

Increased Propane Emissions from the United States

L. Hu^{1,2}, S.A. Montzka², A.E. Andrews², J.B. Miller², S. Lehman³, B. Miller^{1,2}, C. Sweeney^{1,2}, D. Helmig³, E.J. Dlugokencky², J.W. Elkins² and P.P. Tans²

¹Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-5238, E-mail: lei.hu@noaa.gov

²NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305

³Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder, CO 80309

Propane (C_3H_8) is the second most abundant non-methane hydrocarbon in the atmosphere. It contributes to photochemical air pollution, including ozone and aerosol formation in the troposphere. It is also commonly used as a tracer for distinguishing fossil fuel emissions from natural and other anthropogenic emissions for methane. Global atmospheric observations of C_3H_8 suggest a recent reversal of its atmospheric trend, that is largely due to U.S. oil and natural gas production [Helmig *et al.*, 2016]. In this study, we analyzed atmospheric C_3H_8 data observed in the U.S. portion of NOAA's Global Greenhouse Gas Reference Network. We further estimated U.S. emissions of C_3H_8 using inverse modeling and a ^{14}C -tracer-ratio-based method. Inverse modeling results confirm an increase of U.S. C_3H_8 emissions from 2008 to 2014 that are primarily from oil and natural gas production regions (Fig. 1). The derived emission increase is comparable to the relative increase of U.S. C_3H_8 production over the same period. A preliminary estimate from a ^{14}C -tracer-ratio-based method for emissions during 2010 – 2012 is consistent with the inversions (within estimated uncertainty) (Fig. 1).

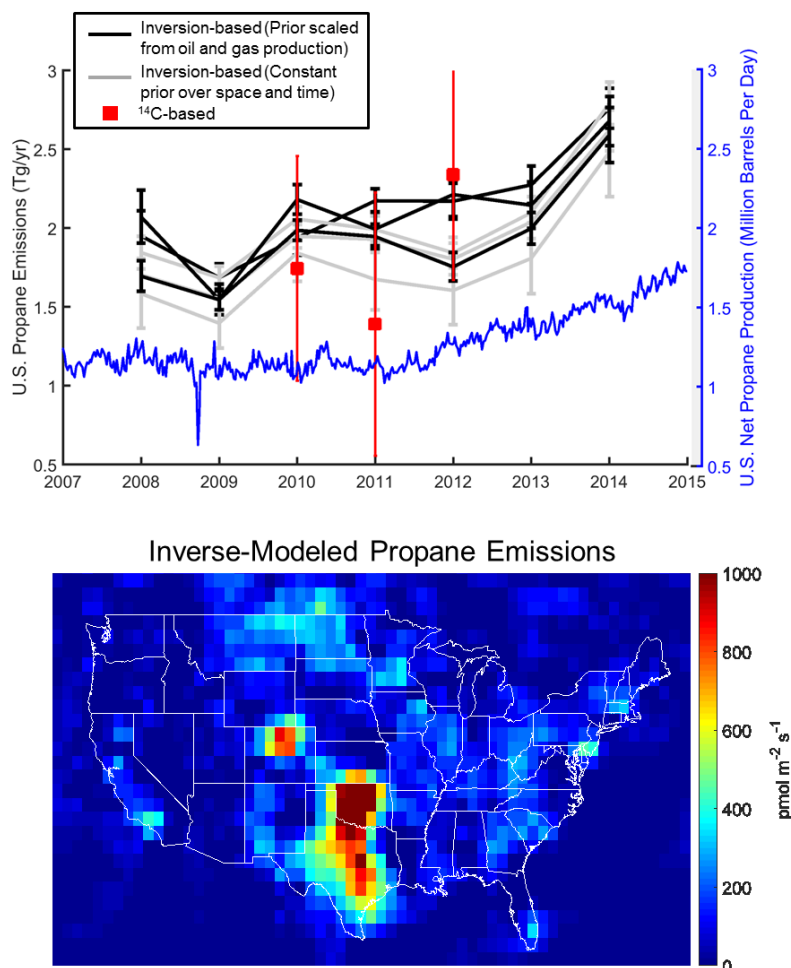


Figure 1. Derived U.S. emissions of propane. (Upper panel) Annual emissions derived from inverse modeling (black and gray lines) and a ^{14}C -based-tracer-ratio method (red squares). Blue line indicates U.S. production of propane reported by U.S. Energy Information Administration. (Lower panel) Average U.S. emissions between 2008 and 2014 derived from inverse modeling with a constant prior over space and time.