The paper by Conley et al. describes the use of aircraft-borne in-situ measurements for the quantification of localized greenhouse gas sources in a heterogenous field of potential sources. Overall, the paper is well written and the well described theoretical method may be a powerful tool to improve quantification of greenhouse gas emissions, especially in a complex area. My main point to criticize is that there is a missing link between the performed LES simulations and the presented aircraft measurements. Therefore it is not totally clear to me whether you use the LES simulations to show whether the suggested flight pattern is suitable in general, or if you use the simulations to actually design the flight pattern (e.g. the loop diameter) for each single mission. Independent from this, I´d suggest to focus on one specific flight/flight series throughout the paper. This would simply help to evaluate how good the LES simulations agree with the observations and e.g. how useful the simulations are to optimize the circling radius etc.

Also, a summarizing paragraph ("Summary/Conclusions/Outlook") is missing (by accident?) and essentially needs to be added.

I suggest publication after the following points have been addressed:

Main comments:

Line 141: According to table 1, you release the emissions in a box of 50x50mx8m (table 1). What means the question mark after 8 in the column dz? Especially the (center of the) release height is a very critical parameter. Have you done sensitivity studies by varying the release height to e.g. account for buoyancy? I assume the release rate is constant after the start of the release? Why is the release rate so small (~3kg/h), especially compared to the stated detection limits of 5 kg/h?

Figure 1/3: See my main point: Is there any possibility to combine/compare both figures in order to see how good the plume shape is represented in the model, compared to the (lower resolved) measurements? At least, you should be able to virtually fly along the flight path, extract the concentration levels and plot it together with the measurements along the time-series of the flight (although I know that this kind of graphic representation may be misleading if the plume is slightly shifted).

Line 299ff/Figure 6 and 7: See my main point: Why don´t you compare the LES results with the Aerodyne real test case? I´d suggest using the same flight example for both simulations and measurements (you may also discuss the variability based on your set of simulations).

Minor comments:

Line 111: I assume that the flow rate is controlled in a way that the lag time of both instruments is independent from the ambient pressure?

Figure 1: Please provide more details such as date/time/duration of flight, (derived) source strength, loop diameter.

Line 300: What means similar? The number of passes?

Line 374: Please give the uncertainty of the release rate.

Technical comments:

Please check the number of the equation in section 3.8

Figure 10: What is the unit of the x-axis? Please correct “geographic distribution of methane” to “ethane” in the caption. Please increase the dot size in the right figure.