ATMOSPHERIC SCIENCE DATA CENTER

Comparison of ERBE-like (ES-4), SRBAVG non-GEO and GEO CERES Fluxes

There are several significant differences between the ERBE-like (ES-4), SRBAVG non-GEO and GEO CERES monthly fluxes that are based on the same instrument footprint radiances. The ERBE-like product uses the same ERBE scene identification technique based on the shortwave and longwave flux: the ERBE ADM to convert radiances into fluxes; the assumption of constant meteorology to temporally interpolate fluxes between measured fluxes over the day, by implementing SW directional models (albedo as a function of solar zenith angle models); and linear temporal interpolation of LW fluxes over ocean; and day-time half sine model to take into account diurnal heating over land. **The ERBE-like dataset is most appropriate for users who would like to combine or compare the historical ERBE data and CERES data**. The SRBAVG non-GEO uses scene and clear-sky identification based on multi-channel MODIS retrievals for a given footprint. CERES requires 99.9% of all MODIS pixels within a CERES footprint to be clear to be classified as clear, a more robust technique than ERBE, which is based on the LW and SW fluxes only. To convert radiances into fluxes the ERBE-like uses the ERBE ADM, which only has 4 cloud amount classifications; whereas the TRMM-CERES-ADM uses surface type, cloud amount, phase, optical depth in the SW and precipitable water, lapse rate, and emissivity in the LW. The non-GEO-SRBAVG also assumes constant meteorology between flux measurements and uses SW directional models based on the CERES ADM scene types, and for longwave uses the same ERBE-like temporal interpolation technique. To evaluate the effects of the improved ADM and directional models, the ERBE-like, ES-4 and SRBAVG non-GEO global fluxes can be compared.

The following table highlights the differences between ERBE-like and SRBAVG non-GEO processing.

Characteristic	**ERBE-like**	**SRBAVG non-GEO**
Geographic location of footprint	Geocentric latitude and longitude at 30km	Geodetic latitude and longitude at the surface
Footprint view angle limit in cross-track mode	70° VZA	65° VZA for Terra or Aqua 45° VZA for TRMM
Reference TOA *Loeb et al, 2002*	30km	20km
Spatial grid resolution	2.5° equal angle regions	1° equal angle regions, polar regions are nested
Scene Identification	ERBE MLE 12-scene algorithm. Scene based on cloud amount and geo-type. Uses only SW and LW fluxes	MODIS cloud retrieval algorithm. Geo-type based on IGBP types. SW scene based on cloud amount, optical depth, and phase. LW based on surface temperature, lapse rate, precipitable water, cloud emissivity, amount, and temperature. Over 600 scenes.
Clear-sky definition	Based on ERBE MLE definition (<2.5% cloud amount)	99% of all MODIS pixels in a CERES footprint must be clear
Angular Distribution Model (radiance to flux conversion) and SW directional models (for temporal interpolation)	Based on Nimbus-7 fluxes using ERBE scene identification	Based on CERES fluxes using MODIS scene identification
LW temporal interpolation	Same method for both. Linear LW flux interpolation between observations, except over land, where a daily half sine fit is used to take into account diurnal heating.	
SW twilight correction *Kato and Loeb, 2003*	Not applied	Applied
Global means	Global mean calculated using only zones with values. Global mean may be biased due to missing zones	Zones with no regional values are interpolated between neighboring zones. Global mean taken from all zones

The SRBAVG GEO enhances the temporal interpolation by combining 3-hourly GEO derived broadband fluxes between 60°N and 60°S and CERES fluxes. The GEO fluxes and cloud properties are an improvement to the constant meteorology temporal models utilized in SRBAVG non-GEO and ERBE-like, since they take into account the diurnal variability of the region. The SRBAVG GEO product then uses the same non-GEO algorithms to derive monthly and global mean fluxes. **There are significant regional differences between the Terra-based GEO and the non-GEO products** where there are strong diurnal cycles, for example sub-tropical maritime stratus in subsidence zones and afternoon convection over land, and desert regions with large surface temperature amplitudes. Example difference between non-GEO and GEO December 2002. The Terra satellite is in a sun-synchronous orbit with a 10:30 AM equatorial crossing time. Most regions on the earth are sampled twice a day (generally once in daylight at 10:30LT and once at night at 22:30LT). Polar regions are sampled up to 14 times a day. Depending on the satellite equatorial crossing time the SRBAVG non-GEO regional monthly mean fluxes may be biased where strong diurnal cycles occurs and that the SRBAVG GEO product would mitigate bias.