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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ozone photochemistry in an oil and natural gas extraction region during winter: simulations of a snow-free season in the Uintah Basin, Utah" *by* P. M. Edwards et al.

Anonymous Referee #2

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The paper reports on the ozone photochemistry during in the Uintah basin during the UBWOS study. The paper is well written and presents some very interesting results on the radical sources using the MCM. There are a few minor points that should be addressed

1. The authors state that the inclusion of Criegee Intermediate chemistry only results in a 1% increase in the OH and O3 formed in the model. Could the authors give more details on the CI scheme used? In particular how are they constraining the fraction of CI from ozonolysis that leads to the formation of HOx cf. to stabilization. The CIs produced in ozonolysis will be produced with a Boltzmann distribution of vibrational

energies. The CIs with enough vibrational energy to overcome the energy barrier to unimolecular decomposition will decompose to produce HOx. The fraction that produces HOx depends on the nature of the alkene, indeed, Donahue et al., 2011 (PCCP, 13, 10848) suggest that for C2-C15 precursors all CI can be completely stabilised. Given that this fraction will govern the impact of CI on the OH in the model, could the authors give more details on how they treat such chemistry. Furthermore, recent experimental studies (Welz et al., 2012, Science, 335, 204) suggest that CI reactivity is considerably different than had previously been assumed in the MCM. This has been further supported by field studies (e.g. Maudlin et al., 2012 Nature, 488, 193) which suggest a more dominant role of CI chemistry in the troposphere, again more details are required.

2. Only 3 non aromatic alkenes are reported in the Supplementary material. Were other alkenes attempted to be measured? Given that 1,3 butadiene is measured it would seem that there is an influence of combustion sources. This would suggest that there would be the possibility of observing other alkenes. If alkenes were measured but were below the limit of detection this should be stated. This again will have a major impact on the CIs on radical sources

3. Ozone deposition rates vary considerably. Rates vary from 0-9 mms-1 (Wesley and Hicks, 2000, Atmos. Environ, 34, 2261; Emberson et al., Water, Air and Soil Pollution, 2001, 30, 577). How is the variability taken into account the author's model and what impact would heterogeneity have their reported results?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 7503, 2013.