Changes

On the following pages the two minor changes made since the last file upload are highlighted.

Revised mineral dust emissions in the atmospheric chemistry-climate model EMAC (MESSy 2.52 DU_Astitha1 KKDU2017 patch)

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Abstract. To improve the aeolian dust budget calculations with the global ECHAM/MESSy atmospheric chemistry-climate model (EMAC) we have implemented new input data and updates of the emission scheme.

The data set comprises landcover classification, vegetation, clay fraction and topography. It is based on up-to-date observations, which is crucial to account for the rapid changes of deserts and semi-arid regions in recent decades. The new Moderate-resolution Imaging Spectroradiometer (MODIS) based landcover and vegetation data is time dependent, and the effect of long-term trends and variability of the relevant parameters is therefore considered by the emission scheme. All input data has a spatial resolution of at least $0.1°$ compared to $1°$ in the previous version, equipping the model for high resolution simulations.

We validate the updates by comparing the aerosol optical depth (AOD) at 550 nm wavelength from a one year simulation at T106 (about $1.1°$) resolution with Aerosol Robotic Network (AERONET) and MODIS observations, the 10 μm dust AOD (DAOD) with Infrared Atmospheric Sounding Interferometer (IASI) retrievals, and dust concentration and deposition results with observations from the AEROCOM dust benchmark data set. The update significantly improves agreement with the observations and is therefore recommended to be used in future simulations.

Also the comparison with dust deposition observations shows improved agreement when using the updated emissions. This is less clear for the comparison with dust concentration data, where original and updated emission scheme do not show a significant performance difference.

While the updates clearly improve the global distribution of aeolian dust, the total amount of globally emitted dust remains unchanged and consistent with literature values.

Subject to the future availability of suitable soil models in EMAC providing soil moisture values for a thin surface soil layer, the activation of the explicit soil moisture dependency of the threshold surface friction velocity might further improve the agreement with observed trends and variability.

Code and data availability

The Modular Earth Submodel System (MESSy) is continuously further developed and applied by a consortium of institutions. The usage of MESSy and access to the source code is licenced to all affiliates of institutions which are members of the MESSy Consortium. Institutions can become a member of the MESSy Consortium by signing the MESSy Memorandum of Understanding. More information can be found on the MESSy Consortium Website (http://www.messy-interface.org). The input data files and all modifications to the EMAC source code presented in this article are available on request until they become part of the official MESSy code.

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