Methane Emissions from the Denver-Julesburg Basin of Colorado Estimated by Bayesian Inversion with Five Datasets

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Emissions of methane (CH_4) from the Denver-Julesburg Basin of northeastern Colorado are estimated using a Bayesian inversion method. The objectives are to use the broadest possible base of measurements, and to understand uncertainties in the process. Five measurement datasets are used: Flights by a small aircraft in May 2012, the Front Range Air Polution and Photochemistry Éxperiment (FRAPPE') and Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) aircraft campaigns in 2014, measurements from a tall tower also in 2014, and the Shale Oil and Natural Gas Nexus (SONGNEX) aircraft campaign in 2015. The 2012 flights have previously been analyzed using a mass balance method. Combining all results, we find methane emissions of 29±10 t CH_4 h-1 (2.9 ± 1.0x107 g h-1), consistent with mass balance results. The reported uncertainty is dominated by uncertainty in the meteorological fields driving the transport model. A primary reason to use inversion techniques is to allow the use of data like the tall tower and DISCOVER-AQ datasets, which sample the atmosphere in ways that do not allow mass-balance calculations. Tall tower data in particular provide the opportunity to observe long-term trends at reasonable cost. Estimation of trends in emissions will be possible if those trends exceed 40% of the total.

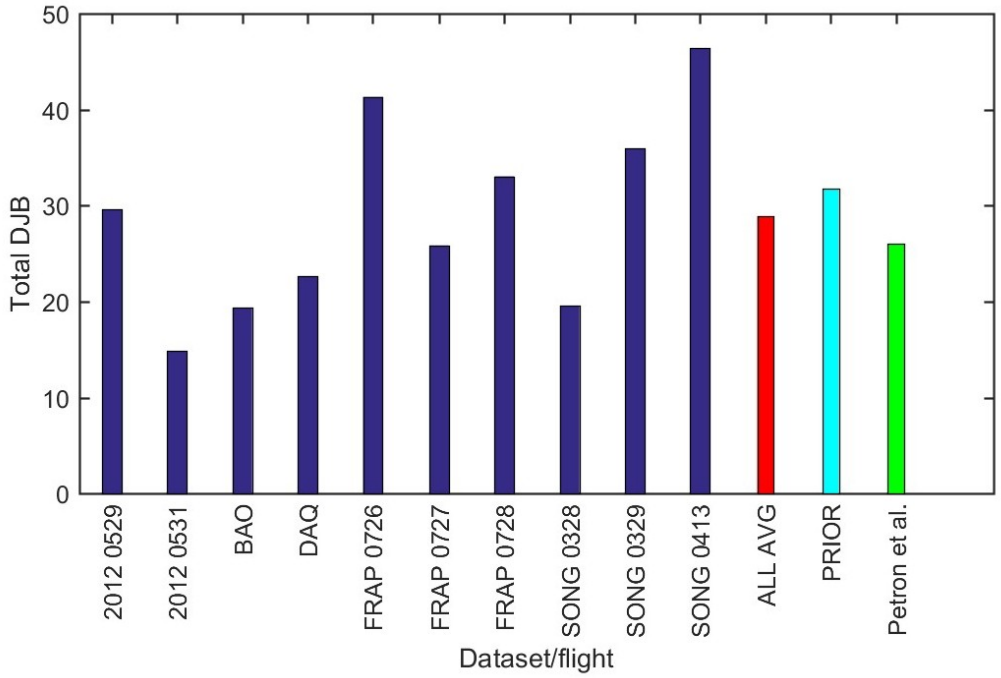

Figure 1. Total methane emissions (t/h) from the DJB derived by this study from individual flights or datasets (blue bars), overall average (red), the prior inventory (cyan), and [*Pétron et al.*, 2014] (green). Flights/datasets are sorted in rough temporal order.