Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10823, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10823
EGU General Assembly 2008

Geoengineering side effects: Heating the tropical tropopause by sedimenting sulphur aerosol?

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Anthropogenic greenhouse gas emissions tend to warm the global climate on surface. Various geoengineering projects are currently discussed that could help extending the grace period for appropriate countermeasure. Sulphur aerosols cool earth surface by reflecting short wave radiation from the sun. By increasing the amount of sulphur aerosols in the stratosphere, for example by sulphur injections, part of the anthropogenic climate warming might be compensated due to enhanced albedo. However, we are only at the beginning of possible side effects. One such effect that such aerosol might have is the warming of the tropical tropopause and consequently the increase of the amount of stratospheric water vapour. Using the 2D AER Aerosol Model we calculated the aerosol distributions for injections of 1, 2, 5 and 10 MT sulphur into the lower tropical stratosphere. The results serve as input for the 3D chemistry-climate model SOCOL, which allows calculating the aerosol effect on stratospheric temperatures and chemistry. Aerosols coagulate readily in the injection region at 20 km and sediment down to the tropical tropopause region. As the aerosol also absorbs IR radiation, tropopause temperatures rise and the entry mixing ratio of water vapour increases. For the extreme scenario of 10 MT it is predicted to more than double. This is predicted to have a significant impact on total ozone, because of enhanced heterogeneous reactions and because the increased water vapour intensifying the HOx and ClOx catalytic ozone destruction cycles.