EBAF Update

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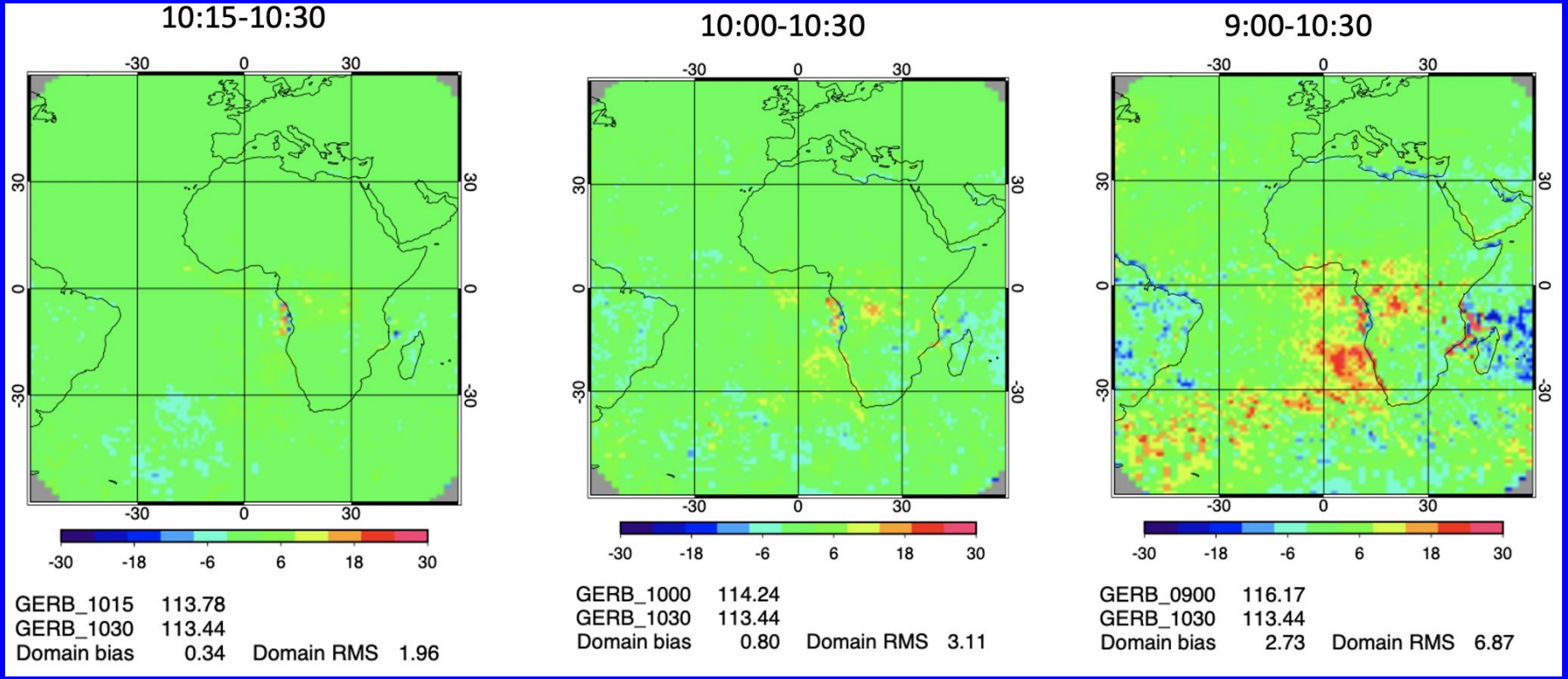
Virtual Meeting

Introduction

- Current version of EBAF (Ed4.1) uses Terra-Only for 03/2000-06/2002 and Terra+Aqua for 07/2002 onwards.
- An update to EBAF prior to Edition 5 is necessary in order to account for:
  1) Changes in Terra and Aqua MLTs.
  2) Artifacts and discontinuities in GEO cloud retrievals, which impact EBAF surface fluxes.
  3) Discontinuities with time in GEOS 5.4.1 meteorological inputs, which impact EBAF surface fluxes.
- New version will be called EBAF Ed4.2.
- **Timeline:** Reprocessing of input data needed for EBAF Ed4.2 will start this fall and complete in spring 2022. Anticipate public release of EBAF Ed4.2 during fall of 2022.

Impact of a Change in MLT on SW Reflected Solar Radiation

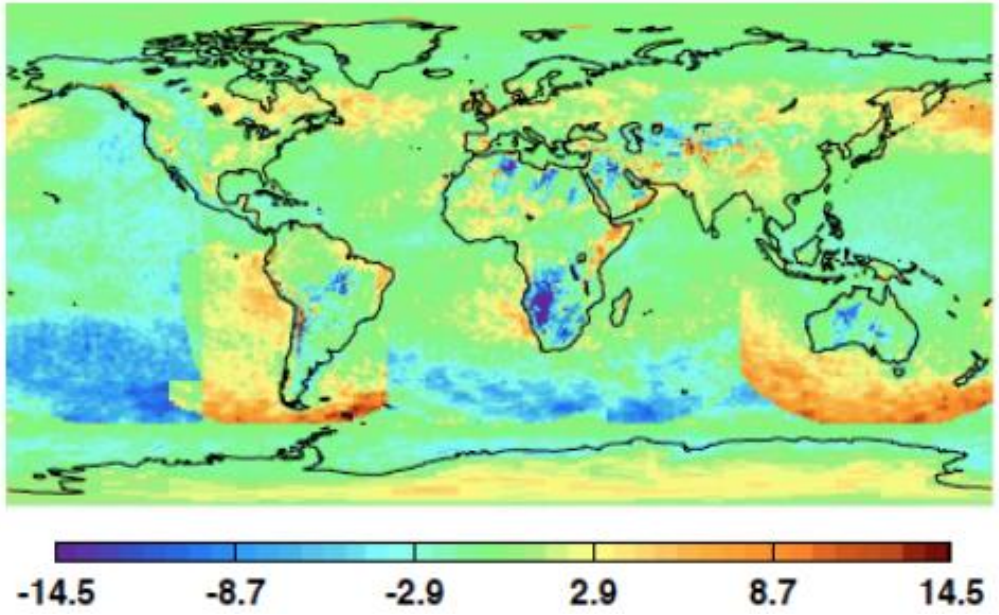
- Compare GERB SW TOA flux at 10:15 am, 10:00 am and 9:00 am vs 10:30 am
- Normalize each observation to a common 10:30 am solar geometry



- To avoid discontinuity in CERES record, MLT must remain within 15 min of 10:30 am for Terra and 1:35 pm for Aqua.
- **EBAF will be reprocessed to ensure an MLT < 15 min by transitioning from Terra+Aqua to NOAA-20.**

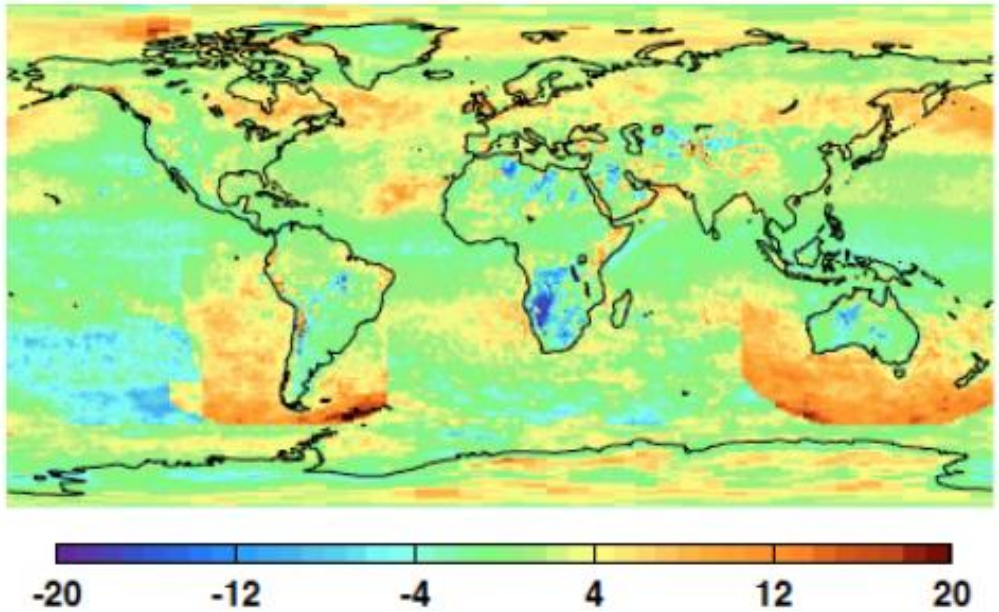
Downward LW Flux at Surface: Sensitivity to GEO Cloud Retrieval Artifacts (Computed DLW MODIS-Only minus Computed DLW MODIS+GEO)

Ter+Aqu_MODIS minus SYN1deg_Ter+Aqu+GEO (July 2019)



Difference (Wm^{-2})

Terra+Aqua_MODIS minus EBAF Ed4.1 (July 2019)



Difference (Wm^{-2})

- The largest effects of GEO artifacts on surface downward longwave flux come from nighttime cloud optical thickness (and depend on GEO).

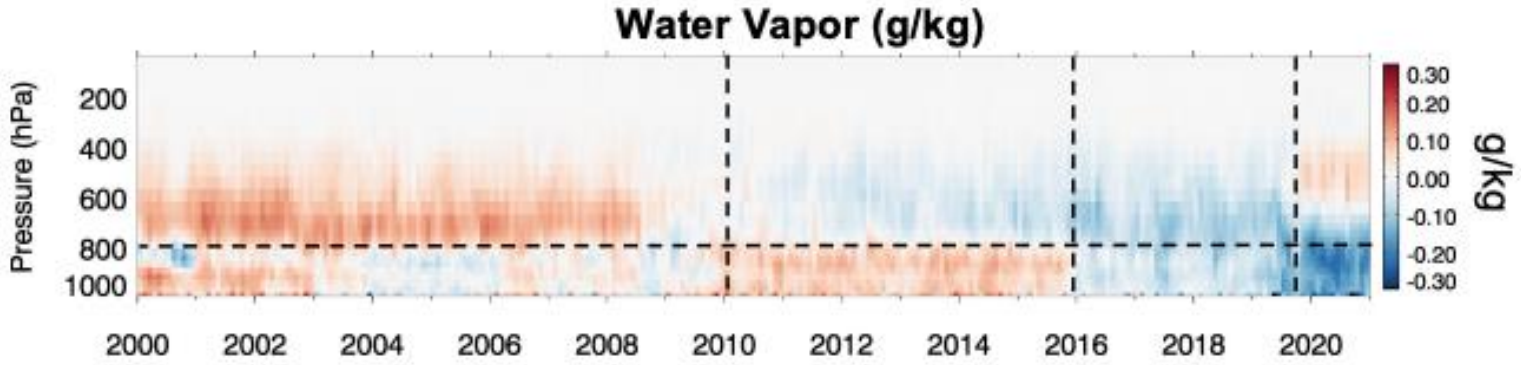
Seiji Kato (Fall 2020 CERES meeting)

Discontinuities in GEOS 5.4.1 Water Vapor Profiles

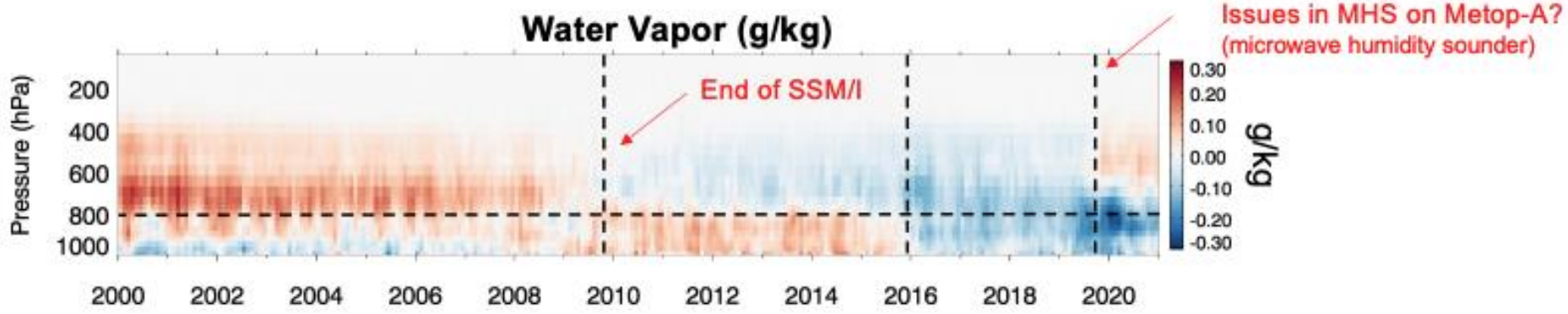
60S-60N Land+Ocean

Area weighted; climatology is obtained using 2003-202(

[G-5.4.1 WV Anomalies] – [MERRA-2 WV Anomalies]



[G-5.4.1 WV Anomalies] – [ERA-5 WV Anomalies]



- The differences between G541 and ERA5 are similar to those between G541 and MERRA-2.
- This implies that the differences are mainly driven by G541 problems.
- The discontinuities in G541 might be related to input observing data changes.

Seung-Hee Ham (Spring 2021 CERES meeting)

Planned Changes in EBAF Processing

1) Transition to NOAA-20:

Terra-Only (03/2000-06/2002)	→	Terra+Aqua (07/2002-06/2022)	→	NOAA20 (07/2022-onwards)

Note: Climatology of Terra-Only and NOAA20-Only will be anchored to Terra+Aqua climatology using overlapping periods.

2) EBAF-Surface fluxes will be processed with MODIS/VIIRS imager cloud retrievals (no GEO).

3) EBAF-Surface fluxes will be re-calculated using MERRA-2 meteorological inputs.

- MODIS/VIIRS imager cloud properties will not be reprocessed (based upon GEOS 5.4.1)

Terra-Only & NOAA20-Only Climatological Adjustment

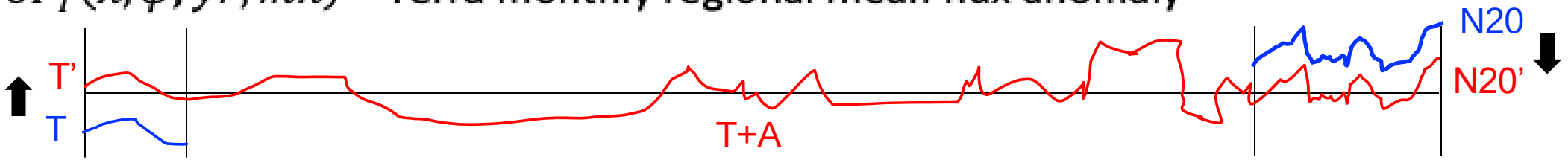
- **Terra-Only**: Use 5-year overlap with Terra+Aqua (07/2002-06/2007) to anchor Terra-Only period (03/2000-06/2002) to Terra+Aqua.
- **NOAA20-Only**: Use 4-year overlap with Terra+Aqua (05/2018-04/2022) to anchor NOAA20-Only period (07/2022-onwards) to Terra+Aqua.

$$F'_T(\lambda,\phi;yr,mn) = F_T(\lambda,\phi;yr,mn) + \{\bar{F}^O_{TA}(\lambda,\phi;mn) - \bar{F}^O_T(\lambda,\phi;mn)\}$$

$$= F_T(\lambda,\phi;yr,mn) + \bar{\Delta}^O(\lambda,\phi;mn)$$

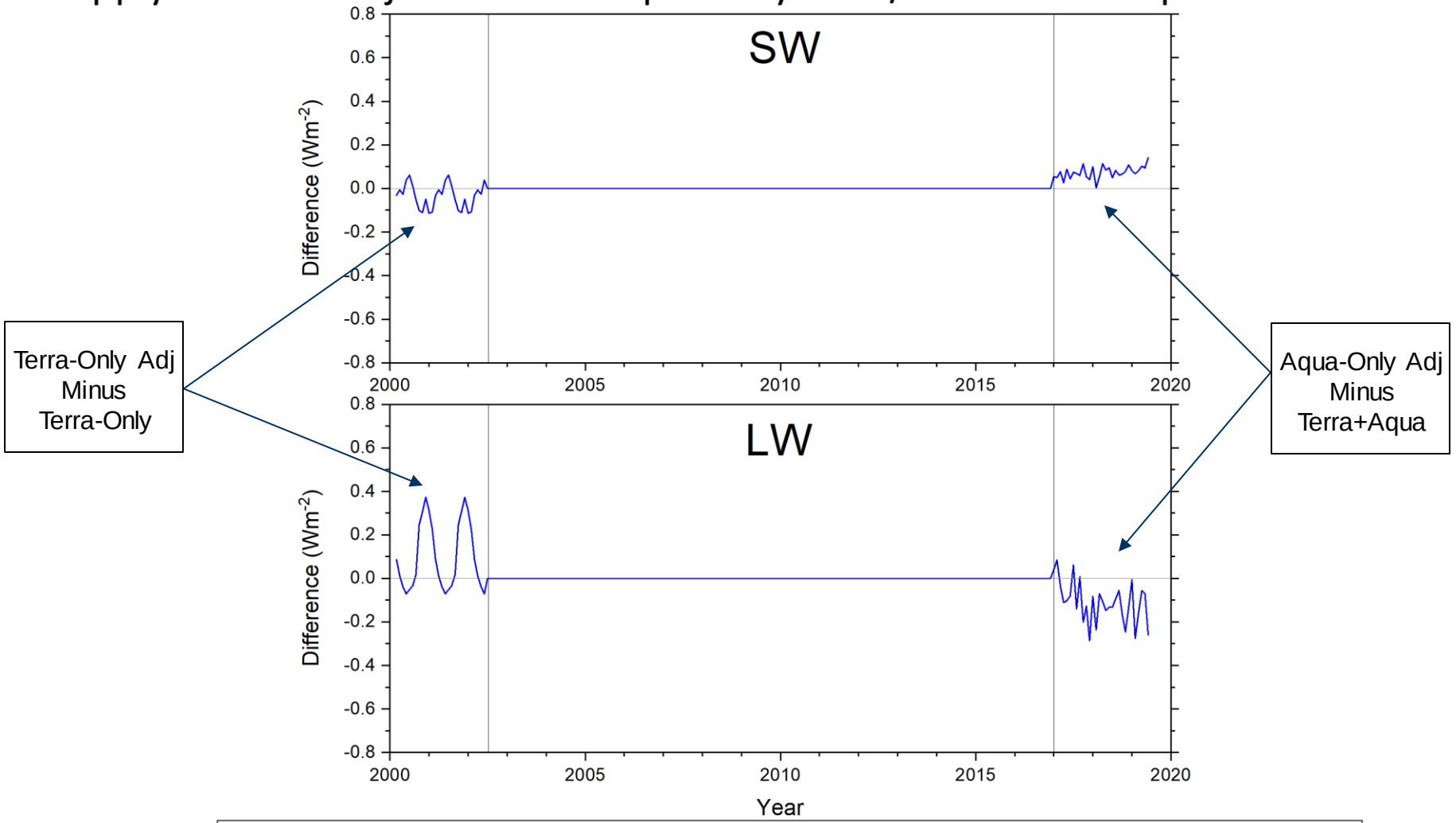
By definition: $\delta F'_T(\lambda,\phi;yr,mn) = \delta F_T(\lambda,\phi;yr,mn)$

$F_T(\lambda,\phi;yr,mn)$ = Terra monthly regional mean flux
$\bar{F}^O_T(\lambda,\phi;mn)$ = Terra climatological monthly regional mean flux for overlap period
$\bar{F}^O_{TA}(\lambda,\phi;mn)$ = Terra+Aqua climatological monthly regional mean flux for overlap period
$\delta F_T(\lambda,\phi;yr,mn)$ = Terra monthly regional mean flux anomaly



Impact of Climatological Adjustment on Global Mean TOA Flux

- Apply climatol. adjustment to Terra-Only vs no adjustment.
- Apply climatol. adjustment to Aqua-Only in 01/2017 and compare with Terra+Aqua

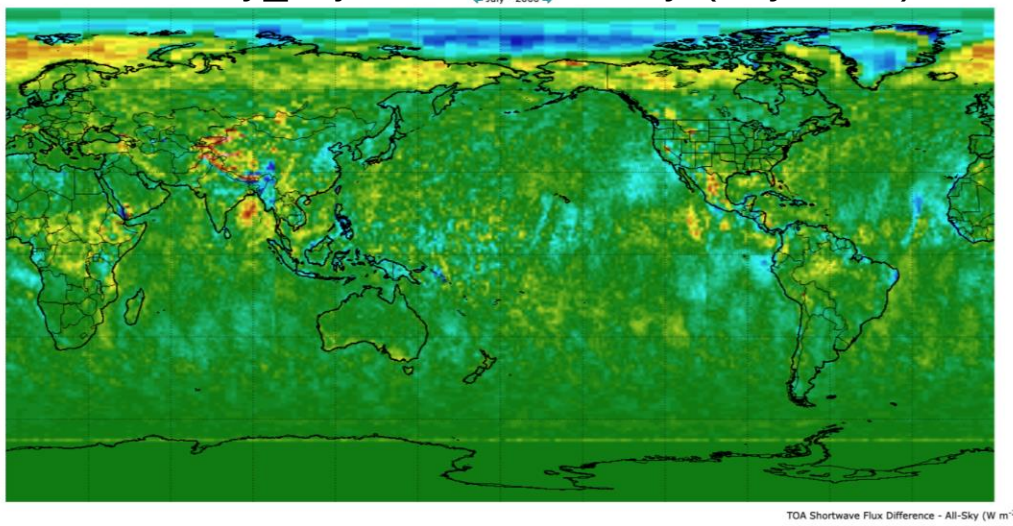


Impact on trends

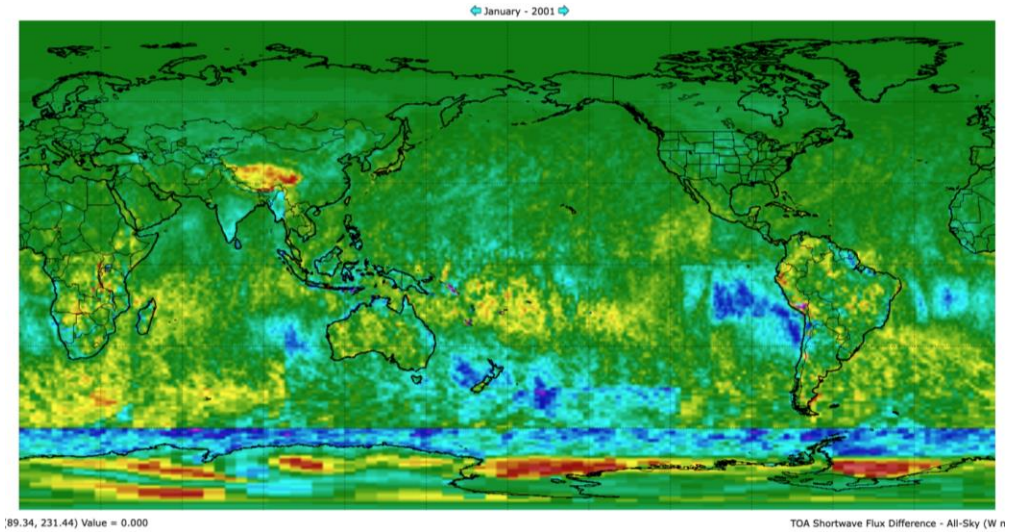
SW: 0.04 Wm^{-2} per decade; LW: -0.07 Wm^{-2} per decade

SW TOA Flux Difference

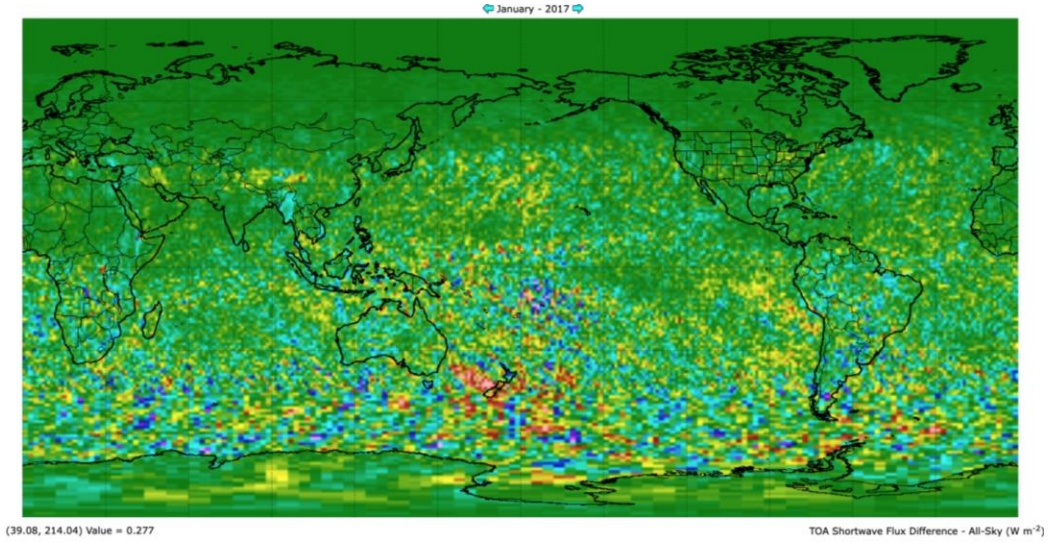
Terra-Only_Adj minus Terra-Only (July 2000)



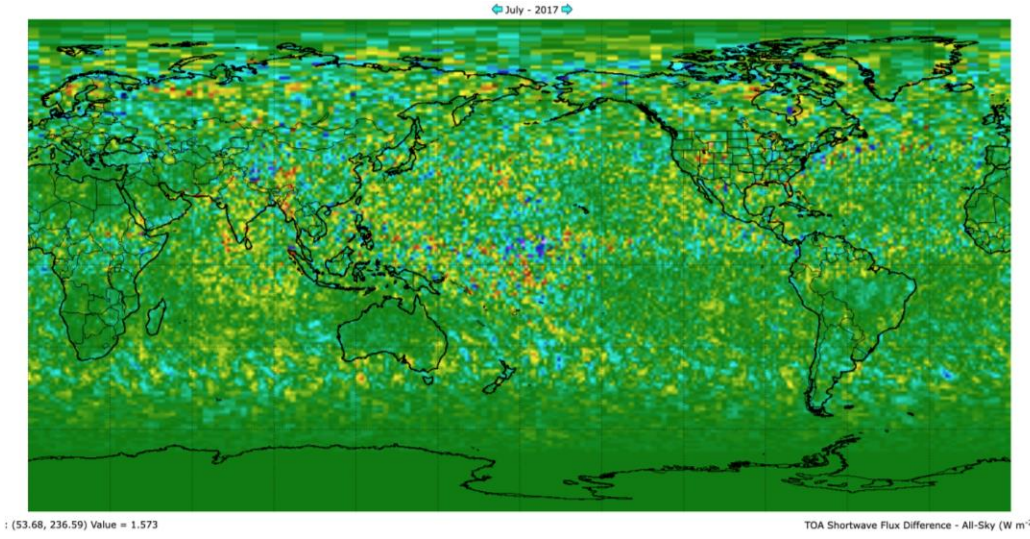
Terra-Only_Adj minus Terra-Only (January 2001)

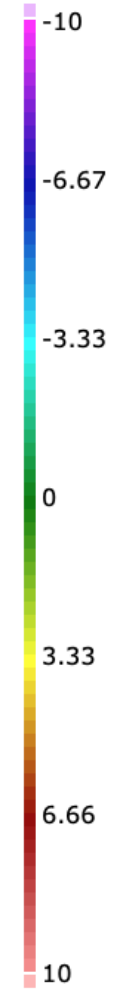


Aqua-Only_Adj minus Terra+Aqua (January 2017)



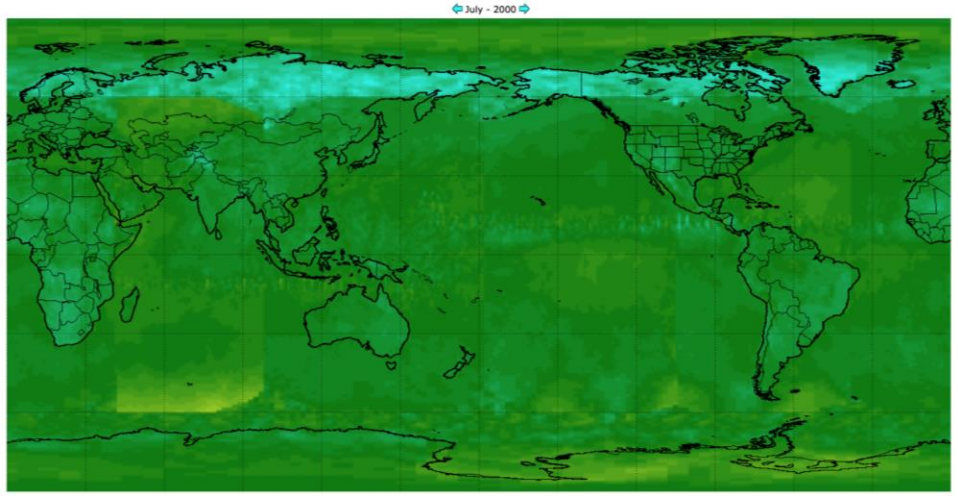
Aqua-Only_Adj minus Terra+Aqua (July 2017)



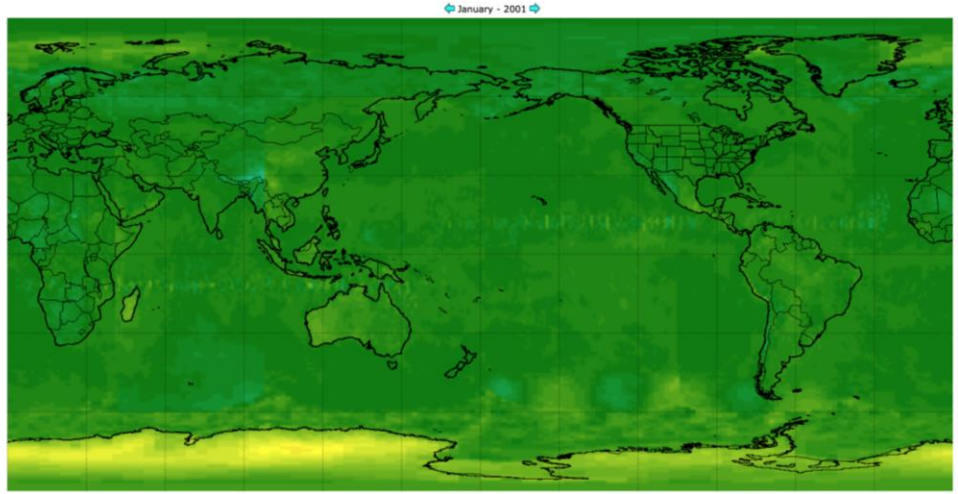


LW TOA Flux Difference

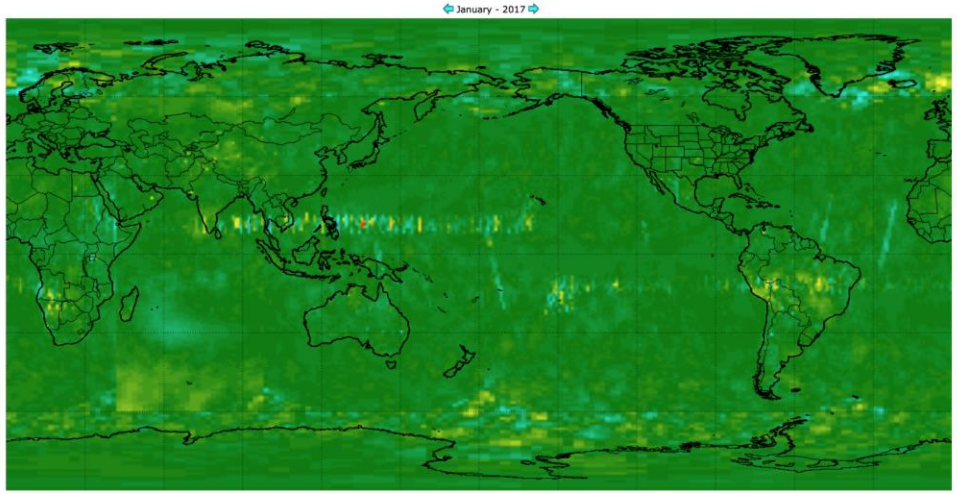
Terra-Only_Adj minus Terra-Only (July 2000)



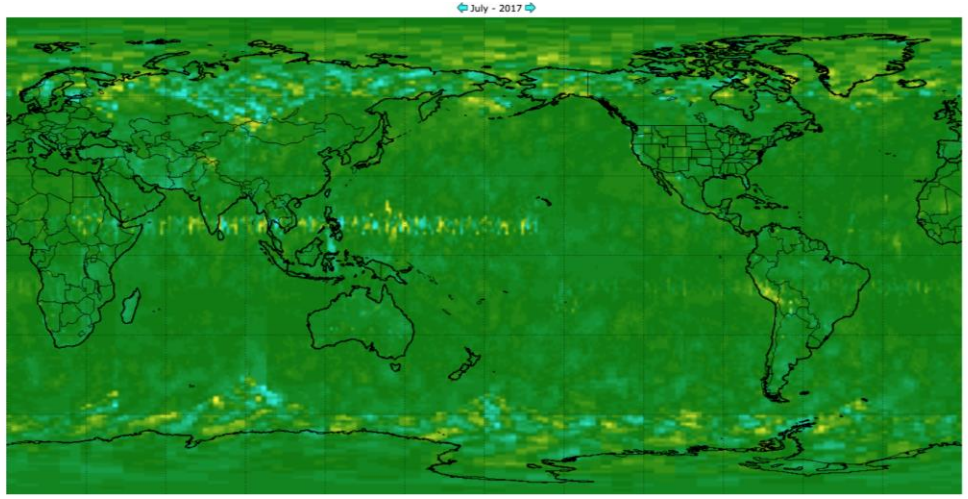
Terra-Only_Adj minus Terra-Only (January 2001)

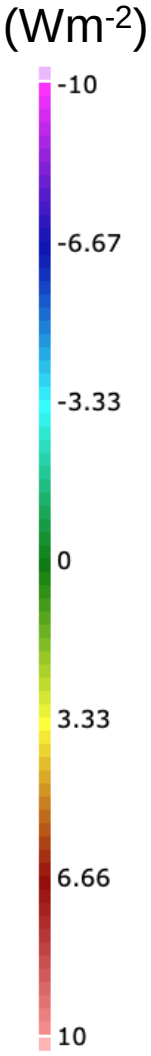


Aqua-Only_Adj minus Terra+Aqua (January 2017)



Aqua-Only_Adj minus Terra+Aqua (July 2017)





Other Changes to EBAF-TOA

- Small correction to GEO-derived diurnal asymmetry ratio used for diurnal averaging near the date-line (GMT-to-local time conversion bug fix).
- Continue to use SYN1deg LW fluxes as key input to EBAF (uses GEO imagers and GEOS5.4.1).
- Generate NOAA-20 SSF1deg and SYN1deg inputs to EBAF.
- Ensure a seamless transition of EBAF Aqua-based clear-sky TOA flux to NOAA20-based clear-sky TOA flux.