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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiation in fog: Quantification of the impact on fog liquid water based on ground-based remote sensing" *by* Eivind G. Wærsted et al.

Anonymous Referee #1

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The meticulous preparation of the authors has resulted in a manuscript that will pass most requirements for publication in ACP. Yet this referee is left with an uncomfortable feeling about this paper. Primary concern is the fact that the authors have omitted a thorough review and discussion of the kinetic energy budgets of the fog layers as a means to deal with radiative heating and cooling. Throughout the manuscript it is stressed that the LW radiation constitutes a source of LWC capable of renewing the entire fog in 1 – 2 hours (see f.e. pg 11, line 16; but there are several other places). Renewal means that there is a substantial sink of LWC. The only sink that this reviewer can think of is precipitation or 'wet deposition'. No credit or evidence is given to the existence of either of these two depletion mechanisms. If there is precipitation then

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Discussion paper

the radar signal would be swamped by it, but there is no evidence of that either in this paper. Consequently there should be at least some credit given to the possibility that the LW cooling at the top gives rise to downdrafts that will mix the fog layer and evaporate the air towards the bottom of the layer. In other words the LW cooling does not give rise to additional condensation but is a source of kinetic energy. Some of the profiles in the back (f.e. Fig 6) show T-profiles with large vertical gradients indicative of an adiabatic state that could potentially be the result of turbulent mixing due to LW-cooling. In addition LW-cooling converted to TKE at the top can drive entrainment of dry air from above the fog top into the fog layer. This is a conversion of potential energy into kinetic energy. It seems to me that this paper needs a convincing treatment of aspects of the TKE budget as it relates to LW cooling and heating in addition to the current treatise which only discusses LW cooling and condensation rates.

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