EGU24-1295, updated on 18 Feb 2025
https://doi.org/10.5194/egusphere-egu24-1295
EGU General Assembly 2024

Instantaneous Radiative Forcings of Greenhouse Gases

William van Wijngaarden[1] and Will Happer[2]
[1]York University, Physics, Toronto, Canada (wavw@yorku.ca)
[2]Physics Dept., Princeton University, Princeton, USA (happer@Princeton.edu)

The top of the atmsophere (TOA) instantaneous long wave radiative forcings resulting from increasing greenhouse gases such as CO2, CH4, N2O and various halogenated gases were found by solving the equation of transfer. The observed altitude dependence of the greenhouse gas concentrations was used as well as the standard midlatitude temperature profile. The calculations used the line intensities or absorption cross sections from the HITRAN database and also considered the effect of scattering by a cloud layer. Various cloud properties were considered including altitude, optical depth and single scattering albedo for both isotropic and forward scattering. The results show that a cloud layer reduces the TOA radiative forcing from its clear sky value. The incremental forcing is even negative for an optically thick high altitude cloud. This occurs because the temperature increases with altitude in the stratosphere.