Geophysical Research Abstracts
Vol. 20, EGU2018-10151-1, 2018
EGU General Assembly 2018

Earth's Radiation Balance Study at Top-of-Atmosphere with reprocessed ERBE/ERBS WFOV Nonscanner Data from 1985 to 1998 and its Validation

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ERBE Wide-field-of-view (WFOV) nonscanner instrument onboard Earth Radiation Budget Satellite (ERBS) provided outgoing broadband irradiances at the top-of-atmosphere (TOA) from 1985 to 1999. However, earlier studies show that the uncertainty in this radiation dataset (Ed3) is significantly higher after the Mt. Pinatubo eruption in 1991 and satellite battery issue in 1992. Furthermore, the differences between day and night longwave irradiance continued to grow with time due to degradation of the shortwave dome. This instrument artifact must be removed using a user-applied Ed3_Rev1 correction. To correct these Ed3 issues, we re-processed the ERBE/ERBS WFOV data using a new spectral unfiltering algorithm similar to that used in the CERES project. This new algorithm reduces the Ed3 artificial drift in daytime longwave irradiance by about 33%. The remaining daytime longwave drifts artifact is eliminated using linear trend removal technique. The final reprocessed WFOV data set (Ed4) is further calibrated to the absolute radiometric scale of the CERES-EBAF irradiances and the spatial coverage of ERBE/ERBS irradiances is also extended to global from near-global (60 degree N to 60 degree S latitudes) using CERES-EBAF climatological near-global to global mean irradiance ratios. Comparing to the previous Ed3 data, the large near-global mean standard deviation of deseasonalized shortwave anomalies is reduced in the new Ed4 data (8.0 Wm-2 vs. 3.2 Wm-2). Similar to Ed3, however, the Ed4 global shortwave irradiance averaged over the 1994 to 1997 period (second period) is smaller by 2.2 Wm-2 compared to that averaged over the 1985 to 1989 period (first period). In addition, the global longwave irradiance in the second period is larger by 0.7 Wm-2 compared to that averaged over the first period. When the difference of two periods is computed (second period minus first period) with the DEEP-C data product (Allan et al. 2014), the difference is 0.5 (-0.3) Wm-2 for shortwave (longwave). The global net imbalance at the TOA computed with ERBS and DEEP-C data sets are, respectively, 0.45 (1.89) Wm-2 and 0.17 (0.96) Wm-2 for the first (second) period. The net imbalance for the CERES period in the 2000s is 0.65 Wm-2. In this presentation, we will further compare Ed4 ERBS-derived TOA net imbalance with ocean heating rates. Re-processed ERBS data product (Ed4) was released in July 2017 from NASA Langley Atmospheric Science Data Center and available from https://eosweb.larc.nasa.gov/project/measures/long-term-toa-m.