Use of GERB-like fluxes to validate NWP models

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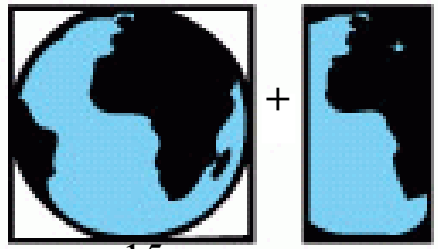
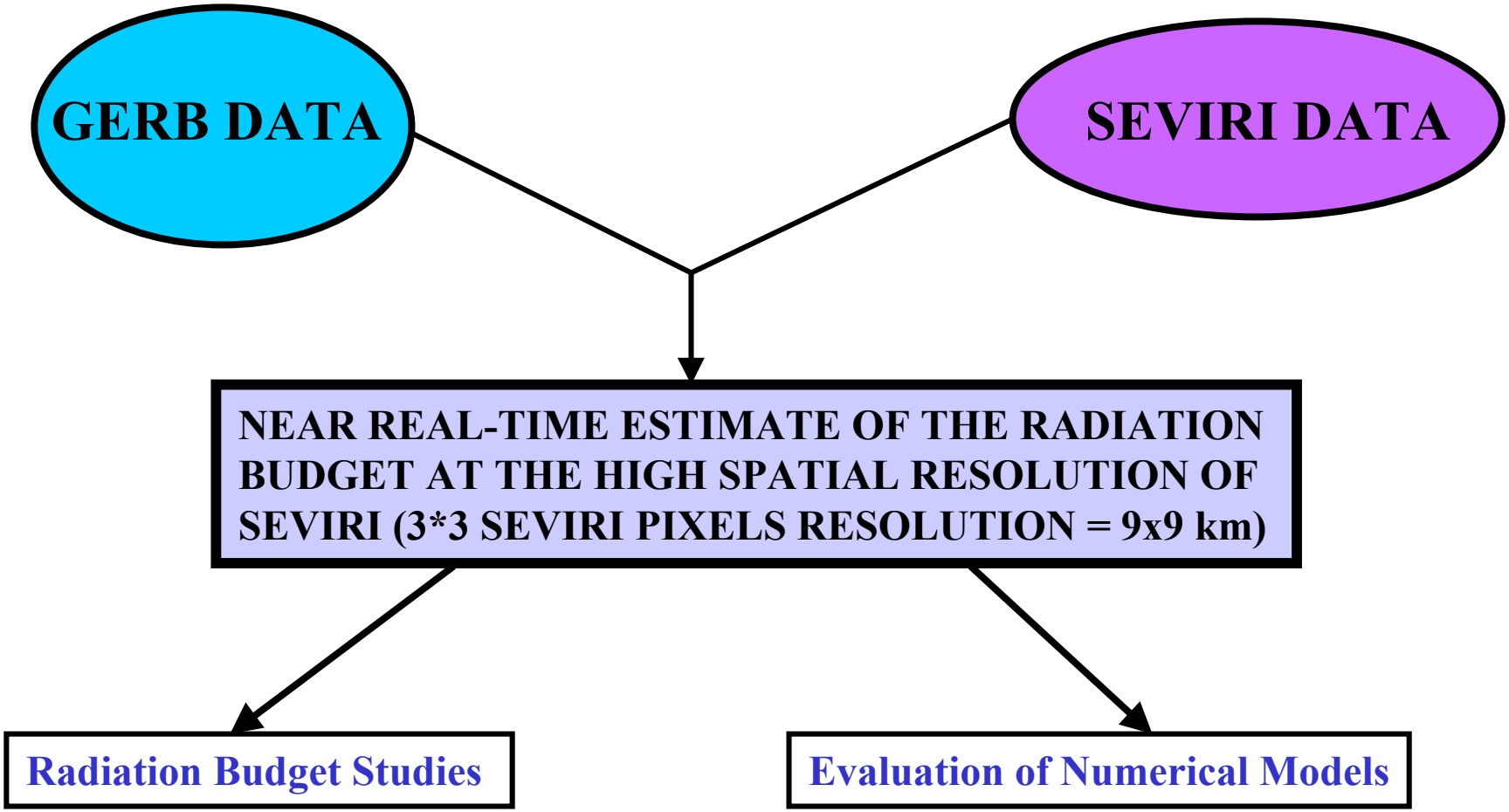
MOP/MSG PERFORMANCE EVOLUTION

Imager:	METEOSAT	SEVIRI (SPINNING ENHANCED VISIBLE AND INFRARED IMAGER)
Imaging Format		
Imaging Cycle	30 mn	15 mn
Channels	Broadband	
		Central wavelenght
Visible	0.5 - 0.9	HRV VIS 0.6 VIS 0.8 IR 1.6
Water vapour	WV 6.4	WV 6.2 WV 7.3
IR window	IR 11.5	IR 3.8 IR 8.7 IR 10.8 IR 12.0
Pseudo sounding		IR 9.7 IR 13.4
Pixel size (at nadir)	2.25 km (visible) 4.50 km (IR+WV)	1 km (HRV) 3 km (others)

Radiometer: GERB
(GEOSTATIONARY EARTH RADIATION BUDGET)

- **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



OUTLINE

- GERB-LIKE FLUXES GENERATION
- ALADIN BELGIUM DESCRIPTION
- RADIATIVE FLUXES COMPARISON
- CONCLUSIONS and PERSPECTIVE

"GERB-LIKE" FLUXES GENERATION

- **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)

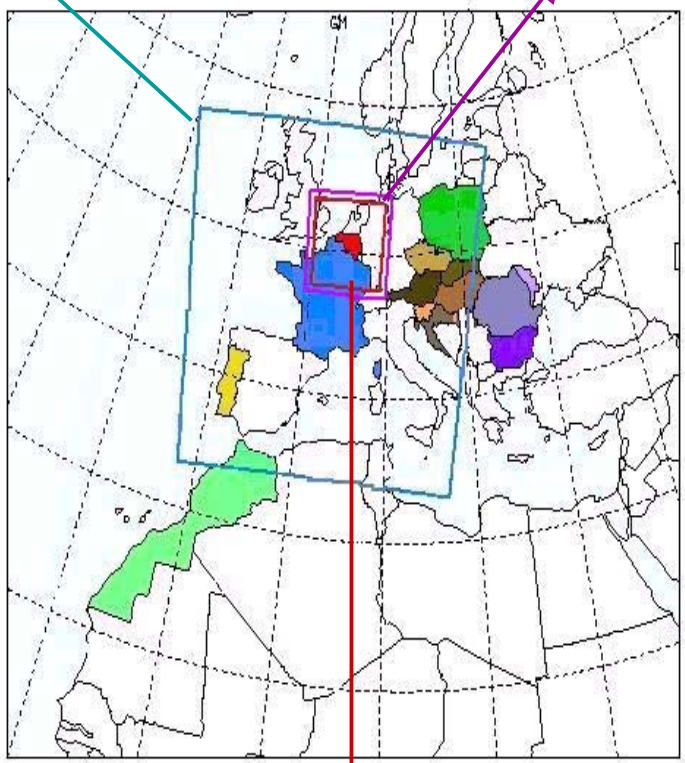
➡ **Solar & Thermal Fluxes at TOA at the same temporal rate than MS7 with a spatial resolution 3 times coarser**

ALADIN BELGIUM: BRIEF DESCRIPTION

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

ALADIN Belgium Full Domain Size
(including extension and coupling zones)
108x108 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
Coupled with: ARPEGE



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

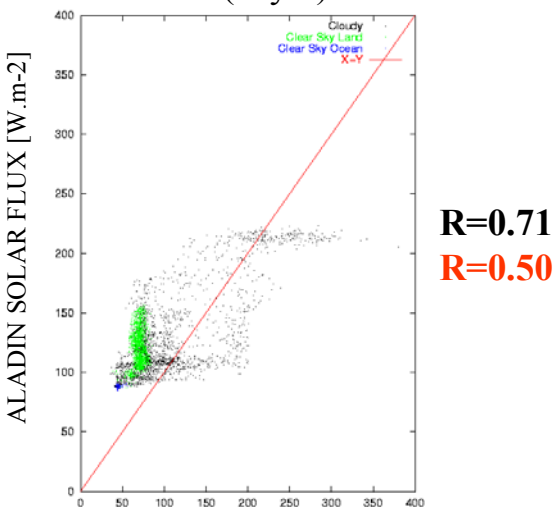
- **Temperature**
- **Wind Components**
- **Specific Humidity**
- **Geopotential**

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

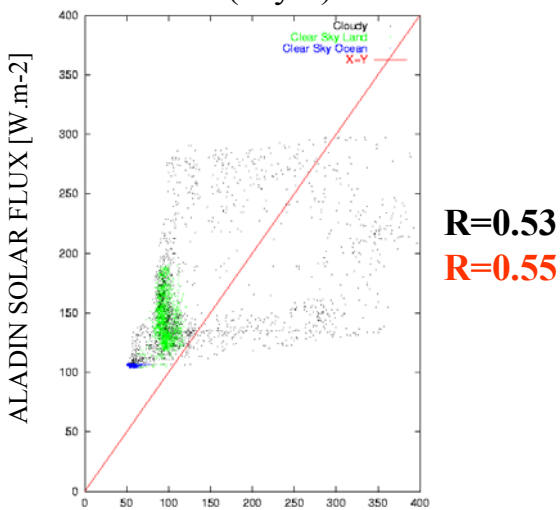
SOLAR FLUX COMPARISON: 2002-02-15
00:00 UTC RUN

09:00 (day 1)



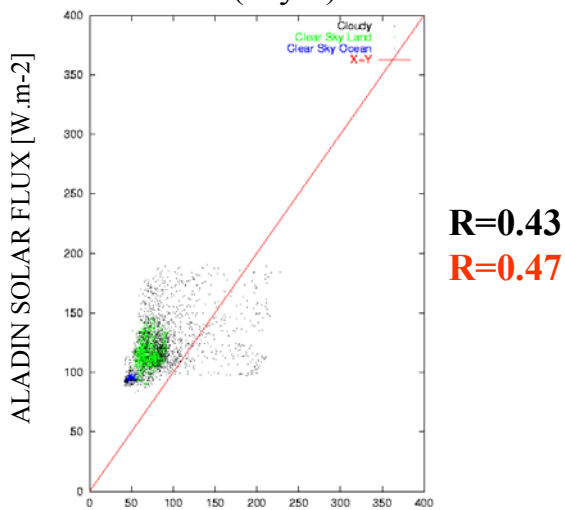
R=0.71
R=0.50

12:00 (day 1)



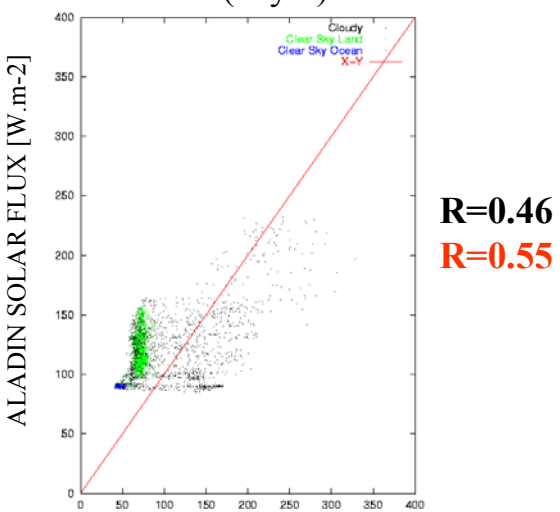
R=0.53
R=0.55

15:00 (day 1)



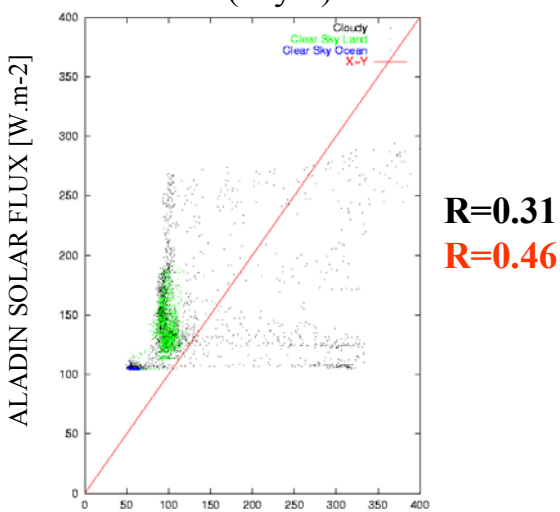
R=0.43
R=0.47

09:00 (day 2)



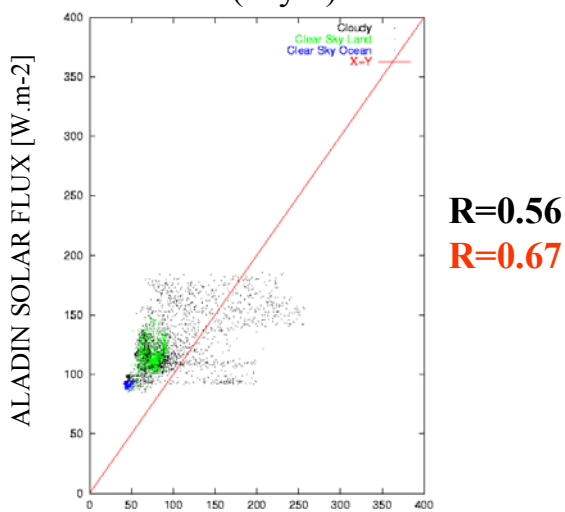
R=0.46
R=0.55

12:00 (day 2)



R=0.31
R=0.46

15:00 (day 2)



R=0.56
R=0.67

CLOUD COVER:

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

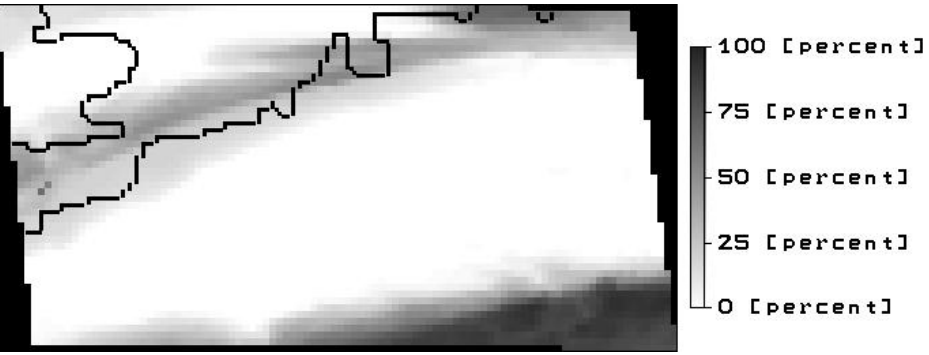
Aladin: 4 kinds of cloud: HIGH, MIDDLE, LOW, CONVECTIF

3 origines for cloudiness:

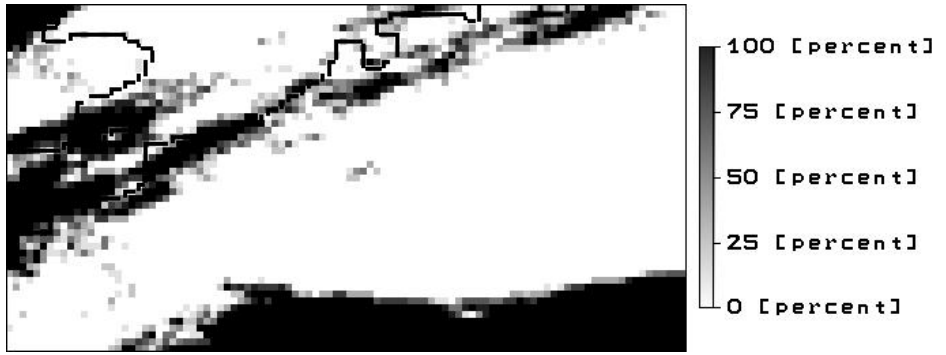
- Large scale over-saturation
- Subgrid shallow convection over-saturation
- Subgrid deep convection over-saturation

CLOUD COVER:15-02-02 (9:00 AM)

TOTAL ALADIN

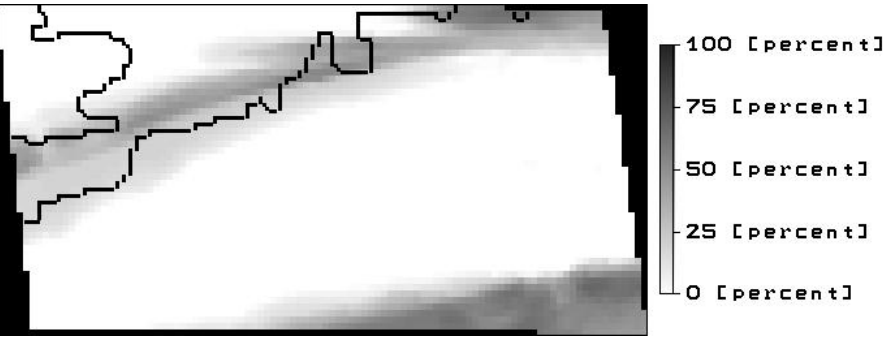


METEOSAT

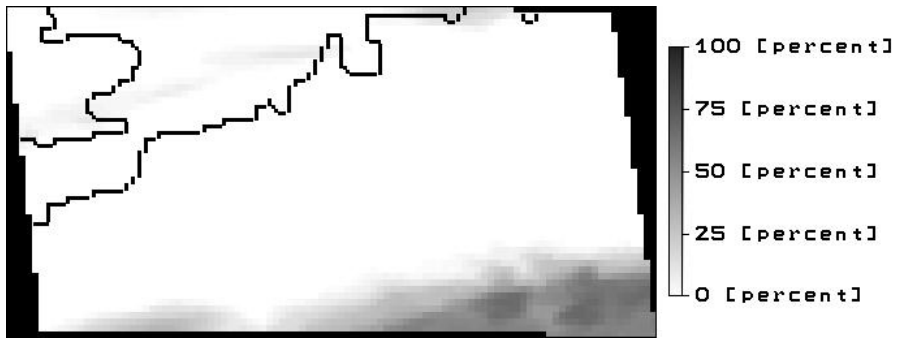


ALADIN

HIGH



MIDDLE

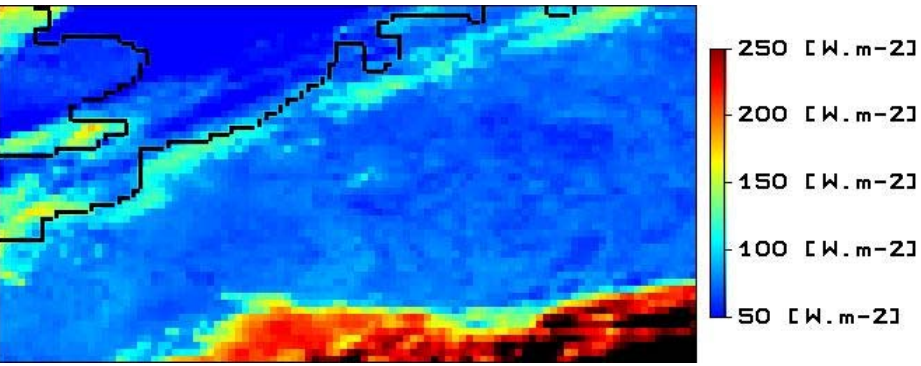


LOW

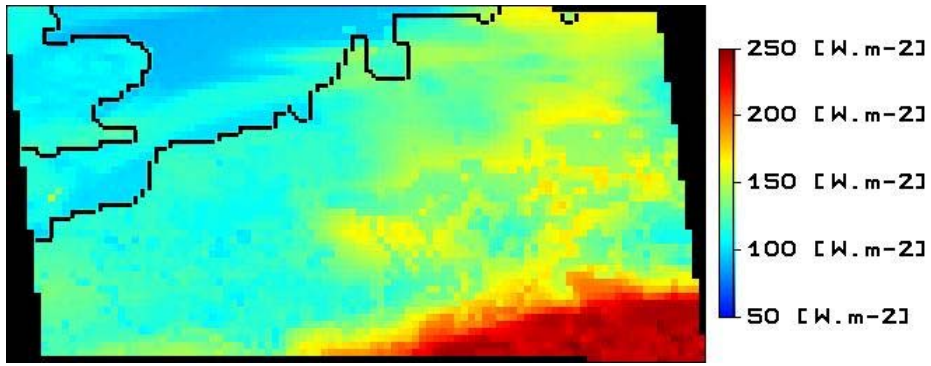
CONVECTIF

SOLAR FLUX COMPARISON:
15-02-02 (9:00 AM DAY 1)

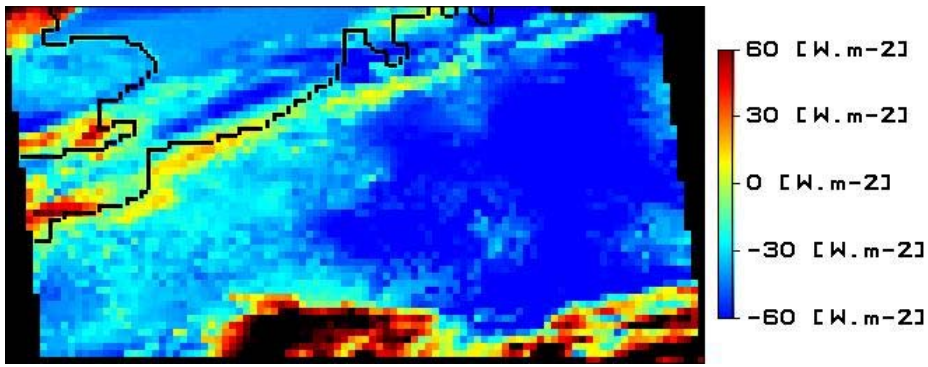
GERB-LIKE SOLAR FLUX



ALADIN SOLAR FLUX



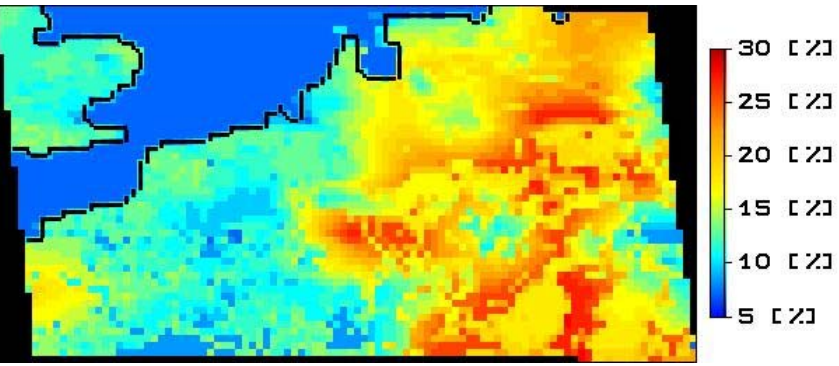
(GERB-LIKE - ALADIN) SOLAR FLUX



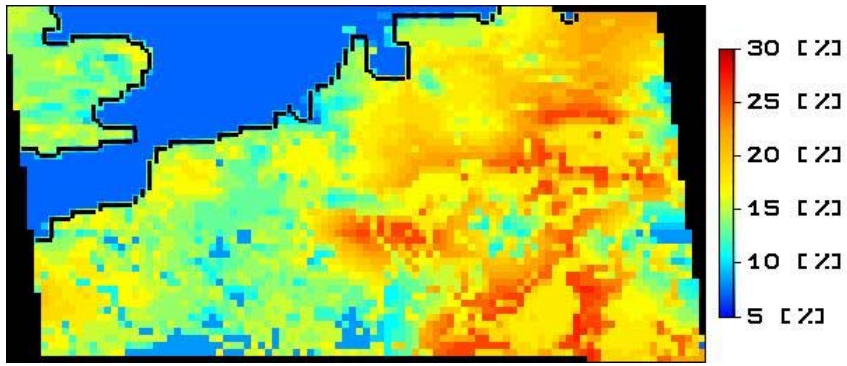
ALADIN SURFACE ALBEDO

Updated monthly!

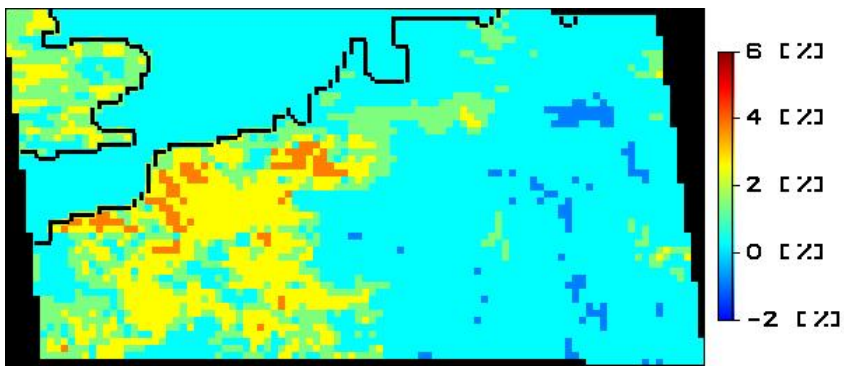
FEBRUARY



MARCH

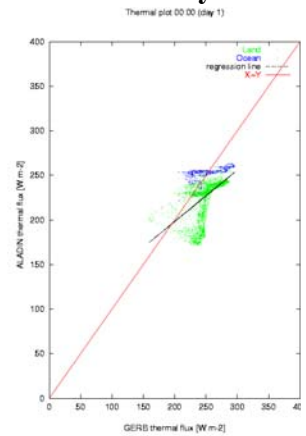


MARCH - FEBRUARY:



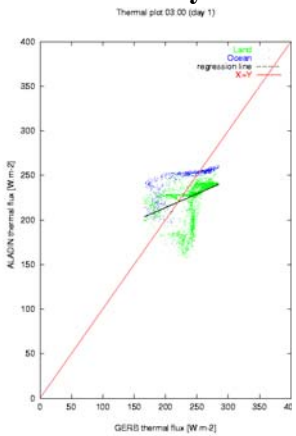
THERMAL FLUX COMPARISON: 2002-02-15
00:00 UTC RUN

00:00 day 1



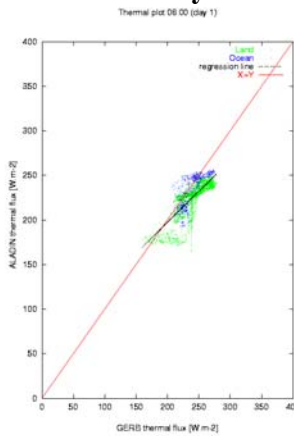
R=0.51

03:00 day 1



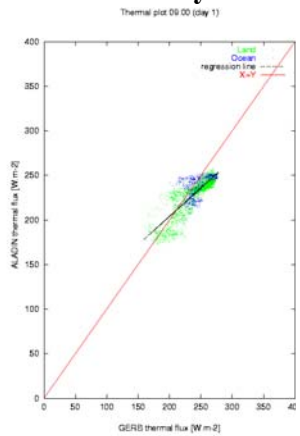
R=0.38

06:00 day 1



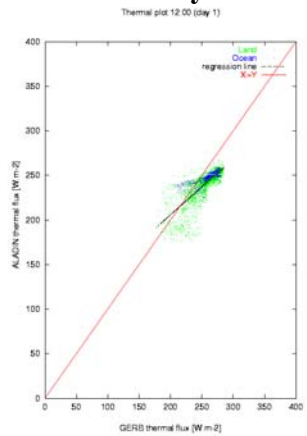
R=0.78

09:00 day 1



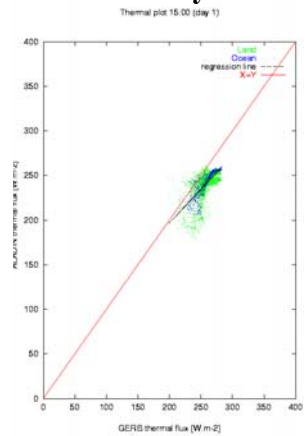
R=0.84

12:00day 1



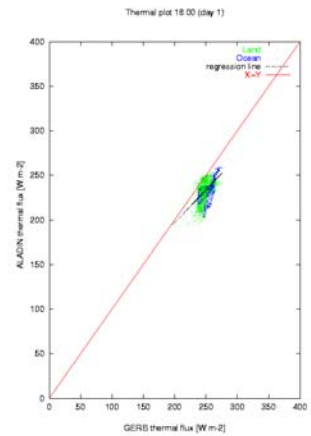
R=0.80

15:00 day 1



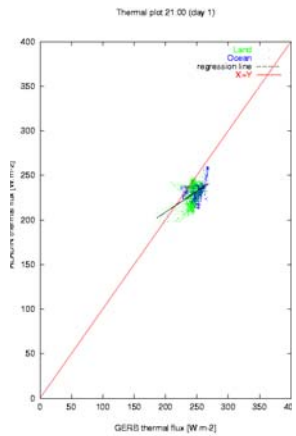
R=0.68

18:00 day 1



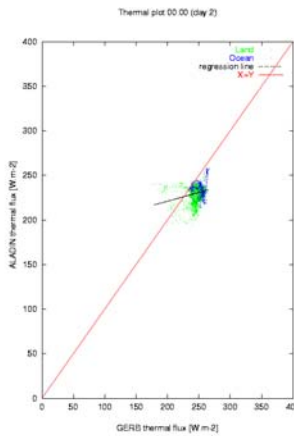
R=0.56

21:00 day 1



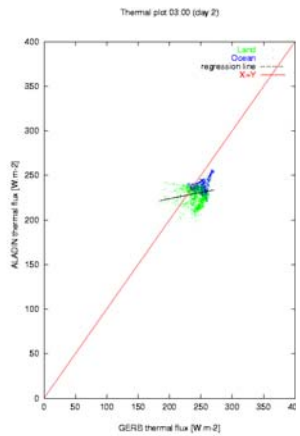
R=0.47

00:00 day 2



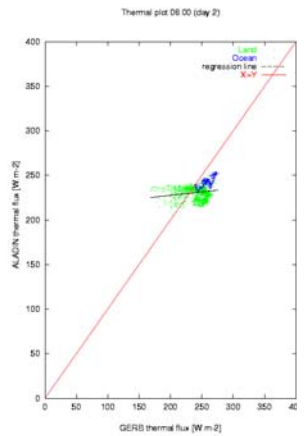
R=0.23

03:00 day 2



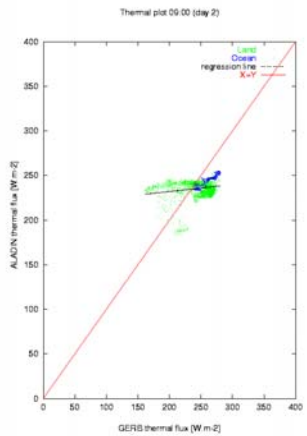
R=0.17

06:00 day 3



R=0.16

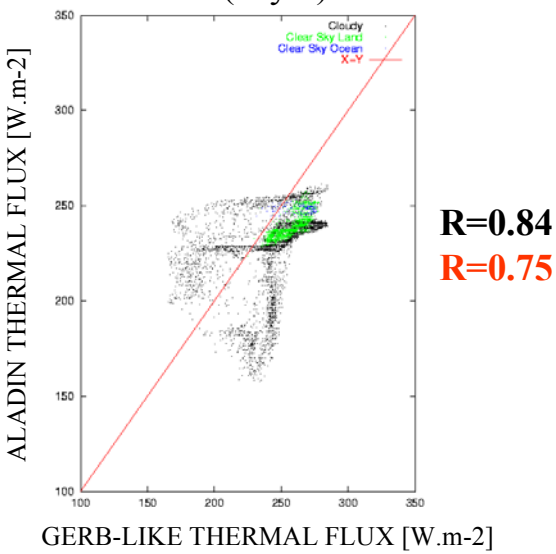
09:00 day 3



R=0.19

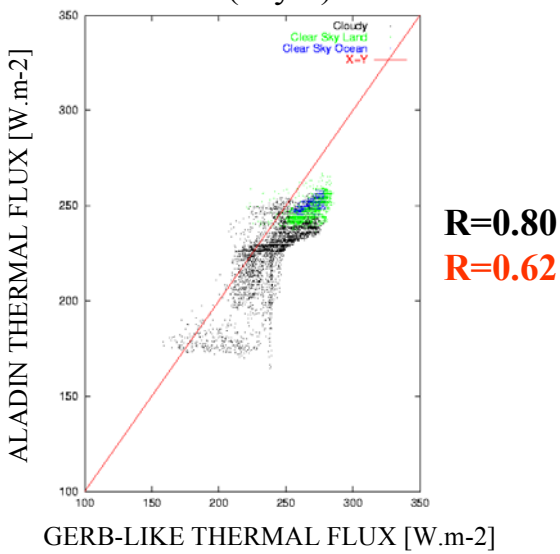
THERMAL FLUX COMPARISON: 2002-02-15 00:00 UTC RUN

09:00 (day 1)



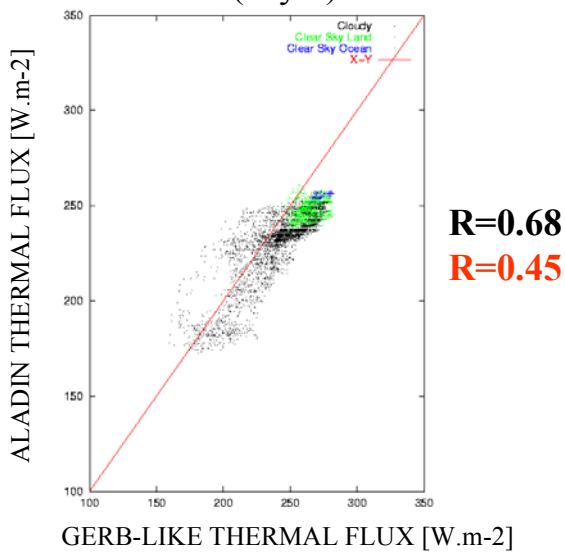
R=0.84
R=0.75

12:00 (day 1)



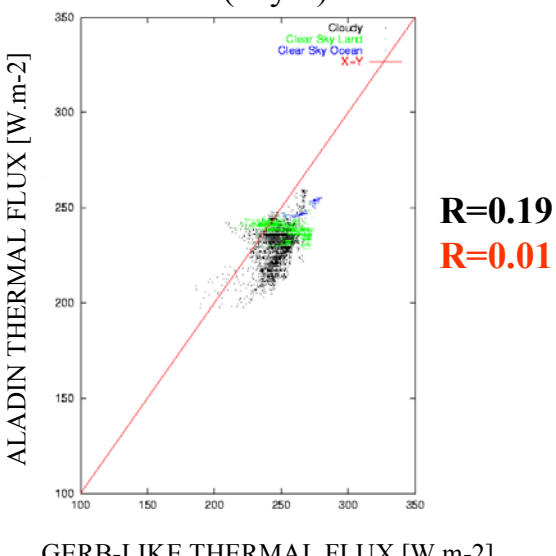
R=0.80
R=0.62

15:00 (day 1)



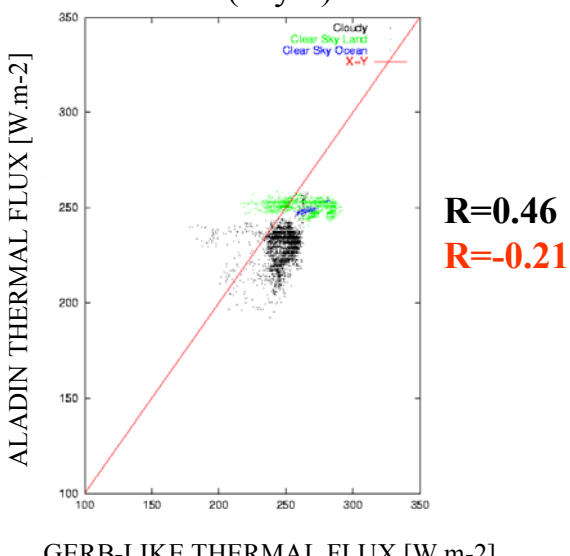
R=0.68
R=0.45

09:00 (day 2)



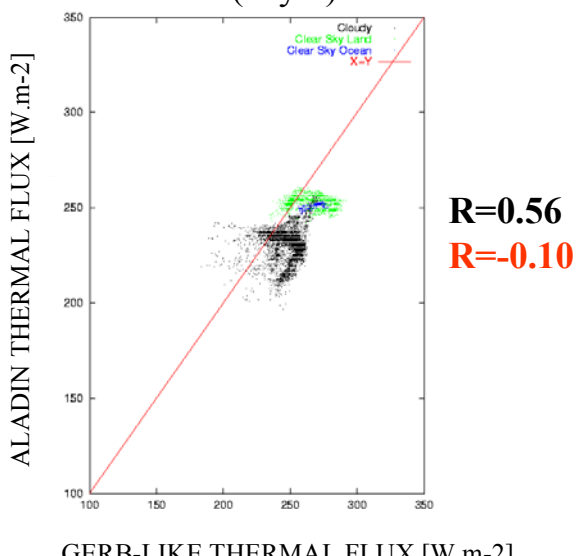
R=0.19
R=0.01

12:00 (day 2)



R=0.46
R=-0.21

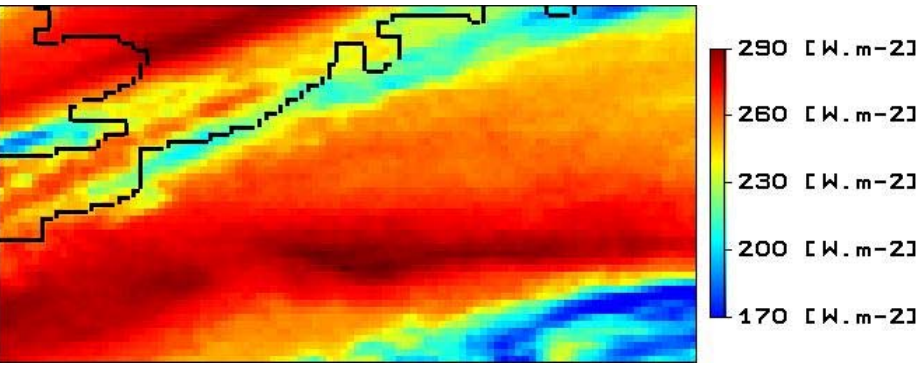
15:00 (day 2)



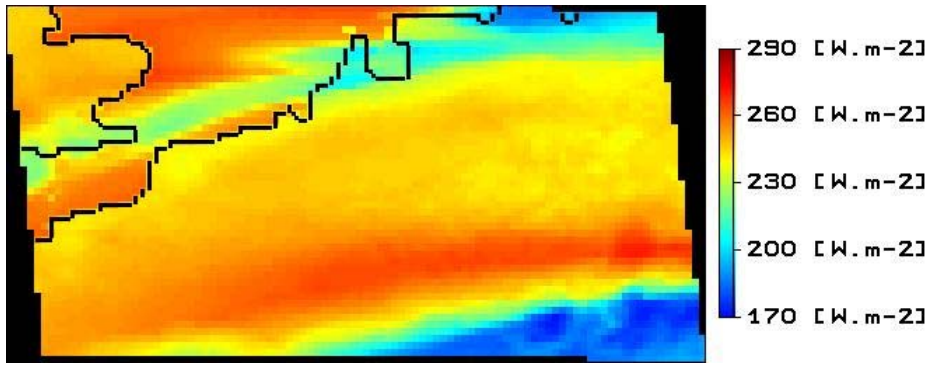
R=0.56
R=-0.10

THERMAL FLUX COMPARISON:
15-02-02 (9:00 AM DAY 1)

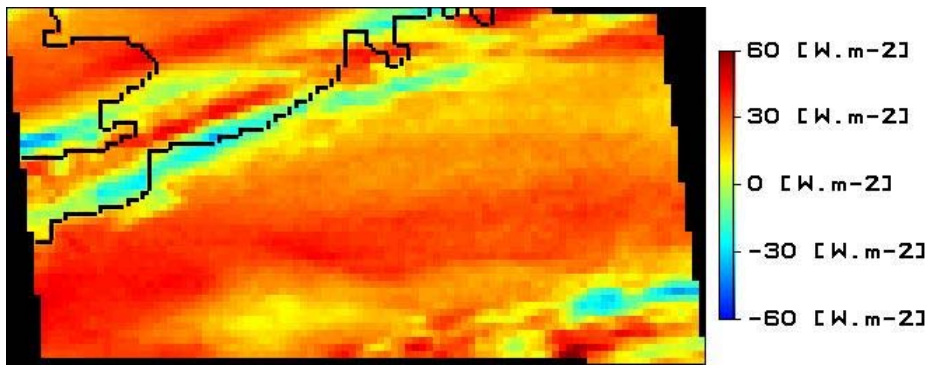
GERB-LIKE THERMAL FLUX



ALADIN THERMAL FLUX



(GERB-LIKE - ALADIN) THERMAL FLUX



CONCLUSIONS AND PERSPECTIVE

- **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**