**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Hygroscopic and chemical characterisation of Po Valley aerosol" by J. Bialek et al.

Anonymous Referee #2

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General Comments

The paper presents the hygroscopic growth factors (HGFs) and organic growth factors (OGFs) of atmospheric aerosol particles and the composition and concentrations of non-refractory components in the particles at San Pietro Capofiume, Italy. The temporal variation and the diurnal variation of hygroscopic growth factors during the study period is reported. Further, two specific time periods (Case 1 and Case 2) are further analyzed. Fractions of particles with HGFs in different ranges and OGFs are explained with comparison to the data of organic components. Based on the results, formation of organosulfates and organonitrates is suggested. Meteorological data and backward trajectories are also utilized to characterize the studied time periods. The paper provides valuable information on the HGFs and the OGFs of atmospheric aerosol particles

at the studied site, and their relation to the chemical composition of the aerosol particles. The data of OGFs is in particular valuable because it may provide unique information on the characteristics of organic components in the studied aerosols. This paper, however, has serious shortcomings with regard to the quality of the presentation and some science, as detailed in the list of my comments below. Although the shortcomings may not critically affect the main point of discussion, readers may sometimes have difficulties in understanding the exact meanings of the explanations, and cannot find justification of the authors' statements by data. Hence, for publication in Atmospheric Chemistry and Physics or in another journal, substantial revision to improve the quality of the presentation and science is necessary. More specific comments and technical comments are listed below. (Although my comments may overlap with the comments from another reviewer, they are all listed.)

Specific Comments

P3248, L3: The particle growth caused by the uptake of ethanol was studied, too.

P3248, L4: The relative humidity condition for the measurement of the HGFs should be presented.

P3249, L3: In the results and discussion section, the relation of the lowest HGFs to the formation of organosulfates is not discussed.

P3249, L18: "(CCN)" may need to be added because this abbreviation appears later.

P3250, L22-27: The references and the explanation of this sentence do not match.

P3250, L28-P3251, L1: The reference(s) reporting the result should be added.

P3251, L5: The expression "HTDMA-AMS tandem" is not appropriate, if the authors intend to state that HTDMA and AMS were operated in parallel. Further, the meaning of the abbreviation "AMS" is not given here.

P3251, L18: The "CPC" should be spelled out because it appears for the first time.

P3252, L15: It seems that "The transfer functions..." is also a reason for "MDF is...".

P3252, L17: "broadened" instead of "smoothed" seems appropriate.

P3252, L17-19: The sentence implies that the effect of multiply charged particles on the measurement of GF has been corrected. If it is true, a brief explanation should be given because it is not explained explicitly in the paper by Gysel et al. (2009).

P3253, L4-5: It is not explained how the error was estimated.

P3253, L25-27: The type of the Aerodyne AMS (e.g., HR-ToF-AMS) should be given.

P3254, L1-3: The collection efficiency used in this study should be explained, with the justification for it.

P3255, L10-11: If the number of the factors is arbitrarily, the reason for the use of five factors should be explained.

P3255, L21-24: Data used for the explanations should be noted.

P3256, L3-7: The air circulation patterns of Po Valley WNW, West1, and West2 are not explained explicitly.

P3256, L12: If "PoV WNW" is identical to "Po Valley WNW", same abbreviation should be used. If not, the characteristics of "PoV WNW" should be explained.

P3256, L24-P3257, L1: The meaning of "overall HGF values" is not clear.

P3257, L2: Some HGF values (overall mean HGF) at night in the last two days seem to be lower than 1.3.

P3257, L19: The word "interpolated" may be more appropriate than "extrapolated".

P3257, L20-22: It is not explained whether the HGFs were lowest regardless of the particle sizes. If the times for the sunrise were earlier than 06:00, the expression "just before" may be inappropriate.

P3257, L22-23: The explanation is difficult to follow. If the increase in the HGFs with

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Interactive Discussion

Discussion Paper

time is the main point, the differences of the HGFs of the particles with same diameters should be explained.

P3258, L12: The time at which the small minimum was observed should be explained.

P3259, L11: According to Fig. 3., the peak of the OGF with the value of 1.13 appeared later (05:00).

P3259, L12-13: It seems that the "fraction" of BH particles is discussed. This is not explained explicitly.

P3259, L14: It is not clear what "HGF" here means. If it corresponds to "overall mean HGF" in Fig. 2a, the diurnal pattern should be presented. Further, clear evidence to support the anti-correlation should be presented. Presentation of the correlation coefficient is worth considering.

P3259, L18-21: The explanation after "although..." is difficult to follow. The part may need to be reworded.

P3259, L21-22: If the diurnal variation pattern of OGFs is discussed in this sentence, this should be noted.

P3259, L22-23: It is not easy to see whether the changes in sulfate/organics and sulfate/nitrate ratios were small from Fig.3. It is not clear why the degrees of the changes are explained in this section.

P3259, L29: It is not explained how the presence of moderately aged aerosol is inferred. Further, it is not explained at which periods they might have been present.

P3260, L3-5: The meaning of "consistent" is not clear. A more explicit explanation is preferable.

P3260, L14-15: The chemical form of nitrate measured using the AMS is specified as "nitric acid" without justification. Further, this interpretation contradicts the explanation later in this paragraph.

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P3260, L17-18: What "thermodynamically" means is not clear. If the statement here is based on the low HGFs, this point should be noted more explicitly. It seems that "nitrate" or "ammonium nitrate" instead of "nitric acid" should be discussed here.

P3260, L18-21: The explanation of this sentence is difficult to follow.

P3260, L21-24: The authors seem to consider the possibility that the nitrate signal was originated from organonitrates. However, this point is not explained explicitly. High load of inorganic nitrate during the nighttime is not supported by the data, if inorganic nitrate and organonitrates cannot be distinguished using the AMS.

P3260, L28: The sentence is written as if 3.2 μ m^{-3} is the maximum concentration of nitrate.

P3261, L8-9: It is written as if the presence of HOA in the BH fraction is a fact. Similarity in the diurnal patterns itself is not sufficient evidence to state that it is a fact.

P3261, L13-14: The dominance of SV-OOA in the LH particles shouldn't be stated as a fact without clear evidence.

P3261, L17: Whereas the expression "regional OOA2 concentration..." is used in page 3259, the expression "local OOA2" is used here.

P3261, L19: It is not clear to what the degree of the diurnal variability of the MH fraction is compared.

P3262, L5-6: It is not very clear why influences of other organic fractions on the peak of OGF can be ruled out.

P3262, L6: High growth factor does not necessarily mean high solubility of the solute. The growth factor could also be controlled by the molecular weight of the solute.

P3262, L10-11: Anti-correlation is not obvious. It is important to check if the correlation coefficient is negative.

P3262, L15: It is important to check if the correlation coefficient between HGF and OGF is negative.

P3263, L13-14: This sentence is difficult to follow. If the increase in the HGFs with time is the point, differences of the HGFs of the particles with same diameters should be explained.

P3263, L16-18: This part may not be appropriate to explain the suggestion of the presence of organonitrates and organosulfates because it is based on the analysis of Case2 time period.

P3263, L22-25: The word "strongest" is not appropriate because the definition of the strength of the patterns is not clear.

P3263, L15-17: This inference should be addressed in the results and discussion section.

Technical Corrections

P3259, L12: The word "HFG" seems incorrect.

P3259, L22: The word "OO1" seems incorrect.

P3259, L28: The expression "plotted against" seems incorrect.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 3247, 2013.

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