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Atmospheric Measurement Techniques Discussions

Interactive comment on "Novel method for fog monitoring using cellular networks infrastructures" *by* N. David et al.

N. David et al.

noamda@post.tau.ac.il

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We thank the referee for his comments. We re-analyzed the heavy fog case that we presented, and added analysis of an additional case of heavy fog that occurred several years prior.This time, we used a different, more sensitive microwave system. The referee's comments are quoted below, with our response immediately following.

" The major problem is revealed in figure four where we see that the attenuation is about 2dB but is recorded with a quantization of 1dB"

Response: In order to derive more precise estimations, we used a microwave link system with a quantization of 0.1dB (as opposed to 1dB in the previous version). We

concentrated on links operating around the 38GHz frequency range. Additionally, measurements were taken by several tens of links deployed in the observed area which was entirely covered in heavy fog in each of the two cases. The links provided instantaneous measurements, simultaneously.

"It is a relatively simple procedure to convert the attenuation by liquid water in clouds in dB/km to a liquid water content of g/m3; in the Rayleigh regions the relationship is linear (see their equation 2). Unfortunately in the paper the coefficient is never quoted".

Response: As proposed, we added a figure showing the expected signal attenuation as a function of frequency, for different liquid water content values (and different temperatures).

"...This value is unrealistically high for fog. We know that fog is caused by cooling air by a few degrees and such high values are never observed."

Response: The results derived from the measurements of the link system that were used in the revised paper were in the range of 0.5 to 0.8 gr/mˆ3. These are high values that match the high value range observed in actual field measurements carried out for prior studies in different test areas in the world (e.g. Herckes et al., 2007, Niu et al., 2010)

"At the end of section 2.1 on 'fog identification' there is a discussion on the problem of the varying background received signal - and the choice of a 'baseline'. This baseline can vary by 1 or 2dB when there is condensation on the radome which is very likely in fog."

"The associated errors in derived lwc due to quantization and problems with choice of a background level 'threshold' should be discussed."

Response: The heavy fog in the two analyzed cases, covered very wide areas (tens of kilometers) including the area where the links we concentrated. The system used comprises short links (hundreds of meters) as well as longer ones (two to three kilometers)

deployed in different directions in the same observed area. We used this diversity, and the multiplicity of measurement sources, and derived an estimation of liquid water content, as well as an estimation of the attenuation caused as a result of a wet antenna at the time of the measurement, from the observations from the entire system. We added error estimations for these values. Additional research is required on these topics and a discussion of the matter was added, as suggested by the reviewer.

" The final stage is to convert liquid water content in to visibility - which depends on the drop size distribution and so introduces further errors"

Response: To calculate the visibility assessment, we use a warm-fog visibility parameterization that takes into account droplet number concentration in addition to liquid water content. This results in higher precision while assessing the visibility, as shown in previous work (Gultepe et al., 2006), there is still room for improvement, but that is beyond the scope of the current paper. Naturally, adding direct measurements/ complementary data of the microphysical characteristics of the fog will allow for more precise results. We added a discussion of this topic to the revised version of the paper. In the revised version we calculated an upper and lower bound on visibility, taking into account the uncertainty that arises from the fog visibility parameterization and from the direct measurements of the microwave links.

References

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