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# ***Interactive comment on “Influence of biomass burning on CCN number and hygroscopicity during summertime in the eastern Mediterranean”***

**by A. Bougiatioti et al.**

**Anonymous Referee #1**

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Overall, the manuscript presents a thorough analysis of four biomass burning events monitored in Finokalia station. Plumes are measured by their particle numbers, sizes, chemistry, CCN activity and hygroscopicity, making it possible to assess the climatic impacts of these biomass burning (BB) aerosols. However, the manuscript does not give any quantitative information about these BB events impact for climate, rather it satisfies with reassuring the previous observations on the organics aerosols impacts on aerosol hygroscopicity. As such, its originality is not very high, yet in Introduction the authors promise “The originality of this study relies on the fact that... very few studies focus on hygroscopicity of ambient biomass burning aerosol for a range of

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atmospheric aging, which is addressed here". This indeed is very interesting and I find the manuscript well written and important, yet I would hope to see slightly deeper analysis of the background conditions for each of the events, to give the manuscript the originality it deserves. Below are my detailed suggestions which I hope the authors would address before manuscript publication in ACP.

## General comments:

- 1) Aging of the BB plumes is mentioned many times, and terminology such as "aged" or "freshly-emitted" BB aerosol are used. Yet, it's not very clear what are the criteria for more or less aged, or fresh, plumes? Also no information on transport conditions (how many hours air masses traveled, on what time of day and over which route) is given, nor any information on the type of fires (grass, forest, soil type). As current, it seems the age of each plume is rather deduced based on measured aerosol quantities, even if vice versa, the BB plume age should be predetermined. Could the authors clearly state how the age of each plume and BB aerosol was determined, and analyse the impact of this aging on each of the remaining measured quantities (as promised in introduction)?
- 2) In many occasions the manuscript analysis the "change" of observed aerosol quantities caused by BB emissions (e.g. 21551 lines 1-2 and 12-15 and 21-23; 21552 lines 1-2; 21555 lines 5-6; etc.). However, it's not always very clear what is the reference point? Measured values prior to BB events, in the beginning of the events, or something else? Could this be more clearly stated? Also, is the reference point relevant for the current location, or representing e.g. typical conditions at Finokalia? Do the air masses remain unchanged over the course of each of the events or may these play a role in observed changes?

## Minor comments:

p. 21552 lines 1-2: Authors state that CCN concentrations increase during the majority of the BB events. I find it very surprising if during a BB event, CCN concentrations are not increasing? Was the site affected by some other aerosol sources on those times

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when concentrations did not increase (compared to reference)?

p. 21553 line 24-25; 21557 lines 1-2 and lines 18-19: Slightly confusing and mixed information is given on observed particle internal/external mixing states. Could the authors check that all this information is consistent?

p. 21555 line 25: Authors say that aging of smaller particles takes longer than aging of larger particles. Maybe so, but in this case, how they rule out e.g. a possibility that these smallest particles were not just born later by a secondary route, but are actually from the same source?

p. 21563 lines 8-9: Importance of coagulation vs. condensation could also be calculated by a dynamical model, having all this information the authors have. Would this support the statement that for 60 nm particles coagulation is dominant over condensation?

p. 21561 lines 1-2: Is kappa(BBOA) factor from ACSM seen to coincide with the occurrence of less-hygroscopic mode seen in HTDMA?

Typo: 2nd sentence of summary has repetition.

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