

# IRC 3DRT Working Group – 2005 Annual Report

**Chair: Cahalan**

**Exec Committee: Barker, Davies, Davis, Evans, Haigh, Macke, Marshak, Mayer, Oreopoulos, Pincus, Pinty, Szczap, Zhuravleva**

## **Documentation:**

1. *RAM| overview, Pinty et al., JGR.*
2. "I3RC: Bringing Together the most advanced RT tools for cloudy atmospheres," *Cahalan, Oreopoulos, Marshak, Evans, Davis, Pincus, Yetzer, Mayer, Davies, I3RC participants, BAMS, To Appear in September 2005 issue of BAMS.*
3. *3DRT in cloudy atmospherics, Elsevier, A.Marshak&A.Davis, eds, multiple chapter authors.*
4. Papers by several participants on a variety of 3DRT applications.

**Remote Sensing Applications:** Coordinated support needed to fully exploit 3DRT!

**Funding/Open Source:** I3RC renewed by NASA & DOE: 3D satellite retrievals, new cases w/multiple satellite instruments MODIS, MISR, and ASTER, and aircraft THOR, & I3RC Open Source Initiative, w/ first release 20 July, 2005. RAM| renewed by EC: New RAM| website completed, with tools for proper formatting of submitted input. Includes Phase 3 RAM| cases. New I3RC web beginning development in August 2005, will include Phase 3 I3RC cases.

**Workshop:** 10-14 Oct 2005, Uni. Kiel, 3DRT Retrievals & Open Source.

**GRP:** GRP meets again 3-6 Oct 2005 in Paris.

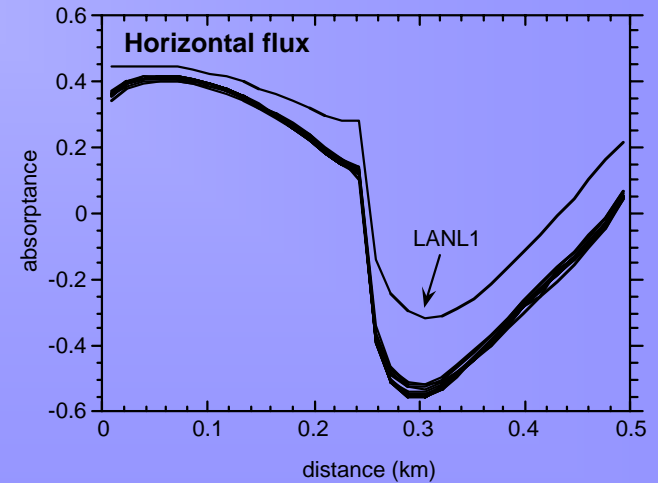
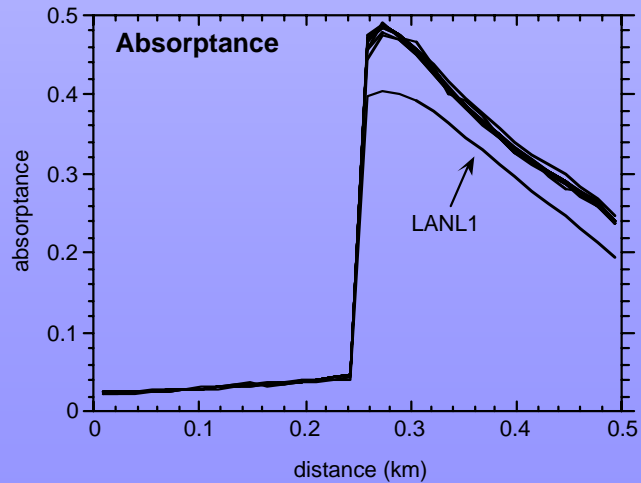
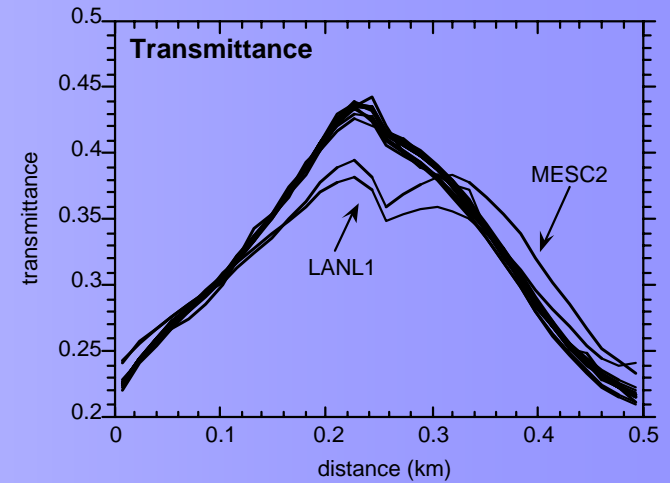
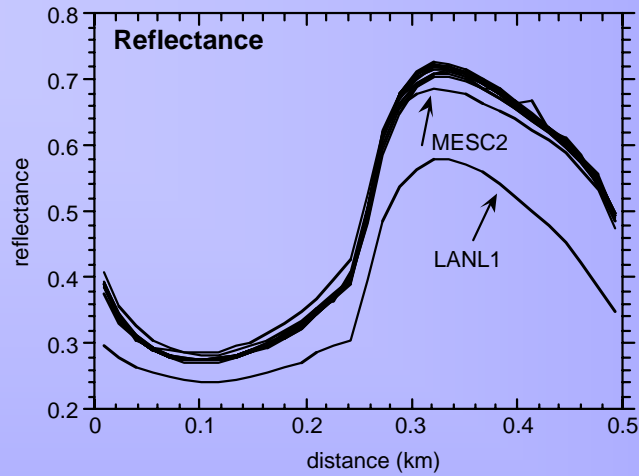


# I3RC Phase 3 Plans

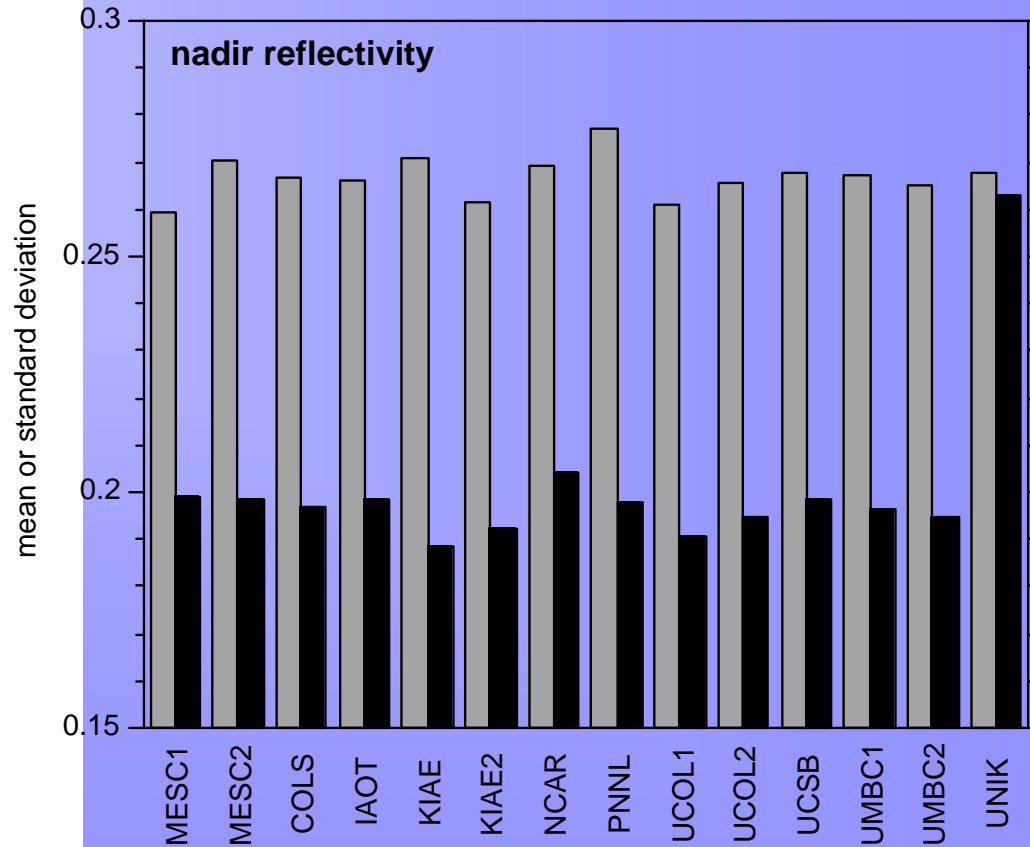
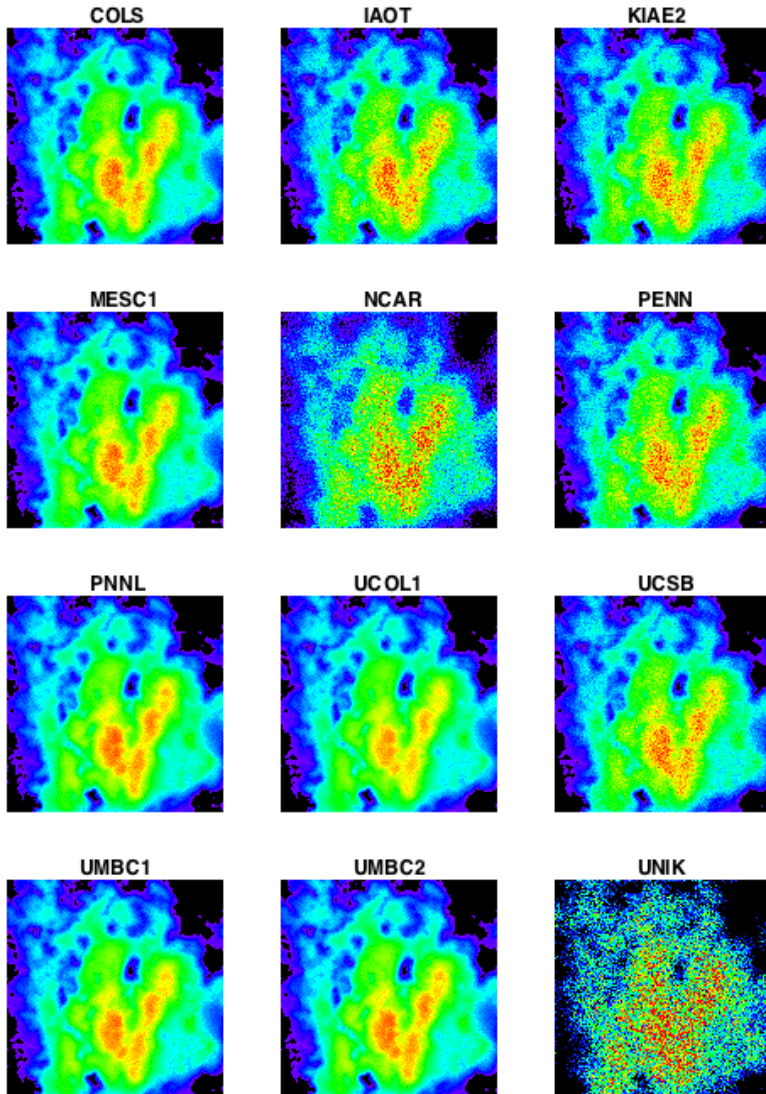
- **Phase 3 I3RC-3 Workshop** to plan and coordinate activities, to be held on October 11-14, 2005 partly in Kiel, Germany and partly on board Baltic vessel "Color Fantasy"
  - **New cases** : (1) *Multi-instrument case*: solar photon transport in a broken cloud field observed by several instruments on the Terra satellite, and (2) *THOR-WAIL case*: 3D spread of lidar pulses in optically thick clouds (THOR-WAIL case).
  - **Community Monte Carlo Code** : enhancements to extend the recently released I3RC 3DRT code
  - **Educational website** development to extend current I3RC site to new 3DRT activities including THOR and RAMI.



# Case 1 fluxes



# Case 3 nadir reflectivity



Phase I fields

Case

CASE 1 CASE 2 CASE 3

Experiment

- Solar Zenith=0, SSAIbedo=1
- Solar Zenith=60, SSAIbedo=1
- Solar Zenith=0, SSAIbedo=0.99
- Solar Zenith=60, SSAIbedo=0.99
- Solar Zenith=60, SSAIbedo=1, sfcIbedo=0.4, Phasefunc=HG
- Solar Zenith=0, SSAIbedo=1, sfcIbedo=0, Phasefunc=C1
- Solar Zenith=60, SSAIbedo=1, sfcIbedo=0, Phasefunc=C1
- Solar Zenith=60, SSAIbedo=1, sfcIbedo=0.4, Phasefunc=C1

Information

Plot Type X-Y Plot 2D Plot Participants

Completion Status Row 1

Variable

- Reflectance (R)
- Transmittance (T)
- Absorptance (A)
- Net Horizontal Flux (H)
- Nadir Reflectivity (Iu)
- Reflectivity, View=60, Azi=0 (I601)
- Reflectivity, View=60, Azi=180 (I602)
- Zenith Transmissivity (Id)

Orientation of X-axis Labels

- Vertical X-axis Labels
- Horizontal X-axis Labels

Select Participants to show on graph

<input type="radio"/> ARIZ	<input type="radio"/> COLS	<input type="radio"/> IAOT
<input type="radio"/> KIAE1	<input type="radio"/>	<input type="radio"/>
<input type="radio"/> LANL2	<input type="radio"/>	<input type="radio"/> MESC1
<input type="radio"/> MESC2	<input type="radio"/> NCAR	<input type="radio"/> PENN
<input type="radio"/> PNNL	<input type="radio"/> UCOL1	<input type="radio"/> UCOL2
<input type="radio"/> UCSB	<input type="radio"/> UMBC1	<input type="radio"/> UMBC2
<input type="radio"/> UMBC3	<input type="radio"/>	<input type="radio"/> UNIK
<input type="radio"/> ALL PART.	<input type="radio"/> Conmean	<input type="radio"/> Conmean-App
<input type="radio"/> Conmean-Out		

Create Image Dump image to EPS

[jrc.gsfc.nasa.gov](http://jrc.gsfc.nasa.gov)  
[rami-benchmark.jrc.it](http://rami-benchmark.jrc.it)

[jeanluc.widlowski@jrc.it](mailto:jeanluc.widlowski@jrc.it)

Needed: Unified 3DRT web  
 CLIVAR MIP list: [meehl@ucar.edu](mailto:meehl@ucar.edu)

## "Heterogeneous" conditions



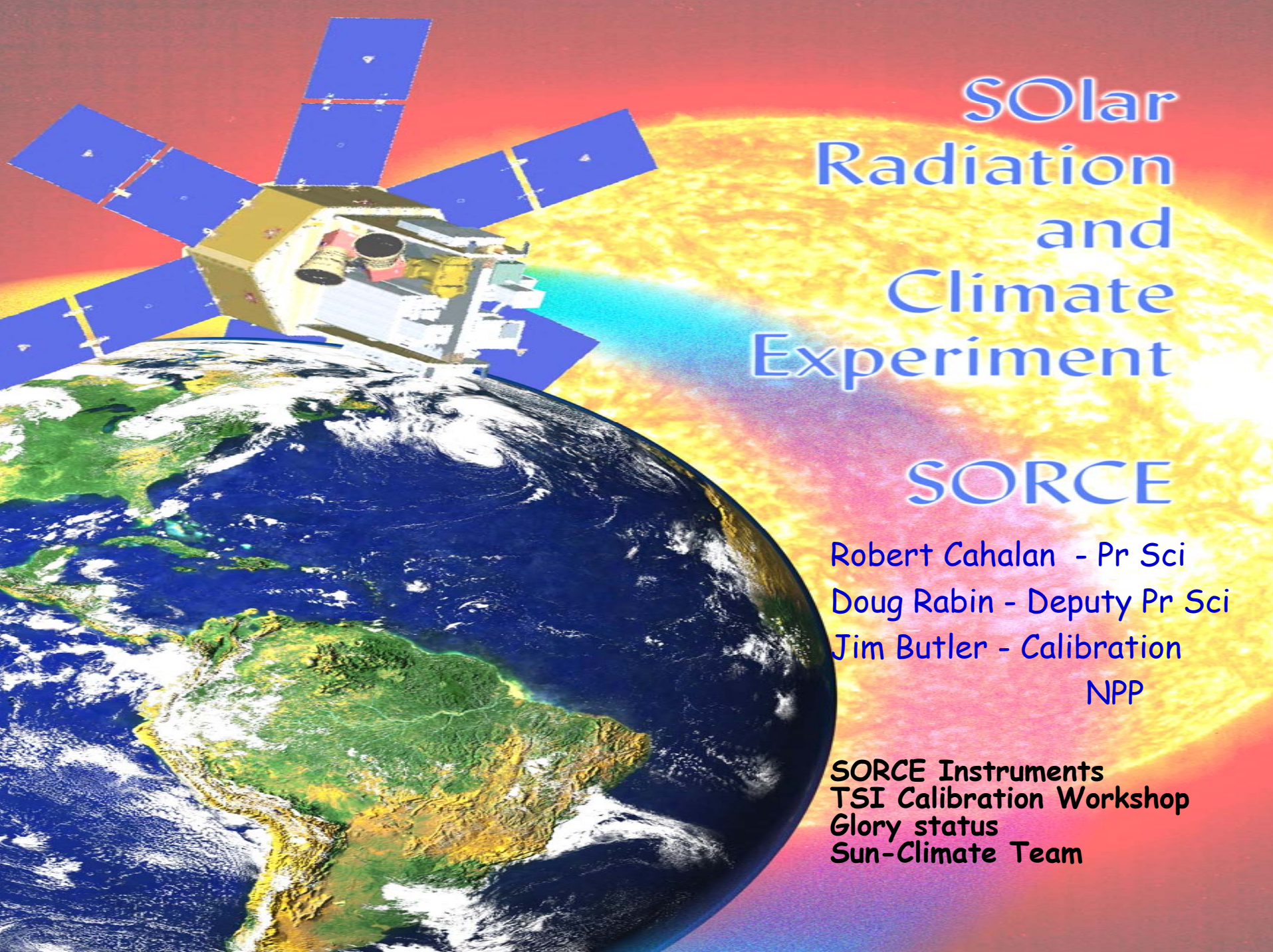
"The radiation transfer model int

## Applications: remote sensing

1. Quantification of uncertainties introduced by 1D approximations
2. Correction or "undoing" of 3D effects:
  - Deconvolution (Marshak et al. 1998)
  - Neural network (Faure et al. 2002)
  - Iterative retrieval (Zinner, 2004)
3. Explicit use of 3D structure
  - Off-beam lidar (Cahalan, Davis)
  - In-situ Lidar (Evans, 2003)
  - Spherical clouds







# Solar Radiation and Climate Experiment

## SORCE

Robert Cahalan - Pr Sci

Doug Rabin - Deputy Pr Sci

Jim Butler - Calibration

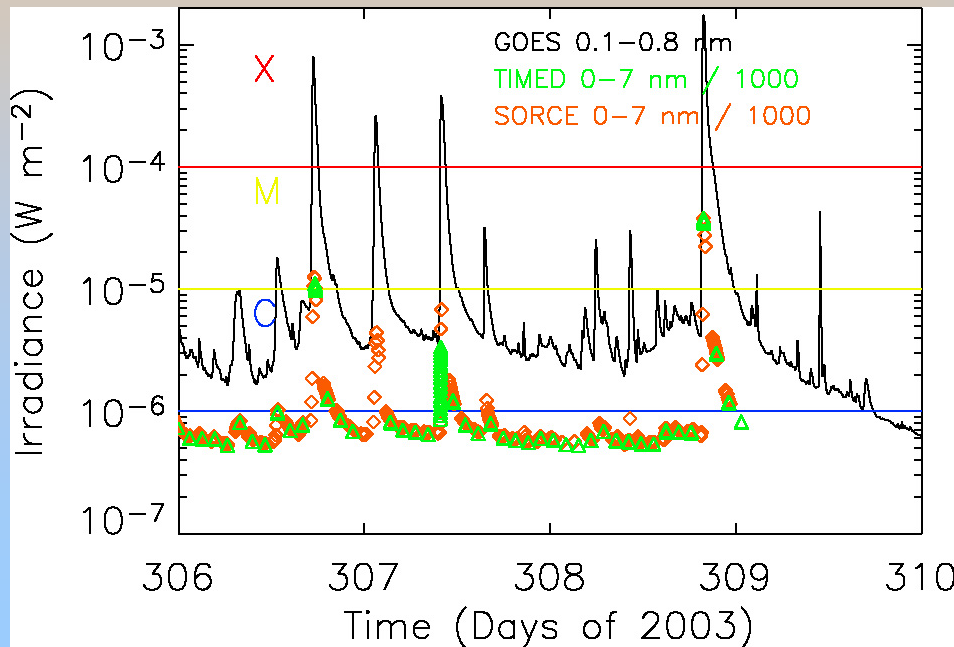
NPP

**SORCE Instruments  
TSI Calibration Workshop  
Glory status  
Sun-Climate Team**



## SORCE PI - Gary Rottman, UCO/LASP

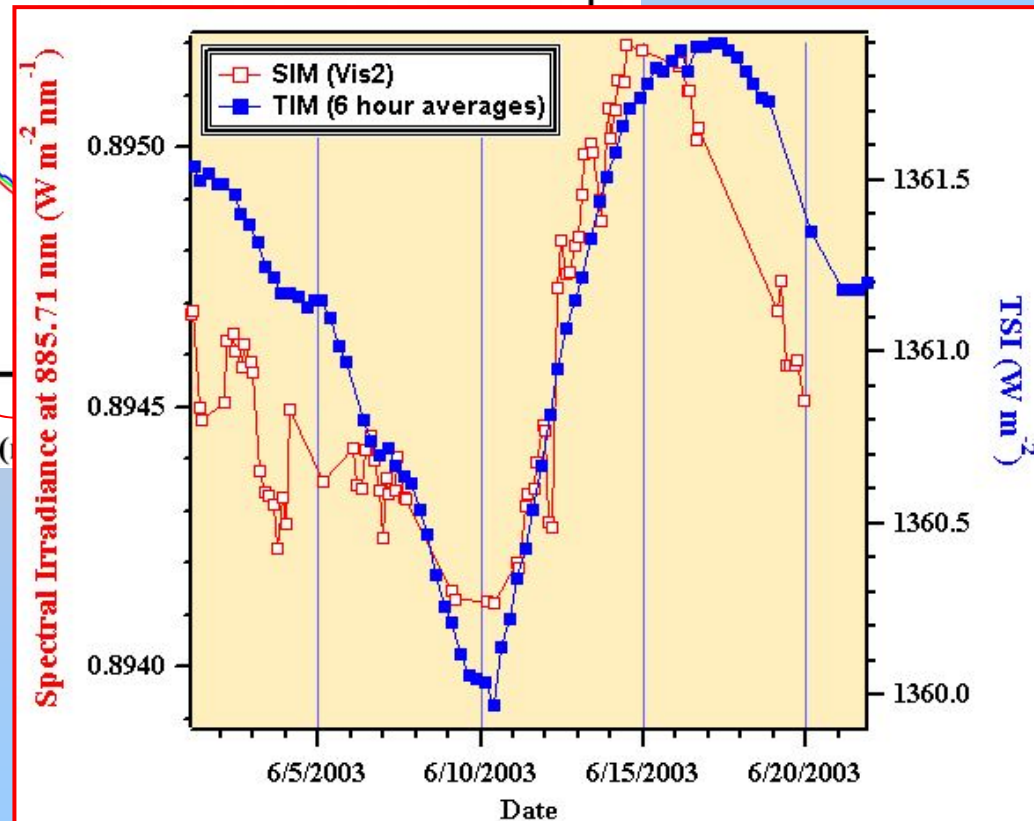
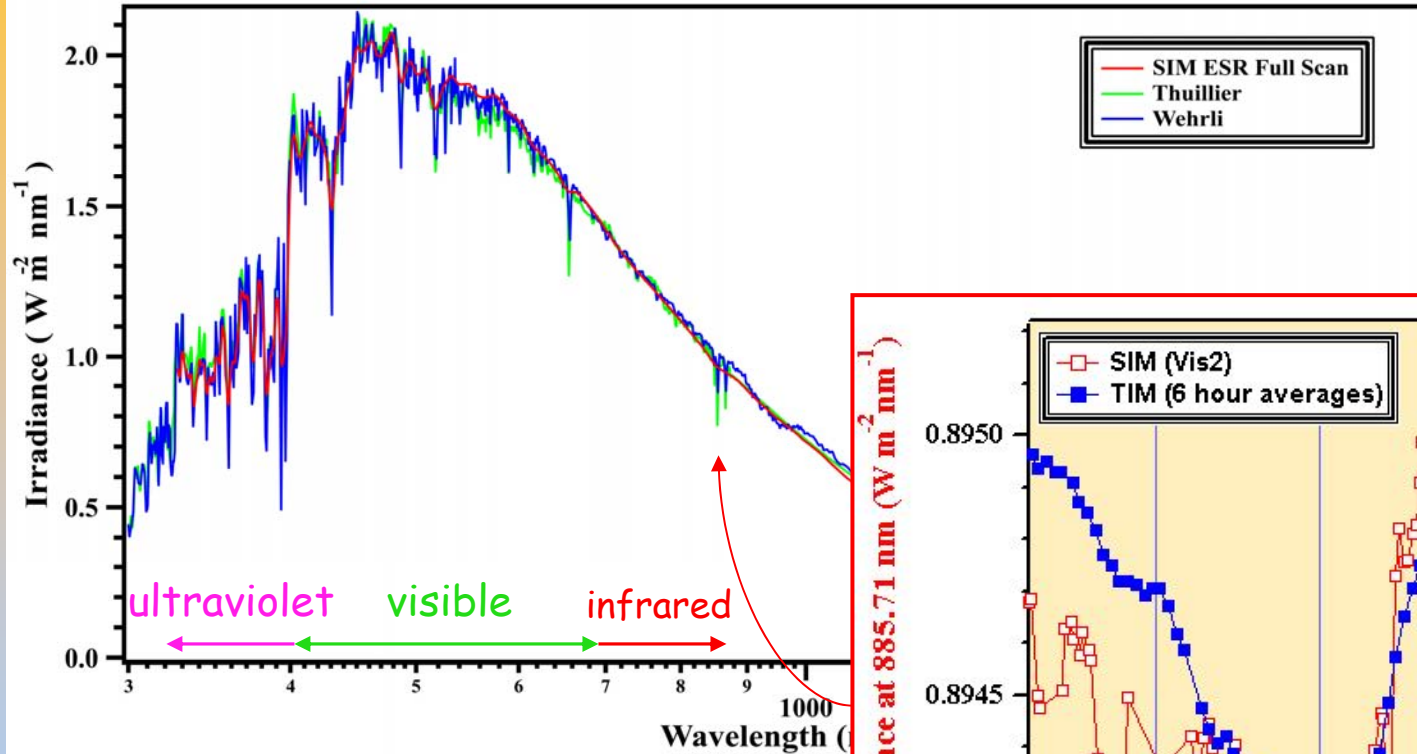
- XPS - Tom Woods (& XPS on TIMED, EVE on SDO)
- Solstice - Bill McClintock (Solstice on UARS)
- SIM - Jerry Harder (New! Across Sun's spectral peak)
- TIM - Greg Kopp (Geo Lawrence-phase-sens detection)



- X-class flares 11/1 - 11/4**
- Nov 4 saturated GOES
  - 0-7 nm QuickTime™ and a YUV420 codec decompressor are needed to see this picture. **100**
  - Comm satellite lost
  - Aurora in Boulder

## SIM - Spectral Irradiance Monitor

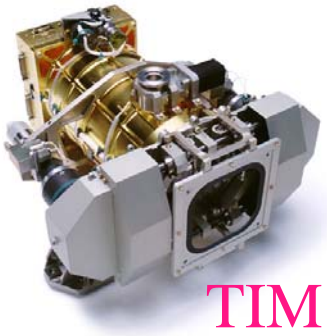
Jerry Harder, SIM Instrument Scientist, UCO/LASP



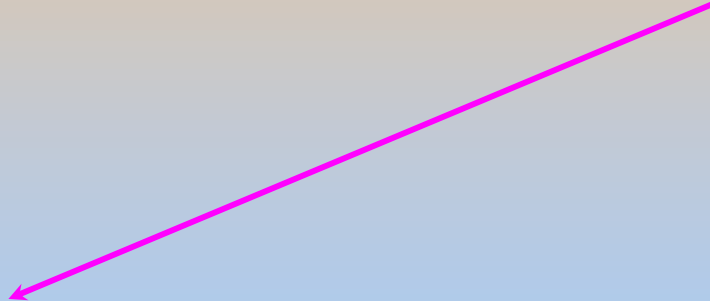
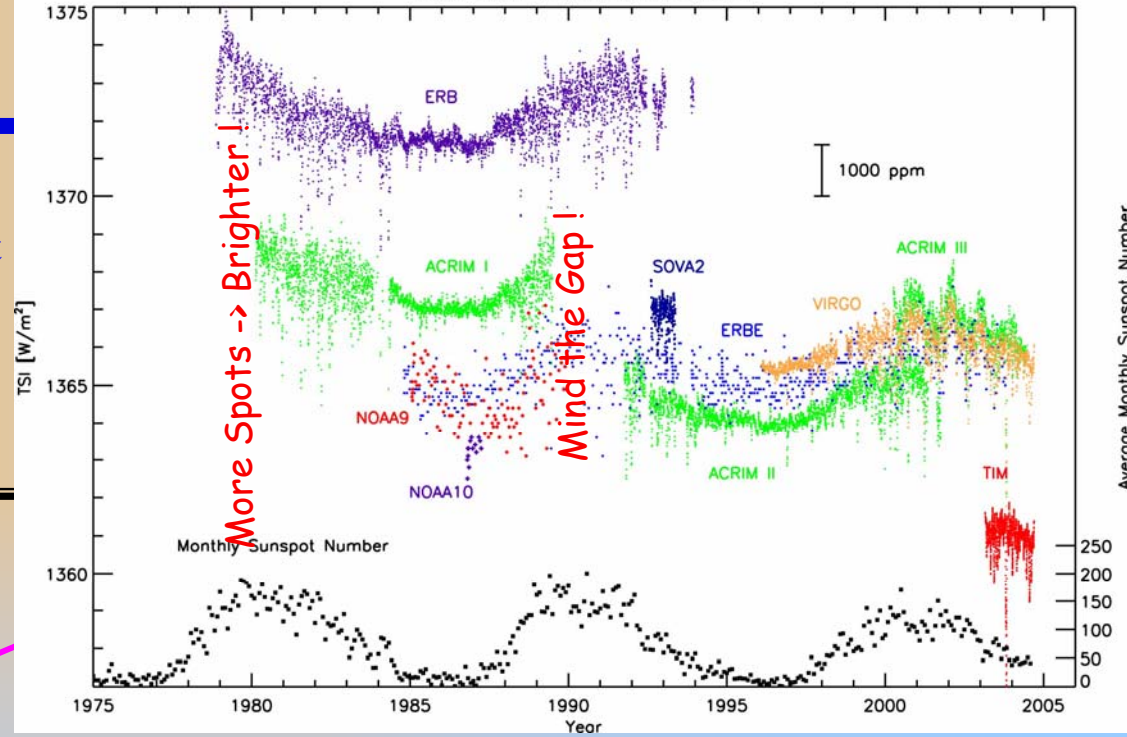


# Solar Energy Variations

Greg Kopp, UCO/LASP  
TIM Instrument Scientist



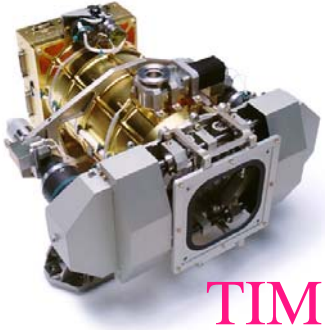
TIM



“If there is any ONE parameter I would like to know better, it would be how much the energy from the Sun is varying, by having a high quality platform outside the atmosphere, a satellite, because the satellite observations that we have have been short-term -- one satellite comes down, another goes up -- very hard to match those things up. So we have very poor understanding of the actual output of the Sun. It’s like trying to balance your checkbook when you don’t know what your income is -- it’s very hard to do.”

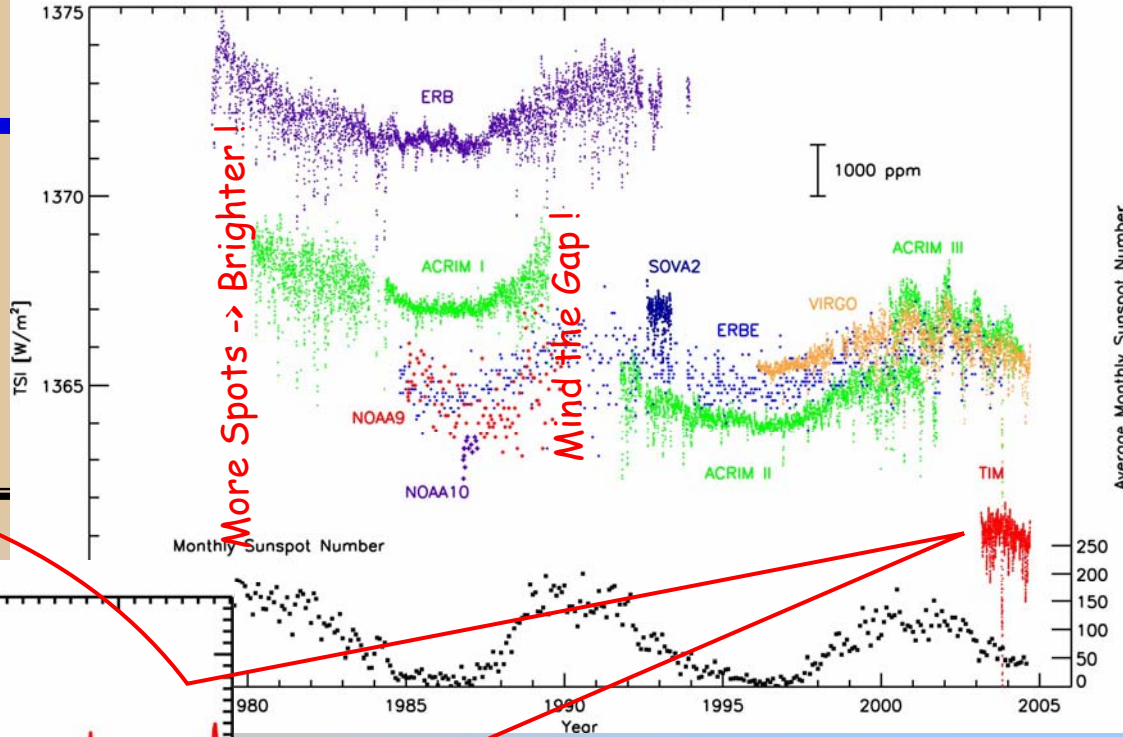
-- Ray Bradley, Umass, author of Paleoclimatology: Reconstructing Climates of the Quaternary. Academic Press, San Diego, 610pp, from 6 Apr 2005 webcast, Understanding Changes in the Earth's Temperature and Climate: The Science Behind the Hockey Stick Graphs and Model Simulations, at <http://www.ucar.edu/webcasts/>

## Solar Energy Variations



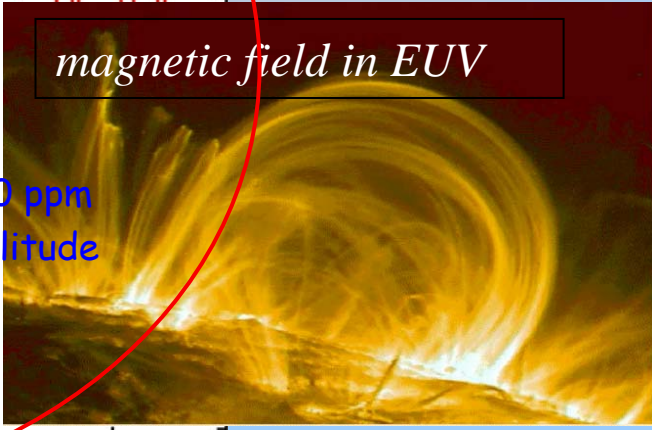
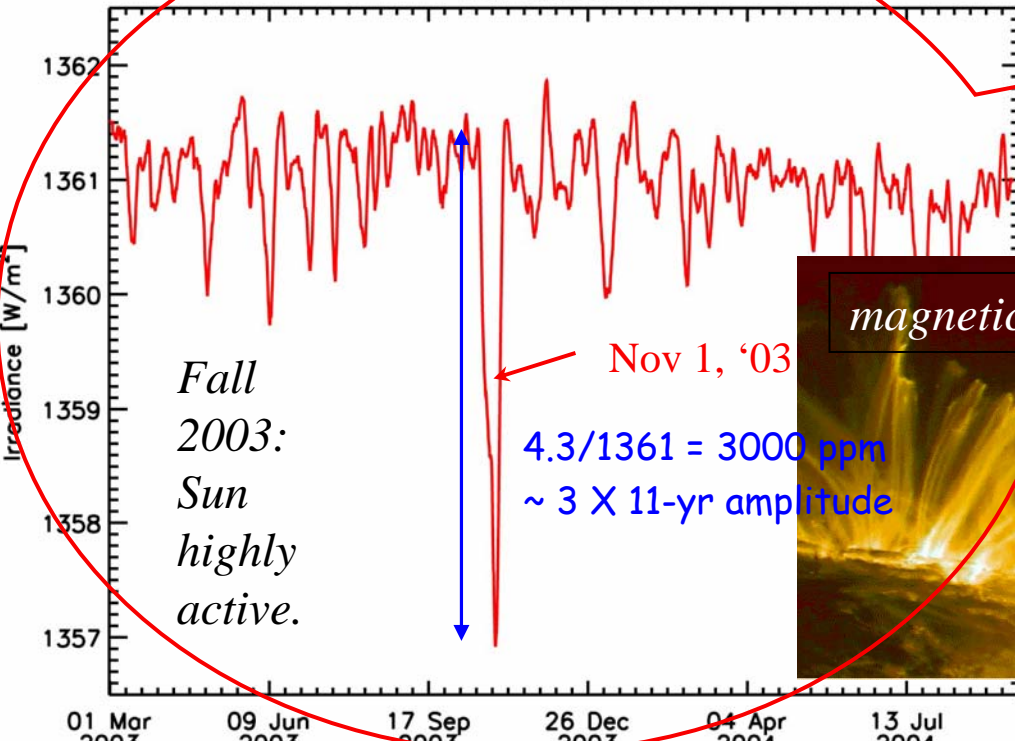
TIM

Greg Kopp, UCO/LASP  
TIM Instrument Scientist

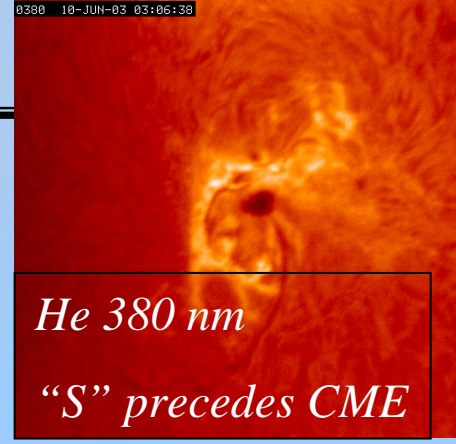


Active region passages:

TIM Irradiance



*magnetic field in EUV*



*He 380 nm*

*"S" precedes CME*

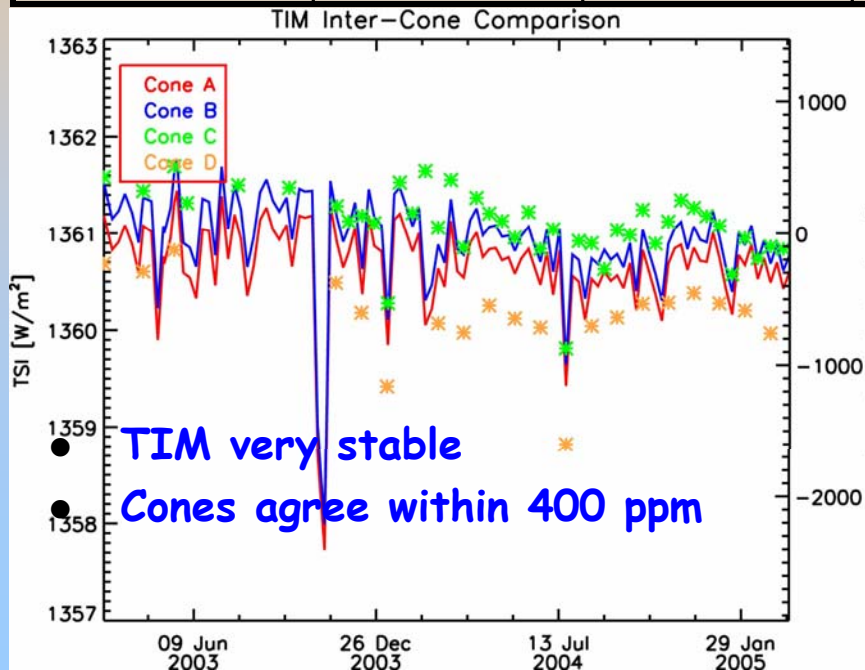
## *Summary of Instruments*

<b>Instrument</b>	<b>Comments on Instruments</b>
ERB (NIMBUS 7)	1 cavity; the best TSI measurement made when it started!
ACRIM I	3-cavity; darks are modeled; passive thermal; TRW aperture calibration questionable; on-board V & I monitors
ACRIM II	3-cavity; dark measurements available (darks are currently modeled); passive thermal; JPL Metrology Lab aperture calibration; questionable TRW calibrations; extended cone tips; on-board V & I monitors
ACRIM III	3-cavity; darks are modeled; passive thermal; JPL aperture calibration (OMIS II); on-board V & I monitors
ERBS	1 cavity; bi-weekly 3-min TSI measurements; dark measurements; large thermal variations during operations; lacks several correction factors; 13-bit resolution
VIRGO-PMO	2-cavity; darks are modeled; good passive thermal stability from L1; low-frequency 'shutter'; on-board V & I monitors
VIRGO-DIARAD	2-cavity; darks are modeled; good passive thermal stability from L1; poor inter-cavity agreement on SOHO; on-board V & I monitors
TIM	4-cavity; frequent dark measurements; active thermal control; aperture and shutter at front; pulse width modulation ESR heating; V & R are references; pulse width non-linearities corrected from ground TIMs



## Summary of Instrument Accuracies

Instrument	TSI Value [W/m <sup>2</sup> ]	Uncertainty [ppm]	Cones $\sigma$ [ppm]	Comments
ERB (NIMBUS 7)	1371.9	10000	-	
ACRIM I	1367.5	1000	784	
ACRIM II	1364.2	2000	3187	apertures? cone tips?
ACRIM III	1366.1	1000	1518	
ERBE	1365.2	833	-	lacks several corrections
VIRGO-PMO	1365.7	1204	299	
VIRGO-DIARAD	1366.4	470	2950	5.7 W/m <sup>2</sup> cavity difference
TIM	1361.0	350	266	4.7 W/m <sup>2</sup> lower than others



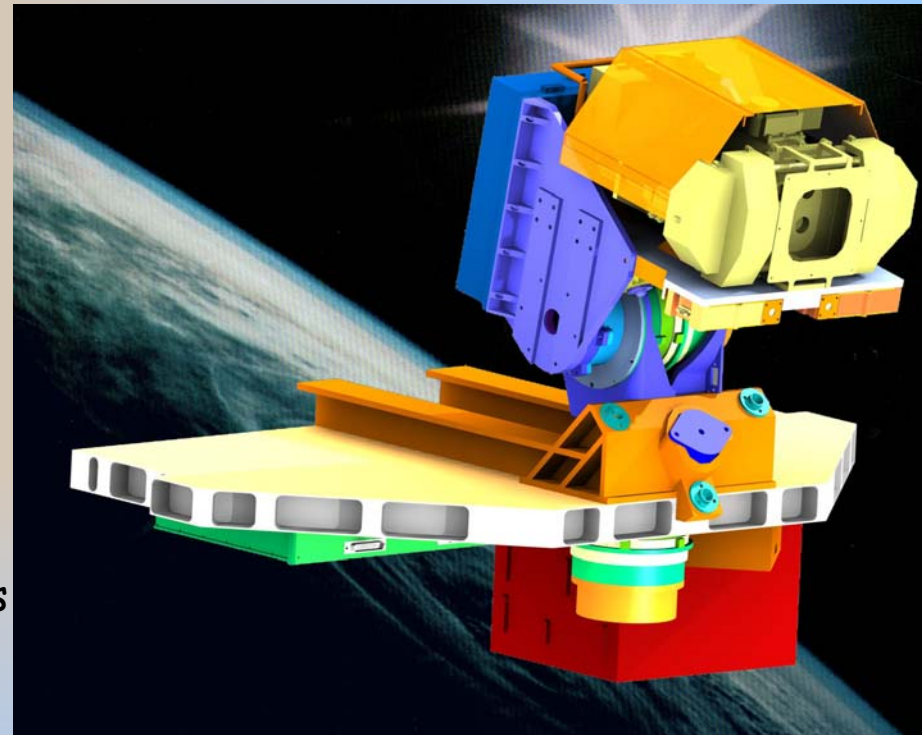
# Atmospheric Aerosols & Total Solar Irradiance

## *GLORY*

The *Glory* satellite will use the refurbished bus of the cancelled VCL satellite and will carry two instruments:

- Aerosol Polarimetry Sensor (APS)
- Total Irradiance Monitor (TIM)

- Launch Scheduled Dec '08
- Project Manager, Richard Burg: "Glory plans to overlap with SORCE. How much overlap is an HQ call. The SIM measurement can only be done by SORCE."
- Satellite and instrument builds funded
- NASA/HQ working to re-instate Taurus contract.
- Glory Project Scientist - Michael Mishchenko, NASA/GISS
- APS Instrument Scientist - Brian Cairns, NASA/GISS
- TIM Instrument Scientist - Gary Rottman/Greg Kopp, UCO/LASP



# International Polar Year - 2007

## Observations Working Group (OWG)

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- *An international program of coordinated research to explore the polar regions, deepen understanding of polar interactions including their role in global climate, expand our ability to detect changes, and extend this knowledge to the public and decision makers. (ICSU IPY Planning Group<sup>4</sup> and NAS US National Committee on IPY, 2004)*
- Key elements
  - **Assess** large-scale polar environmental change
  - **Explore** unknown domains in the polar regions
  - Advance uses of **technology** to enable innovative polar observations
  - Increase **public understanding** of and participation in polar science (Website: <http://www.ipy2007.org>)
- Participating **Agencies**: NSF, NASA, NOAA, DOI, DOE, DOD, EPA, NIH...  
**International** coordination: ICSU, WMO.
- Focus on **human impact** of polar environmental changes and impact of human changes on physical environment
- **Polar feedbacks** are a near-term CCSP priority
- Relates to impacts on **sea level**



# International Heliophysical Year - 2007

## Observations Working Group (OWG)

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- *TSI - an undervalued CCSP observation?*
  - "If there is any ONE parameter I would like to know better, it would be how much the **energy from the Sun** is varying." Ray Bradley, Umass, co-author of "Hockey Stick" plot of 1000-2000 AD global temperatures."
- *IHY: To advance understanding of the processes that govern the Sun, Earth, Planets, and Heliosphere*
- Description - Involves cross-disciplinary studies from
  - Solar Physics
  - Planetary Magnetospheres
  - Heliosphere and Cosmic Rays
  - Planetary Ionospheres, Thermospheres and Mesospheres
  - **Climate Studies**
- Agency and Programs involved
  - NASA, NSF
  - Participating countries across the globe, IUGG
  - Website: <http://ihy2007.org/>
- Coordinating with International Polar Year (IPY) and electronic Geophysical Year (eGY)