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Atmospheric Measurement Techniques Discussions

Interactive comment on "Quantifying methane point sources from fine-scale (GHGSat) satellite observations of atmospheric methane plumes" *by* Daniel J. Varon et al.

P. Rayner (Referee)

prayner@unimelb.edu.au

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This paper investigates the utility of a proposed satellite measurement of methane to constrain this gas's point sources. The proposed measurement is unusual for its resolution and geographic focus. The resolution, in particular, imposes demands on the transport models that relate sources and concentrations. The paper investigates this using an ensemble of transport simulations at 50 metre resolution using the Large Eddy Simulation version of WRF. The paper finds that the classical synthesis inversion approach used for mapping sources won't work under these conditions but that a simpler method, using the integrated mass enhancement in a plume, will work well enough.

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Discussion paper

The paper is well-written and squarely within scope for the journal.

The paper stands in a tradition of work testing the utility of satellite measurements. Like many of these the first essay is almost schematic. This is quite right; their task is to set the conditions under which the proposed measurements can achieve their objective. This paper goes a bit further by comparing methods for using the measurements. This is its most important contribution beyond establishing that the measurement concept is worth pursuing.

the paper does not yet provide convincing evidence that the proposed measurement will, in fact, meet its objectives. There are many questions still to be answered both about the measurement and its interpretation before we can say that. What is the role of pressure, elevation and scattering fluctuations on the mass estimates given that there is no oxygen measurement to normalise photon paths? What will happen when, inevitably, certain measurements are missing from a plume? What is the role of correlated error in differentiating plume from background and calculating uncertainty in mass enhancement? How sensitive is the IME to uncertainties in windspeed and how confident can we be of the extrapolation from surface to effective windspeed in the many combinations of plume elevation and shear that obtain in the real world? the paper does not need to answer any of these but it should open the questions. I request therefore a significantly expanded discussion/conclusions section in which these questions (and I'm sure there are others) can be at least raised, preferably with some suggestions for how they can be addressed.

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