An error estimation for energetic electron flux measured by the high-energy electron experiments (HEP) onboard the Arase satellite.

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We have developed an error estimation method for energetic electron flux data obtained by the high-energy electron experiments (HEP) onboard the Arase satellite. The error estimation is based on the assumption of counting statistics in which the error of raw electron counts measured by the HEP instrument is provided as a square root of the counts. The error propagation from the count error to a differential electron flux value, however, is not as simple as other types of particle instruments, such as electrostatic analyzers. This is because observed electron counts in each energy channel are contributed by not only incident electrons of the designated energy range but also those with energies higher than it, being a convolution of all such electrons. For this reason, we derive differential electron fluxes by applying “deconvolution” matrices, which have been developed with a set of Geant4 simulations best reproducing the response characteristics of the instrument. Accordingly, the same deconvolution needs to be applied also to the error of raw electron counts in order to correctly process the error propagation. The derived flux errors show a rough proportionality to the square root of the corresponding flux values, as expected from the above method. In addition, we confirm that a given flux value can have a range of flux error depending on the power law index of the energy spectrum of electron flux; the harder an energy spectrum is, the relatively larger the resultant flux error is. After initial check and brief validation studies, the preprocessed flux error values are going to be stored in an updated version of level-2 data files and then delivered to data users.

