

Interactive comment on “Study of second-order wind statistics in the mesosphere and lower thermosphere region from multistatic specular meteor radar observations during the SIMONE 2018 campaign” by Harikrishnan Charuvil Asokan et al.

Anonymous Referee #2

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The reviewer apologizes by the authors that the comments are taken to be sarcasm. This was surely not the intention. The reviewer assumed that a world leading atmospheric science group with decades of experience of radar measurements is aware of the research conducted during the past decades and that the paper was just a mistake.

Furthermore, the reviewer investigated the issue further. The electric fields (approx. 4 mV/m at the MLT) transmitted by SIMONE are strong enough to heat the electron

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gas to temperatures far beyond the thermal equilibrium by ohmic heating. The long heating cycle of the cw-transmission pumps energy to the magnetized electron gas. The temperature increase is sufficient to reach the required heat rates to generate the upwelling. Due to the coupling of the hot electron gas with the ions, which are not magnetized (collisional coupled to the neutrals), there is a sufficient ion drag imposed on the neutrals. However, a detailed quantification of all the relevant physics is beyond this review and is left for the authors.

Furthermore, the heating of the electron gas is amplified by the co-located pulsed radar system, which adds further flavor to the modulation to this heating process. The frequency shifts between the cw-transmitter and the pulsed systems is likely to small viz. these pulsed transmitters further pump energy to the electron gas. The collisional cooling, that normally would occur, is inhibit due to the cw-field wave field. The reviewer estimated that the power level of the cw-radar has be reduced by a factor 1000 or a factor 30 for the electric field strength to remove most of the heating effect.

The meteor observations are also biased. Ambipolar diffusion assumes that the electron temperature and the ion temperature are equal ($T_e=T_i$), due to the intense heating of the magnetized plasma outside the trail, this condition is not satisfied as well and, hence, creating an additional issue in the data interpretation. Unfortunately, most likely the radial Doppler and the decay time are altered as well, although the degree of the degradation is small, but noticeable and altitude and time dependent.

Such experiments were performed until the late 70s to investigate the effect of cross-modulation between radio broadcasts, telecommunication and radar applications, which in former years indeed also heated the ionosphere.

The positive aspect of this paper and the SIMONE experiment is that it will trigger intensive research on the VHF-environmental pollution, although it likely takes years to decades to decipher all the complex physics involved and required for the data interpretation. This is truly a very complicated and non-trivial plasma physics problem.

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The reviewer also fears that such systems are not useful to provide scientific geophysical observations concerning the non-heated state of the MLT. The transmitted power is too invasive and, thus problematic to investigate neutral dynamics. The 2 orders of magnitude too strong vertical wind velocities, that are present in all SIMONE publications, are an impressive evidence for that.

Beyond the scientific questions, the reviewer wants to point at another issue. The SIMONE setup is basically a VHF-microwave stove. Human tissue and other biological tissues absorb very efficiently the emitted the radar energy. VHF radiation penetrate deep into the human body and heats the interior. As most temperature receptors are in the human skin, the heating remains hidden to those exposed to such radiation. From epidemiological studies it is known that such radiation causes issues with the nerve system and muscles and even cancer can result depending on the exposure time in close proximity to the antennas (approx. 50m). This requires substantial safety measures. The costs for such safety measures appear to be a bit out of scale for a 7-day campaign.

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