Dear anonymous reviewers,

Thank you very much for your comments on our manuscript [acp-2014-269]. Your comments and suggestions are valuable and very helpful for improving our manuscript. Based on your comments and suggestions, we carefully revised the manuscript, and the point-to-point responses to your comments and suggestions are listed below.

Thank you once again for your time and consideration.

Responds to the comments:

Note: All the revisions are based on the previously submitted manuscript in word format which corresponds to the ACPD. For the modified portions, we provide the page and line numbers of the ACPD format when modifications are needed.

Anonymous Referee #1

There is short of the impacts of heave foggy event on CCN, and more studies about this issue are needed in the subsequent works of the authors.

We thank you for your kind comments and good suggestions. In this study, no heave foggy case was observed and this disables us to explore its impact on CCN. However, a foggy-hazy case was observed which could partly act as references. We will pay more attention to the heave foggy

case and its effect on CCN in the future.

It seems that it is not quite often to use CN larger than a certain size (e.g. CN larger than 80 nm and 100 nm in this paper) to get the activated fraction.

We thank you for your comments. Aerosol CCN activated fraction is usually calculated by using the whole CN size and we have presented this method in our submitted manuscript. However, CN larger than a certain size (e.g. CN larger than 80 nm and 100 nm in this paper) can still be used as references for further analysis, because smaller aerosol particles (e.g. particles smaller than 80 nm) are not activated at 0.2% SS. It will help to reduce the uncertainties from the small particle size which contributes little to CCN formation, and help to gain more information about the CCN-active aerosols.

This paper should give more explanation to MPL, such as calibration, data processing.

We thank you for your comments and suggestions. We have added more explanation to MPL in our revised manuscript. Detailed changes are as following:

Page 17003, line 16: add “The description of the retrieval of aerosol parameters by the MPL will be only briefly summarized here as it has

been given by He et al (2006a). The vertical profile of the aerosol extinction coefficient is determined by a near end approach in solving the lidar equation (Fernald, 1984). The PBL height is determined by the MPL lidar at the altitude where a sudden decrease of scattering coefficient occurs (Boers and Eloranta, 1986). The overlap problem must be solved because it can lead to an underestimation of aerosol backscatter and extinction coefficients in the lowest altitudes having the majority of aerosols (He et al., 2006a). Outlined by Campbell et al (2002), overlap is typically solved experimentally. The system is set to point horizontally to an averaged data sample with no obscuration, such as the late afternoon, when the atmosphere is well mixed and the aerosol loading is low. The backscattering over the target layer is roughly assumed constant. The similar calibration has been performed before this study." behind "…Brooks, 2003)."

A lidar ratio plot would help to gain more information about the aerosol

We thank you for your comments and valuable suggestions. We agree with you that a lidar ratio plot would help to gain more information, but the MPL software we are using now is an old version and this disables the derivation of lidar ratio. We will explore the lidar ratio as soon as the software is updated in the future.

The paper should add more address clearly on time-scale of averaging for meteorological factors, CCN, BC and other data.

We thank you for your comments and suggestions. The PBL and vertical extinction coefficient are processed into 1-min averages. The other factors are processed into 1-hour averages.

Figure 1 needs some modification for time labels.

We accept your valuable suggestions and have modified the time labels for Figure 1 as Figure R1

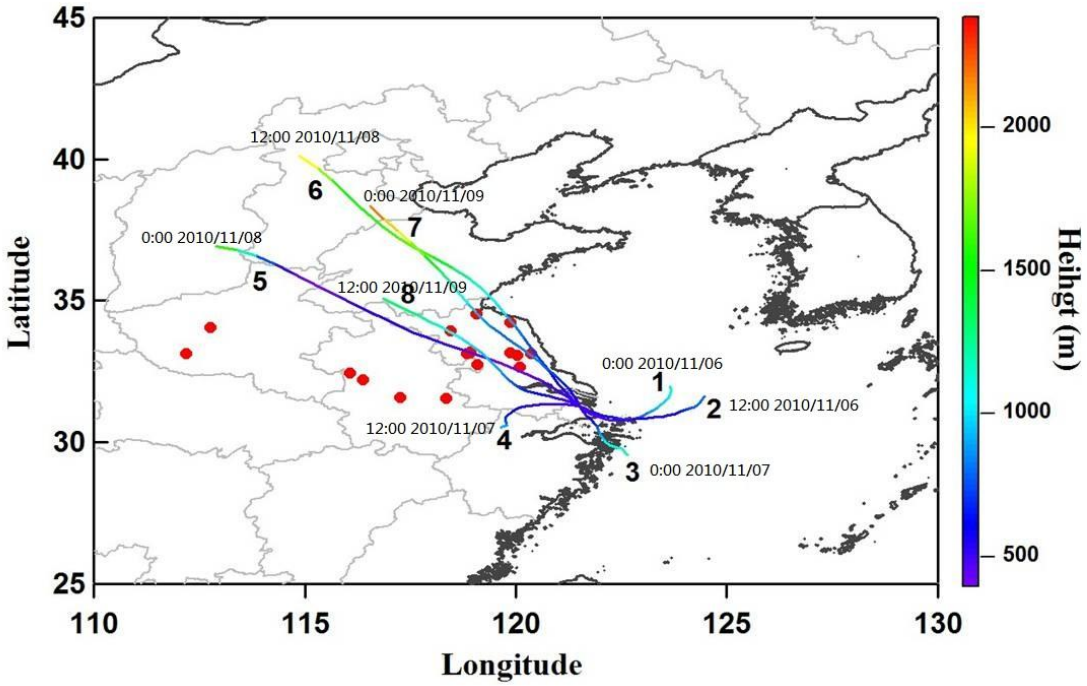

Figure R1 Agricultural fire scattering areas and air mass transport pathways across these regions. All red spots represent biomass burning sites on 7 November measured from MODIS satellite. Starting time (LT) is labeled in the figure.

The authors should give more explanation for the equation 2. More related references should be added and the references style should be adjusted correctly.

We thank you for your comments and suggestions. More explanation and the derivation process for the equation 2 have been introduced in detail by Petters and Kreidenweis (2007) in ACP. Therefore, there is only brief summarization here.

The saturation (i.e. S) over an aqueous droplet can be calculated by:

$$S = a_\omega \exp\left(\frac{4\sigma_{s/a} M_\omega}{RT\rho_\omega D}\right)$$

According to the effect on the water activity of the solution, the hygroscopicity κ is defined as:

$$\frac{1}{a_\omega} = 1 + \kappa \frac{V_S}{V_\omega}$$

where V_S is the volume of the dry particulate matter and V_ω is the volume of the water.

For the equilibrium of a multicomponent system, the total volume of the water is the sum of the water contents due to the individual components, i.e. $V_\omega = \sum V_{\omega i}$ by using the ZSR (Zdanovskii, Stokes and Robinson) assumption. The individual $V_{\omega i}$ can be derived for $a_{\omega i} = a_\omega$.

$$V_\omega = \frac{a_\omega}{1 - a_\omega} \sum_i \kappa_i V_{si}$$

The total volume of the system (water+solute) is

$$V_T = \sum_i V_{si} + \sum_i V_{\omega i} = V_s + V_\omega$$

The individual dry component volume fractions are defined as $\varepsilon_i = V_{si}/V_s$, then

$$V_T - V_S = \frac{a_\omega}{1 - a_\omega} V_s \sum_i \kappa_i \varepsilon_i$$

Defining D_d as the dry diameter, $D_d^3 = 6V_S/\pi$, also $D^3 = 6V_T/\pi$

Then we can derive the equation 2 in ACPD, namely "κ-Köhler theory".