Ring current effect on energetic particles

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The ring current is known to change drastically the magnetic field in the inner magnetosphere during magnetic storms. This means that all the energetic particles trapped in the inner magnetosphere should be heavily influenced by the situation of the ring current. We have investigated effects of the ring current on the energetic particles by solving particle transport under self-consistent electric and magnetic fields. A kinetic equation of particles was solved with respect to four-dimensional phase space density. In order to obtain self-consistent electric fields, a closure of the electric current between the magnetosphere and the conducting ionosphere was taken into account. A force-balanced magnetic field was calculated using the Biot-Savart law in the three-dimensional simulation space. Initial result of the numerical simulation shows a reduction in the plasma pressure and more stretched magnetic field lines as compared with that under the non-self-consistent magnetic field. The (Region 2) field-aligned current almost preserves its form and intensity regardless of the inclusion of the self-consistent magnetic field because the reduction of the plasma pressure results from the reduction of the local magnetic field in the simulation. An interesting result is that particle fluxes with energy about 100 keV and more show a dumbbell-type pitch angle distribution where the development of the ring current is significant. This implies that in addition to the drift-shell splitting, the adiabatic cooling due to the enhancement of the ring current can result in the dumbbell-type pitch angle distribution which is observed by satellites near the equatorial plane.