Unit 13 ATM401, ATM601 and CHEM601

Application, analysis, and evaluation

1. Graduate students: An IR imager observes a cloud layer with $T = 250K$. Assume that the cloud layer radiates as a blackbody and the near-surface air temperature is $16oC$. Determine cloud base height, temperature and cloud top height. Assume an evironmental and a saturated lapse rate of $0.65K/100m$ and $0.5K/100m$ to determine cloud top height. Assume the cloud top acts like a blackbody over the entire long-wave range and calculate the upward flux of long-wave radiation that would be observed by a radiometer mounted to an aircraft flying just above the cloud.

2. All students: What is meant by the planetary albedo? Graduate students: Planet XYZ has on average $8 \cdot 10^7 km$ distance to the Sun and an planetary albedo of 0.85. The same quantities on Earth are $1.5 \cdot 10^8 km$ and 0.28, respectively. Solar constant on Earth is $1361 Wm^{-2}$. Calculate the effective temperature of the two planets. Based on the given quantities and your results, can you conclude on the surface temperature of the planets? Explain!The unperturbed atmosphere of planet XYZ absorbs a fraction f=40% of the long wave radiation. Calculate the change of temperature at the surface of planet XYZ induced by the greenhouse effect under the assumption of an sothermal layer that is transparent to solar radiation.