

## Emissions of CH<sub>4</sub> from Natural Gas Production in the United States Using Aircraft-based Observations

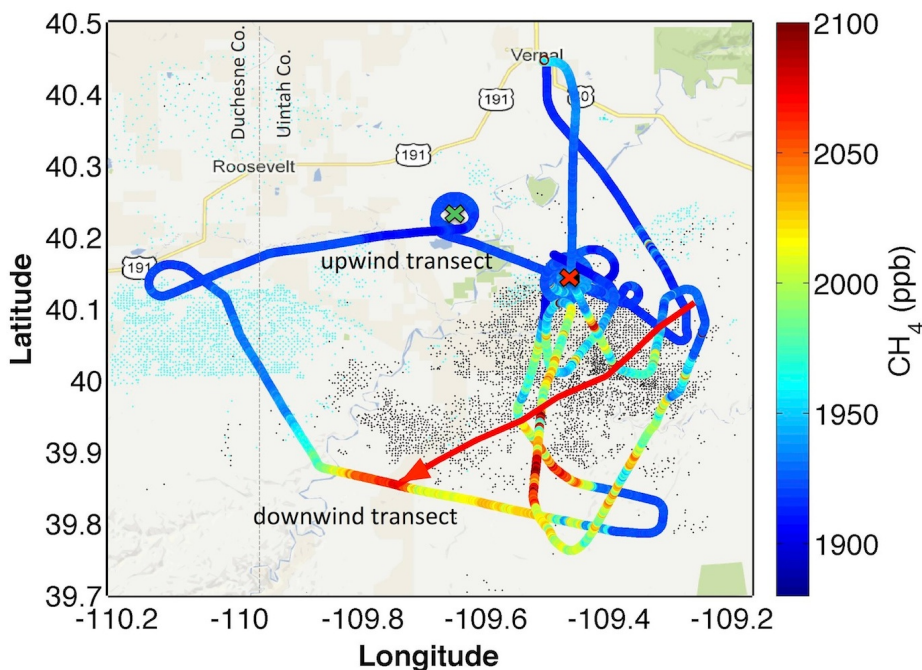
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New extraction technologies are making natural gas from shale and tight sand gas reservoirs in the United States (U.S.) more accessible. As a result, the U.S. has become the largest producer of natural gas in the world. This growth in natural gas production may result in increased leakage of methane, a potent greenhouse gas, offsetting the climate benefits of natural gas relative to other fossil fuels. Methane emissions from natural gas production are not well quantified because of the large variety of potential sources, the variability in production and operating practices, the uneven distribution of emitters, and a lack of verification of emission inventories with direct atmospheric measurements. Here we detail two aircraft measurement studies which show methane emissions of natural gas production in the Uintah County, Utah and the Denver-Julesburg in Colorado natural gas field from atmospheric measurements made during a few select aircraft research flights in February and May of 2012. These emissions estimate is significantly higher than inventory-based estimates from these regions and higher than the U.S. Environmental Protection Agency nationwide average estimate of leakage from the production and processing of natural gas. Although the emissions for Uintah and Denver-Julesburg may not be representative of other natural gas fields, these studies demonstrate the importance of verifying emissions from natural gas production to enable an accurate assessment of its overall climate impact. The relevance of these emissions to the U.S. and global CH<sub>4</sub> budget will be discussed in the context of recent results from NOAA's CarbonTracker CH<sub>4</sub> data assimilation system.



**Figure 1.** CH<sub>4</sub> plume measurements, February 3, 2012, Uintah County, UT. Aircraft flight track overlaid on natural gas (grey dots) and oil (blue dots) well locations along with color-coded CH<sub>4</sub> mole fraction. Bold red line shows a 3-hr back trajectory of the downwind air mass. The locations of two vertical profiles over Horse Pool (red X) and one northwest of Horse Pool (green X) are also indicated.