Use of GERB-like fluxes to validate NWP models

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### Imager: METEOSAT SEVIRI

<table>
<thead>
<tr>
<th>Imaging Format</th>
<th>METEOSAT</th>
<th>SEVIRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging Cycle</td>
<td>30 mn</td>
<td>15 mn</td>
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<table>
<thead>
<tr>
<th>Channels</th>
<th>Central wavelength</th>
<th>HRV</th>
<th>VIS 0.6</th>
<th>VIS 0.8</th>
<th>IR 1.6</th>
<th>WV 6.2</th>
<th>WV 7.3</th>
<th>IR 3.8</th>
<th>IR 8.7</th>
<th>IR 10.8</th>
<th>IR 12.0</th>
<th>IR 9.7</th>
<th>IR 13.4</th>
</tr>
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<tbody>
<tr>
<td>Visible</td>
<td>0.5 - 0.9</td>
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<tr>
<td>Water vapour</td>
<td>WV 6.4</td>
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<tr>
<td>IR window</td>
<td>IR 11.5</td>
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<td>Pseudo sounding</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pixel size (at nadir)</th>
<th>2.25 km (visible)</th>
<th>1 km (HRV)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.50 km (IR+WV)</td>
<td>3 km (others)</td>
</tr>
</tbody>
</table>

### Radiometer: GERB

- **2-channels broadband**
  - (0.32 μm - 4.0 μm and 0.32 μm - 30 μm)
- **Radiometer**
- **Earth disk scanning in 15 mn**
- **On-board calibration**
- **Pixel size of (NSxEW)**
  - 44.6 x 39.3 km at nadir
RMIB GERB-SEVIRI PROCESSING

GERB DATA

SEVIRI DATA

NEAR REAL-TIME ESTIMATE OF THE RADIATION BUDGET AT THE HIGH SPATIAL RESOLUTION OF SEVIRI (3*3 SEVIRI PIXELS RESOLUTION = 9x9 km)

Radiation Budget Studies

Evaluation of Numerical Models
OUTLINE

• GERB-LIKE FLUXES GENERATION

• ALADIN BELGIUM DESCRIPTION

• RADIATIVE FLUXES COMPARISON

• CONCLUSIONS and PERSPECTIVE
• RGP-SEVIRI processing but applied to Meteosat-7 data
• Calibration:
  VIS: RMIB Calibration
  WV & IR: EUMETSAT Calibrations
• NB to BB Conversion:
  VIS: solar reflected BB radiance
  WV&IR: thermally emitted radiance
• Radiance to flux conversion:
  Solar: scene id. + ERBE ADM’s
  Thermal: RMIB Thermal ADM version 2 (no-spectral)

Solar & Thermal Fluxes at TOA at the same temporal rate than MS7 with a spatial resolution 3 times coarser
ALADIN BELGIUM: BRIEF DESCRIPTION

ALADIN France Central Domain Size: 277x277 points of 9.5 km

Number of level: 41
Map Projection: Lambert
Advection Scheme: semi-Lagrangian
Time-Stepping Scheme: two-time-level semi-implicit
Model time step: 360 s
Coupled with: ARPEGE

ALADIN Belgium Full Domain Size (including extension and coupling zones) 108x108 points of 7 km

SW corner: 47.47 N 0.11 E
NE corner: 53.47 N 9.60 E

Runs at 48 hours ranges two times a day (0h00 and 12h00)

Coupling: Every 3 hours from the output of ALADIN-FRANCE

Temperature
Wind Components
Specific Humidity
Geopotential

ALADIN Belgium Central Domain Size) 97x97 points of 7 km

Number of level: 41
Map Projection: Lambert
Advection Scheme: semi-Lagrangian
Time-Stepping Scheme: two-time level semi-implicit
Model Time Step: 360 s
SOLAR FLUX COMPARISON: 2002-02-15
00:00 UTC RUN

09:00 (day 1)  
GERB-LIKE SOLAR FLUX [W.m⁻²]  
R=0.71  
R=0.50

12:00 (day 1)  
ALADIN SOLAR FLUX [W.m⁻²]  
R=0.53  
R=0.55

15:00 (day 1)  
GERB-LIKE SOLAR FLUX [W.m⁻²]  
R=0.43  
R=0.47

09:00 (day 2)  
GERB-LIKE SOLAR FLUX [W.m⁻²]  
R=0.46  
R=0.55

12:00 (day 2)  
ALADIN SOLAR FLUX [W.m⁻²]  
R=0.31  
R=0.46

15:00 (day 2)  
GERB-LIKE SOLAR FLUX [W.m⁻²]  
R=0.56  
R=0.67
**Meteosat-7**: vertically integrated cloud cover:

\[ C = \frac{L(\tau) - L(o)}{L(128) - L(o)} \]

- \( L(\tau) \) = measured visible radiance
- \( L(o) \) = measured clear-sky visible radiance
- \( L(128) \) = simulated cloudy visible radiance

**Aladin**: 4 kinds of cloud: HIGH, MIDDLE, LOW, CONVECTIF

3 origins for cloudiness:

- Large scale over-saturation
- Subgrid shallow convection over-saturation
- Subgrid deep convection over-saturation
SOLAR FLUX COMPARISON:
15-02-02 (9:00 AM DAY 1)

GERB-LIKE SOLAR FLUX

ALADIN SOLAR FLUX

(GERB-LIKE - ALADIN) SOLAR FLUX
ALADIN SURFACE ALBEDO

Updated monthly!

FEBRUARY

MARCH

MARCH - FEBRUARY:
THERMAL FLUX COMPARISON: 2002-02-15
00:00 UTC RUN

00:00 day 1 03:00 day 1 06:00 day 1 09:00 day 1 12:00 day 1 15:00 day 1

R=0.51  R=0.38  R=0.78  R=0.84  R=0.80  R=0.68

18:00 day 1 21:00 day 1 00:00 day 2 03:00 day 2 06:00 day 3 09:00 day 3

R=0.56  R=0.47  R=0.23  R=0.17  R=0.16  R=0.19
**THERMAL FLUX COMPARISON: 2002-02-15**

**00:00 UTC RUN**

**GERB-LIKE THERMAL FLUX [W.m-2]**

09:00 (day 1)  
R=0.84  
R=0.75  

12:00 (day 1)  
R=0.80  
R=0.62  

15:00 (day 1)  
R=0.68  
R=0.45  

09:00 (day 2)  
R=0.19  
R=0.01  

12:00 (day 2)  
R=0.46  
R=-0.21  

15:00 (day 2)  
R=0.56  
R=-0.10  

**ALADIN THERMAL FLUX [W.m-2]**

**GERB-LIKE THERMAL FLUX [W.m-2]**
THERMAL FLUX COMPARISON:
15-02-02 (9:00 AM DAY 1)

GERB-LIKE THERMAL FLUX

ALADIN THERMAL FLUX

(GERB-LIKE - ALADIN) THERMAL FLUX
Accurate estimates of SW and LW radiative fluxes from space observations will enable an independent assessment of the NWP models:
- cloud prediction scheme
- radiative transfer scheme
- surface process scheme

Comparisons with GERB-like fluxes have highlighted some weakness of the ALADIN Belgium NWP model:
- overestimation of the reflected solar flux
- underestimation of the emitted thermal flux
- cloud cover occurrence and distribution.
CONCLUSIONS AND PERSPECTIVE

PLAN:
FOCUS ON CLEAR SKY RADIATIVE FLUXES COMPARISON

Use of satellite-borne instruments to retrieve the Earth surface albedo over the ALADIN Belgium domain