

# Volcanic contribution to decadal changes in tropospheric temperature

## Objective

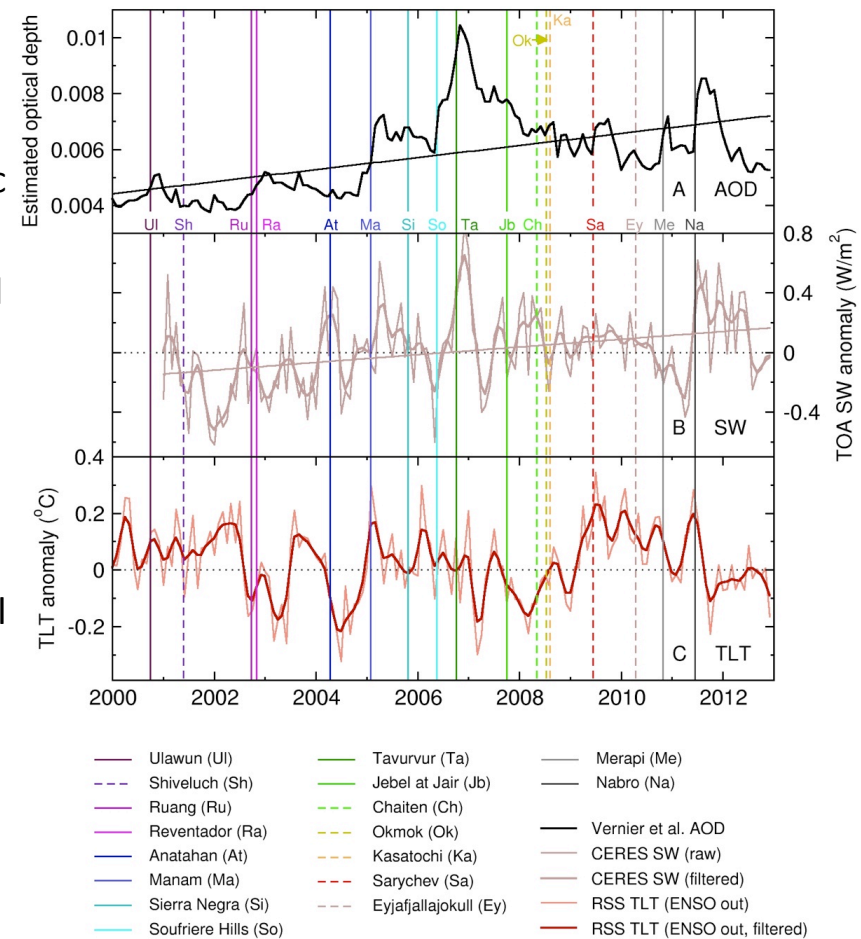
- Improve scientific understanding of the volcanic contribution to the post-1998 “warming hiatus”

## Research

- To determine whether signals of early 21<sup>st</sup> century volcanic activity are identifiable in satellite observations
- To understand the causes of differences between modeled and observed tropospheric warming trends

## Impact

- Early 21<sup>st</sup> century volcanic activity had a cooling influence on surface and tropospheric temperature
- This cooling influence is statistically identifiable in satellite observations of correlations between stratospheric aerosol optical depth (SAOD) and tropospheric temperature (and between SAOD and SW fluxes at the top of atmosphere)
- Omitting the cooling effect of early 21<sup>st</sup> century volcanic activity from CMIP-5 simulations of historical climate change contributes to a model-average warm bias in tropospheric temperature trends
- Results do not support claims of a factor of three error in model climate sensitivity estimates



Changes in observed stratospheric aerosol optical depth (SAOD; panel A), net-clear sky short-wave fluxes at the top of the atmosphere (panel B), and lower tropospheric temperature (after statistical removal of ENSO effects; panel C). Vertical lines denote the start dates of early 21<sup>st</sup> century volcanic eruptions. For further details, refer to Fig. 2 in Santer *et al.* (2014)

**Reference:** B. D. Santer, C. Bonfils, J.F. Painter, C. Bonfils, M.D. Zelinka, C.A. Mears, S. Solomon, G.A. Schmidt, J.C. Fyfe, J.N.S. Cole, L. Nazarenko, K.E. Taylor, and F.J. Wentz (2014): Volcanic contribution to decadal changes in tropospheric temperature. *Nature Geoscience*, **7**, 185-189.