

Ground Measurements of Ethane to Methane Ratios in the Dallas/Fort-Worth Area

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Advances in natural gas extraction methods have led to significant increases in the quantities being produced from U.S. continental shales. Compared to other sources of fossil fuel power production, natural gas is a more efficient fuel than other fossil sources in that less CO₂ is produced per work extracted. A growing number of studies have suggested that methane lost to the atmosphere during production and use of natural gas is significant. Methane has a much greater greenhouse warming potential than CO₂, per-molecule in the 25 and 100 year time frames. Thus, methane emissions trade back the potential benefit radiative forcing benefit of natural gas.

Methane has numerous emission vectors from anthropogenic and natural sources. In the Barnett Shale in the Dallas/Fort-Worth area of Texas, enhancements in methane above the tropospheric background are believed to be due to a combination of oil & natural gas production and biogenic production (cattle, landfills, etc). The ratio of ethane to methane in natural gas sources is typically 2-8% by volume. The ratio of ethane to methane in the emissions from biological sources is significantly less than 1%. Evaluation of the ethane to methane ratio can be used to corroborate apportionment of enhanced methane observations to sources.

The Aerodyne Research, Inc., Ethane-mini, employs a new room temperature tunable diode laser operating at 3 μm. The fundamental spectroscopic measurement of ethane is based on differential infrared absorption in a closed, known pathlength multipass astigmatic herriot cell operated at ~ 1/20th of an atmosphere. Ground-level measurements of ethane and methane were performed in and around the Dallas/Fort-Worth area as part of the 2013 Barnett Oil and Gas Observation study. Daytime measurements observed varying ethane to methane ratios as a function of individual sources. Sources sampled include oil and gas processing and distribution sites in and out of the Barnett Shale formation, landfills and cattle. Nighttime measurements under low-wind conditions were also performed with the goal of sampling broad areas of accumulated methane and ethane. These results are used to determine fingerprint ethane to methane ratios for individual sources as well as for area-wide emissions. These ratios can be used to verify the relative contributions of oil and gas sources versus biogenic sources of methane in the Dallas/Fort-Worth area.



Figure 1. The Aerodyne and NOAA/GMD Mobile Laboratories are shown alongside the daytime route taken.