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Reconstruction of Holocene and LGM atmospheric dust aerosol concentrations from paleoclimatic archives

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Atmospheric mineral dust aerosols affect the global climate by scattering and absorbing solar and thermal radiation, as well as providing micronutrients to primary production regions. Present and past global atmospheric dust concentrations have so far been deduced from model simulations. We present a new estimate of atmospheric dust concentrations and dust aerosol radiative forcing based on measurements of dust deposition in paleoclimate archives (mainly the DIRTMAP 3 dataset). Using a kriging technique, the dust deposition data from terrestrial, marine, and ice core records was interpolated to a global grid for both average Holocene and Last Glacial Maximum climatic conditions. By combining the data with some parameters from dust models we reconstructed Holocene and LGM surface and atmospheric dust concentrations. This new dataset's dust concentrations and radiative forcing is compared to the results from dust model simulations. We show how this new dataset can be used by calculating dust radiative forcing in polar areas. Dust appears to play an important role in the polar amplification phenomenon during dusty times by cooling down the surface and heating the upper atmospheric layers.