3.053 Short-term variability in natural gas methane emissions from the Marcellus Shale.

Early Career Scientist

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Abstract:

As the objective to decrease methane emissions from the natural gas sector has become an urgent concern, accurate methods to identify ‘super-emitters’ (infrastructure with anomalously high methane emissions that would be economically favorable to mitigate) are critically needed. The Marcellus shale, the most productive natural gas shale field in the United States, has received less intense focus than other basins due to its complex topography and is investigated to provide insights into the characteristics of the distribution of methane emissions.

In July and November of 2015 and June of 2016 over 300 unique well pads were sampled using the Princeton Atmospheric Chemistry Experiment (PACE). This mobile lab includes commercial meteorological, position and methane sensors as well as custom ammonia and ethane sensors. The majority of sites were sampled 1-3 times with selected test sites sampled ~10 times. Several sites that had been successfully sampled previously were resampled several times (5-20) over the course of a day to identify any changes of emission strength.

An inter-comparison of different methodologies including the inverse Gaussian plume method and Large Eddy Simulation modeling was used to provide robust error estimates

related to the methodology. This allows more confidence to be placed on both the distribution retrieved and trends observed in the data. Specifically, well-level traits that may be related to the overall emission strength or intermittency of the source strength were examined. Well production values appeared to be a poor predictor of emissions strength. Overall ~10% of the sites sampled accounted for ~60% of emissions. Variation in source strength from single sites were observed within the time scales of a single day and multiple days that significantly exceeded the uncertainty estimates deduced from multiple methods. Intermittent plumes may have a direct impact on what is labelled a super-emitter and implementing appropriate mitigation strategies.