

**Sulfate aerosol control of Tropical Atlantic climate over the 20th century**

Ching-Yee Chang<sup>†</sup>; John Chiang; Michael Wehner

<sup>†</sup> UC Berkeley, USA

Leading author: [chingyee.chang@gmail.com](mailto:chingyee.chang@gmail.com)

Many modeling studies have suggested that sulfate aerosol radiative forcing can exert an asymmetric cooling across the equator, causing the interhemispheric gradient to change. In observation, influence of anthropogenic aerosols' long term temporal variation on large scale climate in the 20th century has not gained as much attention. This study will present an observed trend in Tropical Atlantic sea surface temperatures (SST) gradient that indicates South Atlantic continuously warming stronger than North Atlantic. Consistent signals are found in Atlantic ITCZ, West African rainfall, and Atlantic equatorial meridional winds. A similar long-term forced trend is found in a multimodel ensemble of forced 20th century climate simulations of CMIP3 models. Through examining the distribution of the trend slopes in the multimodel 20th century and preindustrial models, we conclude that the observed trend in the gradient is unlikely to arise purely from natural variations; we suggest that at least half the observed trend is a forced response to 20th century climate forcings. Further analysis using 20th century single-forcing runs indicates that sulfate aerosol forcing is the predominant cause of the multimodel trend. We conclude that anthropogenic sulfate aerosol emissions, originating predominantly from the Northern Hemisphere, may have significantly altered the tropical Atlantic rainfall climate over the 20th century. We will also present some preliminary CMIP5 results for the same problem.