



## **Disentangling Aerosol Cooling and Greenhouse Warming to Reveal Earth's Climate Sensitivity**

Trude Storelvmo, Thomas Leirvik, Petter Phillips, Ulrike Lohmann, and Martin Wild

Yale University, Department of Geology and Geophysics, New Haven, United States (trude.storelvmo@yale.edu)

Earth's climate sensitivity has been the subject of heated debate for decades, and recently spurred renewed interest after the latest IPCC assessment report suggested a downward adjustment of the most likely range of climate sensitivities. Here, we present a study based on the time period 1964 to 2010, which is unique in that it does not rely on global climate models (GCMs) in any way. The study uses surface observations of temperature and incoming solar radiation from approximately 1300 surface sites, along with observations of the equivalent  $\text{CO}_2$  concentration ( $\text{CO}_2, \text{eq}$ ) in the atmosphere, to produce a new best estimate for the transient climate sensitivity of 1.9K (95% confidence interval 1.2K – 2.7K). This is higher than other recent observation-based estimates, and is better aligned with the estimate of 1.8K and range (1.1K – 2.5K) derived from the latest generation of GCMs. The new estimate is produced by incorporating the observations in an energy balance framework, and by applying statistical methods that are standard in the field of Econometrics, but less common in climate studies. The study further suggests that about a third of the continental warming due to increasing  $\text{CO}_2, \text{eq}$  was masked by aerosol cooling during the time period studied.