Review of M.D. Lewan's: Comments on "Ideas and perspectives: is shale gas a major driver of recent increase in global atmospheric methane?" by Robert W. Howarth (2019)

General

This paper is a rejection of the proposal by R.D. Howarth (2019, cited by Lewan) that in the past decade, shale gas extraction in North America has been the main driver of increased global methane emissions from fossil fuels, and a major factor in the total growth of the atmospheric methane burden.

Howarth's argument hinges on the isotopic data, asserting that emissions from shale gas extraction can drive the methane burden towards lighter, more negative $\delta^{13}C_{CH4}$ values.

Lewan attacks this assertion by presenting an assortment of detailed data from many US gasfields, and then concludes that these numbers show that the $\delta^{13}C_{CH4}$ values of shale gas are typically heavier than those of conventional gas. This is the opposite of Howarth's conclusion. In particular, Lewan finds the mean shale gas $\delta^{13}C_{CH4}$ a little heavier than -37‰, markedly heavier than values near -47‰ taken by Howarth.

There is relevant new information available, published very recently in the well-argued paper by Milkov et al. (2020). In contrast to the scattered data used by both Howarth and Lewan, Milkov et al. (2020) construct a volume-weighted estimate of emissions, finding a volume-weighted average $\delta^{13}C_{CH4}$ of −39.6‰ for US shale gas extracted since 2008. This value is not far from Lewan's estimate, but made from a much stronger database and more rigorous methodology than used by either Lewan or Howarth. From this, Milkov et al (2020) conclude that the "increase in global atmospheric CH_4 is not dominated by emissions from shale gas and shale oil developments."

Lewan cites Lan et al. (2019), who found little evidence for growth in North American methane emissions over the past decade. Note that Bruhwiler et al. (2018), also found that North American CH4 emissions in 2000-2012 have shown little change. These two papers, taken together with Milkov et al. (2020), collectively provide compelling evidence against Howarth's hypothesis.

Thus, while Lewan's conclusion is not far distant from the findings of Milkov et al (2020), the detail and methodology of the Milkov et al (2020 approach is significantly superior. Thus, my recommendation is that while the broad conclusions are likely valid, this comment paper should be returned for significant revision and any resubmitted version should fully take into account Milkov et al. (2020).

Specific

Line 60. Lewan comments that the work by Townsend-Small (2015) is inappropriate because the finding of a $\delta^{13}C_{CH4}$ value of -46.5 ‰ includes only atmospheric samples and ignores well-head gas. But it is exactly the emission that reaches the air that is crucial to the discussion! Townsend-Small's paper is important as it is a direct measurement.

REFERENCES

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