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Changes in anthropogenic contribution of mineral dust since pre-industrial time.

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A new method to derive interactively potential dust sources is developed, which allows to account for land cover changes interactively within the climate-aerosol system ECHAM6-HAM2 and to distinguish between dust emissions from natural and agricultural source regions.
We find that around 10 % of global dust emissions originate from agricultural source regions in present day conditions. The emissions and burden increase by 183 Tg/a (which correspond to 20 % of today's emissions) and 2.15 Tg, respectively, between pre-industrial conditions and today. This increase is caused by both climate change and anthropogenic land cover changes (ALCC), although the contributions of these factors vary between regions. In North Africa most of dust sources are of natural origin and the increase of 15% in dust emissions is caused by climate change. For North America we find that nearly 67% of all dust emissions take place in agricultural areas. There, the increase in dust emissions of 63% is caused by both climate change and ALCC. ALCC result in sharp increase in dust emissions in Australia due to the biogeophysical feedbacks.
The global change in clear sky net radiative forcing on top of the atmosphere between pre-industrial times and today is -0.14 W/m2. If only accounting for ALCC the change in net forcing would be -0.05 W/m2. Changes in climate alone correspond to a change in net forcing of -0.083 W/m2.
Our findings suggest that anthropogenic land cover changes should be accounted for to quantify past and future changes in the dust cycle.