FYS4630/FYS9630

Assignment #6 Tuesday October 10, 2017

1) The two-stream equations for a homogeneous atmosphere and isotropic scattering phase function is:

$$\bar{\mu}\frac{dI^+(\tau)}{d\tau} = I^+(\tau) - \frac{\varpi}{2}\, I^+(\tau) - \frac{\varpi}{2}\, I^-(\tau) - \, (1-\varpi)B$$

$$-\bar{\mu}\frac{dI^-(\tau)}{d\tau} = I^-(\tau) - \frac{\varpi}{2}\, I^+(\tau) - \frac{\varpi}{2}\, I^-(\tau) - \, (1-\varpi)B$$

We assume uniform illumination at the top of the atmosphere: $I^-(\tau = 0) = \mathfrak{I} = constant$ and a non-reflecting lower boundary, $I^+(\tau = \tau^*) = 0$. (This is prototype problem 1)

Solve the two-stream equations above for ϖ= 1 (conservative scattering) and show that:

$$I^+(\tau) = \frac{\mathfrak{I}\cdot(\tau^* - \tau)}{2\bar{\mu} + \tau^*}$$

$$I^-(\tau) = \frac{\mathfrak{I}\cdot[2\bar{\mu} + (\tau^* - \tau)\,]}{2\bar{\mu} + \tau^*}$$

$$S(\tau) = \frac{\mathfrak{I}\cdot[\bar{\mu} + (\tau^* - \tau)]}{2\bar{\mu} + \tau^*}$$

$$F(\tau) = -\frac{4\pi\bar{\mu}^2\mathfrak{I}}{2\bar{\mu} + \tau^*}$$

$$H(\tau) = 0$$

2) Derive Eq.(7.7) on page 229. Specifically find $I_d^-(\tau, \mu = \mu_0, \varphi)$. Also derive Eq.(7.8) on page 230.