FYS4630/FYS9630

Assignment #8 Tuesday October 24, 2017

1) A cloud begins to form in the sky overhead as the cloud thickens. The visual brightness of the cloud's bottom side will brighten, reach a maximum and then begin to decrease as the cloud becomes optically thicker. Ignore effects of ground reflection. (We consider solar radiation only.)

   a) Explain the behaviour in physical terms.

   b) Use the two-stream program to find the cloud optical depth for which the diffuse downward irradiance at the ground reaches a maximum. Assume an asymmetry factor of 0.95, pure scattering ($\bar{\omega} = 1$), no surface reflection. We model the atmosphere to consist of a single layer only, i.e. a pure cloud layer. Find the results for an overhead sun ($\mu_0 = 1$) and for $\mu_0 = 0.5$. Is δ-M scaling important for the results?

2) Problem 3, Exam 2016.

How to compile, link and run the program:

Download twostream.zip.
unzip the file (command: unzip twostrream.zip). The following files are found in the twostream-folder:

1. two-stream-main2017.f is the main program (driver). Here the optical properties of the atmosphere etc. are defined. This is the only file you need to edit.
2. twostr.f is the twostream equation solver
3. ErrPak.f contains error handling routines
4. slimpak.f routines to solve a set of linear equations
5. R1MACH.f and D1MACH .f
6. twostr.doc (note: this is a text file not a word file!). This file is not part of the program, but provides Information about the twostream code.

To compile and link the program, use the command (note: one single line):

g95 two-stream-main2017.f twostr.f ErrPak.f slimpak.f R1MACH.f D1MACH.f -o prog

prog is now the executable program.

Note: You have to be on a Linux or a Unix platform

if this does not work try to replace g95 with f95, gfort or ifort.

To run the program use the command:

./prog

Or

prog

Every time you make changes to the program you have to compile and link as explained above.

The following variables have to be set:

umu0 : (μ_0)
albedo
gg(1) : (asymmetry factor in layer 1)
ssalb(1) : (single scattering albedo in layer 1)
dtauc(1) : (optical depth in layer 1)
deltam ; (δ-M scaling. deltam=.true. means it is on, deltam=.false. means off)