



Impact of statistically extrapolated changes in total solar irradiance on results of 21st–23rd projections with a global climate model under RCP scenarios

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Statistical projections of changes in total solar irradiance (TSI) are made for the 21st–23rd centuries in a way similar to (Mokhov et al., 2008). The respective statistical models were trained either by the CMIP5 total solar irradiance curve extended back to year 850 (see <http://climate.uvic.ca/EMICAR5/forcing>) or by the respective reconstructions prepared at the Max Planck Institute for Solar System Research (e.g., the reconstructions by Krivova et al.) or by ^{10}Be -based reconstructions (as reported by Steinhilbert et al.).

These projections, together with the RCP (Representative Concentration Pathways) anthropogenic scenarios, are used to force the global climate model developed at the A.M. Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences (IAP RAS CM). The projections are constructed as continuations of historical runs for 850–2005 performed with the same model and forced by respective TSI reconstructions and past changes in stratospheric aerosol optical depth and anthropogenic forcings. For the historical runs, interrelations between TSI and surface air temperature is exhibited at time scales of few decades both in model simulations as well as in empirical data.

In the 21st century, near-surface global warming in the IAP RAS CM is $1.1 - 2.9 \text{ K}$ depending on imposed RCP scenario (Mokhov and Eliseev, 2012). If anthropogenic forcing is stabilised in the late 21st century, climate inertia adds another $0.2 - 3.3 \text{ K}$ in the 22nd to 23rd centuries for scenarios RCP 4.5–8.5. Locally, temperature changes during the 21st century may be as large as $4 - 8 \text{ K}$ and another $6 - 10 \text{ K}$ during the 22nd–23rd centuries. In contrast, different future TSI scenarios modify these values not more than by 0.1 K globally and not more than 1.5 K locally. These values are moderately important for the simulations forced by scenario RCP 2.6 but relatively small for more aggressive scenarios RCP 4.5, RCP 6.0, and RCP 8.5.

Mokhov, I.I., V.A. Bezverkhny, A.V. Eliseev and A.A. Karpenko, 2008: Model estimations of possible climatic changes in 21st century at different scenarios of solar and volcanic activities and anthropogenic impact. *Cosmic Res.*, **46** (4), 354-357, doi: 10.1134/S0010952508040114.

Mokhov, I.I. and A.V. Eliseev, 2012: Modeling global climatic variations in the 20th–23rd centuries under new RCP scenarios of anthropogenic forcing. *Doklady Earth Sci.*, **443** (2), 532-536, doi: 10.1134/S1028334X12040228.