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Numerical modeling of artificial ionospheric layers driven by high-power HF-heating BENGT ELIASSON, Ruhr-University Bochum, Germany, XI SHAO, G. MILIKH, University of Maryland, College Park, E.V. MISHIN, Air Force Research Laboratory, USA, K. PAPADOPOULOS, University of Maryland, College Park — We present a multi-scale dynamic model for the creation and propagation of artificial plasma layers in the ionosphere observed during high-power high frequency (HF) heating experiments at HAARP. Ordinary mode electromagnetic waves excite parametric instabilities and strong Langmuir turbulence near the reflection point. The coupling between high frequency electromagnetic and Langmuir waves and low-frequency ion acoustic waves is numerically simulated using a generalized Zakharov equation. The acceleration of plasma electrons is described by a Fokker-Planck model with an effective diffusion coefficient constructed using the simulated Langmuir wave spectrum. The propagation of the accelerated electrons through the non-uniform ionosphere is simulated by a kinetic model accounting for elastic and inelastic collisions with neutrals. The resulting ionization of neutral gas increases the plasma density below the acceleration region, so that the pump wave is reflected at a lower altitude. This leads to a new turbulent layer at the lower altitude, resulting in a descending artificial ionized layer that moves from near 230 km to about 150 km. The modeling results reproduce artificial ionospheric layers produced for similar sets of parameters during the high-power HF experiments at HAARP.

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