Review of the paper "Measurements of atmospheric ethene by solar absorption FTIR spectrometry" and author responses (in blue)

The authors thank the reviewer for their most careful and thorough review. We appreciate the considerable time that this must have taken.

Anonymous Referee #1
This paper describes the retrieval of atmospheric ethene amounts from 30 years of solar remote sensing measurements from the ground and stratospheric balloon. Ethene absorbs only weakly in the spectra, and the analysis is very careful, comprehensive and reliable. The measurements are described in detail, and compared to a range of other published remote sesnig and in situ measurements. The conclusions focus on the observed decrease in C2H4 amounts over the period, but the discussion of reasons for this decline is somewhat disjointed and anecdotal. A restructure of the discussion and conclusions sections would improve the paper and do justice to the high quality measurements. The paper is suited to ACP readers and I recommend publication after minor revisions listed below.
Thank you.

L 11 ethane should read ethene
Fixed

L 11 1990s not 1990's
Fixed

L 17-18. Suggest rephrasing without "etc." for example "Atmospheric ethene is formed primarily by incomplete combustion from sources such as biomass burning, power plants and combustion engines."
Done.

L 17-25 Ambiguity: Sawada and Totsuka are referenced 3 times, redundantly, together with Goldstein, but it is not clear if the referenced fluxes are all fluxes or just biogenic. Please rephrase.
Removed one of the Sawada and Totsuka references. Hard to remove another because the first use is for their ethene emissions, whereas the second use is for their ecosystem areas. The second reviewer wanted more serious revisions to the Introduction, which have somewhat over-run these changes.

L 31 Not all readers will be familiar with "MkIV" - briefly describe "MkIV" at first use, for example ". . . with the remote sensing results described here from the MkIV solar infrared interferometer.
I have added "an infrared Fourier transform spectrometer that uses the sun as a source."

L44 The website reference may change in the future. Could a snapshot or table of the webpage be added as an appendix or supplementary info to the paper?
Good point. The other reviewer also complained about this. I have added a new Table in Supplementary Information.

L 55/Fig 1 The red C2H4 and H2O spectra are almost impossible to distinguish, please choose a colour that makes C2H4 stand out. It is in fact clearer in Figure 2, but the reader may not realise this.

I have remade figs 1 & 2 will more color separation between the C2H4 (red) and H2O (orange). But in doing so, the CO2 is now more yellow, which is a hard-to-see color. The fundamental problem is that in a figure containing 10 colors (11 if you include black), it is difficult to make them all clearly distinct from each other.

L107 This text is exactly repeated in the Figure 2 caption. It could be left out of one or the other.
Done. Omitted from caption.

L125 The solid lines in Figure 3 show. . . (not shows. . .)
Done.

L 148 The names and locations of the 12 sites should be provided here or in a table. Many (most) readers will not be familiar with the MkIV sites.
Added a reference here to the new table in Supplemental Information.

L177 "Where" or "While" rather than "Whereas"?
Changed sentence to: "In the 1990's C_2H_4 often topped $15x10^{15}$ molec.cm^{-2}, but since 2010 a column exceeding $7.5x10^{15}$ has only been observed once."

L 184 et seq. This statement is out of place here – it is more in the nature of discussion than presentation of results, and represents the authors' opinion without real quantitative backup. This sentence and other similar points in the results section may be better collected in the discussion section.
Moved it to the Discussion.

L198 have => having
Agreed.

Figure 6 The colours are different from those in Fig 1 & 2, can they be made consistent (with C2H4 easy to distinguish from other gases).
Good idea.

L 296 spell out AOD and MIR
Done.

L311 Figure 2 of ???? et al.
Strange. Says Herbin in the MS Word document, but is blank in PDF. Font problem?

L 319 Is it possible to ask Herbin or co-author rather than speculate about the log retrieval?
I asked Chris Boone of the ACE science team and a co-author on the Herbin paper. Chris confirmed my suspicion that a log(vmr) retrieval was performed. So I have therefore changed the text from "speculate" to "believe".

L321 retrieval mis-spelt
Fixed.

L335 Ethene measurements, not ethane
Fixed.

L337 lower case P in Profiles Discussion
Fixed.

L404-417. This paragraph is a little frustrating – do the authors believe that the urban areas are NOT responsible for the high CO and C2H4, or that the trajectories are inaccurate ("wrong" is a strong word). Having mentioned both possibilities, the discussion is left hanging without any conclusion.

I completely agree. And I was hoping that I would discover some kind of an error in my use of the Hysplit tool by now. But this hasn't happened. So what to do? Omit the paragraph and pretend that I never did a Hysplit analysis, or own up to a negative result? This paragraph has been moved into Methods at the suggestion of the other reviewer.

L418-424 There a few points scattered through the results pointing towards the secular decrease and its causes that could be pulled together here into the discussion, which is currently rather light. Some of this discussion currently resides in the summary and conclusions – I would recommend expanding the discussion and reducing the Conclusions to the main points of the study

Okay. But the other reviewer has requested moving some material out of Discussion and into Methods.