Geophysical Research Abstracts,
Vol. 11, EGU2009-8078, 2009
EGU General Assembly 2009

Global dimming and brightening studies at ETH

M. Wild, K. Makowski, M. Chiacchio, and D. Folini
ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland (martin.wild@env.ethz.ch)

Global dimming and brightening refers to the decadal variations in solar radiation received at the Earth surface. Measurements suggest that surface solar radiation declined at widespread observation sites ("global dimming") between the 1950s and 1980s, and then partially recovered between the 1980s and 2000 ("brightening", Wild et al. 2005).
In this presentation, an overview is given over the global dimming/brightening-related work currently underway at ETH Zurich. These include the update of the Global Energy Balance Archive, a database for the worldwide measured surface energy fluxes, with data beyond 2000. Overall, the available data suggest continuation of surface solar brightening beyond the year 2000 at numerous locations, yet less pronounced and coherent than during the 1990s, with more regions with no clear changes or declines (Wild et al. 2009, Wild 2009a).
Modelling attempts are under way at ETH to reproduce the observed dimming and brightening with a Global Climate Model. We run a special version of the ECHAM model series, which includes a sophisticated interactive treatment of aerosol and their emission histories (ECHAM5 HAM). This model is therefore particularly suited for the simulation of dimming and brightening.
Further the impact of global dimming and brightening on the global climate system is investigated (Wild 2009a). 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 (Wild et al. 2007). Surface temperature rise accelerated 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 (Wild et al. 2007, Makowski et al. 2008). This suggests that daytime solar dimming did no longer counteract nighttime thermal warming since the 1980s, thereby no longer diminishing the diurnal temperature range. These effects are not adequately reproduced in the current generation of global climate models used in IPCC AR4 and CMIP3 (Wild 2009b).
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 (Wild et al. 2008).

Selected related references:

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

Wild, M., Grieser, J. and Schär, C., 2008: Combined surface solar brightening and greenhouse effect support recent intensification of the global land-based hydrological cycle. Geophys. Res. Lett., 35, L17706, doi:10.1029/2008GL034842.

Makowski, K., Wild, M., and Ohmura, A., 2008: Diurnal temperature range over Europe between 1950 and 2005, Atmos. Chem. Phys., 8, 6483-6498, 2008.

Wild, M., Trüssel, B., Ohmura, A., Long, C.N. König-Langlo G., Dutton, E.G., and Tsvetkov, A., 2009:

Global Dimming and Brightening: an update beyond 2000. Submitted to J. Geophys. Res.

Wild, M., 2009a: Global dimming and brightening: A review on decadal changes in surface solar radiation. Submitted to J. Geophys. Res.

Wild, M., 2009b: How well do the IPCC AR4/CMIP3 simulate global dimmingIbrightening and 20th century daytime and nighttime warming? Submitted to J. Geophys. Res.