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Evaluation of the surface radiation budget in the atmospheric component of the Hadley Centre Global Environmental Model (HadGEM1)

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We present an analysis of the present-day climate simulation of the surface radiation budget in the atmospheric component of the new Hadley Centre Global Environmental Model (HadGEM1), and assess the simulations by comparing the results with fluxes derived from satellite data from the International Satellite Cloud Climatology Project (ISCCP) and ground measurements from the Baseline Surface Radiation Network (BSRN). Comparisons against radiative fluxes from satellite and ground observations show that the model tends to overestimate the surface incoming solar radiation. Overall, the simulation of downward longwave radiation is closer to observations than its shortwave counterpart. The model underestimates the downward longwave radiation with respect to BSRN measurements.

Comparisons of land-surface albedo from the model and estimates from the Moderate Resolution Imaging Spectroradiometer (MODIS) show that HadGEM1 overestimates the land-surface albedo over deserts and over mid-latitude land masses in the Northern Hemisphere in January. Analysis of the seasonal cycle of the land-surface albedo in different regions shows that the amplitude and phase of the seasonal cycle are not well represented in the model, although a more extensive validation needs to be carried out.

Two decades of coupled model simulations of the 20th century climate are used to look into the model's simulation of global dimming/brightening. The model results are in line with the conclusions of the studies that suggest that "global dimming" is far from being a uniform phenomenon across the globe.