**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Characterization of a boreal convective boundary layer and its impact on atmospheric chemistry during HUMPPA-COPEC-2010" *by* H. G. Ouwersloot et al.

Anonymous Referee #3

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This paper is designed to look at boundary layer dynamics and their impact on atmospheric chemistry. It does this using observations from the HUMPPA-COPEC campaign at the Finnish Smear-II station in summer 2010. After classifying different prototypical boundary layers they proceed to study its evolution on one day in detail. They do this by combining the observations with a mixed layer model. They first demonstrate that the model is able to capture the main features of the boundary layer evolution before proceeding to understand the impacts of subsidence and advection. They then proceed to study chemical evolution within this framework , demonstrating that a good understanding of boundary layer evolution is necessary to capture the ozone and nitrogen dioxide observations. They conclude by considering future measurement

strategies recommending more continuous observations from sources such as LIDAR. This is a useful, detailed study which I am happy to see published subject to some changes.

I found that the introduction did not sit quite well in tone with the rest of the paper. During the rest of the paper the principal focus is on boundary layer dynamics. The introduction opens with a discussion about the boreal regions, which I found a little at a tangent to the abstract. I would rewrite the introduction to follow on more naturally from the abstract, i.e talking about the ABL. The paragraph that starts 'Concentrations of chemical . . ..' on p13622 would, to me at least, make a more natural starting point.

If the subject of climate change on conditions at the site (p13622, para2) is to be retained (which I would not deem to be essential) then it needs a bit more justification, with at least a citation for their statement. In addition I found it hard to reconcile the general technique of classifying boundary layer prototypes with this emphasis on the importance of changing climate, especially as they apply their techniques to an Amazon case study later on.

I feel that the introduction would benefit from a discussion of different types of boundary layers that we might expect and why they are different. For instance synoptic high pressure systems will generate more convection which in turn will produce a different type of boundary layer.

Given the importance of chemistry to this study I would appreciate a more detailed description of the chemistry with emphasis on changes from the standard scheme and choice of boundary conditions such as emissions. How sensitive are relatively short lived species such as NO2 to your initialisation?

You mention the free tropospheric gradient in several places. I think the work would benefit from a more detailed discussion as to how this is calculated.

On p13627-8 you discuss classifying the boundary layer types but you don't discuss

how. Was this done by inspection or was there a more quantitative technique?

On p13633 and 13634 you talk about both warm and cold air being entrained from the free troposphere without trying to distinguish why sometimes this effect is to warm and sometimes to cool.

p13635 It would be useful to clarify that the Amazonian case only refers to the chemistry and that the boreal meteorology etc is retained

p13636 I would find it interesting to put the changes in OH in context with the size of the variation seen from changes to chemical schemes such as that discussed by Lelieveld et al in Nature (2008), or some such similar work.

Minor comments/suggestions

p13620: 'characterised as a convective boundary layer' …... 'characterised as one type, that of a convective boundary layer'

p13621 L16 'extends on' -> 'builds on' or just 'extends'

p13623 L21 Define upper atmosphere: Do you mean the free troposphere?

p13623 L23 'used chemical observational techniques '-> 'chemical observational techniques used'

p13624 L1 Place height in context of canopy height here (or define canopy height in text before this)

p13624 L10 'radiosondes have been' -> 'radiosondes were' (i.e. past tense rather than future perfect continuous). There are a couple of other places were tenses need checking to ensure consistency.

p13624 L20 'Next to a GPS' -> 'As well as a GPS'

p13624 L25 'The software of the ground station calculates ' -> 'We calculated'

p13625 L4 gathered -> collected

p13625 L12 'over 10Hz' -> 'of 10Hz'

p13628 L1 'thus be linked to the representations' -> this sentence is unclear

p13629 L29 'of the previous day ' -> 'from the previous day'

p13631 L21 I would restrict this to saying that 'All instruments were functioning and the the weather conditions were typical'

p13631 L25 'Closely related . . .' This sentence is a bit unclear. perhaps something like 'Additional dynamical processes, which can easily be overlooked, are also important in interpreting atmospheric chemistry.'

p13632 L13 'is at lower heights' -> 'is near the surface'

p13632 L13 'higher altitude' -> 'higher altitudes'

p13632 L19 'as initial profile'-> 'as an initial profile'

p13633 L8 'case under study' -> 'case study'

p13633 L23 'stronger' ->'greater'

p13633 L29 ';fades'->'decreases'

p13634 L21 'The rate at which. . .': This sentence is unclear

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 13619, 2012.