

# Proposal for UTLS aerosol analysis

Mian Chin

# Objectives and background

- Objective:
  - To assess the anthropogenic, volcanic, and biomass biomass burning contributions to UTLS aerosol composition and decadal variations
- Background:
  - The UTLS is a crucial region for Earth's climate
  - Recently studies have found the increase of LS aerosols in the past decade, but the studies do not agree on if the increase is by the increase of Asian anthropogenic emissions or by the increase of volcanic activities
  - Can we use the models to help sort out the origin of UTLS aerosols?
- Coordination with the SSiRC's "model intercomparisons of transient aerosol records (MITAR)" activity

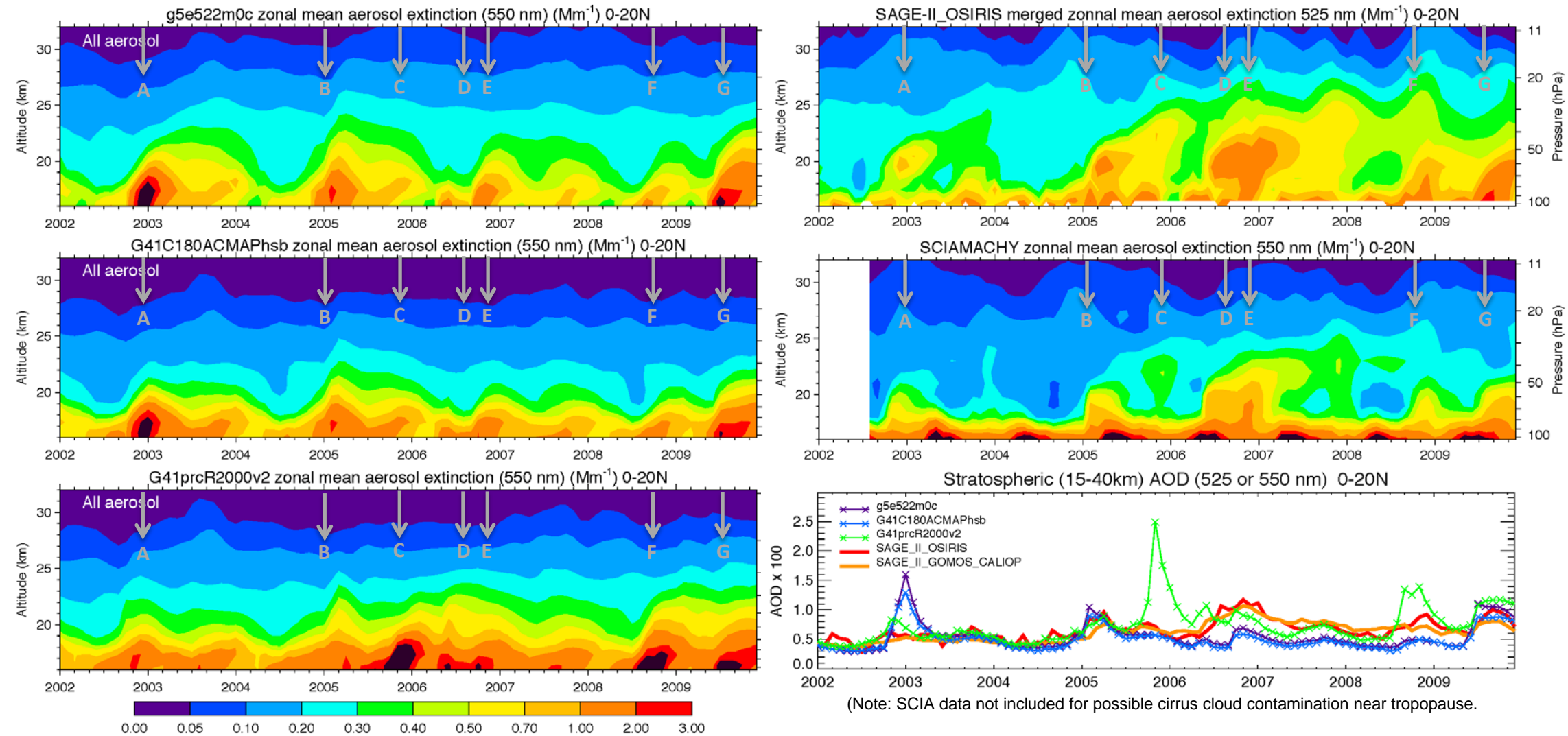
# Available data for model evaluation

- Satellite:
  - Aerosol extinction from SAGE II, OSIRIS, SCIAMACHY, GOMOS, CALIOP
- Aircraft:
  - CARIBIC, HIPPO, INTEX-A and -B, ARCTAS, ICATT, POLARCAT

# Zonal mean aerosol extinction at 550 nm ( $\text{Mm}^{-1}$ ), 0-20N

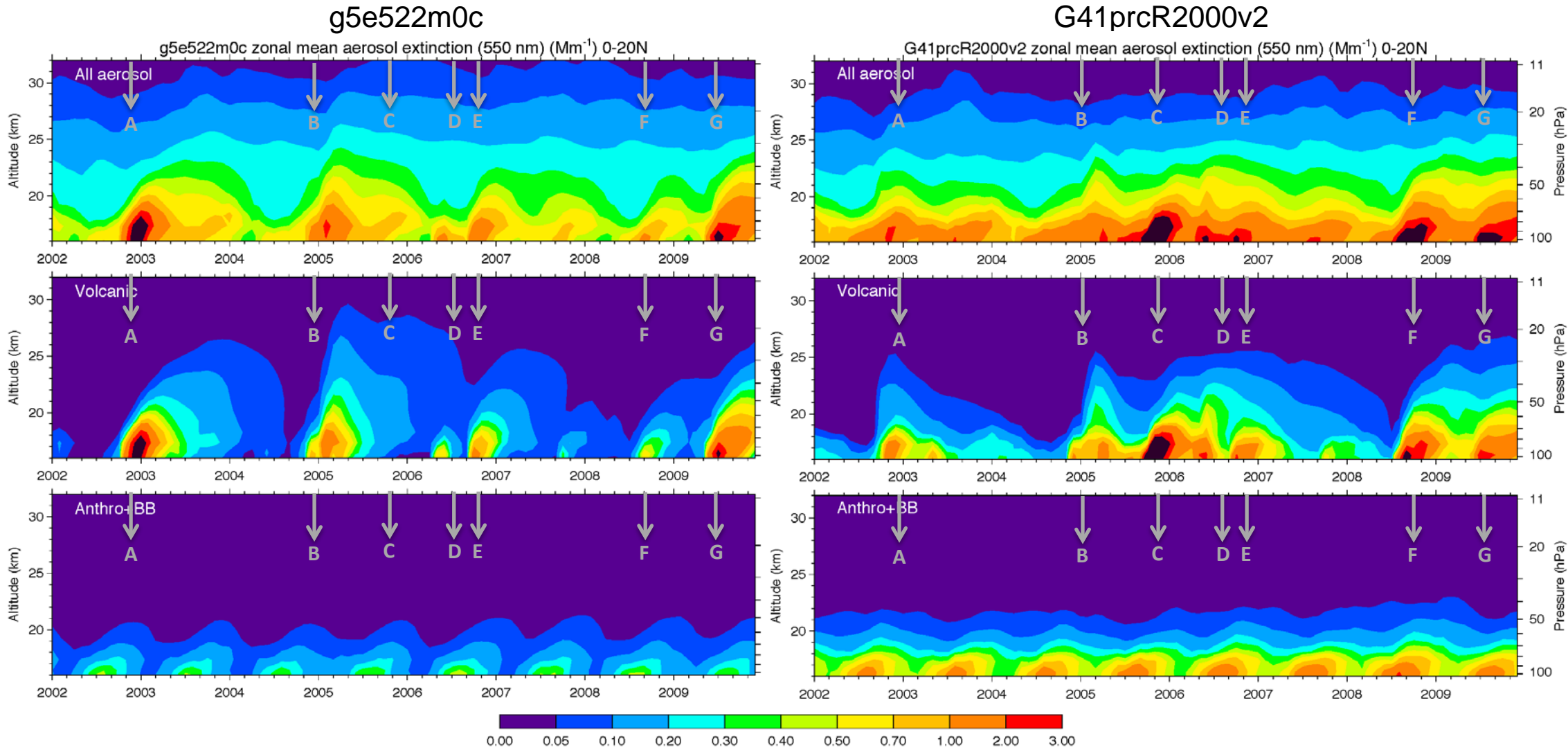
Model simulations

Satellite data



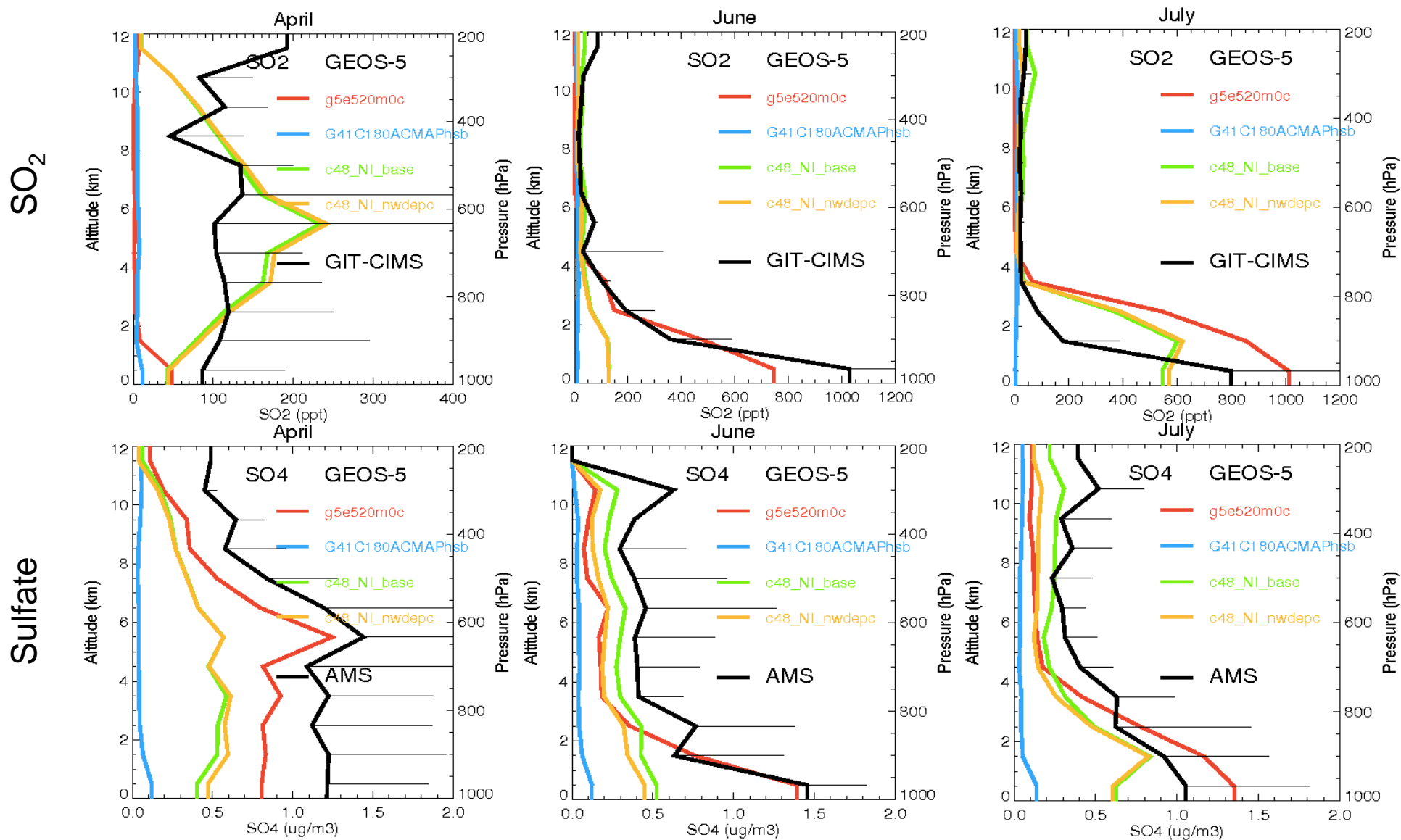
A. Reventador (0.08°S, Nov 2002), B. Manam (4°S, Jan 2005), C. Sierra Negra (0.83°S, October 2005), D. (Soufriere Hills (16°N, May 2006), E. Tavurvur (4°S, Oct 2006), F. Kasatochi (52°N, Aug 2008), G. Sarychev Peak (48°N, July 2009)

# Total aerosol extinction at 550 nm ( $\text{Mm}^{-1}$ ), 0-20N and anthropogenic and volcanic contributions

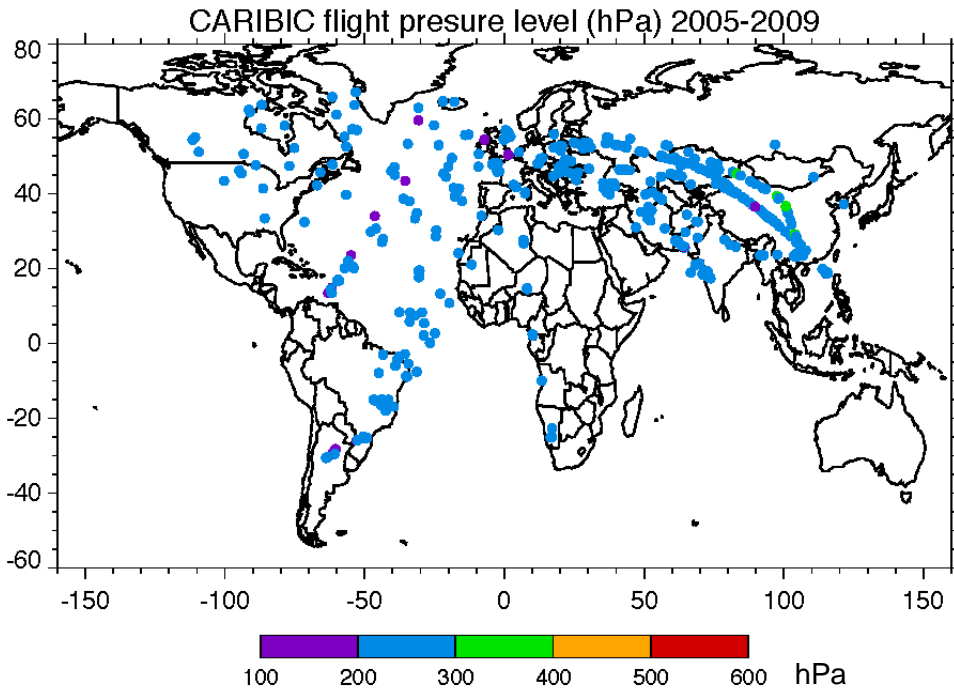


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# SO<sub>2</sub> and sulfate vertical profiles during ARCTAS (2008)

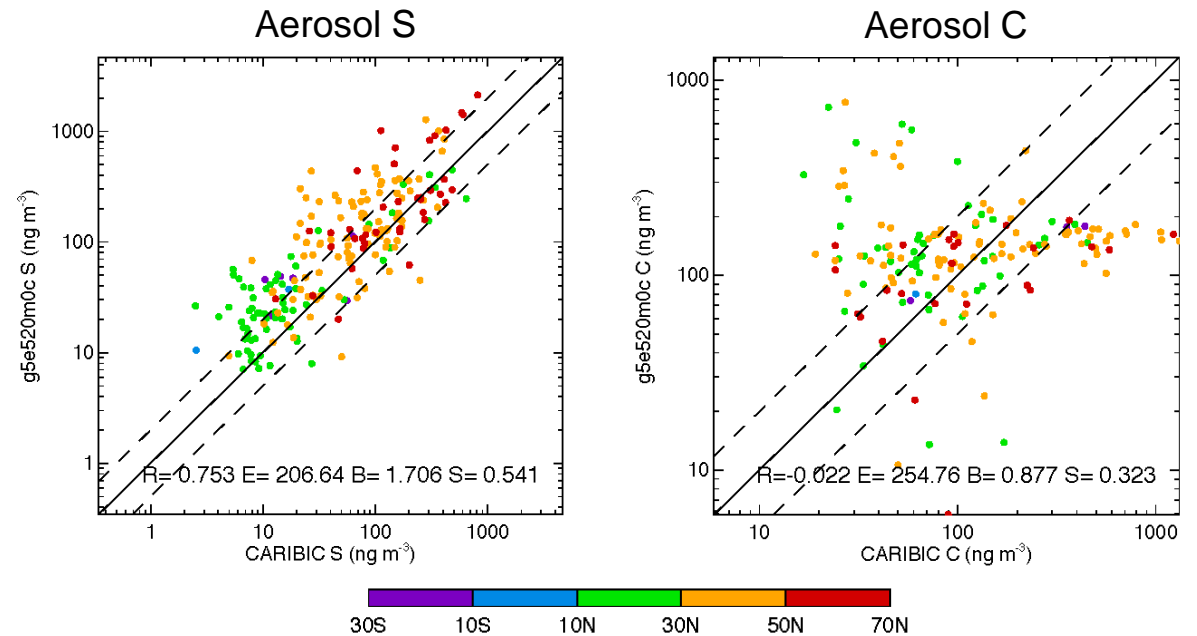


# Free Tropospheric aerosol S and C measurements from CARIBIC



Majority of the data are taken at 200-300 hPa altitude

Comparisons between observed and simulated aerosol concentrations at different latitudes in 2008-2009



Model shows simulated aerosols S agree with the data with  $R=0.75$ , but over estimate by 70%. On the other hand, model cannot reproduce the aerosol C at all

# Model simulation

- Period:
  - 2000 (or 2005)-2012
- Emissions:
  - Anthropogenic emission: from ACCMIP or EDGAR
  - Biomass burning emission: PyroCb based on parameterized AI-height (Guan et al., 2010) or MISR plume height
  - Volcanic emission: Diehl database (needs update) or Carn database
- Model simulation:
  - Base, natural only, volcano only; base simulation including sulfate from OCS oxidation
- Output:
  - Daily 3-D output of aerosol extinction and mass concentrations for all species