

SATELLITES AND RADAR

Homework assignment

SATELLITE Problems:

1. Describe how the Planck function is useful in satellite meteorology. Include in your answer how this function gives us information about the spectral emission of radiation [3pts]

Use the Planck function to determine the radiance ($W m^{-2} Sr^{-1} \mu m^{-1}$) emitted by a black body at a wavelength of $\lambda=1 \mu m$ ($10^{-6} m$) for two black body temperatures (6000 K and 300 K, corresponding to the approximate sun and earth surface temperature). [3pts]

Given the earth-sun distance, calculate the *irradiance* ($W m^{-2} \mu m^{-1}$) at the height of geostationary orbit at $\lambda=1 \mu m$ for radiation coming from the sun and radiation coming from the earth. If 30% of solar radiation at this wavelength is reflected by the earth/atmosphere system, what does this tell you about separating solar and terrestrial contributions in this wavelength region of the spectrum? [3pts]

2. Describe the key differences between active and passive remote sensors. Give the advantages and disadvantages of each. [4pts]

3. Explain the concept of atmospheric sounding using passive satellite measurements [4pts].

RADAR Problems:

4. Describe why radar beams from weather radars are typically not straight. How does this impact the ability to detect radar echoes (signals) from large distances? [3pts]

5. The radar reflectivity factor describes how a population of particles will interact with microwave radiation. Calculate the reflectivity factor for two populations of spherical particles: (a) 100 cloud droplets per cm^3 of diameter $20 \mu m$; (b) 1 raindrop per m^3 with diameter 1 mm. [4pts]

Explain why insects can cause a big problem for radar remote sensing over continental areas in summer. [2pts]

6. Describe two different commonly-used scan types for meteorological radars. Highlight the advantages and disadvantages of each type. [4pts]