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Atmospheric Measurement Techniques Discussions

Interactive comment on "VHF antenna pattern characterization by the observation of meteor head echoes" *by* Toralf Renkwitz et al.

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We appreciate the major comments by Referee #1 Prof. T. Sato and first of all apology for the slow reply caused by travel and vacation reasons. Furthermore we intensively used the time to go again through the calibration procedure described in the paper. We certainly agree to the referee that the intensity of the first side lobe is a good indicator to monitor the performance of the antenna array. In Chau et al. 2014 only eight examples of meteor head echoes are shown and used for the comparison, which were selected events with limited direct comparison of main to side lobe intensity due to dynamic range issues. Here, in this study we do not exclude any meteor head echoes as long as they have sufficient amount of detected trajectory points.

The radiation pattern simulations described in this manuscript were performed for the

MAARSY array under the assumption of perfect health, e.g. no random phase or amplitude variations. In the discussion section of the manuscript we raised the point that random variations of phases and amplitude lead to modifications of the radiation pattern, which in extreme is caused by malfunctioning transceiver modules or their connected array elements. As for MAARSY every array element has its own transceiver module it sensitively reacts on the adjacent antennas and their emissions. In case of e.g. unfavorable superposed mutual coupling of the antennas resulting in excessive VSWR the monitoring circuitry temporarily or permanently disables modules during the experiments. Additionally, in some cases amplifier modules may get damaged over time, which are repaired during the next maintenance. All of these situations will certainly affect the radiation pattern of MAARSY and are stored in a database. However, for the period analyzed in this manuscript the database unfortunately got lost due to a hard disk failure about a year ago. Therefore, we now performed thorough simulations in which about 5 percent of the array elements were disabled (quasi randomly distributed). Contrary to our initial assumption seeing an increase of first side lobe intensity we actually found a decrease of about 3dB, of course, on the expensive of increased intensity of higher order side lobes. The superposition of this resulting radiation pattern with that of 49 antennas on reception agrees now much better to the meteor head echo occurrence we derived. An updated figure of the comparison will be used in an updated version of this manuscript and attached here. A simulation with about 10 percent disabled and randomly distributed array elements still showed a decrease of first order side lobe (-2dB at most).

Besides these findings, we like to underline the reasoning in the discussion section that the initial detection of the meteor head echoes already defines the preselection of the analyzed events. Generally, the SNR of events detected with the first side lobe are typically smaller, which leads to a larger angular variability/uncertainty of the calculated trajectories and therefore deteriorates the accuracy of the first null and adjacent first side lobe intensity as well as their positions to some extent.

We will modify the manuscript as described above.

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