Anthropogenic and volcanic contributions to the stratospheric aerosol trends

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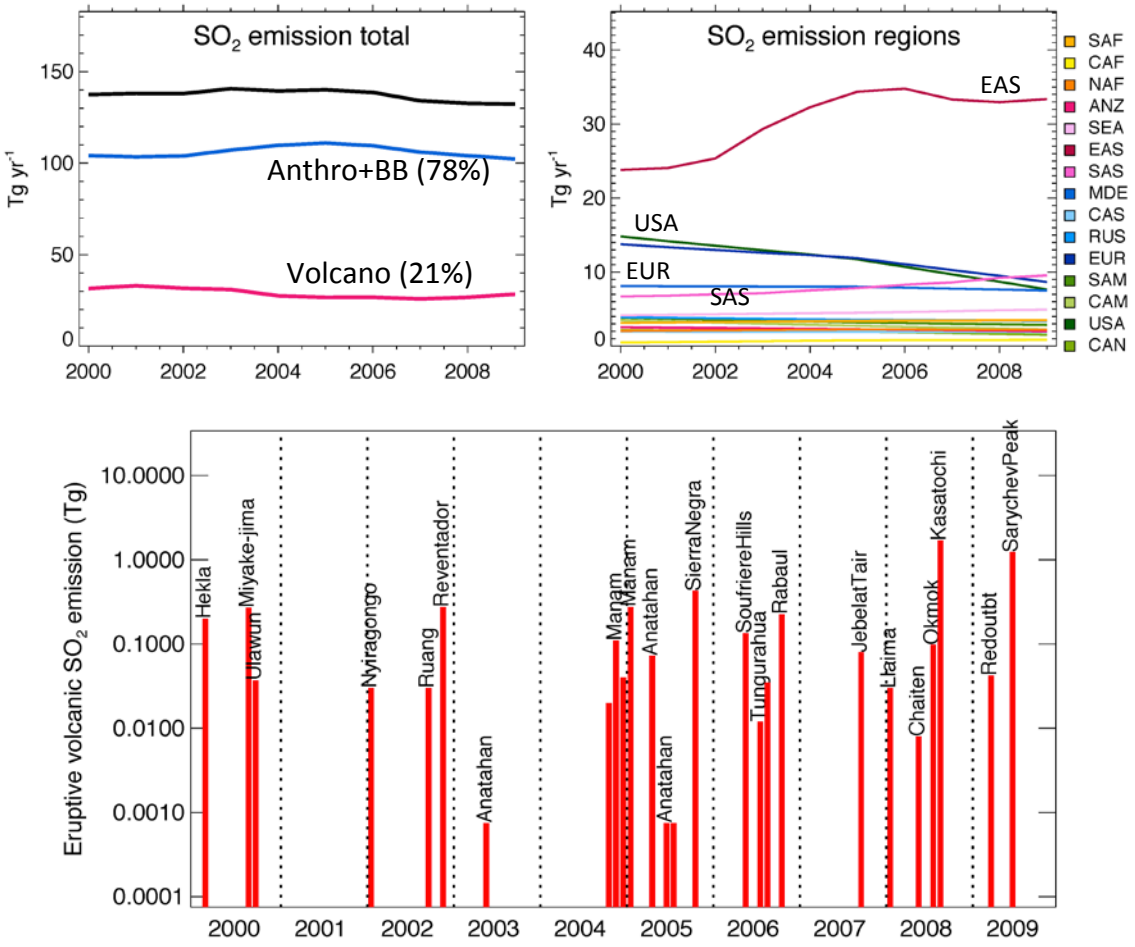
- Recent observations seem to suggest that the stratospheric "background" aerosol has been increasing in the past decade, and anthropogenic emission increase in Asia was proposed to be the cause of this increase.
- However, even without large volcanic eruption (i.e., at the magnitude of El Chichon or Pinatubo) in the last decade, there have been many numerous volcanic eruptions, putting SO_2 into the upper troposphere or stratosphere.
- This study attempts to use the GOCART model to estimate the anthropogenic and volcanic contributions to the stratospheric aerosol trends/variations in the past decade (2000-2009)



SO_2 emission from eruptive volcanoes from 2000 to 2009 with injection height above 10 km. Data source: TOMS, OMI, GVP, and in-situ measurements reported in literature. (work compiled by Thomas Diehl.)

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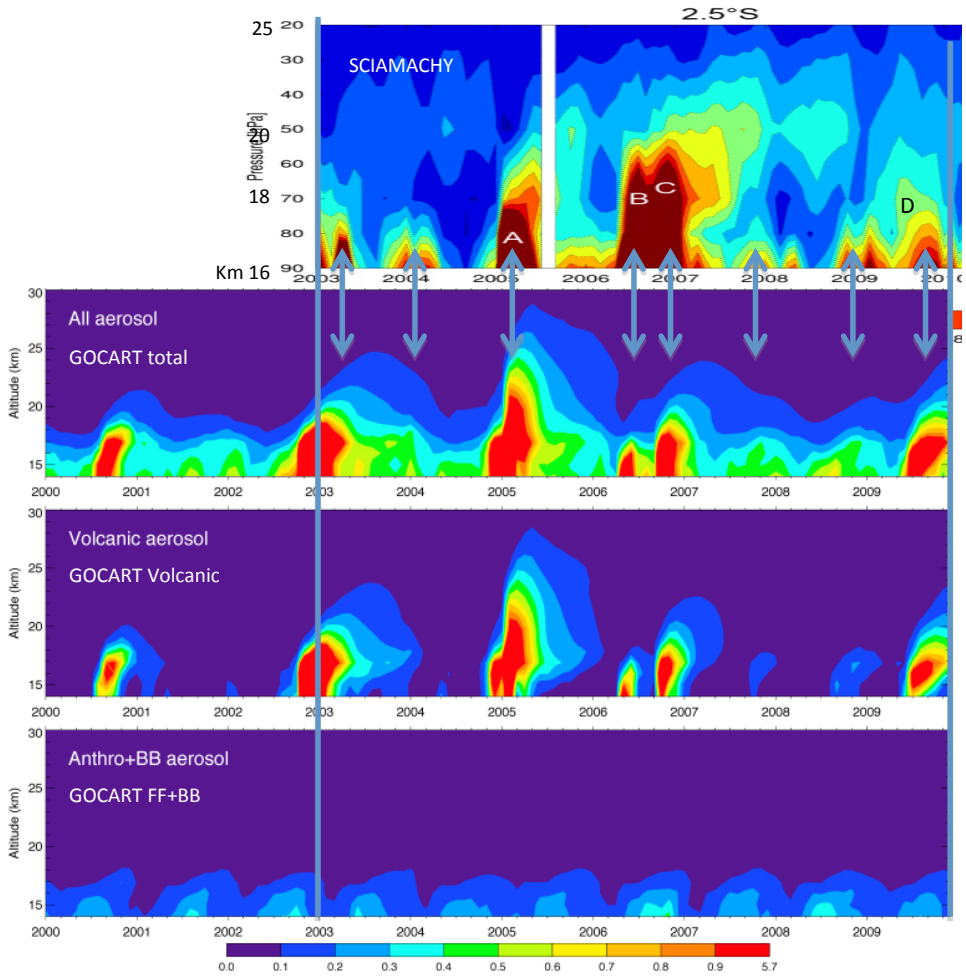
Results

- Both satellite data and model have shown that even without major explosive volcanic eruptions, volcanic emissions frequently perturb the stratospheric “background” aerosols, making it difficult to define non-volcanic background aerosol values in the stratosphere.
- The model suggest that the increase of Asia pollution does contribute to the stratospheric aerosol, but they are mostly confined in the lower stratosphere with organized seasonal cycles and is much less than volcanic aerosols.



Time series of zonal and monthly averaged stratospheric aerosol extinction vertical profiles at 2.5°S from SCIAMACHY observations (top panel), GOCART simulation (2nd panel), GOCART volcanic aerosol only (3rd panel) and GOCART anthropogenic (fossil fuel +biomass burning) aerosol only (last panel). Major volcanic eruptions: A. Manam (Jan 2005, 4°S) B. Soufriere Hills (May 2006, 16°N) C. Tavurvur (Oct 2006, 4°S) D. Sarychev Peak (July 2009, 48°N)

Work supported by NASA Aura Program