Have We Detected Large Increases in U.S. Emissions of CH_4 from Oil and Gas Production?

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Recent studies have proposed significant increases in methane (CH_4) emissions from North America over the past decade, and implicated rapid growth in U.S. oil and gas production. The evidence for the increase in North American oil and gas emissions is based on (1) observed increases in co-emitted species such as ethane and propane (2) a trend derived from different atmospheric inversions (3) spatial differences across North America derived from space-based retrievals of column CH_4 abundance. We examine these claims using an ensemble of time-dependent inversions collected as part of the Global Carbon Project, and we also consider what long-term observations from the NOAA aircraft observation network tell us about U.S. emissions. We find that none of the time-dependent inversions estimate large trends in U.S. emissions, and this is true for inversions using only surface observations and for those that use retrieved column CH_4. Furthermore, we find that short term (< 5 year) trends of up to 1.5 ppb/yr can occur in spatial gradients between the Pacific "background" CH_4 values and continental locations due to transport effects, and that the trends in spatial differences are very sensitive to what is chosen as the background value. Furthermore, we show that zonal spatial differences for long-lived atmospheric species are not likely to be sensitive to even large trends due to relatively fast synoptic zonal transport. Finally, we consider the extent to which trends in co-emitted hydrocarbons can be used to estimate emissions of CH_4.

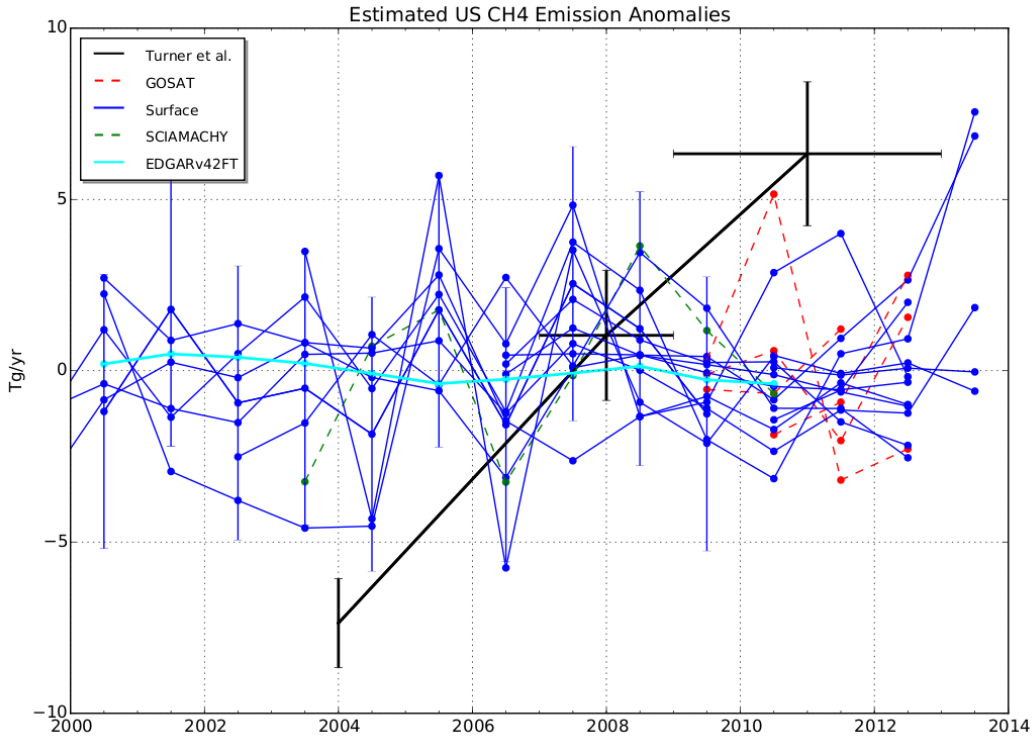

Figure 1. Annual U.S. CH_4 emission anomalies from time-dependent global inversions (blue) archived by the Global Carbon Project (GCP). Dashed lines indicate inversions using space-based retrievals of XCH_4 (red: GOSAT, green: SCIAMACHY). The black points and line shows results used by Turner et al. (2016). Note that error bars are shown for only 1 GCP inversion, since it is difficult to obtain uncertainty estimates for solution methods used by some groups.