

***Interactive comment on* “Observations of ozone depletion events in a Finnish boreal forest” by Xuemeng Chen et al.**

Anonymous Referee #2

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Summary

This study provides a very detailed analysis of a long term (about 20 years) dataset in order to gain a better understanding of ozone depletion events in a 'pristine' Boreal forest environment. Detailed chemical and meteorological datasets are analysed to highlight the key processes that contribute to such events on both a diurnal and vertical profile basis. Overall it is indicated that dynamics play a very strong role (E.g. low temperature, high humidity and stable conditions) in these depletion events which typically occur during autumn and winter. This therefore suggests the meteorological conditions act to enhance ozone deposition which is not able to be replaced by photochemical production and other chemical processes. This paper is very well written and clear and provides a very useful addition to the literature. Therefore I feel it should be

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published in ACP after the following very minor comments are addressed.

Specific Comments:

Section 3.3 first paragraph: Figure 7 appears to show a positive correlation between ozone and temperature and a strong negative correlation between humidity and ozone. It would be quiet interesting to see a plot of temperature versus humidity to see the trends between these variables. This could serve as an insight into the potential role stomatal closure of plants plays in the ozone depletion events. E.g. Lower temperatures and higher humidities tend to lead to plants opening stomata and thus enhancing ozone deposition leading to lower concentrations. The authors go onto showing the impacts of both RH and temperature together in Figure 10 for a couple of isolated events but it would be interesting to see the trend in the combined effect of RH and temperature over all events to see if this can explain any potential changes stomatal conductance could have on deposition and hence concentrations.

Section 3.3. final paragraph, page 8 lines 15-20. The authors briefly touch on the influence of CO and NO_x concentrations have on the specific ozone depletion events that they present in Figure 10. Although no clear trend is shown for the first event (Figure 10e and f), for the full depletion event (Figure 10 k and l) it is shown that both NO_x and CO concentrations are high during the event and CO in particular is high leading up to the ozone depletion period. These values are a lot higher than is expected in typically clean forest environments. The location of the site is to the North/North East of two large cities (Tampere and Helsinki) and therefore perhaps regional transport of pollutants could be playing a role? I am thinking mainly in the terms of transport of high NO_x which could contribute to ozone titration and enhanced depletion. Could this be a potential chemical pathway to the ozone depletion events?

Minor Comments:

Page 4, Line 33: Please correct extend to 'extent'

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References: Please ensure that all references have associated DOIs.

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