The 3D Distribution of Artificial Aurora Induced by HF Radio Waves in the Ionosphere

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We present new 3D modelling results of artificial aurora in the ionospheric F-layer, induced by high frequency (HF) radio waves from the EISCAT heating facility. Projections of the modelled volume emission distribution were compared to observational images of the artificial aurora, taken simultaneously at four separate ground based imaging stations. The simultaneous multi-station imaging permitted the use of tomographic inversion methods. The 3D reconstruction of the artificial aurora was done in the green line (5577 Å), the red line (6300 Å) and for the first time in the infra-red line (8446 Å). Three different auroral construction techniques were considered, theoretical, semi-theoretical and free parameter search. The theoretical aurora model was constructed using previously published excitation rate profiles from numerical simulations of supra-thermal electron energy distributions. The projections of the semi-theoretical and free parameter search aurora models were in agreement with the observational images, whereas the projections from the theoretical aurora model were not. Inspection of the constructed models suggests that the emission distribution lies within a thinner horizontal layer than predicted by the theoretical excitation rate profiles. Possible explanations will be discussed.