ARM Radiative Processes Working Group Meeting November 2008

Welcome!

- Joint meeting with the Cloud Modeling WG
- Major objectives of this meeting:
  - Share our results with our peers
  - Foster collaborations and discussions
  - Make recommendations to the infrastructure
  - Discuss the new ARM Science Plan

Science and Infrastructure Steering Committee (SISC)

- Advisory board for DOE ARM program managers
- Assist ARM Science and Infrastructure Program Managers to
  - Develop overall science vision and strategy for implementation
  - Develop strategies to produce/decommission VAPs
  - Develop strategies for measurement systems
  - Identify parameters that need to be measured or diagnosed
- Membership:
  - ARM Chief scientist
  - Chairs from each of the 4 working groups
  - AMF chief scientist
  - Infrastructure management board members
    - Including AVP and DQO representatives

ARM Working Group Chairs

- Radiative Processes: Dave Turner
- Aerosol: Beat Schmid
- Cloud Properties: Matthew Shupe
  - Replaces Eugene Clothiaux
- Cloud Modeling: Ann Fridlind
  - Replaces Steve Klein

Steering Committee

- Working groups have steering committees to help the chairs

- I lean heavily on the SC for RPWG
  - Sally McFarlane
  - Bob Ellingson
  - Chuck Long
  - Andy Vogelmann

RPWG Highlights (1)

- 17 Research Highlights Contributed to ARM Web page from January - July 2008 that had contributions from the RPWG !
- There is lot of cross-over between the ARM working groups, so some of these fall into more than one WG (e.g., CLOWD highlights)
- Simple to do via ARM web page: just have a simple image and 2-3 paragraphs to explain the result in “everyman’s” language

RPWG Highlights (2)

- A simple algorithm to estimate cloud optical depth from broadband radiometers (Barnard et al., Open Atmos Sci J)
- Shortwave absorption in tropical clouds (McFarlane et al., JGR)
- Forcing BL cloud systems with 3-D radiative transfer (Mechem et al., JAS)
- Accurately estimating AOD in presence of 3-D RT effects of BL clouds (Kassianov and Ovtchinnikov, GRL)
- Apparent bluing of aerosols near clouds (Marshak et al, JGR)
- The large contribution of small marine clouds to cloud fraction and reflectance (Oreopoulos et al., Atmos Chem Phys)

RPWG Highlights (3)

- Susceptibility of clouds to first aerosol indirect effect (Platnick and Oreopoulos, JGR)
- A stochastic model generating broken cloud optical depth and cloud top height fields (Prigarin and Marshak, JAS)
- How much condensed water is needed to make a “cloud” (Long et al., GRL)
- Improved daytime water vapor measurements from Vaisala RS-92 radiosondes (Cady-Pereira et al., JTECH)
- Minimal SW anomalous absorption found over ACRF sites (Dong et al., JGR)
- ARM “QC-Rad” goes global (Long and Shi, Open Atmos Sci J)

RPWG Highlights (4)

- Paper on clouds with small amount of LWP ranked “Hot” (Turner et al., BAMS)
- Wide angle imaging lidar for probing dense cloud structure (Davis, JGR)
- Cloud-radiation effects on sea ice loss (Kay et al., GRL)
- Single scattering properties of aggregates of bullet rosettes in cirrus (Um and McFarquhar, JAMC)
- Quantifying optical depth of mixed-phase clouds accurately with passive sensors (Turner and Eloranta, GRSL)

Upcoming Campaigns

- Low-latitude marine StCu LWP, Oct-Nov 2008, Paquita Zuidema
- RACORO, SGP Jan-Dec 2009, Andy Vogelmann
- CLAP-MBL, Azores Apr-Dec 2009, Rob Wood
  - Extended for another year!
- RHUBC-II, Chile Aug-Oct 2009, Dave Turner

General Outline of Meeting

- Mon AM
  - International meeting summaries
  - CLOWD activities
- Mon PM
  - Shortwave Spectrometry
  - Breakout sessions (Instruments and Atmospheric State)
- Tues AM
  - Breakout sessions (Instruments and Atmospheric State)
- Tues PM
  - Summary of breakout sessions
  - RPWG science directions and focus
  - RPWG recommendations to infrastructure
- Wed AM (Joint with CMWG)
  - Climate model developments at modeling centers
  - Selected PI presentations
- Wed PM (Joint with CMWG)
  - ARM programmatic issues (RPWG adjourned at 3 pm)
- Thur and Fri: CMWG meeting

CERES / GERB Fall 08 Science Team Meeting

- Steve Klein and I were originally working with Norman Loeb to organize a joint CERES / ARM meeting
  - Didn't work this time; perhaps in future ?
  - I gave an overview of recent RPWG activities
- Meeting was held at NASA GISS in NYC
  - 2.5 days for CERES, 1.5 days for GERB
- Approximately 40 participants, primarily from US and Europe
- CERES meeting had two main objectives:
  - Review status of CERES instruments and data products
  - CERES specific co-I reports

Some of the Presentations

- Bruce Wielicki: State of US CCSP/EOS/CERES/ NPP/NPOESS/Decadal Survey Missions
  - NASA committed to following decadal survey advice, but needs significantly more budget than currently available
- Several presentations on calibration
- Several presentations on cloud algorithms
- Several presentations on their surface flux algorithms and validation activities
- Breakout sessions on
  - Angular modeling
  - Surface to TOA fluxes
  - Cloud Properties

Some of the Presentations

- Calipso/CloudSat/CERES/MODIS cloud product
- Examples of how CERES data are being used for model evaluation
- GERB-2 (in geo) is being used as a calibration transfer standard to compare various CERES sensors: SW ratios are 1.059, 1.045, 1.054, 1.071, and 1.067
- NASA senior reviews for Terra and Aqua will occur in Mar 2009

Some Personal Observations

- CERES team very dependent on Fu-Liou RT code
- Earth science is about 7% of NASA budget with space science being about 21%
  - Bruce postulated that a true space-borne climate observing system would require ~20% of current NASA budget
- CLARREO is a major advancement for TOA climate measurements
  - Aims to be an “irrefutable and high accuracy SI-traceable data record” for decadal climate change
  - Implications on the accuracy of the record (how accurate is required?), traceability on-orbit, sampling strategy, etc.
  - Aims to be a “calibration first” approach

CLARREO Science Questions (1)

Climate Forcing: Natural and Anthropogenic
1) How is aerosol direct effect radiative forcing changing over time? How accurately is this forcing change represented in climate models?
2) How is solar radiative forcing changing over time? How accurately is this forcing change represented in climate models?
3) How is the anthropogenic greenhouse gas radiative forcing changing over time? How accurately is this forcing change represented in climate models?
4) How is radiative forcing due to land use changing over time? How accurately is this forcing change represented in climate models?
5) How is the aerosol indirect effect radiative forcing changing over time? How accurately is this forcing change represented in climate models?

CLARREO Science Questions (2)

Climate Response: Change Detection, Attribution, and Prediction Accuracy

6) How is the vertical temperature and water vapor structure in the atmosphere changing over time? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

7) How are cloud properties (fraction, optical depth, emissivity, height, temperature, phase, particle size) changing over time? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

8) How is the nadir infrared radiance emission spectra of the Earth at TOA changing over time? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

9) How is the nadir solar reflectance spectra of the Earth at TOA changing over time? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

10) How are the solar reflected, infrared emitted, and net radiative fluxes at TOA changing over time for clear and all-sky? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

CLARREO Science Questions (3)

11) How are the amplitude and phase of diurnal cycles of Earth emitted and reflected spectra changing over time? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

12) How is vegetation responding to climate change, including ocean color? What part of the change is consistent with anthropogenic forcing? How accurately do climate models predict the changes?

Climate Feedbacks and Climate Sensitivity

13) What is the amplitude of cloud feedback? How accurately is it represented in climate models?

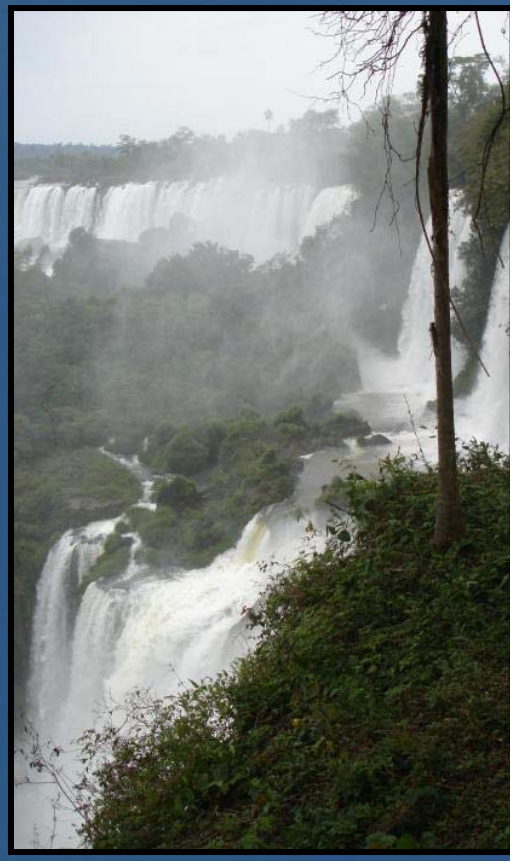
14) What is the amplitude of water vapor feedback and lapse rate feedback? How accurately is it represented in climate models?

15) What is the amplitude of surface snow and ice albedo feedback? How accurately is it represented in climate models?

16) How is the net radiative energy balance of the earth, a key measure of climate sensitivity, changing over time? How accurately is it represented in climate models?

International Radiation Symposium

- Held every 4 years
- 4 - 8 August in Foz do Iguacu, Brazil
- Strong representation by ARM funded investigators
  - 26 oral presentations
  - 44 total ARM-affiliated investigators present
  - ARM-funded scientists won two major awards:
    - IRS Gold Medal – Graeme Stephens
    - Young Scientist – Dave Tobin



IRS Sessions

- Radiative transfer theory and modeling
- Molecular radiative properties
- Particle radiative properties
- General remote sensing
- Satellite measurements
- Surface measurements and field experiments
- Radiative budget and forcing
- Weather and climate applications
- Biosphere-atmosphere interactions influencing the radiation budget

Iguacu Falls

The Science Never Stops…