# Radiative Transfer
# Beer-Lambert Law and Greenhouse Effect

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**Abstract**

Analysis of radiative transfer in the atmosphere including absorption, scattering, and the greenhouse effect.

## 1 Introduction

Radiative transfer describes how electromagnetic radiation propagates through the atmosphere.

## 2 Beer-Lambert Law

$I(z) = I_0 e^{-\tau}$

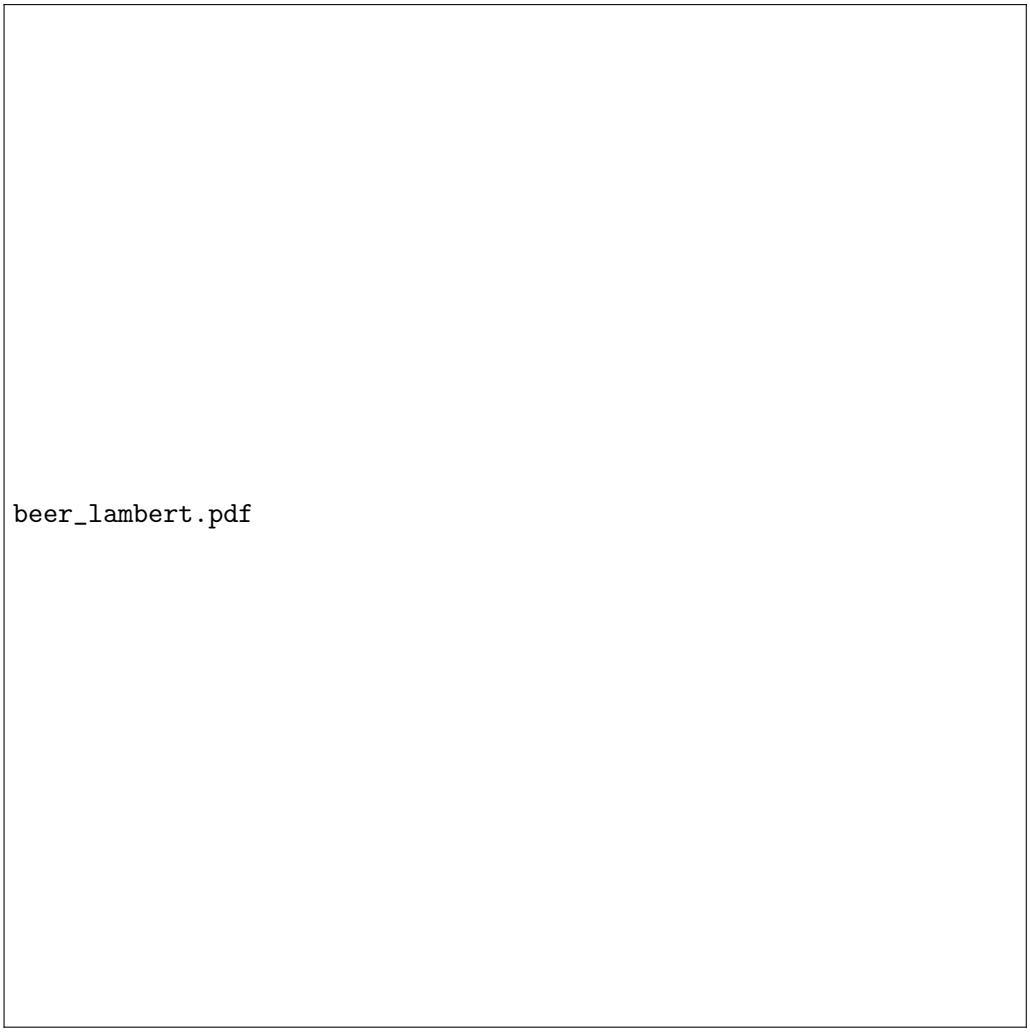


Figure 1: Transmission as function of optical depth.

## 3 Planck Function

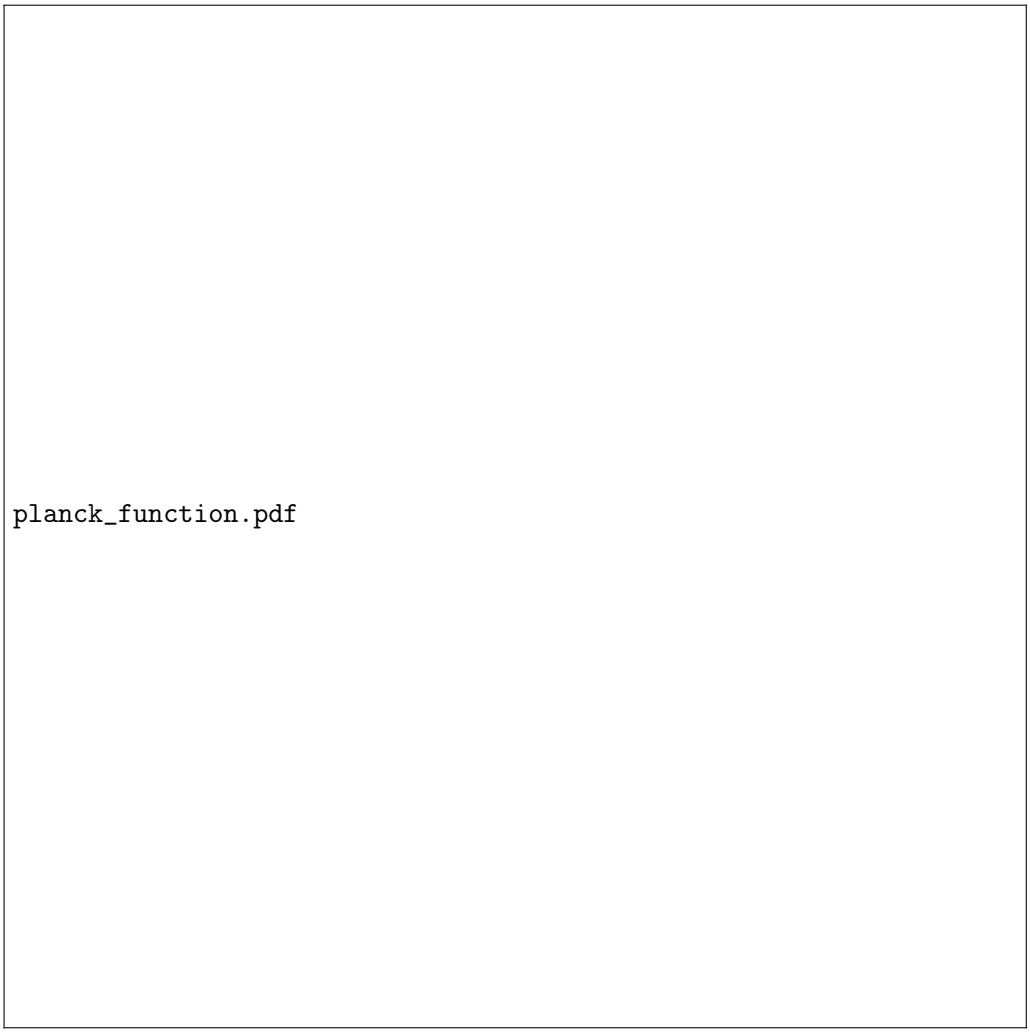


Figure 2: Planck blackbody spectra at different temperatures.

# 4 Atmospheric Absorption

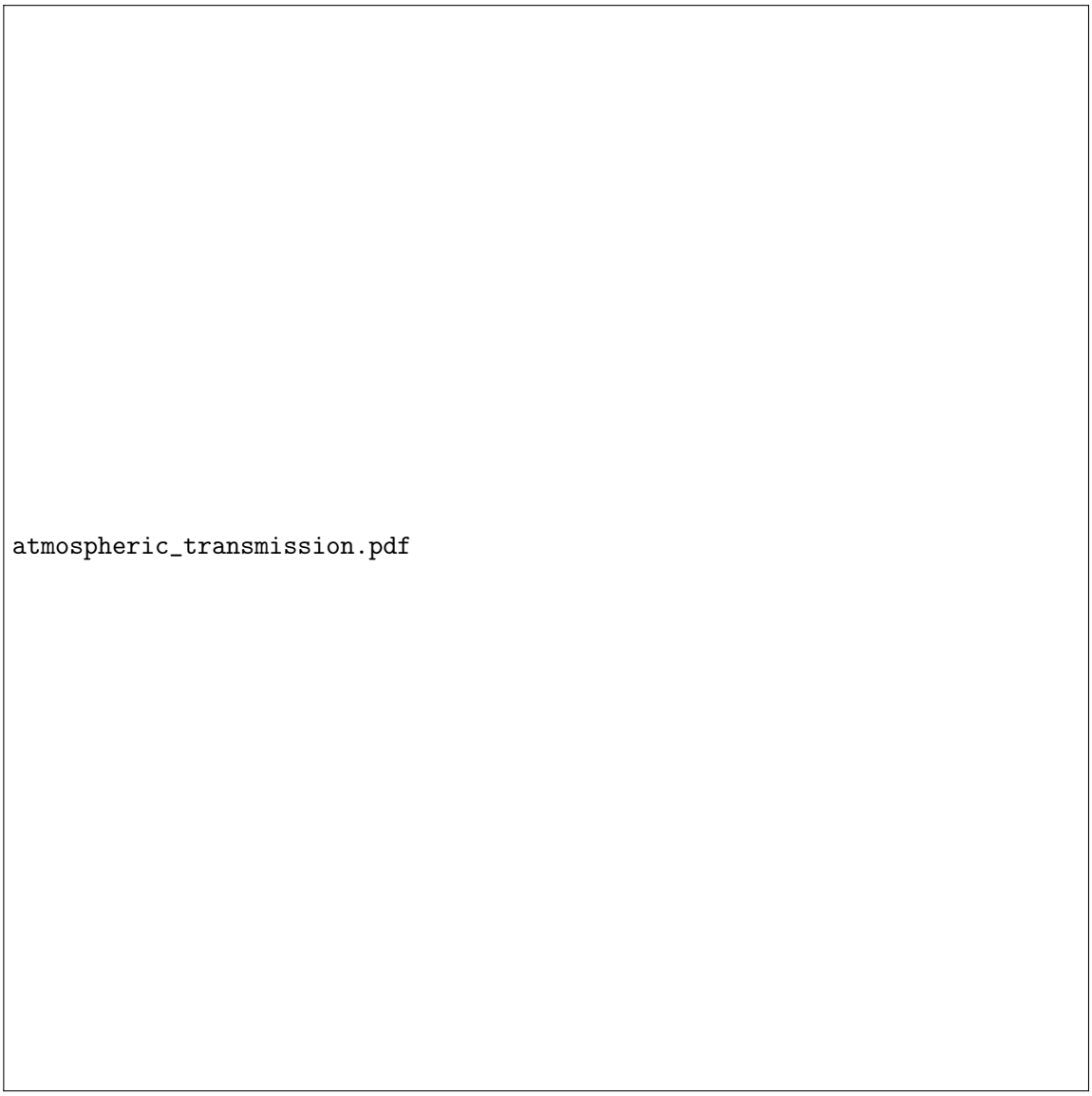


Figure 3: Atmospheric transmission showing absorption bands.

## 5 Greenhouse Effect


Figure 4: Surface temperature vs atmospheric emissivity.

## 6 Radiative Forcing

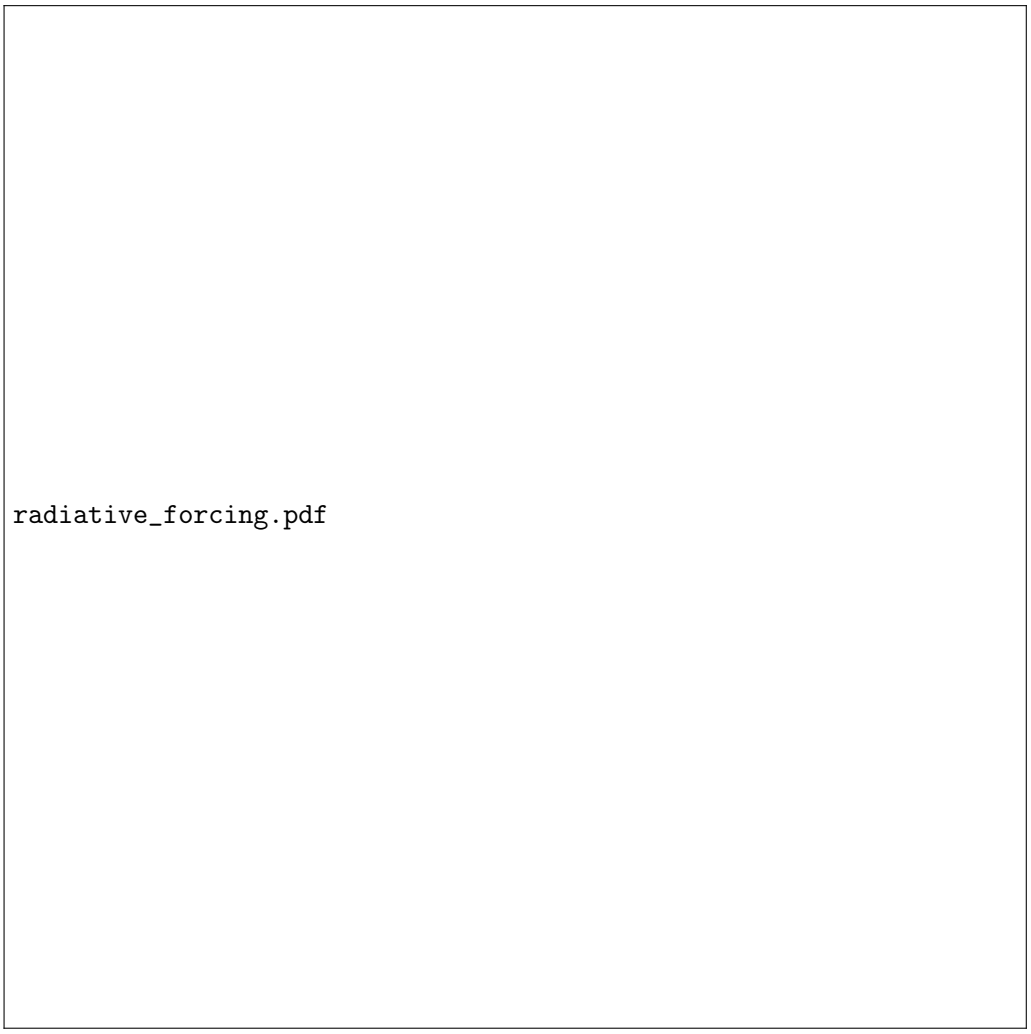


Figure 5: Radiative forcing from $CO_2$ increase.

## 7 Scattering


Figure 6: Wavelength dependence of atmospheric scattering.

## 8 Results

## 9 Conclusions

Radiative transfer processes control Earth's energy balance and climate.