International trade and globalization of aerosol climate forcing

An NSFC-funded study revealed the complex impacts of international trade on aerosol pollution and its forcing on the global climate (*Nature Geoscience*, 2016, 9: 790—794). Prof. Lin Jintai (**林金泰**) at Peking University, Prof. Zhang Qiang at Tsinghua University and Prof. Yi Huang at McGill University are the corresponding authors of this paper. Lin Jintai and Tong Dan, a graduate student from Tsinghua University, are the first authors.

Production of goods and associated economic processes (transportation, power generation, etc.) result in tremendous amounts of air pollutant emissions. This impacts greatly on regional air quality and global atmospheric pollution transport. Aerosol (a. k. a. PM) pollution affects the climate system by scattering and absorption of solar radiation, the direct radiative forcing. It also interacts with the cloud-precipitation processes. In current globalized economy, international trade separates regions consuming goods and services from regions where goods and related aerosol pollution are produced. This has enormous consequences on regional pollution and their radiative forcing.

In their previous Cozzarelli Prize-winning PNAS paper (2014, (111): 1736—1741), Lin et al. revealed for the first time the coupled mechanism for global pollution transfer through trade and atmospheric processes. They showed that up to one third of air pollutants in the surface atmosphere of East China were caused by the country's export-related emissions. Certain portions of China's export-related pollutants were further transported by weather systems to downwind regions.

In this *Nature Geoscience* study, Lin et al. further revealed the overall impacts of global multi-lateral economic trade and atmospheric processes on global air pollution, geographic transfer, and, for the first time, the top-of-atmosphere direct radiative forcing of aerosol pollution. This paper provides comprehensive data on radiative forcing. For the forcing contributed by East Asia (mostly China), the largest net exporter region, aerosol radiative forcing that comes from its consumption (RF_c) is much lower than from its production (RF_p). The situation is the other way round for Western Europe, a giant net importer. Overall, international trade has transferred radiative forcing from developed countries to developing countries. Due to the short lifetime of aerosol pollutants, the difference between any region's RF_c and RF_p has substantial geographical variability (Figure), with important impactions for climate responses.

The studies of Lin et al. revealed strong yet previously hardly-recognized linkage between consumption, trade, and environmental and climate consequences, which calls for improved international cooperative efforts to reduce emissions in the exporting countries.

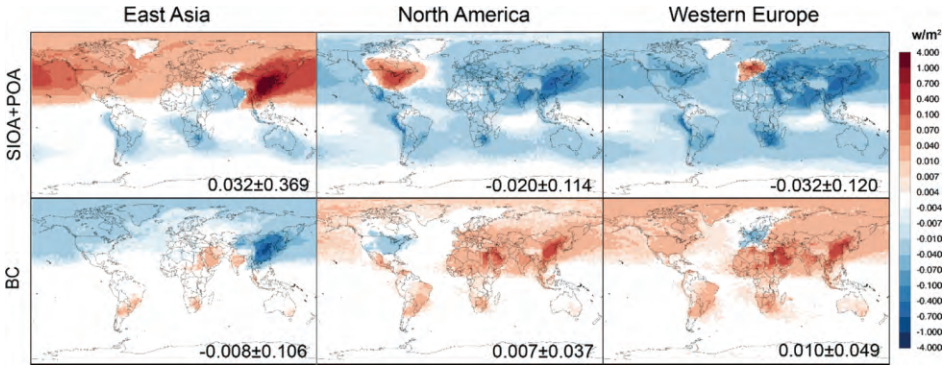

Figure Global differences between consumption- and production-based radiative forcing (RF_c—RF_p) contributed by three representative regions in 2007.