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Interactive comment on “Soot and SO₂ contribution to the supersites in the MILAGRO campaign from elevated flares in the Tula Refinery” by V. H. Almanza et al.

Anonymous Referee #1

Received and published: 4 August 2012

This paper analyzes flares using two distinct modeling approaches: small scale combustion modeling of the flare and larger scale dispersion and reaction of the plume on the urban to regional scale. The methods are well described and the results contribute to the understanding of a policy-relevant issue. I recommend publications subject to the following comments.

Major Comments

Table 1: I would have expected CO₂ to be conserved – or to increase if the plume is reacting. The decrease suggests that something is not quite right. Also, the purpose of showing the slices should be better defined and results presented accordingly, for

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example, is it to show reactions? Also, the definition of the slices seems a bit strange. Would it not make more sense to have spacing that increases gradually. There is no colorbar for Fig 2. It would also be interesting to report the maximum temperature of the plume with distance for the different slices.

Sec 3.1.2: I may have missed this, but what are the differences between the 3 flares? The paper discusses a single flare modeled by OpenFOAM, and then jumps to comparison with 3 flares in IMPei. Pg18192In13 then speculates about composition differences between the flares – is there different and more comprehensive information that goes into IMPei? This should be spelled out.

Pg15184In22: Could you specify the mass fluxes of the three flares used here? The whole discussion comparing the flare mass fluxes with the IMPei model and RdF is dependent on what estimate is used for the flux in the stack.

Also, in terms of emissions, table 6 has a hint of the different sources from the Tula Industrial Complex. However this is not very clearly spelled out. Are the flares the main sources from the refinery? What other point sources are there, and how do the flares compare with those? Past studies focused on total emissions from the TIC, so providing this information would help make a correct comparison of flare emissions with previous work. It would help to have a brief description of the IMPei model and how much of the input data is the same between IMPei and the present work.

Table 5: could you confirm in the caption that the mass flow rates for WRF-Chem are taken from the flare model?

Pg15189In17: What is the conversion rate of H₂S? Is all the sulfur in the plume converted to SO₂? It would be interesting to have a plot of concentration for a species that is being diluted in the plume and one that is being formed in the plume (eg. Fig 2 with 2 extra panels, zooming on the plume).

I'm not sure I could see the point of discussing the E1 and E2 methods for mass flow

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estimation. E1 is clearly better; I would recommend removing the discussion of E2. If the estimate from E2 gives a better fit with prior work, it seems that it is more likely because the emissions are overestimated than because E2 is a better way to estimate the fluxes.

Pg15192In25: How does the amount of HONO predicted by the method compare to the concentrations in Li et al.? Maybe a rough box model calculation can be used to obtain a sense of the magnitudes involved. Likewise for HCHO. This section should be enhanced if it is to be retained.

Sec 3.3.1 and 3.3.2 are very long – could they be shortened somewhat? Is there any reaction of SO₂ on the timescales considered? Does it make a difference using WRF-Chem versus just a transport model with no reactions? Fig. 6 shows the EC and SO₂ plumes, but it seems that because both of these are basically just transported with limited reaction in the basin they both look the same.

Table 6: Expand the caption to remind the reader that FPRPP is the power plant and MHR the refinery. Also, use S0 and S5 and refer to Fig 2 for the cross sections. How was the percentage contribution calculated? (This also applies for Fig 7) Could you add this in the text with a brief reminder in the caption?

Could you say something about the impact on air quality in the MCMA of replacing the refinery, as is currently being planned?

Minor Comments:

Pg15181In1: could you provide a reference for the estimate?

“transient code” – shouldn’t this be “unsteady” or “time-varying”?

Pg15185In20: the discussion about the other paper is vague. Is there a clear split between the two? Does the other one contain information pertinent to this paper? You might one to remove this or clarify the difference.

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Tables 3 and 4 could be merged. Also, please include units.

The labels for Fig 6 is illegible.

The captions for the tables and figures could be expanded to make it easier to understand what is going on.

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