FYS4630/FYS9630

Assignment #5 Wednesday October 8, 2014

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

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

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

We assume istropic incidence at the top of the atmosphere: $I^-(\tau = 0) = \Im$ and non-reflecting lower boundary, $I^+(\tau = \tau^*) = 0$. (This is prototype problem 1)

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

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

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

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

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

$$H(\tau) = 0$$

2) Derive Eqs. 7.94 – 7.99 on page 247