Status Report of the 3D RT working group
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I3RC status (I3RC is an ongoing project initiated in the late 1990s): http://i3rc.gsfc.nasa.gov/

Objectives

- comparing methods available for 3D atmospheric RT calculations

- providing benchmark results for testing 3D RT codes

- publishing an open source toolkit (community 3D MC code)

- providing resources related to I3RC and 3D RT (codes, models, workshops, publications)

Activities
• The most important issue to report is public release of the first 3D RT online calculator
(see http://atmospheres.gsfc.nasa.gov/climate/index.php?section=179).
[The number of unique visitors to the online calculator since its release in Dec 2011: 325. 120 of these visitors returned more than once; these returning visitors came from 21 countries. Almost 300 visits went past the front page. (The total number of visits was over 600, but that includes accidental visits by people not interested in I3RC.)]

• What's now available:
- A new image archive about 3D radiative processes
- Consensus results of I3RC intercomparison for model verification
- Publicly available codes on 3D radiative transfer
- Expanded publication list on website: over 400 publications in the I3RC publication database

Plans
Suggestion: to rename the "3D RT" working group into "Radiative Transfer Theory and Modeling"
- RT Session at IAMAS in 2013-2014;
- creating an educational web pages on 3D RT;
- adding polarization to the I3RC community code.
- adding Rayleigh scattering to the I3RC community code.
- adding aerosols to the I3RC community code.

RAMI status (RAMI is an ongoing project initiated in the late 1990s): **http://rami-benchmark.jrc.ec.europa.eu/**

Objectives
- acting as common platform for comparison efforts of canopy RT models
- documenting uncertainties and errors among canopy RT models
- establishing protocols for the evaluation of RT models
- fostering the scientific debate

Activities:
• RAMI On-line Model Checker (ROMC)
    - web-based benchmarking facility to provide real-time evaluations of RT models.
    - ROMC graphs used as 'proof of model quality' in scientific publications.

• RAMI4PILPS
    - addresses quality of Land surface schemes in SVATs, NWPMs & GCMs
    - uses 'credible' 3D MC model identified during RAMI-3 as reference

• RAMI-IV
    - addresses quality of canopy RT models in complex plant environments
    - simulations of RT quantities at multiple scales (in situ & air/space borne instruments)

Status
- new layout of the RAMI website completed.
- RAMI4PILPS results graphs posted on website
- new layout of ROMC website under preparation.
- inclusion of RAMI4PILPS test cases into ROMC to be completed before end 2012
- analysis of abstract canopy cases of RAMI-IV completed (manuscript under preparation)
- includes effort to make use of ISO-13528 as a means to evaluate model proficiency
- presentation of preliminary RAMI-IV results at the plenary of the IVOS subgroup (2012) of CEOS' working group on calibration and validation.
- Participation in MetEOC project started with goal to evaluate 'credible' RAMI Monte Carlo models against laboratory measurements of man-made targets under perfectly controlled conditions (using the facilities of national reference laboratories in UK, Italy and Finland)
- manuscript under preparation to highlight role of 'verified' 3D Monte Carlo radiative transfer models in setting up a traceable quality assurance framework for field validation efforts of remotely sensed surface ECVs.

Plans
- complete analysis of RAMI-IV (actual canopy cases) (2012/13) and writing of manuscript (2013)
- presentation of RAMI-IV results in scientific meeting and publication online (2012/13)
- compare model simulations to laboratory measurements in the context of the MetEOC project and include the generated datasets into the ROMC (2013/14)
- participate/plan field campaigns in preparation of RAMI-V.

Recommendations of the 3D RT working group

- increase awareness among user community of the limitations and possible biases of 1D canopy RT models in the interpretation/simulation of medium to high spatial resolution optical remote sensing data over vegetated surfaces when 3D structures are significant.

- provide the user community of canopy reflectance models with access to at least one freely available and properly documented 3D RT model having a verified quality record.

- strengthen the usage of verified 3D RT models in quality assurance efforts of the methodologies employed during field validation campaigns of satellite derived Essential Climate Variables (ECVs) over land (e.g., albedo, LAI, FAPAR).

- intensify the collaboration between cloud and surface 3D RT modeling activities, possibly by setting up a field experiment where detailed measurements of canopy structure, its spectral properties and the incident radiation at the top-of-the-canopy are acquired concurrently with atmospheric composition measurements to constitute a possible test case for a future I3RC/RAMI phase.

- space agencies and funding agencies to increase/standardize their quality requirements for cloud and surface RT models when used in operational algorithm development, scientific research proposals and future mission concept studies. A vehicle for this could be to make some sort of model grading or certification available via the IRC's 3D RT activities and to update these regularly.