how these source-receptor relationships have been incorporated into LEAP-IBC, a decision-support tool developed by SEI with support from US EPA, UNEP and the Climate and Clean Air Coalition (CCAC). LEAP-IBC connects policy-level decisions and related emissions (modeled in LEAP) to the impacts of those emissions on air pollution and associated health, crop, and climate impacts (modeled in IBC).