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# Electron transport and energy degradation in the ionosphere: evaluation of the numerical solution, comparison with laboratory experiments and auroral observations


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**Abstract.** Auroral electron transport calculations are a critical part of auroral models. We evaluate a numerical solution to the transport and energy degradation problem. The numerical solution is verified by reproducing simplified problems to which analytic solutions exist, internal self-consistency tests, comparison with laboratory experiments of electron beams penetrating a collision chamber, and by comparison with auroral observations, particularly the emission ratio of the $N_2$ second positive to $N^+_2$ first negative emissions. Our numerical solutions agree with range measurements in collision chambers. The calculated $N_2$2P to $N^+_2$1N emission ratio is independent of the spectral characteristics of the incident electrons, and agrees with the value observed in aurora. Using different sets of energy loss cross sections and different functions to describe the energy distribution of secondary electrons that emerge from ionization collisions, we discuss the uncertainties of the solutions to the electron transport equation resulting from the uncertainties of these input parameters.