

5.008 Aerosols and climate interaction in Community Earth System Model.

Early Career Scientist

Presenting Author:

Yangyang Xu, NCAR, yangyang@ucar.edu

Co-Authors:

J-F Lamarque, NCAR, Boulder, CO, USA

Ben Sanderson, NCAR, Boulder, CO, USA

Abstract:

Two environmental challenges that the world faces today are air pollutions (such as particulate matters or aerosols) and climate change. Using NCAR's global climate model (CESM1) that couples an online aerosol module, we studied how these two problems are entangled.

Firstly, on aerosol effects on climate, we showed that the decline of aerosol pollutions projected in the next few decades will lead to additional warming in the Northern Hemisphere, and longer and stronger heat extremes in the tropics. Surprisingly, per degree of global warming, the role of aerosols in causing warming even outweighs greenhouse gases over some regions, due to stronger changes in atmospheric circulations.

Secondly, on climate effects on aerosols, we continue to show that global warming in general leads to heavier pollution concentration in the atmosphere, even at current emission level. This suggests that air pollution regulations needs to be further strengthened to meet the current air quality standard. The results are counterintuitive because the total rainfall that removes aerosols from the air is increasing under global warming conditions. The underlying mechanisms for such a warming-driven pollution rise were investigated using CESM1.