New Radiative Transfer Code for CCSM4

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Topics

• Why change RT code now?
• SE concerns
• Code design
• Init/Run phases
• Please ask questions as we go!
New Science

- Gas spectroscopy
- New broadband methods
- Aerosol optics (SW and LW)
- Cloud microphysics (dynamic size, type, number concentration)
Application Needs

- Need greater accuracy
- Traceability (Where did this number come from?)
- Contexts: CAM, WACCM, Single-Column-Model, Offline, WRF
Science Requirements

- Flexibility (Constituents and optics)
- Flexibility for cloud geometry and inhomogeneity (ICA - subcolumns)
- Standardize constituent specification
- Offline repeatability (Data output)
- Comparison to line-by-line computations
Potential Candidates

- Bugsrad from CSU
- They are comparing with RTMIP
- Nothing integrated with CAM yet
- RRTMG from AER
- Will compare with RTMIP soon
- They have integrated with CAM3.4
SE Concerns

- Speed
- Memory Footprint (scalability)
  - gas, aerosol, cloud optics parameter
- Portability (machines/compilers)
- Thread/task safe
- Portability (other software contexts)
- Improve interfaces
CAM or Offline Driver

Collects Configuration Info (namelist)
Calls LW and SW with physical (sub)column(s)

RT Code

Converts physical column to fluxes and heating rates

Optics Module

Converts constituents to radiative properties, mixes optics

Rad_constituents

Registers gases
Registers aerosols
Pointer to data

Other components

Subcolumn/Cloud generator
Surface/Top B.C.s (state?)
Initialization Phase

• Read optical data for clouds, aerosols, and gases (RT)
• Register all possible sources of constituent data (CAM)
• Register namelist RT configurations (Rad or Radtest) (CAM)
• Verify optics and constituents for RT configurations are present (CAM,RT) and are the same (how?)
Summary

- New science requires new RT code
  - Spectroscopy
  - Contemporary RT methods (Accuracy)
- Concerns: scalability, speed
- Target an improvement in SE standards for interfaces.