

Evaluating AeroCom phase III TOA clear-sky flux using the CERES Energy Balanced and Filled (EBAF) product

Wenying Su

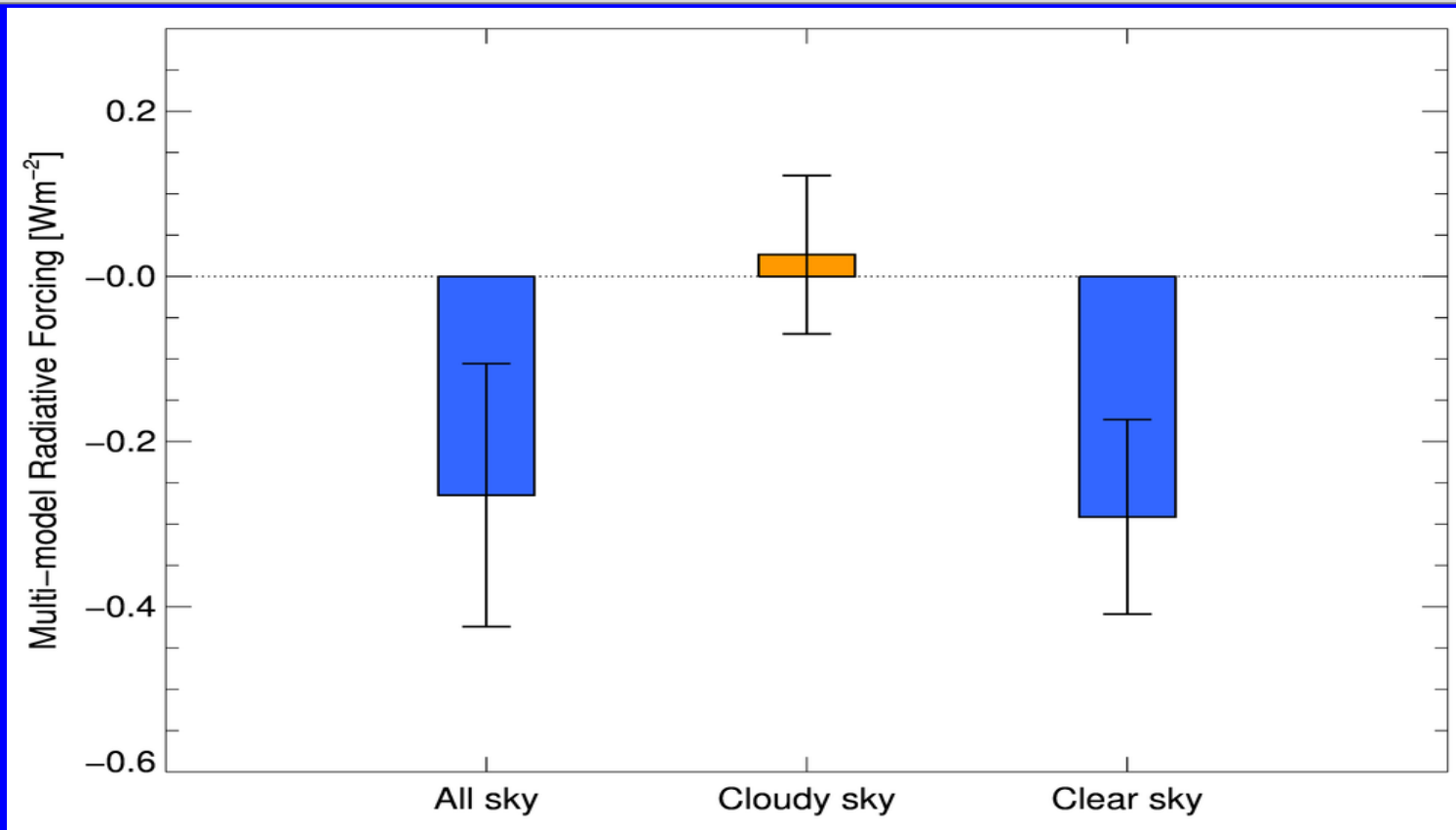
Details on Edition 4 TOA EBAF product are provided in Loeb et al. (2018).

The uncertainty of monthly mean clear-sky TOA SW flux in $1^\circ \times 1^\circ$ region is estimated to be 5 Wm^{-2} .

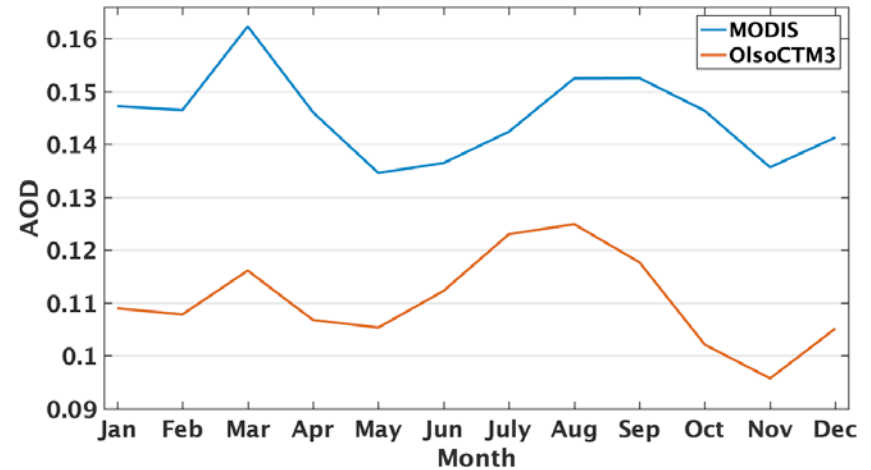
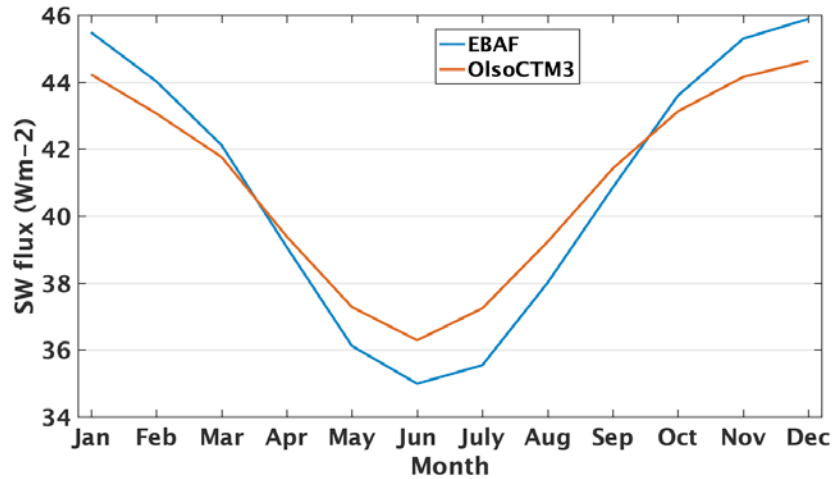
MODIS v6.1 dark target and deep blue combined AOD is also used here.



The sky forcing can be divided into clear sky and cloudy sky contribution.



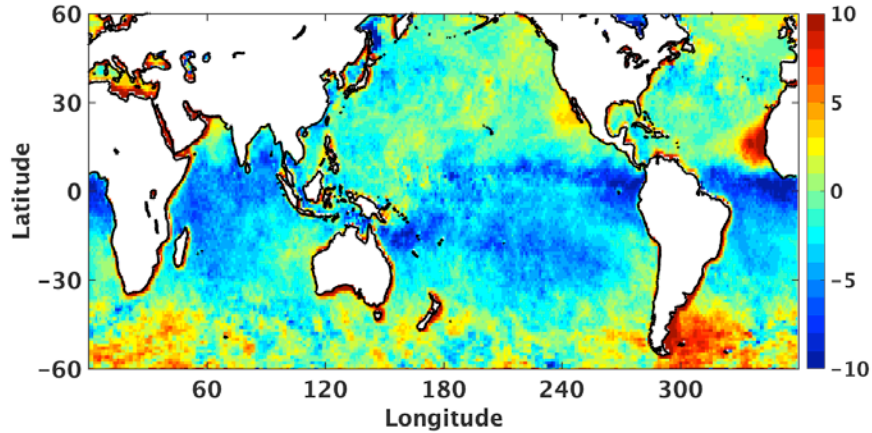
Monthly mean clear-sky flux and AOD comparison: over ocean



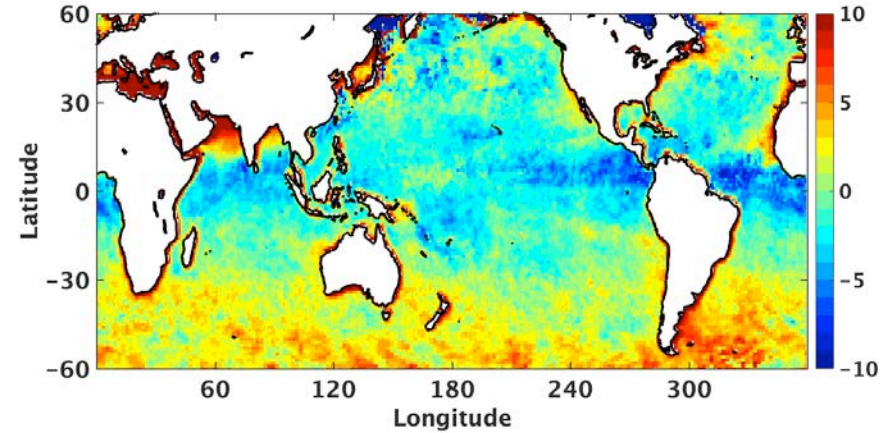
- Monthly mean difference of TOA upwelling SW flux between OlsoCTM3 and EBAF is within 2 Wm⁻².
- Monthly mean AODs from OlsoCTM3 are smaller than MODIS AOD by about 0.04.

Regional clear-sky SW flux differences between OlsoCTM3 and EBAF

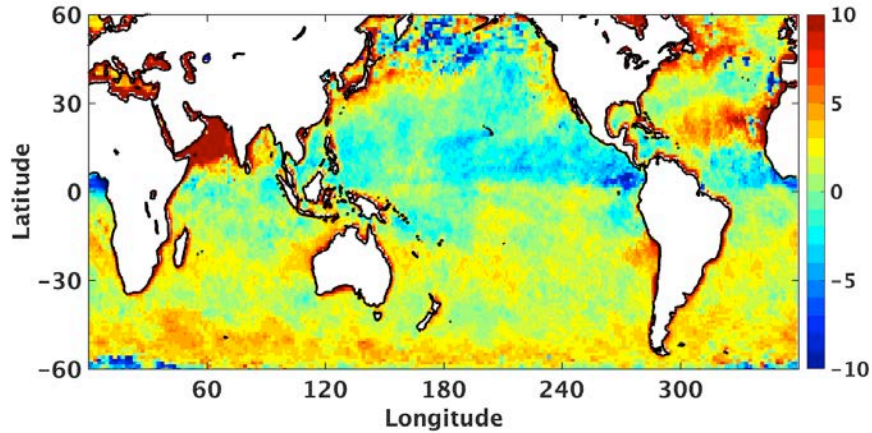
Jan:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[-1.1/-1.3/-2.2/-0.7/-1.4]



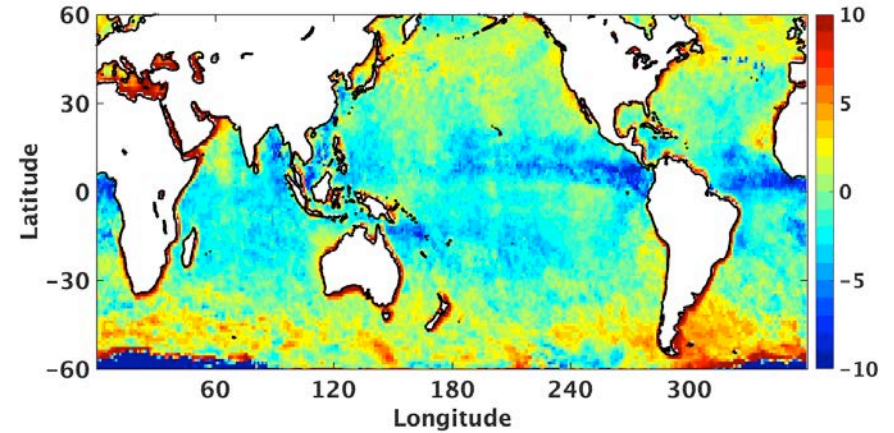
Apr:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[-0.3/0.3/-0.8/-2.0/1.0]



Jul:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[2.0/1.7/1.4/2.7/1.5]

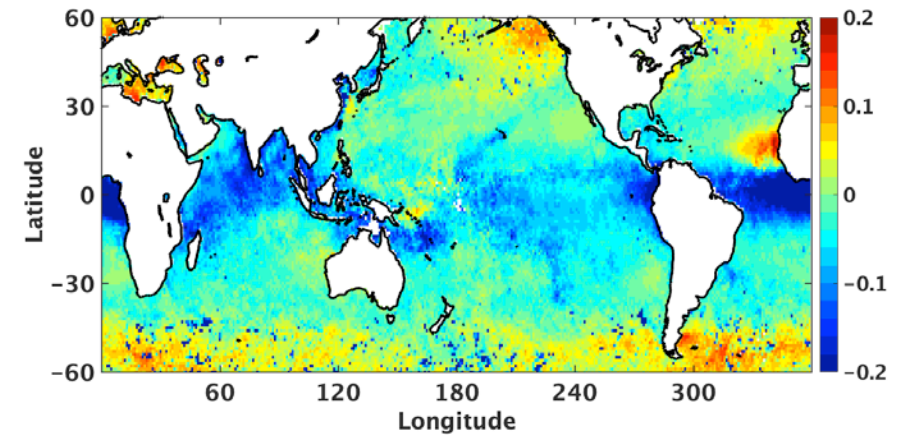


Oct:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[-0.9/-0.5/-1.2/-0.1/-1.5]

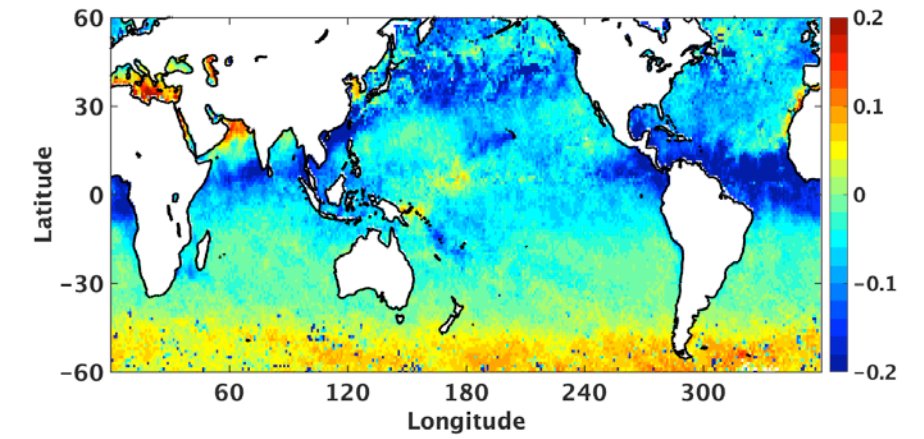


Regional aerosol optical depth differences between OlsoCTM3 and MODIS

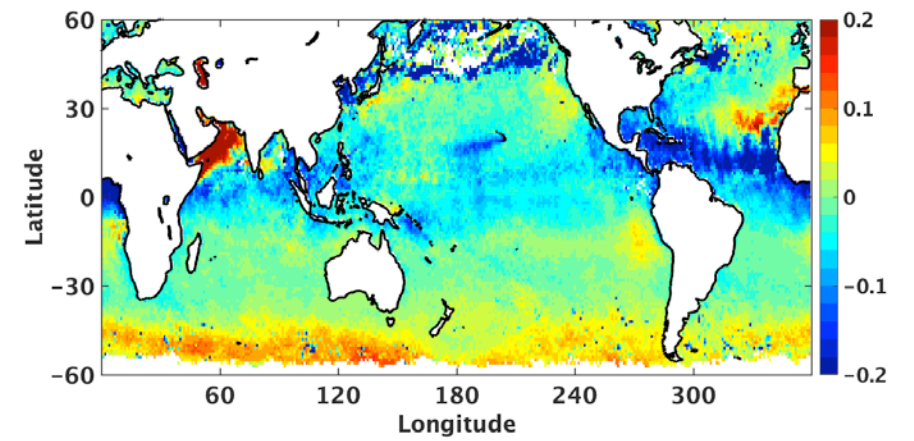
Jan:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.033/-0.038/-0.056/-0.032/-0.033]



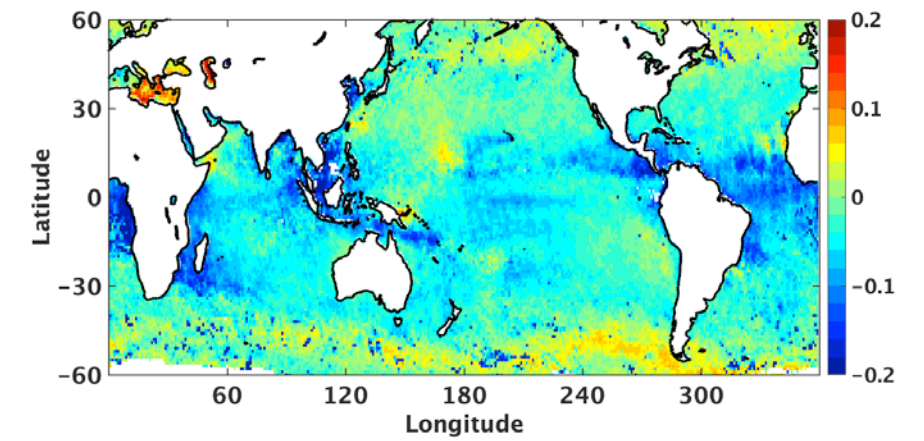
Apr:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.043/-0.039/-0.064/-0.086/-0.012]



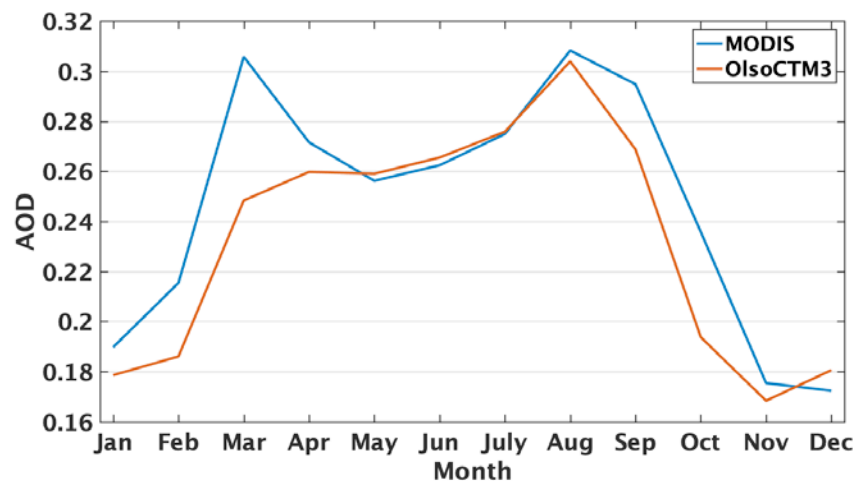
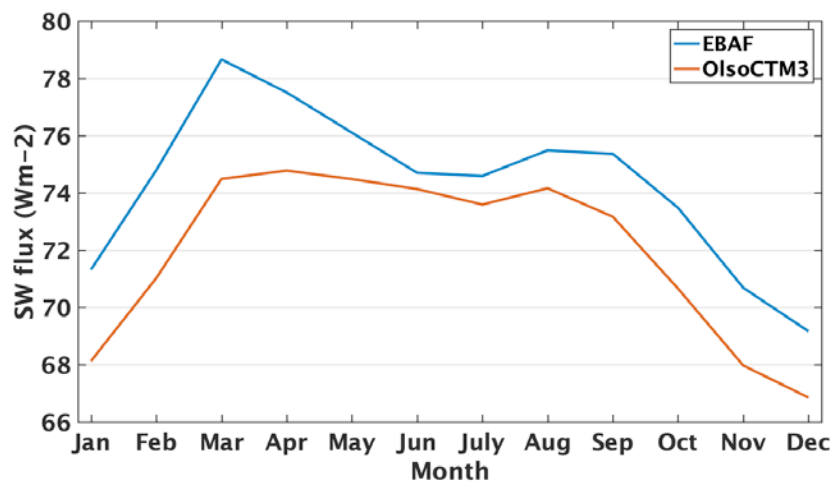
Jul:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.027/-0.019/-0.037/-0.060/-0.001]



Oct:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.039/-0.044/-0.056/-0.035/-0.042]



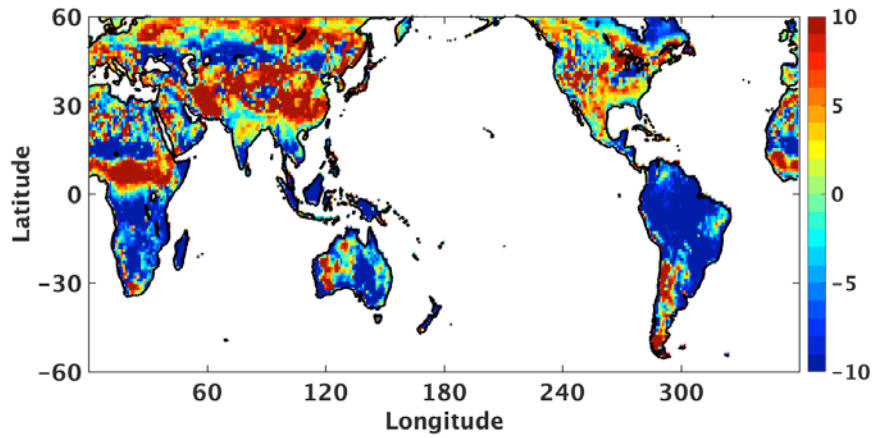
Monthly mean clear-sky flux and AOD comparison: over land



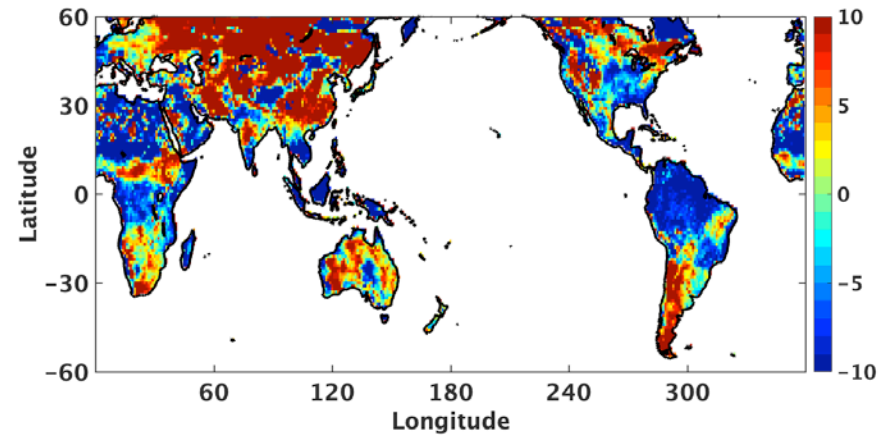
- OlsoCTM3 underestimates the clear-sky TOA SW fluxes, with the largest difference of 4 Wm⁻² occurs in March;
- Comparing to the MODIS AOD, OlsoCTM3 underestimates the AOD over land during the boreal winter months, and agrees well during the boreal summer months.

Regional clear-sky SW flux differences between OlsoCTM3 and EBAF

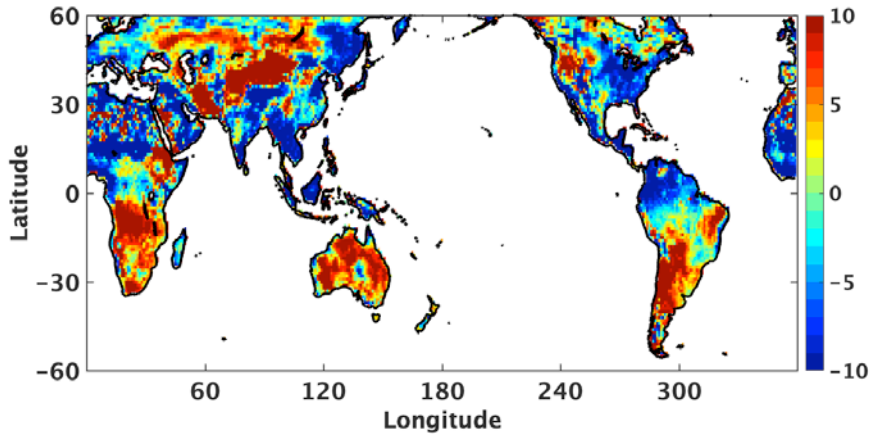
Jan:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[-2.4/-3.2/-4.4/0.6/-8.7]



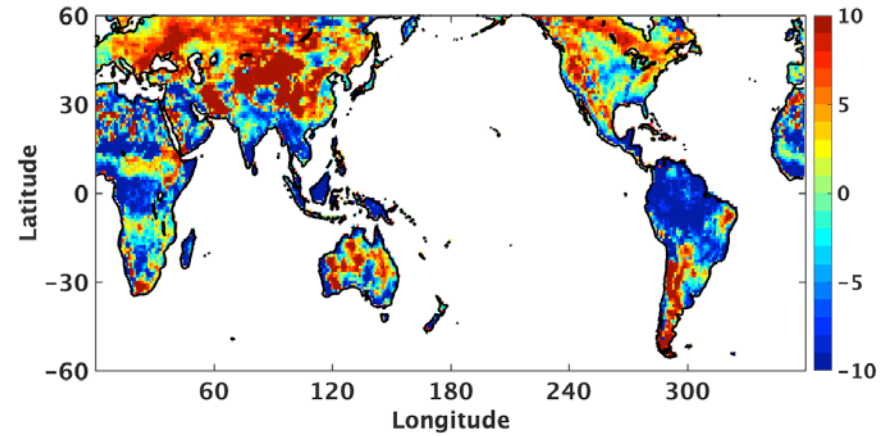
Apr:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[-1.3/-2.7/-3.9/-1.2/-1.6]



Jul:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[1.3/-1.0/-1.6/0.6/2.7]

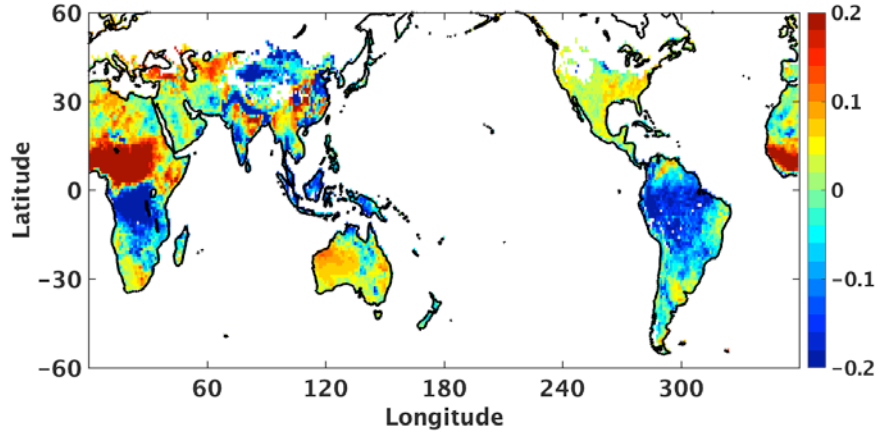


Oct:OlsoCTM3-EBAF SW [glb/sts/trp/nh/sh/]:[-0.6/-2.8/-4.1/0.5/-2.8]

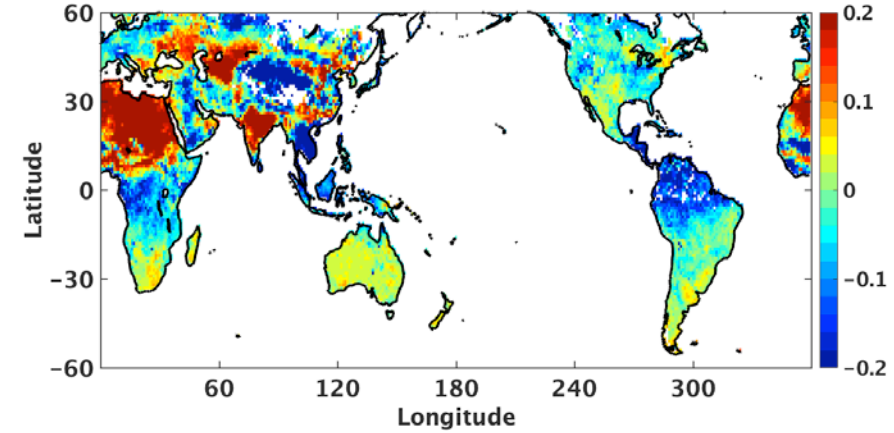


Regional aerosol optical depth differences between OlsoCTM3 and MODIS

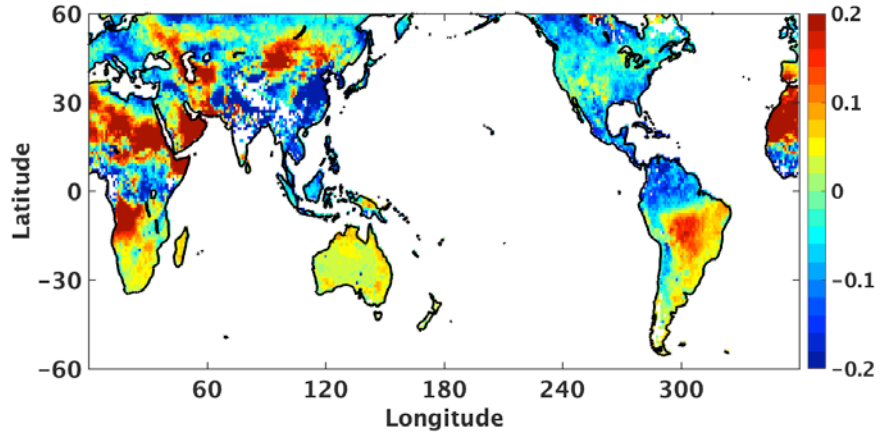
Jan:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.010/-0.009/-0.012/0.028/-0.070]



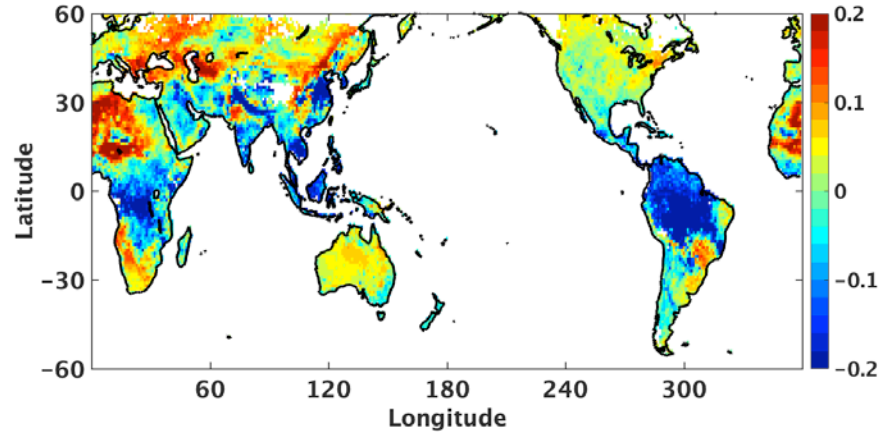
Apr:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.015/-0.009/-0.007/-0.008/-0.032]



Jul:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.012/0.005/0.017/-0.027/0.029]



Oct:OlsoCTM3-MODIS AOD [glb/sts/trp/nh/sh/]:[-0.016/-0.040/-0.043/0.002/-0.059]



Some observations

- Over ocean, during boreal summer months, the TOA clear-sky upwelling SW flux from OlsoCTM3 is greater than that from CERES EBAF, even though the AOD from OlsoCTM3 is smaller than that from MODIS.
- Comparing with the MODIS aerosol optical depth, OlsoCTM3
 - Overestimates AOD over Sahara regions
 - Underestimates AOD over the west coast of Africa and over the Amazon
- From the AOD differences and flux differences, it seems
 - Surface albedo for the Sahara specified in OlsoCTM3 might be too small
 - Surface albedo over snow/mountainous regions used in OlsoCTM3 might be too large