Commodity flows across spatial scales

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Commodity flows are the spatial and temporal redistribution of goods. Recently, there has been a surge of research in international trade in the scientific literature, primarily due to an interest in the natural resources embodied in the traded commodities (e.g. water, carbon, nutrients). International trade is typically measured annually between countries, but commodity flows occur at many different scales, though data availability at finer temporal and spatial resolutions is typically limiting. Here, we present an empirical analysis of commodity flows in primary units (i.e. mass and value) across three spatial scales: global, national, and village. To do this, we obtain data on international trade, national commodity flows of the United States, and village commodity flows in Alaska. Importantly, we segment the data into food and non-food commodity classes to evaluate the unique features of food flows. We determine the network properties of commodity flows for each spatial scale, finding that node degree distributions are fit by normal distributions, node strength distributions are fit by Weibull distributions, and a power law relationship exists between node degree and strength across scales. A core group of nodes exists in each network. This work sheds light on the scaling properties of commodity flows, indicating some unifying underlying mechanisms and can be used to estimate commodity flows at scales for which empirical information is not available.

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