Interactive comment on **"Understanding high wintertime ozone pollution events in an oil and natural gas producing region of the western US"** ***by*** **R. Ahmadov et al.**

Reply to anonymous Referee #1

We thank the reviewer for the valuable comments on our paper. Below we provide answers (highlighted in blue) describing how we addressed the comments.

The authors present a thorough analysis of the modeling of ozone in the Uintah Basin. The central outcome is that modeling of ozone in 2013 with the use of a top down emissions estimate (from measurements) is better able to reproduce episodic ozone than with bottom up emissions estimate (from inventory calculations). This is an important point in particular given the apparent lack of difference in 2012. The authors explore the importance of model setup besides emissions and provide useful observations. The paper could be improved by some re-working of sections as noted below:

Abstract reads like a summary and could be shorter to ensure main points are not too diluted.

We shortened the Abstract a bit. However we tried to keep the major statements in the Abstract, as this paper has several important conclusions.

Also the issue of under or over estimation is inferred from the performance of ozone modeling. Emissions are not validated directly against measurements of the given emission parameters. So the abstract has the cart before the horse. Summary is too long and seems like an extension of the discussion of results.

In Table 3a and b we present the model evaluation statistics for multiple gaseous species including ozone. As we discuss in the paper these comparisons support our judgment about the accuracy of the bottom-up and top-down emission inventories. Using atmospheric models we can't verify emission profiles for individual sources in the oil/gas sector. The profiles and speciation of the emissions for different sources can be validated by sampling individually emissions of those sources. We think the following statements in the Summary section address the raised comments: "Although using emissions based on observations offers significant improvement over the bottom-up emissions inventory, there are potentially important details missing in the top-down emission estimates. Speciation profiles for oil vs. NG wells, and other

stationary sources, are known to be different (Warneke et al., 2014). Thus, a synergy between bottom-up and top-down approaches will be needed in order to develop more accurate emission inventories for the oil/gas sector in the US."

We shortened the Summary section substantially and made some statements more succinct and clear as the reviewer suggested.

It also explicitly states some important points for the first time (e.g. p20322 line 9 Air quality models.....; p20323 line 21 Since the analysis.....; p20324 line 12 Our results suggest.....). The latter example is a critical point that is somewhat buried by surrounding material. Perhaps a conclusions section would help bring the main points into clearer focus?

We realize that the sentence "Air quality models…" makes a statement about all the air quality models, while this study is based on the WRF-Chem model. So we removed this sentence, also to shorten the Summary section in order to address the reviewer's suggestion.

We removed the sentence "Since the analysis…", as indeed the box and 3D models can't be compared in a straightforward manner even if they use the same parameterizations.

The statement "Our results suggest..." is based on our finding that the emissions of aromatic VOCs contribute to daytime ozone at the surface nearly as much as alkane species, which are the dominant fraction of the VOC emissions. These sensitivity simulations are presented in Section 4.2.3. Consequently, reducing the aromatic VOC emissions would be more efficient in ozone reduction than other species.

Finally letters labels in Figure 2 seem to be invisible.

We updated Figure 2 with letters and labels to illustrate it better.