SIMBA the nanosatellite: the Sun-earth IMBALanance radiometer

Steven Dewitte
3 Unit cubesat
Sun – Earth measurement

SW: 0-4 micron
1364 W/m²
Average: 341 W/m²

LW: 4-100 micron
240 W/m²

TOT = SW + LW
0-100 micron
max day: 500 W/m²
Average: 340 W/m²
Science goal 1

• Continue measurements of long term Total Solar Irradiance observations
• Importance: Essential Climate Variable
• How: make solar measurements with cavity radiometer
• Heritage: DIARAD type radiometers
Cycle 23+24 TSI variations
Science goal 2

- Improve knowledge of the TSI absolute level: the solar constant
- Importance: THE radiometric reference measurement
- How: cavity radiometer with improved design: no baffle, good spatial uniformity + aperture measurements + pre-flight ground comparison with cryogenic radiometer
- Heritage: DIARAD
Science goal 3

• Continue Earth Radiation Budget measurements
• Importance: Essential Climate Variable
• How: measure Total and Shortwave/Longwave radiation with cavity radiometer
• Heritage: GERB, NASA ERBE WFOV, NASA CERES, BOS
Earth radiation (annual mean)

Emitted thermal

Reflected solar

Total outgoing
Science goal 4

• First ever measurement of the Earth Radiation Imbalance
• Importance: driver of climate change
• How: accurate intercomparison of incoming solar and outgoing terrestrial radiation with single cavity radiometer
Pointing modes

nadir pointing:

zenith pointing:

solar pointing:

EARTH

EARTH

EARTH

SUN
Foldout view

- Secondary sensor face: nominally zenith pointing
  - Black flat sensor
  - White flat sensor
- Nominal front face
  - +X face
  - -Y face
- Nominal back face
  - -X face
- Main sensor face: nominally nadir pointing
  - Must contain accurate sun and earth pointing sensors
  - +Z face
  - +Y face

Nominal flight direction: +X

Blue: solar panels
Red: payload area
Aperture
Current status

- QM cavity main mechanical parts constructed, surface treatment ongoing
- Testing electronics principle and noise measurement
- Satellite mechanical structure purchased
- Electrical Power Supply ordered
- Open ITT's: ADCS system, radio communication, solar panels
- To be ordered: On Board Computer, Command & Data Handling Software
Conclusions

SIMBA: fast development, low-cost nanosatellite for measurement TSI & ERB
Components to be ordered by end 2012
Satellite ready end 2013
Launch early 2014
Open for collaboration
SIMBA team

Royal Meteorological Institute of Belgium : lead institute

• Steven Dewitte: Principal Investigator
• Andre Chevalier: Project Manager
• Christian Conscience, Sami Bali, Joel Pierrard, Pierre Malcorps: instrument realisation
• Els Janssen, Sabri Mekaoui: instrument science
• Nicolas Clerbaux : Earth Radiation Budget science

Cols from partner institutes

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