Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02257, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02257
EGU General Assembly 2008

Update on global dimming and brightening

M. Wild

Insitut for Atmospheric and Climate Science, ETH Zurich, Universitätsstr 16, CH 8092 Zurich, Switzerland (martin.wild@env.ethz.ch)

This presentation gives an overview over global dimming/brightening-related work currently underway at ETH Zurich.

Observations: Widespread direct measurements of radiation reaching the Earth surface started in the 1960s. Many of these observations are stored at ETH Zurich in our database of worldwide measured surface energy fluxes, the Global Energy Balance Archive (GEBA). These observations suggest that surface solar radiation, after decades of dimming, reversed into a brightening from the mid 1980s up to 2000 at widespread locations. We are currently undertaking a major effort to update the time-series in GEBA from 2000 to near present. First results from this update will be presented and document the evolution of global dimming/brightening beyond 2000.

Modelling: In an attempt to simulate the dimming and brightening with Global Climate Models (GCM), we run a special version of the ECHAM model series, which includes a sophisticated interactive treatment of aerosol and their emission histories (ECHAM5 HAM). The model is shown to be capable of reproducing the reversal from dimming to brightening in cloud-free conditions in many parts of the world, in line with observational evidence. This points to aerosol effects as major causes for the observed changes. The simulations further suggest a distinct latitudinal dependence of the transition from dimming and brightening.

Impact studies: The fade of global dimming in the 1980s had major consequences for climate change, as it enabled the greenhouse effect to become finally visible at its full dimension. We show in different impact studies that this had major consequences for various elements of the climate system. For example, surface temperature rise accel-

erated over recent decades when the damping effect of global dimming was no longer present. This is also seen in diurnal temperature ranges which show, after decades of decline, a distinct tendency to level off since the mid 1980s. This suggests that daytime solar dimming did no longer counteract nighttime thermal warming since the 1980s, thereby no longer diminishing the diurnal temperature range. Further, the increase in available surface energy from both increasing downwelling solar and thermal radiation may have been at the origin of the observed acceleration of the hydrological cycle during the 1990s. It may also have contributed to the significant retreat of Swiss glaciers in the same period. It is therefore evident that the variations in surface radiative fluxes have largely influenced the evolution of climate over the 20th century.

Related references:

Wild, M., Ohmura A., Makowski, K., 2007: Impact of global dimming and brightening on global warming. Geophys. Res. Lett., 34, L04702, doi:10.1029/2006GL028031.

Norris, J.R., and Wild, M., 2007: Trends in direct and indirect aerosol radiative effects over Europe inferred from observed solar “dimming” and “brightening”, J. Geophys. Res. 112, D08214, doi:10.1029/2006JD007794.

Wild, M., and Co-authors 2005: From dimming to brightening: Decadal changes in solar radiation at the Earth’s surface. Science, 308, 847-850.

Wild, M., Ohmura, A., Gilgen, H., and Rosenfeld, D., 2004: On the consistency of trends in radiation and temperature records and implications for the global hydrological cycle. Geophys. Res. Lett., 31, L11201, doi: 10.1029/2003GL019188.