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Interactive comment on "Substantial secondary organic aerosol formation in a coniferous forest: observations of both day and night time chemistry" *by* A. K. Y. Lee et al.

Anonymous Referee #2

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Authors present the results obtained during a 20 days field campaign carried out in a coniferous forest mountain region at Whistler (British Columbia, CA). Results presented combine mainly HR-ToF-AMS for NR submicron aerosol composition, PTR-ToF-MS for VOCs mixture composition and OH-CIMS for OH measurements. This dataset is undoubtedly of prime interest for the scientific community.

However, I suggest to complete the data analysis with local meteorological data and in particular wind direction and in a lesser extend wind speed (if any) in order to draw more robust conclusions. As mentioned by the authors "mountains flow (. . .) contribute to the diurnal variations in chemistry at the site". From my experience, I'd go further.

Slope winds alternation can be one of the main driver of the atmospheric concentrations in such environment. For example, the sharp morning decrease of monoterpenes concentrations is most probably due to a breeze alternation than pure chemical processes. It seems that these dynamic aspects are treated in MacDonald et al (in prep), but without a clearer idea of wind direction influences it is difficult for me to fully validate the conclusions of the paper. Also is there a difference between periods (ie. Biogenic and Biogenic/anthropogenic period) in terms of wind patterns? In other word can the authors add the wind direction diurnal cycle (in fig 4 or 5) and any relevant polar plots in the main text (and/or SI) and add an in-depth discussion of the effect of local meteorology on their observations.

My second main point is related to the f91 discussion and especially the comparison to previous studies. The recent intercomparison exercise of ACSMs (+ToF-AMS) highlighted a significant variability of the fX ratios from one instrument to another (Fröhlich et al, 2015). The discrepancy is much more marked for f44. This section should thus be rewritten/adapted in the light of these recent findings, and the conclusions should probably be smoothed.

Specific comments/questions: P28010 Not clear if PMF was performed with HR or UMR AMS data matrix. If UMR was used for the PMF analysis, can the authors explain why? (Particularly important for m/z 43)

P28011 Specify the E/N used for PTR measurements. I'm also surprised that only 6 VOCs (or group of isomers) were quantified within this study. Light aromatics (Benzene, toluene, ..) could have been useful to characterize the anthropogenic influences since no BC is shown in the paper.

P28012-28013 - What about O3 and OH concentrations differences between the two periods? - Sulfate seems to present a clear diurnal patterns (especially during the second period) and not ammonium. Does it mean that we are in presence of an acidic aerosol or organo sulfates?

P28014 – Remove one “the” (line 1) - First §and fig 2, can we really distinguished the influence of dynamic (mostly accumulation in this case) from chemistry? - Second §, the previous comment regarding the use of the HR data matrix for the PMF analysis, is here particularly important, and may explain why the O/C ratios are not so different between BSOA1 and BSOA2.

P28018 – line 15 . . .between 13 and 18 July - I’m very surprised that no diurnal cycle is observed for the ratio NO+/NO2+. Do you observe any differences in this ratio between the different periods?

P28019 line 16 : Xu et al 2015 paper has been corrected. Organo nitrates account now for 20-30% of LO-OOA. Also this estimation of organo nitrates contents (as performed here) suppose that NO+ and NO2+ signal originate solely from organo nitrates (ie. not from inorganic nitrate). This assumption should be discussed.

Figure 1: Can the authors add to this figure the time series of O3 and OH.

Figure 4 : add in the legend “biogenic and anthropogenic influenced period”

Figure 5 a-b : Add the NO+/NO2+ ratio time series

Figure 5 c-d: Are the diurnal cycles specific of one period or representative of the whole campaign?

Supporting information / Calculation of organic nitrate mass There is a mistake in the first equation. Coefficients 62/46 and 62/30 are missing. Also explain [NO+] and [NO2+] : ion intensities? Concentration eqNitrates?

Ref: Fröhlich, R., Crenn, V., Setyan, A., Belis, C. A., Canonaco, F., Favez, O., Riffault, V., Slowik, J. G., Aas, W., Aijälä, M., Alastuey, A., Artiñano, B., Bonnaire, N., Bozzetti, C., Bressi, M., Carbone, C., Coz, E., Croteau, P. L., Cubison, M. J., Esser-Gietl, J. K., Green, D. C., Gros, V., Heikkinen, L., Herrmann, H., Jayne, J. T., Lunder, C. R., Minguillón, M. C., Močnik, G., O’Dowd, C. D., Ovadnevaite, J., Petralia, E., Poulain, L., Priestman, M., Ripoll, A., Sarda-Estève, R., Wiedensohler, A., Baltensperger, U., Sciare, J., and Prévôt, A. S. H.: ACTRIS ACSM intercomparison – Part 2: Intercomparison of ME-2 organic source apportionment results from 15 individual, co-located aerosol mass spectrometers, Atmos. Meas. Tech., 8, 2555-2576, doi:10.5194/amt-8-2555-2015, 2015.

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