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Impact of vegetation and landuse changes on dust interaction with radiation and ocean biogeochemistry.

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Mineral dust particles interact with the Earth's Climate System by absorbing and scattering solar and terrestrial radiations. Deposition of dust on open oceans provides nutrients for phytoplankton blooming. These interactions may feedback on dust emissions mostly through modulation of the hydrological cycle. Several studies have documented the failure of CMIP5 models to reproduce long-term variability of dust concentration, which may be related to vegetation changes in response to perturbations in the hydrological cycle. Because vegetation and its characteristics are affected by both direct human influences (e.g. deforestation) and climate change (e.g. dieback due to drought), it is important to include vegetation dynamics as one of the predictors of dust emission to accurately simulate past, present, and future dust forcing.
The new GFDL Earth's System Model (ESM) version 4 contains fully interactive and consistent dust life cycle: from its emissions calculated by the dynamic land model (LM4.1) to its long-range transport in the atmospheric model (AM4) followed by its deposition to the ocean where it feeds the tracers of the bio-geochemistry model (COBALT). In this poster, we present an analysis of the amplification of dust forcing by vegetation and land-use changes, and its consequences on radiative forcing and ocean productivity, based on GFDL ESM4 simulations in support of CMIP6.