Sun glint removal for GERB Edition-1

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Royal Meteorological Institute of Belgium

22 September 2011
1. Introduction

2. Sun glint correction

3. Albedo ratio

4. Maps
Aim

- Estimate flux in sun glint-affected area
- To be applied to Edition-1
- To be applied to BARG (but currently only HR)
Problem

- Under certain conditions, sun rays are reflected specularly towards the detector
- Scene identification is unreliable → radiance-to-flux conversion fails
- Currently there’s a big black patch over the area defined by the geometric condition SGA < 15°
masked out over clear/cloudy ocean + over land

(quantisation factor = 0.25)
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Radiance-to-flux conversion

- Scene identification is unreliable
- Solution: extrapolate scene ID just before sun glint to sun glint
- Not an interpolation between pre- and post-glint; it should work in near-real time
Scene ID extrapolation

- Last valid cloud cover, cloud phase & cloud optical depth are stored
- Do not keep scene ID longer than 2.5 hours
- Stored scene ID replaced with real scene ID as soon as available
scene ID extrapolation

- stored data > 2.5 hours invalid
- not required over land
Correcting sun glint

- **SGA < 15°**
  - Clear ocean: CERES TRMM climatology (albedo + incoming solar → flux)
  - Cloudy ocean: radiance-to-flux conversion using extrapolated scene ID
  - Land: radiance-to-flux conversion

- **15° < SGA < 25°**
  - Clear ocean: CERES TRMM climatology
Example: 7 July 2004, 14:30

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Example: 7 July 2004, 14:30

- flux over land restored
- reasonable-looking fill-in
Example: 7 July 2004, 14:30
Example: 7 July 2004, 14:30

- flux over land restored
- reasonable-looking fill-in
- black spot due to missing scene ID
Example: 7 July 2004, 17:30

- Color scale intentionally clipped from 80 to 120 W m$^{-2}$ (clear ocean)
- Step change in flux at SGA 25° transition
Why the step change?

GERB flux for clear ocean is calculated as follows:

\[ F_{\text{GERB}} = a \frac{F_{\text{solar}} \cos \theta}{\tilde{r}^2} \Gamma \]

where \( a \) is CERES TRMM albedo, and \( \Gamma \) is (known) GERB–TRMM albedo ratio.
Outline

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How the following maps have been obtained

- Clear ocean points
- Outside of the sun glint area
- With a solar zenith angle $< 70^\circ$
- With a viewing zenith angle $< 70^\circ$
- With the dust detection flag off
- Surrounded by points meeting the same criteria
average GERB–TRMM albedo ratio 2004
average = 1.049
average GERB–TRMM albedo ratio Dec 2004
spread GERB–TRMM albedo ratio 2004
### Average GERB–TRMM albedo ratio

<table>
<thead>
<tr>
<th>Month</th>
<th>GERB-2</th>
<th>GERB-1</th>
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<tbody>
<tr>
<td>01</td>
<td>1.02525</td>
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<td>02</td>
<td>1.02731</td>
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<td>09</td>
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<tr>
<td>2011</td>
<td>0.9189</td>
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### Standard deviation GERB–TRMM albedo ratio

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<td>0.08074</td>
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Next

- Decide what to do with the GERB–TRMM ratio
- Produce BARG
Acknowledgements

- Dr. Jacqueline E. Russell, Imperial College
- GERB team at RMIB
- RMIB
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Average GERB–TRMM albedo ratio

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Spread GERB–TRMM albedo ratio, yearly

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Spread GERB–TRMM albedo ratio, yearly

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Spread GERB–TRMM albedo ratio, yearly

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Spread GERB–TRMM albedo ratio, yearly

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average = 0.07764
Spread GERB–TRMM albedo ratio, monthly

average = 0.07306
GERB-like

21 June 2004: **before**
- tends to increase cloud cover
- tends to decrease crispness
GERB-like

21 June 2004: after

- tends to increase cloud cover
- tends to decrease crispness
GERB-like

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7 July 2004: before