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Seasonal differences in electron precipitation driven by lightning

E.S. Gemelos [1], **U.S. Inan** [1], **M. Walt** [1], **J-A. Sauvaud** [2], **M. Parrot** [3]

[1] Stanford University, Stanford, USA
[2] CESR, Toulouse, France
[3] LPCE/CNRS, Orléans, France

Analysis of the DEMETER spacecraft particle precipitation data over a two-year period shows that energetic electron fluxes in the drift loss cone exhibit a seasonal dependence consistent with lightning-induced electron precipitation (LEP). Over the United States, energetic electron fluxes in the slot region (between L = 2 and 3) are found to be significantly higher in the Northern summer than in the winter, consistent with the seasonal distribution of lightning activity in the northern hemisphere. The association of precipitation flux levels with lightning over the Continental United States is further explored using lightning location data from the National Lightning Detection Network (NLDN). This study is limited to geomagnetic quiet times in order to minimize the effect of energetic electron injection events associated with geomagnetic storms. The increased and sustained precipitation of particles into the drift loss cone over the Northern hemisphere in the summer is consistent with expected pitch-angle scattering by non-ducted whistlers, showing that lightning is indeed a significant contributor to the loss of inner belt electrons, as has been theoretically predicted by Abel and Thorne [1998].