PROTON-HYDROGEN ATOM TRANSPORT IN THE ATMOSPHERE: A COMPARISON OF CALCULATIONAL TECHNIQUES

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This paper compares three methods for calculating the transport of energetic protons and hydrogen atoms in the earth's atmosphere. The methods are (1) a Monte Carlo (MC) simulation, (2) a discrete energy loss solution to the linear transport (LT) equations, and (3) a continuous slowing down approximation (CSDA). In the calculations performed, all three methods used similar cross sections, the same three component (N_2,O_2,O) neutral atmosphere, and incident isotropic Maxwellian proton fluxes of various characteristic energies (1-20keV). A variety of results will be presented including energy deposition and ionization rates, ev/ion pair, hemispherically averaged differential fluxes of protons and H atoms, energy integrated differential fluxes, and proton and H atom flux fractions. It was found that the results obtained from the different techniques are in reasonably good agreement. However, the MC simulation can include processes such as beam spreading and magnetic mirroring that are neglected in the other two models. The differences that these processes can cause and the possibility of using specific MC results to improve the results from the LT or CSDA models will be discussed.