Minutes: ITT 5433/07/NL/HE – Towards a Generic Radiative Transfer Model for the earth's Surface – Atmosphere System: ESAS light

Deutsches Zentrum für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Minutes-Nr.	Meeting	Organisations.	Date	Meeting place
05	ESASLight MTR	ESA, DLR	01.04.2009	Noordwijk The Netherlands

Arbeitssitzung/Besprechungsthema

Minutes of the ESASLight MTR meeting

Start: 09:30

End: 16:30

Meeting leader	Telefon-Nr.	Minute taker	Telefon-Nr.	Invitation and Agenda from
		Claudia Emde and Arve Kylling	+49 08153 28 3031	25.03.2009

Meeting participants — absent with valid excuse — Additional distribution list

Marc Bouvet (MB), ESA
Claudia Emde (CE), DLR
Arve Kylling (AK),
Bernhard Mayer (BM), DLR

Several attendees from ESA

Agenda

http://esaslight.libradtran.org/internal/Wiki/doku.php?id=agenda_20090401

Minutes

1. General overview of ESASLight

The meeting started with a presentation of those present. Next MB gave the background for ESASLight which is a GSP study. He highlighted the two main areas of use of libRadtran within ESA: the definition of instruments; and development of retrieval algorithms.

BM gave an overview presentation of libRadtran. This was followed by an ESASLight overview presentation by CE. After the presentations several issues connected to ESASLight and libRadtran were discussed. These included the following comments and questions:

- A discussion about Monte Carlo methods in general
- The EarthCare BBR swath width and effects
- Are there plans for developing a radar model? This is not part of ESASLight, but would certainly be of interest for all parts
- Licensing of libRadtran? It is licensed under GPL
- Discussion of the impact of the corona during the eclipse presented by BM
- Discussion about aerosol models. Other aerosol input may include GEMS and AERONET. The magnitude of polarization effects depends on the aerosol optical depth.
- Spectral emissivity is included by the IGBP surface properties.
- There is an interest in the calculation of Jacobians. This may be possible using the MYSTIC solver.

2. Task 3 – Algorithm development

WP 3100 – Raman scattering

AK presented the status of the Raman scattering implementation. The following issues were discussed:

- MB asked whether it is expensive to include 2nd order Raman scattering. AK said that it is computationally very expensive because the number of required RT calculations for 2nd order is the square of the number of contributing wavelengths
- For validation the results shall be compared to measurements (1. UV measurements taken in Garmisch, 2. SCIAMACHY measurements)
- Specification of user-defined Raman cross-section will not be possible, because formulas are not simple
- Raman scattering in presence of clouds does not work properly and needs further investigation
- Suggestion by MB: Perform side study about impact of Raman scattering on surface pressure retrieval at 765 nm in O2-A band (nadir viewing geometry, 1.25nm wide slitfunction).

WP 3200 – Polarization

CE gave an update on the implementation of polarization which has been fully integrated into MYSTIC.

The only open issue is to decide which tool(s) to compute single scattering properties for aspherical particles should be included into libRadtran. So far T-matrix and DDSCAT which converge only for small size parameters have been tested. For larger size parameters, a tool based on geometrical optics is required.

WP 3300 - Extension of surface properties

BM has implemented the AMBRALS BRDF for the simulation of land surfaces. Parameters of this BRDF are available as MODIS data product. It is planned to include also wavelength dependent BRDFs.

For water surfaces Cox and Munk is implemented. It was agreed that this is one of the best BRDFs for water surfaces and that it is not necessary to implement further functions. Since reflection by water surfaces is strongly polarization dependent it shall be checked, whether it is possible to extend the Cox and Munk routine to include polarization.

WP 3400 - Flexible aerosol treatment

CE gave an update on the extension of aerosol properties. Aerosol properties based on the OPAC database are fully included. Now, it is also possible to include arbitrary mixtures of the basic aerosol types as defined in OPAC. Some pre-defined profiles of aerosol mixtures (e.g. continental clean) should be included into libRadtran.

WP 3510 - Graphical user interface

A preliminary, but fully working, version of the GUI was demonstrated by AK. The GUI is developed in wxPython. MB asked for the options to choose between units of brightness temperature, radiance, reflectance and transmittance. Furthermore it should easily be possibly to perform calculations for satellite geometry, i.e. at the top of the atmosphere.

WP 3500 - Other extensions

CE presented netcdf I/O capabilities that have been implemented by Ulrich Hamann (DLR). It is possible to use ECMWF-date as input for global radiative transfer calculations or simulations of satellite images. Furthermore surface albedo and topography maps may be provided as netcdf data files. The libRadtran output may also be in netcdf format which is handy for calculations of larger domains or for the simulation of satellite images.

As a second tool for line-by-line calculations the tool MIRART developed by Franz Schreier (Remote Sensing Technology Institute (IMF), DLR) will be made available. An interface between libRadtran and MIRART is being developed by Franz Schreier.

The second order intensity correction of the DISORT solver is currently modified. Since it uses all Legendre terms of the phase function it is inconvenient for strongly asymmetric phase functions (especially ice clouds). A new method which uses the phase function directly (not the Legendre terms) has been developed and is currently implemented.

3. Task 4 - Verification

WP 4100 - Verification plan

AK and CE presented the verification plan. This includes detailed setups to validate Raman scattering and polarization.
Furthermore it includes a plan for the development of an extensive test suite including three parts: 1. extensive tests of optical properties (no RT), 2. test suite for all solvers and all applications (might include about 1000 tests, should run continuously in random order), 3. randomly created tests to be run with development version and stable version of libRadtran.
The test suite requires that all available options are grouped in a systematic way.
Building the test suite is a larger project than can not be finished within the ESASLight study. A first (not complete) version will be delivered by the end of September.

4. Next steps

Review of action items

1. Check whether it is possible to include polarization in Cox and Munk BRDF (BM and CE)
2. Include pre-defined aerosol mixtures from OPAC into libRadtran (CE)

Agreements

1. AK will look at the effect of Raman scattering in the oxygen A-band at 765 nm.
2. MB asked for overview description of the physics in the various solvers including mystic, disort, twostr and polradtran. This could be part of a user's guide. All developers should think about the best place to put this overview and also about what exactly should be included.
3. The first libRadtran version (including MYSTIC) will be delivered to ESTEC by the end of September

Next meetings

- The next meeting will be a telecon on 17th of June at 10:00.
- The following meeting will take place on the 18th of September,in Ålesund, Norway.

Arve Kylling Claudia Emde