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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Overview of the Manitou Experimental Forest Observatory: site description and selected science results from 2008–2013" *by* J. Ortega et al.

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We sincerely appreciate reviewer #3 for agreeing to thoroughly review our manuscript and we express thanks for the helpful comments. Our responses are listed below.

The initial draft of this manuscript reflected what was thought to be a temporary hiatus in long-term trace gas measurements. Due to a variety of factors and other obligations, these long-term continuous measurements were not continued. In the future, NCAR is planning to carry out limited (season-specific) measurements in an effort to continue year-round coverage without the requirements of having to be there every day

of the year. The meteorological data on the chemistry tower has been running mostly continuously.

The text describing the meteorological tower has been changed to past tense. The following text has been added to section 1.3 after the description of the chemistry tower trace gas instruments:

The Waldo Canyon fire in June 2012 forced the removal of the trace gas instruments from the chemistry tower at the same time instruments were removed from the micrometeorological tower mentioned above. Fortunately, the fire did not directly affect the site, and meteorological measurements from the chemistry tower have been running continuously (see Table S1). Since the two towers had generated 3-4 years of data and the instruments were required for other projects and field sites, it was decided to stop continuous measurements. Measurements at the Manitou Experimental Forest Observatory are now planned on a seasonal basis to continue long-term measurements that capture each of the seasons. The intent here is to continue the time series, but with fewer resources than are required for continuous year-round coverage.

2. The label "Chemistry Tower" is sometimes capitalized and sometimes not. Capiltalization does not seem necessary, but either way it should be consistent.

The label "chemistry tower" has been changed to lower case throughout the manuscript.

3. As other reviewers have noted, the contributions of several different authors is clear in the writing. This occasionally affects the organization of the overall work; there are places where material is presented in a section where it does not fit. The most obvious example is the chemical data presented with the meteorology in section 1.4, but this issue occurs occasionally throughout the manuscript.

The discussion of NOx in section 1.4 with meteorology has been simplified and the original Figure 3 has been removed.

4. In section 3.1, the cited paper by Zhao et al. describes the TAG system, but not it's coupling to an aerosol mass spectrometer. Is there a better reference available? Has the described work from the MEF site been peer-reviewed and published?

A new publication by Williams et al., 2014 has been added. The relevant text has been modified in the following way:

A newly developed Thermal desorption Aerosol Gas chromatograph - Aerosol Mass Spectrometer (TAG-AMS) was deployed and analyzed semi-volatile VOCs (∼C14-C25) on a bihourly timescale. The sample collection, thermal desorption and chromatography systems have been described previously by (Zhao et al. (2013), however the 2011 BEACHON-RoMBAS campaign was one of the first to couple it to the AMS as a detector (Williams et al., 2014).

5. Most of the results presented in the paper are described only briefly, because they are based on previously peer-reviewed and published work. This is an appropriate approach for an overview paper. However, in some cases results of advanced measurements and analyses are presented that have not been previously peer-reviewed. This is the case, for example, for the results presented in Figs. 9 and 10. Since these are 'new' results, the scrutiny for review is higher, and significantly more detail about the measurements and analysis is required. This detail is not provided in Section 3.3, nor are the appropriate papers cited for readers to understand how the results were attained. Similar concerns exist for Figs. 12 and 13 in section 4.2. The authors need to provide sufficient detail that these new results can be fully evaluated, or they should cite appropriate companion papers that contain the details, or these parts of the manuscript should be removed.

To support the OH and HO2 measurements, the following references were added: Edwards, G. D., Cantrell, C. A., Stephens, S., Hill, B., Goyea, O., Shetter, R. E., Mauldin, R. L., Kosciuch, E., Tanner, D. J., and Eisele, F. L.: Chemical ionization mass spectrometer instrument for the measurement of tropospheric HO2 and RO2, Analytical

Chemistry, 75, 5317-5327, 10.1021/ac034402b, 2003.

Hornbrook, R. S., Crawford, J. H., Edwards, G. D., Goyea, O., Mauldin, R. L., Olson, J. S., and Cantrell, C. A.: Measurements of tropospheric HO2 and RO2 by oxygen dilution modulation and chemical ionization mass spectrometry, Atmospheric Measurement Techniques, 4, 735-756, 10.5194/amt-4-735-2011, 2011.

Mauldin, R. L., Eisele, F. L., Cantrell, C. A., Kosciuch, E., Ridley, B. A., Lefer, B., Tanner, D. J., Nowak, J. B., Chen, G., Wang, L., and Davis, D.: Measurements of OH aboard the NASA P-3 during PEM-Tropics B, Journal of Geophysical Research-Atmospheres, 106, 32657-32666, 10.1029/2000jd900832, 2001.

For more clarification on the particle size distribution measurements used for Figure 8, we have added the following text in the beginning of section 3.3.

The instrument used for these measurements consists of the following components: âĂć Optical Particle Counter (200 – 2500 nm); Lasair model 1002 from Particle Measurement Systems (Boulder, CO), âĂć Regular scanning mobility particle sizer (SMPS; 30-300 nm): Custom sheath air and HV control unit combined with TSI model 3081 Differential Mobility Analyzer (DMA) and TSI model 3760 Condensation Particle Counter (CPC; TSI Inc., Shoreview, MN), and âĂć Nano SMPS (4-30 nm): Custom sheath air and HV control unit combined with TSI model 3085 DMA, and TSI model 3025a CPC. Particle size distributions started at midnight at exact 5 minute intervals for a total of 288 size distributions per day.

For more clarification on the measurements used for Figure 9, we have changed the appropriate text in section 3.3. Previous text: During the summertime 2011 BEACHON-RoMBAS study, AMS (Aerosol Mass Spectrometry) measurements showed average PM1 mass loadings of 2.5 ug m-3 (Figure 10). Also included in this figure is black carbon aerosol as measured with a single particle soot photometer (SP2, Droplet Measurement Technologies).

New Text: During the August 2011 BEACHON-RoMBAS study, chemical speciation and mass loadings of non-refractory PM1 aerosol were measured using a high resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS, Aerodyne Research, Inc., Billerica, MA; DeCarlo et al., 2006). Average mass loadings during the campaign were 2.5 ug m-3 (Figure 10). Also included in this figure is black carbon aerosol as measured with a single particle soot photometer (Droplet Measurement Technologies, Boulder, CO, model SP2).

Similar concerns exist for Figs. 12 and 13 in section 4.2. The authors need to provide sufficient detail that these new results can be fully evaluated, or they should cite appropriate companion papers that contain the details, or these parts of the manuscript should be removed.

The results presented here for the WRF-Chem model are based on already published model versions. The study on OA formation presented in Figure 12 is based on the WRF-Chem model simulations described in Fry et al. (2013). In that version, SOA formation from anthropogenic VOCs and semi/intermediate volatility compounds (S/IVOCs) is based on Hodzic and Jimenez (2011), whereas treatment of biogenic SOA follows Shrivastava et al. (2011).

The WRF-Chem simulations that were used to study the transport of anthropogenic pollutants to the site, as well as new particle formation and effect on CCN, are configured as described in Cui et al., 2014. This is now explained better in the manuscript: These modeling studies focused particularly on organic aerosol (OA) formation from forest BVOC emissions, and the influence of anthropogenic pollutants transported to the site. To study OA formation, the WRF-Chem model was configured as described in Fry et al. (2013) using the SOA module based on Hodzic and Jimenez (2011) for anthropogenic precursors and Shrivastava et al. (2011) for biogenic precursors. To study the influence of anthropogenic pollution on aerosol formation, the WRF-Chem model was configured as described in Cui et al. (2014).

The following references have been added:

Hodzic, A.; Jimenez, J. L. Modeling anthropogenically controlled secondary organic aerosols in a megacity: A simplified framework for global and climate models. Geosci. Model Dev. 2011,4,901−917, DOI: 10.5194/gmd-4-901-2011.

Shrivastava, M., Fast, J., Easter, R., Gustafson Jr., W. I., Zaveri, R. A., Jimenez, J. L., Saide, P., and Hodzic, A.: Modeling organic aerosols in a megacity: comparison of simple and complex representations of the volatil- ity basis set approach, Atmos. Chem. Phys., 11, 6639–6662, doi:http://dx.doi.org/10.5194/acp-11-6639- 201110.5194/acp-11-6639-2011, 2011.

Cui, Y. Y., Hodzic, A., Smith, J. N., Ortega, J., Brioude, J., Matsui, H., Turnipseed, A., Winkler, P., and de Foy, B.: Modeling ultrafine particle growth at a pine forest site influenced by anthropogenic pollution during BEACHON-RoMBAS 2011, Atmos. Chem. Phys. Discuss., 14, 5611-5651, doi:10.5194/acpd-14-5611-2014, 2014.

6. Figures 8 and 10 do not resolve adequately for publication. This should be resolved in the final on-line publication. Thank you for noticing.

Table 1 and the new Figure 2 can be viewed in our response to reviewer #1

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 1647, 2014.