FYS4630/FYS9630

Assignment #9 Tuesday October 31, 2017

Problem 1

Exam 2016, problem 4.

Problem 2

Download the Disort code from our web site. Compile and link (Linux or Unix) with command:

f95 main-disort-2017.f disort.f ErrPack.f LINPAK.f D1Mach.f R1Mack.f -o prog

Run the executable program with the command

./prog

or

prog

We assume a three-layer atmosphere, each layer having an optical thickness of 0.1, and a Rayleigh scattering phase function in each layer. The surface albedo is $A = \pi\rho_L = 0.05$ (Lambert surface), incoming solar flux at the top of the atmosphere is $F^s = 1.0$, $\mu_0 = 0.51$, single scattering albedo $\varpi = 1.0$ (conservative scattering). These values are already set in main-disort-2017.f.

a) Use computer simulations to calculate the **diffuse** downward irradiance (same as flux) at the surface according to the table below. 'exact' in the fifth column is $F^-(\tau^*)$ with 48 streams and δ-M scaling turned on. Comment the results. In the main program (main-disort-2017.f) use the variable 'nstr' to set the number of streams, the variable deltam to set delta-M on or off (.true. or .false.).

N-stream	Code	$F^-_{diffuse}(\tau^*)$ No δ-M	$F^-_{diffuse}(\tau^*)$ δ-M	Ratio column 4/exact
4	Disort			
6	Disort			
8	Disort			
10	Disort			
12	Disort			
16	Disort			
32	Disort			
48	Disort			1.0

b) Repeat a) for a cloud layer. In your simulations replace layer 2 with a pure cloud layer with asymmetry factor g = 0.95 and τ = 20.0 . Single scattering albedo is still ϖ = 1.0 for all layers. The only thing you need in order to do b) is to let dtauc(2) =20.0 and vary nstr in the main program. Comment the results.

c) Repeat a), but now compute the radiance at the surface for μ = - 0.4 (already set in the in main-disort-2017.f.) The radiance is the same as intensity, and is found at the bottom of the output. Comment the results.

d) Repeat c), but now with a cloud layer as in b). Comment the results.