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Do mineral dust aerosols warm or cool the global climate system?

Abstract: Mineral dust aerosols are suspended soil particles that account for more than two-thirds of all aerosol particles in the atmosphere. As a result, they substantially influence several critical aspects of the global climate system, including the global energy balance. Specifically, dust interactions with the shortwave (SW) radiation primarily cool the climate, while its interactions with the longwave (LW) radiation warms the climate system. However, whether the net effect (SW+LW) of dust cools or warms the global climate system is still unclear. That is because climate models find it difficult to accurately represent the critical dust properties – dust size distribution, dust shape, and dust complex refractive index – that determines the sign of its direct radiative effect. Because there are no direct continuous measurements of these dust properties from satellite-based or ground-based remote-sensing platforms, constraining their representation in climate models has been challenging. This talk will highlight a framework that combines in-situ measurements with available remote-sensing observations of dust aerosols to constrain these dust properties and their impact on the global climate system. I will show that most climate models miss about three-quarters of coarser dust particles in the atmosphere, misrepresent dust shapes, and overestimate the dust imaginary refractive index. Whereas current models indicate that dust cools the climate, I will show that our constraints on dust properties increase the likelihood of dust warming the global climate system.

Bio: *Yemi Adebiyi* is an Assistant Professor in the Department of Life and Environmental Sciences. He obtained his M.Sc.-equivalent diploma in Earth System Physics at the International Center for Theoretical Physics, Trieste, Italy, and his Ph.D. in Meteorology and Physical Oceanography from the University of Miami, Florida. Before joining UC Merced, he was a UC President's Postdoctoral Fellow at UCLA. Yemi's research focuses on understanding the impacts of clouds and atmospheric aerosols, such as dust and smoke, on the regional and global climate.