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Interactive comment on "Radiation fog formation alerts using attenuated backscatter power from automatic Lidars and ceilometers" *by* Martial Haeffelin et al.

Anonymous Referee #3

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GENERAL COMMENTS

This paper describes a new algorithm for now-casting of fog formation. Fog now-casting can be very valuable, especially for airports where low visibility can cause major disturbances. This algorithm uses the hygroscopic growth of the attenuated backscatter to provide alerts prior the formation of radiation fog. The algorithm was tested on 45 fog cases from 2011 to 2015 at two sites (SIRTA and Uccle).

This manuscript presents a new and valuable technique that can be applied on a large number of existing stations. The manuscript is clearly written and the algorithm is well described. The analysis of the alert occurrence also provides interesting results concerning the altitude where the cooling process lead to aerosol activation.

However, the possibility of false-alarms was not evaluated. A discussion about the algorithm limitations is missing to fully appreciate the usefulness of these observations to complement the Numerical Weather Predictions (NWP).

Therefore I recommend the publication of this manuscript but only after the correction of the following major comment.

MAJOR COMMENT

As the author mentioned in the introduction, air traffic at busy airports can be significantly disrupted in case of low visibility. New observations and warnings can be very valuable for airport forecasters but only if their forecasting skills are higher than NWP's.

This study shows an evaluation of PARAFOG performance between 2011 and 2015. If no false alarm occurred during this period, the authors should mentioned it. If it is not the case, the authors should present a case study and statistics about the hit-rate and false-alarm occurrences. For the same SIRTA site, Menut et al. (2013) described a method to forecast fog from ground based measurements with an hit-rate of 87%. They also mentioned a false-alarm rate of 39%. Similar statistics are required to evaluate the performances of the PARAFOG algorithm.

Further discussions about algorithm limitations and possible improvements of the algorithm would also be valuable.

SPECIFIC COMMENTS

Page 3 line 14 and l 20: Please replace "Roman-Cascon et al. 2015" by "Roman-Cascon et al. 2016"

Page 5 lines 19-21: What is the impact over the oversampling on the PARAFOG algorithm ?

Page 11 line 8 eq. 12: Please define the greek letter xi

Page 15 line 10 eq. 18: What does the acronym RG stands for ?

Page 16 line 7: could you discuss the impact of these thresholds ?

Page 19 line 4: How the mean extinction was calculated ? What was the Lidar Ratio assumption?

Page 27 line 19 : Please replace " Román-Cascón, C., Steeneveld, G. J., Yagüe, C., Sastre, M., Arrillaga, J. A., & Maqueda, G., Forecasting radiation fog at climatologically contrasting sites: evaluation of statistical methods and WRF. Quarterly Journal of the Royal Meteorological Society, 2015" by "Román-Cascón, C., Steeneveld, G. J., Yagüe, C., Sastre, M., Arrillaga, J. A., & Maqueda, G., Forecasting radiation fog at climatologically contrasting sites: evaluation of statistical methods and WRF. Quarterly Journal of the Royal Meteorological Society, 2016"

Page 33 figure 1: Please add units for the relative difference.

Page 33 figure 1: Please check the caption. "(bottom)" and "(top)" are inverted

Page 37 figure 5: Please check the caption. Could you replace "time series" by "scatter plot".

Page 38 figure 6: Please check the caption. Units is missing for the altitude of aerosol activation ("100m agl" instead of "100 agl"). (a) and (b) labels are missing, could you replace it by (top) and (bottom)?

Page 39 figure 7: Please check the caption. Units is missing for the altitude of aerosol activation ("100m agl" instead of "100 agl"). (a) and (b) labels are missing, could you replace it by (top) and (bottom)?

Page 39 figure 7: Where is the horizontal visibility line?

Page 40 figure 8: (a) and (b) labels are missing, could you replace it by (top) and (bottom)?

Page 41 figure 9: (a) and (b) labels are missing, could you replace it by (top) and (bottom)?

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