AEROSOL OPTICS, RADIATIVE FORCING, AND CLIMATE CHANGE

Hans Moosmüller

Division of Atmospheric Sciences, Desert Research Institute, Reno, NV 89512, USA

The common perception of climate change is dominated by the greenhouse effect due to gases such as carbon dioxide. Aerosols influence the earth's direct radiative forcing and climate largely through modifying the planetary albedo, which is the whiteness of the planet as seen from space. If aerosols are whiter than the underlying scene, they increase the planetary albedo, have a negative radiative forcing and cause cooling (more solar energy is scattered back into space); otherwise if they appear darker, they decrease the planetary albedo, have a positive radiative forcing and cause heating (more solar energy is retained by earth). In addition, aerosols can continue to cause radiative forcing after deposition. In particular, dark aerosols can strongly decrease surface albedo after deposition on high-albedo surfaces such as snow and ice.

The dominant aerosol optical property that determines radiative forcing is the aerosol single scattering albedo (SSA) integrated over the solar spectrum with an additional contribution from the asymmetry parameter or hemispherical backscatter ratio (Chýlek and Wong, 1995). The SSA is the ratio of scattering to extinction coefficient, with the extinction coefficient being the sum of scattering and absorption coefficient. The ambient aerosols with the most uncertainty in their SSA spectra are carbonaceous aerosols emitted by combustion processes and entrained mineral dust.

References:

Chýlek, P., and J. Wong (1995). Effect of Absorbing Aerosol on Global Radiation Budget. *Geophys. Res. Lett.*, **22**, 929-931.