Climatic impacts of black carbon aerosols over South-East Atlantic underestimated, research shows

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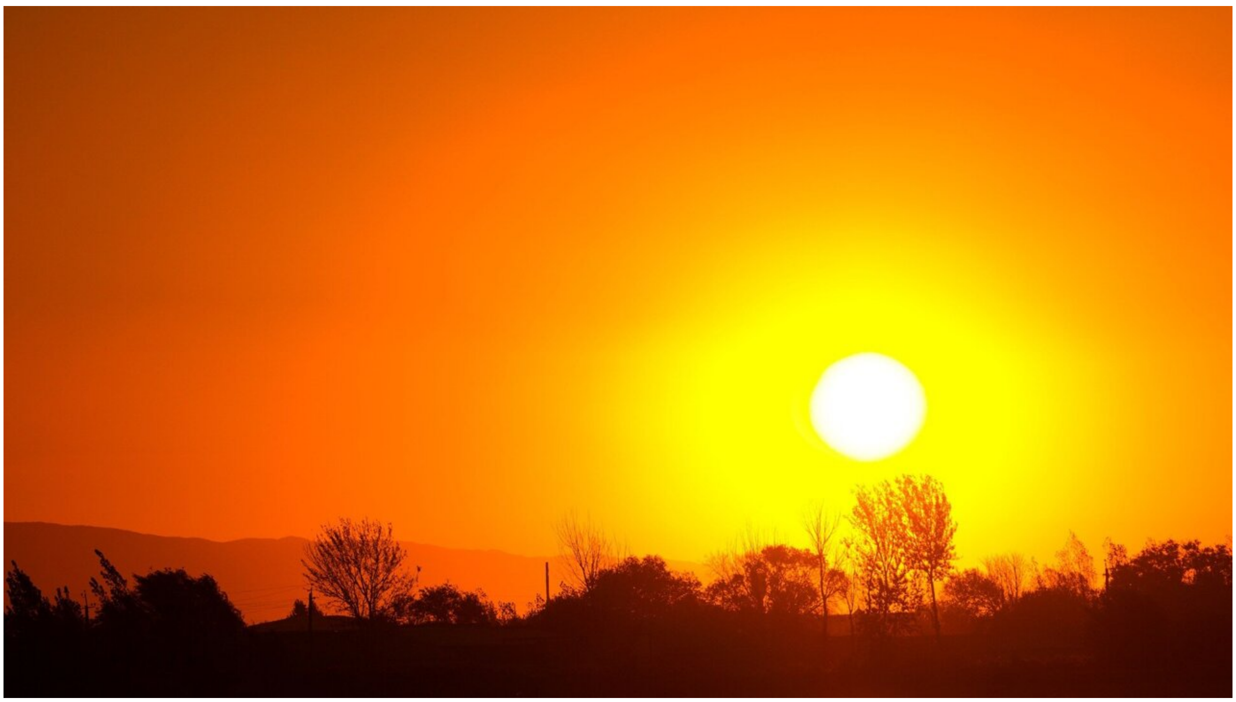

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The full magnitude of the impact of smoke from seasonal fires in Central Africa—and in particular, the potential climate warming from the absorption by the black carbon component of the aerosol—is underestimated by some climate models over the South-East Atlantic, new research has shown.

The underestimations include some of the CMIP6 climate models which are used to inform the decisions around limiting global warming to 1.5C in the 2018 Paris Agreement.

A pioneering new study, led by Dr. Marc Mallet from MeteoFrance in Toulouse, using satellite and ground-based remote sensing data backed-up by aircraft measurements has identified shortfalls in climate modeling in capturing the real climate effect of biomass-burning aerosols that are transported over the South-East Atlantic.

Professor Jim Haywood from the University of Exeter led the UK's involvement in the field supporting measurement campaign and was a key partner on the modeling study led by Dr. Mallet.

The study is published in the leading journal *Science Advances* on Friday, October 8th 2021.

Black carbon aerosols are microscopic particulates suspended in the atmosphere. They are generated by man-made and natural fires and absorb a significant amount of sunlight.

Black carbon's ability to absorb sunlight means it can play a pivotal role in heating the atmosphere, and play a significant role in the effects of climate change at regional and continental scales.

The research team, including scientists from CNRM, the University of Lille and the UK Met Office compared how the CMIP6 models represented several crucial variables—including smoke aerosols, low-level stratocumulus clouds and solar absorption—using innovative and recent space-based remote-sensing observations, backed-up by aircraft observations.

It showed that biomass burning aerosols lead to an increase in absorbed sunlight over the South East Atlantic, something that would likely warm the climate system as a whole, while many models suggested the opposite—an erroneous cooling effect.

The research represents the culmination of several years of international efforts investigating smoke aerosols over the SE Atlantic from seasonal fires over Africa with satellite, surface-based, and in-situ sampling.

These efforts included operations of the UK's heavily equipped FAAM research aircraft in August and September 2017, when the aircraft was based in Ascension Island in the middle of the Atlantic ocean, and the US-led ORACLES and LASIC programs and the French-led AEROCLO-Sa project.

Professor Jim Haywood, who led the detachment to Ascension Island and is a professor of Atmospheric Science at the University of Exeter and a Research Fellow at the Met Office Hadley Centre said, "The results from the study are quite conclusive. Despite decades of research, the climatic impacts of aerosols are still inadequately modeled by our climate models, which leads to significant uncertainties in future climate projections".

Dr. Ben Johnson, from the Hadley Centre added : "The heating from black carbon aerosol also has unique impacts on clouds and regional rainfall patterns, making it an important process to understand and capture in climate simulations. The Met Office and University of Exeter work closely on these issues together with other academic partners in the UK and wider international community, to better understand the role of aerosols in past and future climate change."

More information: Marc Mallet, Climate models generally underrepresent the warming by Central Africa biomass-burning aerosols

over the Southeast Atlantic, *Science Advances* (2021). DOI: 10.1126/sciadv.abg9998. www.science.org/doi/10.1126/sciadv.abg9998

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