Exploring transnational city carbon footprint networks with the Industrial Ecology Virtual Laboratory

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Cities are leading actions against climate change through global networks. More than 360 global cities announced during the 2015 Paris Climate Conference that the collective impact of their commitments will deliver over half of the world's urban emissions reductions by 2020. Previous studies on multi-city carbon footprint networks using sub-national, multi-region input-output (MRIO) modelling have demonstrated a greater opportunity for addressing the negative impacts of climate change through joint actions between cities in a country. However, similar links between city carbon footprint have not yet been studied across countries. In this study, using data from the Industrial Ecology Virtual Laboratory (IELab), we develop a multi-scale, global MRIO model to describe a transnational city carbon footprint network among the four Chinese province-level municipalities and the five largest Australian capital cities. We firstly assess the emissions embodied into the bilateral trade driven by urban demand for goods and services. Furthermore, we present a city emissions 'outsourcing hierarchy' based on the balance of emissions embodied in intercity and international trade. This is juxtaposed with the typical pattern of national territorial emissions and carbon footprints. We explore the policy implications for transnational city emissions mitigation by investigating scenarios for low-carbon bilateral trade under the background of the China-Australia Free Trade Agreement. Furthermore, we evaluate and discuss opportunities for matching China's regional pilot carbon trading schemes with the ambition of Australian cities to claim carbon neutrality. Finally, we discuss the prospect of Chinese and Australian cities pioneering joint actions to meet the Compact of Mayors agreement of the Paris Climate Conference.