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Recalibration of the NOAA/POES MEPED instrument using a statistical approach

Linn-Kristine Glesnes Ødegaard (1,2), Kjellmar Oksavik (1,2), Finn Søraas (1,2), Hilde Nesse Tyssøy (1,2)

(1) Birkeland Centre for Space Science, Bergen, Norway, (2) University of Bergen, Department of Physics and Technology, Bergen, Norway

The NOAA/POES satellites have operated with almost identical instrumentation for more than 30 years and have collected valuable information about the particle environment in the Earth's magnetosphere and ionosphere. The investigation of long-term trends and multi-satellite studies using NOAA/POES satellites involves a number of challenges. The solid state detectors used in the MEPED instrument suffer from radiation damage by energetic particles, which leads to an increase in the energy thresholds of the instruments. As a consequence, particle fluxes are underestimated. In order to use the particle data in quantitative studies the different satellites must be intercalibrated. We do a recalibration of the MEPED instruments onboard NOAA 15-18 using a statistical approach. Right after the launch of NOAA 19 in 2009, we chose a period of three months. During this period daily average fluxes were calculated for NOAA 15-19. Energy spectra based on the averaged measurements were compared for NOAA 15-18 with the newly launched NOAA 19. By using average fluxes collected over a long time period, we argue that satellites sampling in different regions can be compared. The method is suitable for determining the temporal development of the degradation by implementing the technique right after the launch of any NOAA/POES satellite. Our approach makes use of all available proton data during the chosen calibration period, and it estimates the change in energy thresholds of the four lowest energy channels of the MEPED instrument. It is mandatory to perform a cross calibration between the different POES satellites when the particle data are used for long-term studies or calculations on the effects of particle precipitation on the atmosphere. Our new energy thresholds are compared to results obtained by Asikainen et al. (2011 and 2012). We also investigate the difference between corrected and uncorrected proton fluxes in regard to the ionization in the mesosphere and lower thermosphere.