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Global surface temperature and sea level rise from emissions traced to major industrial carbon producers

The United Nations Framework Convention on Climate Change (UNFCCC) established the principle of “common but differentiated responsibilities” among nations, signaling the recognition that nations that had produced the larger share of historical emissions bore a greater responsibility for avoiding “dangerous anthropogenic interference with the climate” (UNFCCC 1992; UNFCCC 1998). Reflecting this principle, the Paris Agreement establishes common commitments, for example to global net-zero greenhouse gas emissions in the second half of this century, while allowing flexibility in mitigation efforts to accommodate different national capacities and circumstances (United Nations 2015).

Outside of the domain of the UNFCCC, broader societal discussions have begun to consider the climate responsibilities of non-state actors. These include individual high emitters regardless of nationality (Chakravarty et al. 2009) and high-emitting industries regardless of where they are incorporated (Allen and Lord 2004). They also include the major multinational fossil energy companies at the base of the carbon supply chain. Attention to the responsibilities of fossil fuel producers is supported by recent research by Heede (2014), who found that nearly two-thirds of all industrial carbon dioxide (CO₂) and methane (CH₄) emissions can be traced to the products of a small number of major industrial carbon producers; 83 producers of coal, oil, natural gas, and 7 cement manufacturers. We use a simple climate model to quantify the contribution of historical (1880–2010) and recent (1980–2010) emissions traced to these producers to the historical rise in global atmospheric CO₂, surface temperature, and sea level. Emissions traced to these 90 carbon producers contributed ~57% of the observed rise in atmospheric CO₂, ~42–50% of the rise in global mean surface temperature (GMST), and ~26–32% of global sea level (GSL) rise over the historical period and ~43% (atmospheric CO₂), ~29–35% (GMST), and ~11–14% (GSL) since 1980 (based on best-estimate parameters and accounting for uncertainty arising from the lack of data on aerosol forcings traced to producers).