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Global occurrence of continuing currents in lightning and lightning-ignited wildfires predicted for the next century

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Lightning flashes can produce a discharge in which a continuing electrical current flows for more than 40 ms. Such flashes have been proposed to be the main precursors of lightning-ignited wildfires.

In this work, we used lightning measurements provided by the Geostationary Lightning Mapper (GLM) over the continental United States of America during the summer of 2018 to confirm the role of lightning with continuing currents in the ignition of wildfires. We investigated projections in the occurrence of lightning with continuing currents and in the meteorological conditions that favor wildfires over the next century by applying a new parameterization of continuing currents based on the updraft strength. The simulations are performed by using the European Center HAMburg general circulation (ECHAM) / Modular Earth Submodel System (MESSy) Atmospheric Chemistry (EMAC) model [1]. We found a 41% increase in the occurrence of lightning with continuing currents worldwide. Increases are largest in South America, the western coast of Northern America, Central America, Australia, Southern and Eastern Asia, and Europe, while only regional variations are found in northern polar forests, where wildfires can affect permafrost soil carbon release.

We obtained a possible increase in the risk of lightning-ignited fires in Europe, Eastern Asia, North America, the Western coast of South America, Central Africa and Australia. In turn, the simulations suggest a decrease in the risk of lightning-ignited wildfires in polar regions of Eurasia and North America. Finally, projections do not show any clear tendency in the Amazon rainforest during the typical fire season.

[1] Pérez-Invernón, F. J., Huntrieser, H., Jöckel, P., and Gordillo-Vázquez, F. J.: A parameterization of long-continuing-current (LCC) lightning in the lightning submodel LNOX (version 3.0) of the Modular Earth Submodel System (MESSy, version 2.54), Geosci. Model Dev., 15, 1545–1565, https://doi.org/10.5194/gmd-15-1545-2022, 2022.