Global Comparison of Albedo from CRS and MODIS BRDF/albedo products

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Methodology and Data

CERES data: CRS ed 2G data for 2008-09;
MODIS data: MCD43C1, 0.05° grid BRDF;
CERES FOV is modeled with 4×4 MODIS grid boxes surrounding the FOV’s center;
CERES albedo is the ratio of untuned SW upward and downward fluxes;
MODIS albedo is retrieved from BRDF parameters with CERES input (SZA, AOD, etc.)
FOV selection criteria:
  clear sky,
  pure surface type (land only),
  must have valid MODIS albedo value,
  must pass additional clear snow/ice test over the cryosphere.
CERES vs MODIS albedo comparison

Global land albedo comparison, year: 2008, month: 01

ST -> IGBP:
1 -> 1
2 -> 2
3 -> 3, 4
4 -> 5
5 -> 6, 7
6 -> 8
7 -> 9
8 -> 10, 11
9 -> 12
10 -> 14
11 -> 15
12 -> 16
13 -> 18
14 -> 19

Global land albedo comparison, year: 2008, month: 04

Global land albedo comparison, year: 2008, month: 07

Global land albedo comparison, year: 2008, month: 10
Global albedo 1° map, January 2008

CERES surface albedo

CERES - MODIS

Distribution of FOVs

IGBP map
Global albedo 1° map, April 2008

CERES surface albedo

CERES - MODIS

Distribution of FOVs

IGBP map
Global albedo 1° map, October 2008

CERES surface albedo

CERES - MODIS

Distribution of FOVs

IGBP map
Spectral albedo, evergreen broadleaf forest

Red/pink – CERES
Dark/light blue - MODIS

[Year: 2008; Month: 01; IGBP type: 2; N_FOV: 10964]

[Year: 2008; Month: 04; IGBP type: 2; N_FOV: 7477]

[Year: 2008; Month: 07; IGBP type: 2; N_FOV: 48423]

[Year: 2008; Month: 10; IGBP type: 2; N_FOV: 9873]
Spectral albedo, deciduous broadleaf forest

- Red/pink – CERES
- Dark/light blue - MODIS
Spectral albedo, desert

Red/pink – CERES
Dark/light blue - MODIS
Spectral albedo, permanent snow/ice

Red/pink – CERES
Dark/light blue - MODIS

year: 2008; month: 01; IGBP type: 15; N$_{FOV}$: 1410659

year: 2008; month: 04; IGBP type: 15; N$_{FOV}$: 173140

year: 2008; month: 07; IGBP type: 15; N$_{FOV}$: 149079

year: 2008; month: 10; IGBP type: 15; N$_{FOV}$: 558806

\( \lambda, \text{micron} \)
Dependence of albedo on solar zenith angle, permanent snow/ice.
Dependence of albedo on solar zenith angle, desert
Region of interest: the Antarctic

CRS ed 2:
All SZAs: \( N_{FOV} = 45496 \),
albedo: \( 0.758 \pm 0.039 \) (CRS), \( 0.814 \pm 0.042 \) (MODIS),
linear fit: \( a_{MODIS} = 1.0727 \times a_{CERES} \);
SZA < 70: \( N_{FOV} = 26879 \),
albedo: \( 0.751 \pm 0.025 \) (CRS), \( 0.806 \pm 0.039 \) (MODIS),
linear fit: \( a_{MODIS} = 1.0724 \times a_{CERES} \).

CRS ed 4:
All SZAs: \( N_{FOV} = 18036 \),
albedo: \( 0.745 \pm 0.026 \) (CRS), \( 0.800 \pm 0.038 \) (MODIS),
linear fit: \( a_{MODIS} = 1.0719 \times a_{CERES} \);
1. CERES surface albedo retrievals are in good agreement with MODIS retrievals over most of surface types;

2. CERES algorithm slightly underestimates albedo in comparison with MODIS;

3. The greatest discrepancies between two products are observed over permanent snow/ice and deserts;

4. These discrepancies can be addressed to the difference in spectral albedo shapes;

5. CERES spectral albedo shape is not season dependent; the analysis shows that this assumption is not correct over some targets; inclusion of the season dependency based on MODIS in edition 4 will fix this problem;

6. Great difference between CERES and MODIS albedo retrievals over the Antarctic may be addressed to unrealistic spectral shape in edition 2 algorithm. This will be fixed in edition 4 algorithm.