

A Reversal of Long-term Global Trends in Atmospheric Ethane and Propane from North American Oil and Natural Gas Emissions

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Ethane, the longest-lived and most abundant non-methane hydrocarbon (NMHC) peaked in the background atmosphere around 1970. This was followed by a ~20% reduction of the atmospheric burden and a resulting atmospheric downward trend for the next four decades, mostly due to reduced emissions from oil and gas industries and stricter air quality controls. Here, we show that the near 40-year trend of declining global ethane halted between 2005-2010 in most of the Northern Hemisphere (NH), and that since it has reversed. The largest increases in ethane and of the shorter-lived propane are seen in the central and eastern U.S. and immediately downwind, identifying this region as the primary source of increased NMHC emissions. The spatial distribution of observed concentration increases for ethane and propane provides convincing evidence that renewed emissions are primarily associated with the growth of oil and natural gas development in North America. Using source region relationships, emission estimates for increases of co-emitted NMHCs and methane, as well as impacts on tropospheric ozone production have been developed.

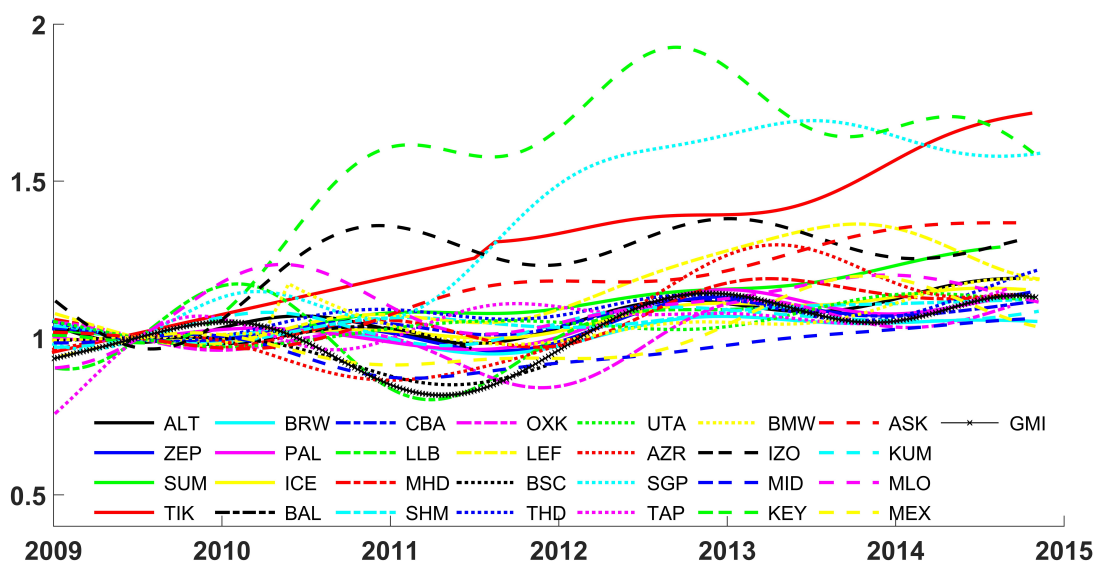


Figure 1. Ethane de-seasonalized five-year rate of change at 29 NH Global Greenhouse Gas Reference Network (GGGRN) sites normalized to 2009.5 mixing ratios.