



Global dimming/brightening and 20th century warming as observed and simulated in GCMs

Martin Wild

ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland (martin.wild@env.ethz.ch)

Observations indicate that greenhouse induced 20th century warming has been strongly modulated by variations in surface solar radiation. Between the 1950s and 1980s declining surface solar radiation (“global dimming”) likely caused a dampening of global warming, whereas increasing surface solar radiation (“brightening”) may have contributed to the rapid warming in the last two decades and possibly also the first half of the 20th century. This is also reflected in the decadal evolution of diurnal temperature range, which is highly correlated with surface solar radiation, and which shows a distinct transition from a strong decrease between the 1950s and 1980s, towards a levelling off thereafter (Wild et al. 2007, Makowski et al. 2008, 2009). The present study investigates to what extent these effects are simulated in the latest generation of climate models used in the 4th IPCC assessment report. The analysis suggests that the models tend to underestimate the decadal variations in surface temperature over global land surfaces, not only in the mean temperature evolution, but particularly also in diurnal temperature range, indicative for a lack of decadal variations in surface solar radiation in the models (Wild 2009).

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.

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

Makowski, K., Jäger, E., Chiacchio, M., Wild, M., Ewen, T., and Ohmura, A., 2009: On the relationship between diurnal temperature range and surface solar radiation in Europe. *J. Geophys. Res.*, 114, D00D07, doi:10.1029/2008JD011104.

Wild, M., 2009: How well do the IPCC AR4/CMIP3 models simulate global dimming and brightening and related effects on 20th century day- and nighttime warming? *J. Geophys. Res.*, 114, D00D11, doi:10.1029/2008JD011372.