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Electron Intensity Measurements by Cluster Mission in Radiation Belts of the Earth

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The Cluster mission, launched in 2000, has produced a large database of electron flux intensity measurements in the Earth's magnetosphere by the Imaging Detector (RAPID)/ Imaging Electron Spectrometer (IES) instrument. However, electron intensity measurements are contaminated with high-energy electrons (>400 keV) and inner-zone protons (230-630 keV) in the radiation belts and ring current and thus have rarely been used for inner-magnetospheric science. Two algorithms of background contamination removal are proposed. The first method is based on the empirical contamination percentages by both protons and electrons. The second algorithm uses simultaneous proton observations. The corrected Cluster data were compared with Van Allen Probes/Magnetic Electron Ion Spectrometer (MagEIS) measurements for 2012-2015. IES data are in good agreement with MagEIS, showing the ratio of measurements close to 1. The algorithm of adiabatic invariants calculations for the Cluster data is presented, allowing the more correct representation of the processes in radiation belts. Solar cycle dependence of the corrected IES electron intensities was analyzed for 2001- 2016. Spin-averaged yearly mean IES electron intensities in the outer belt for energies 40-400 keV at L-shells between 4 and 6 showed high positive correlation with AE index and solar wind dynamic pressure. The relationship between solar wind dynamic pressure and IES electron measurements in the outer radiation belt was derived as a uniform linear-logarithmic equation. This model can be easily used for space weather applications.