Radar simulation engine based on the convolution operation

Marcial Garbanzo-Salas[(1)], Wayne Hocking[(2)]

(1) University of Costa Rica, marcial.garbanzo@ucr.ac.cr

(2) University of Western Ontario, whocking@uwo.ca

A new radar simulation engine based on the convolution operation was created. The radar received signal is obtained by convolving the transmitted pulse and the profile of electric permittivity perturbation. In order to use the engine under realistic conditions a large eddy simulation (LES) product was used to obtain the atmospheric information. The weather research and forecast (WRF) model was configured as a LES model with a resolution (in all coordinates) of 4 meters. A radar frequency of 12.5 MHz (wavelength 6 times larger than the models resolution) was used to generate the radar pulse. The initial conditions for the LES were obtained from a radiosonde in Costa Rica showing intense surface heating and a narrow jet stream in the first 2 km. The atmospheric variables were set up according to the radiosonde information. The backscatter obtained from the simulation showed strong echoes in the boundary layer and in the large wind shear regions. A decrease in echoes from the lower atmosphere was observed 20 minutes into the simulation. The simulated radar was pointed in different directions to test the anisotropy of the echoes. The off-vertical direction generated greater returns than the vertical direction in the boundary layer, but in the upper region the observed maxima alternated between tilted and vertical transmission. Warrants regarding using LES models in radar simulations will be presented as big errors can be induced under certain conditions. A full-3D version of the model is currently under development and preliminary results will be presented.