Aerosol Working Group Report

ARM STM 2008 Norfolk, VA

Connor Flynn for B Schmid

and AWG Members

AWG Instruments

- Raman Lidar - SGP
- Micropulse Lidars – all sites
- Aerosol Sampling – SGP, NSA, AMF
  - scattering, absorption, number, size distribution, hygroscopicity, CCN, composition (major ions).
- In situ Aerosol Profile (Cessna)
  - scattering, absorption, number, hygroscopicity,
- Radiometers:
  - MFRSR, NIMFR, RSS, Cimel, AERI, SWS

AWG-related Field Campaigns

- **Recent Past:**
  - **MASRAD (Marine Stratus Radiation, Aerosol, and Drizzle, CA, 2005)**
  - **ALIVE (Aerosol Lidar Validation Experiment, SGP, 2005)**
  - **RADAGAST (Niger, 2006)**
  - **CLASIC (SGP, June 2007), with ASP CHAPS**
  - **COPS, AMF, (Germany, 2007)**
- **Near Future:**
  - **ISDAC (NSA, 2008)**
  - **AMF (China, 2008)**

AWG
Research Highlights

ARM Web Site has

-- Peer reviewed papers: 20 (in 2007)
-- Research Highlights: 13

related to aerosol

The Radiative Impact of Saharan Dust Over Niamey, Niger

T. Ackerman, ***University of Washington***

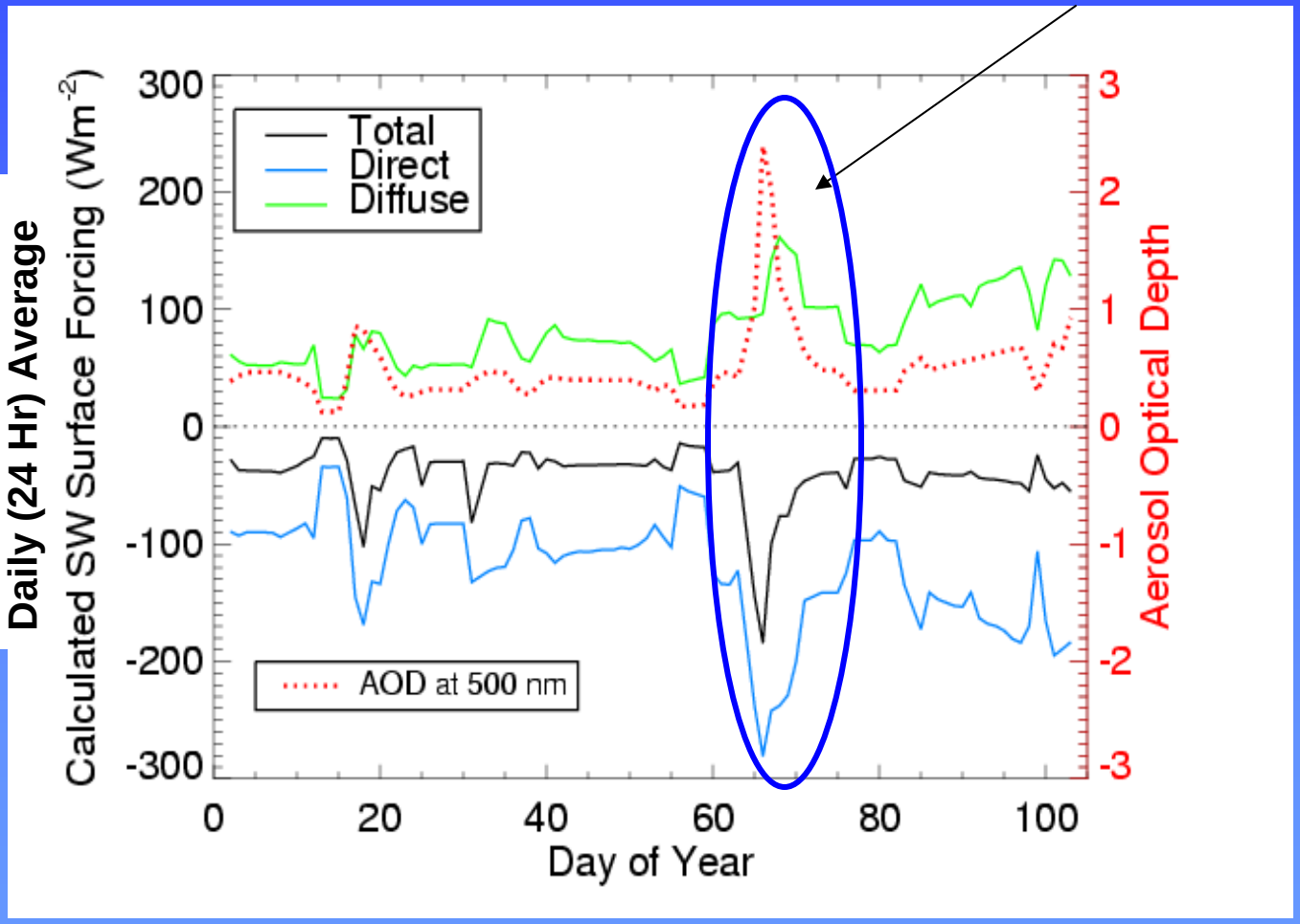
S. McFarlane, E. Kassianov, C. Flynn
Pacific Northwest National Laboratory

D. Turner, ***University of Wisconsin***

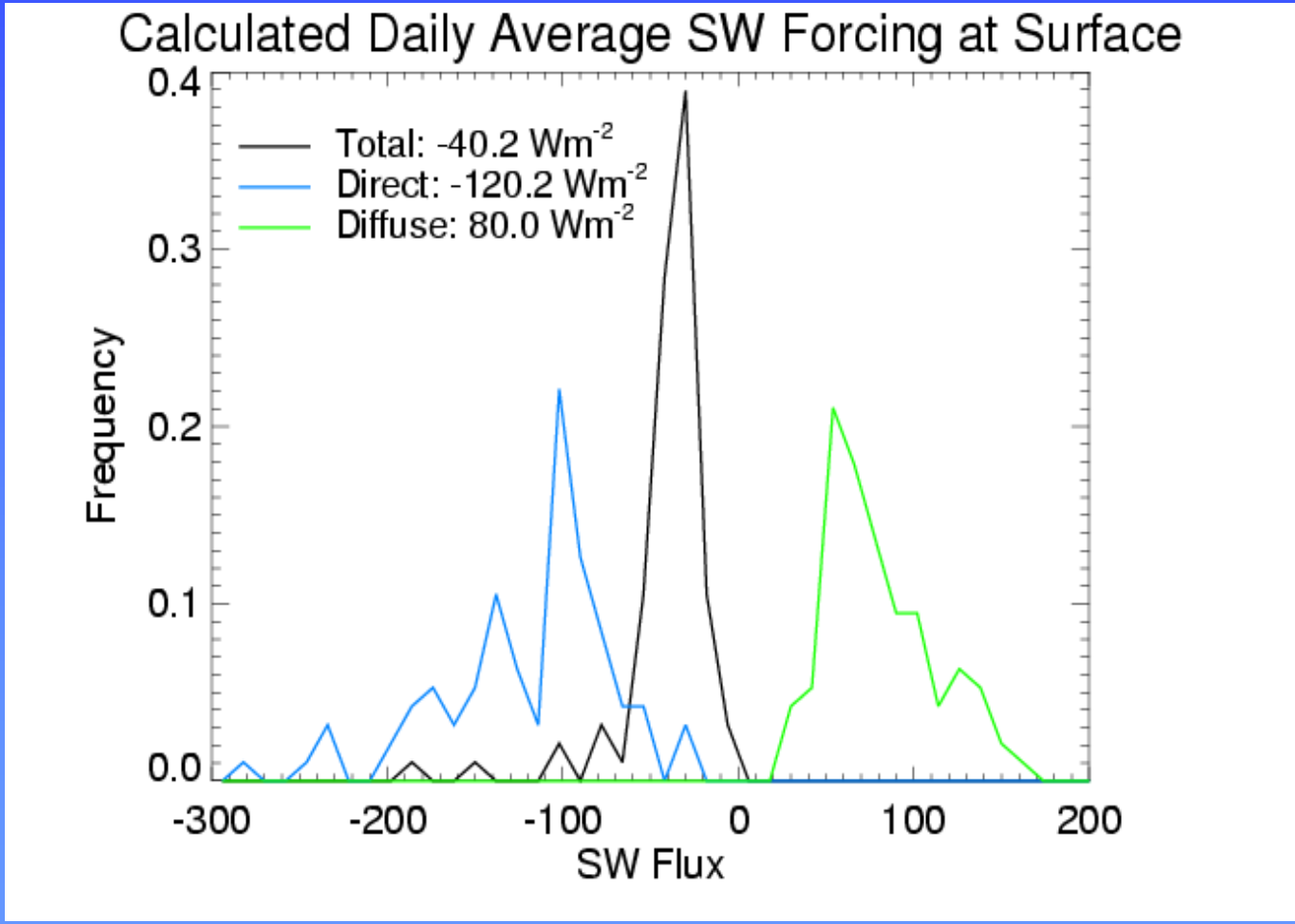
N. Ghosh Roy, ***University of Washington***

Long-term Aerosol SFC Radiative Forcing

March Dust Storm

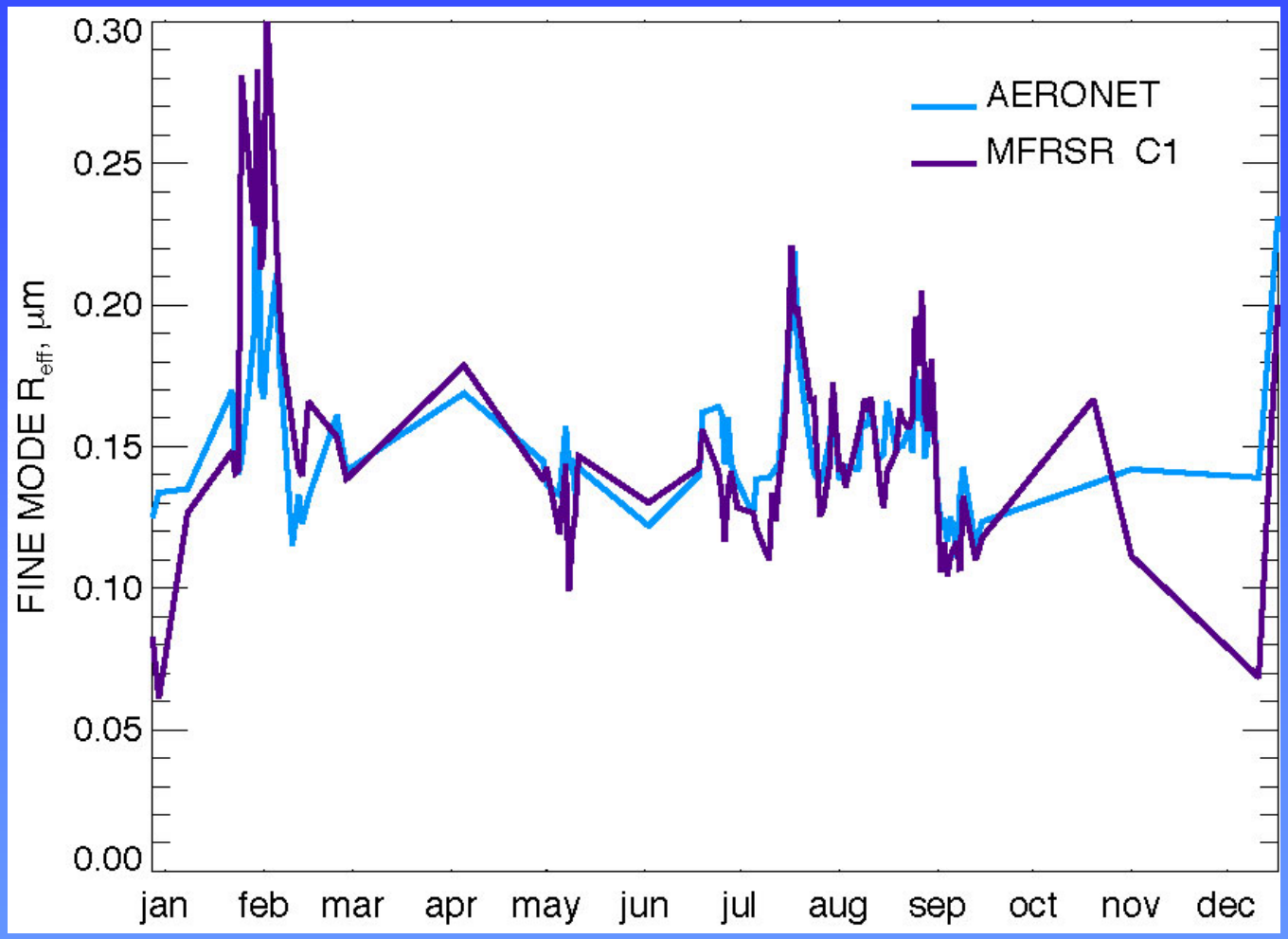


Long-term Aerosol SFC Radiative Forcing



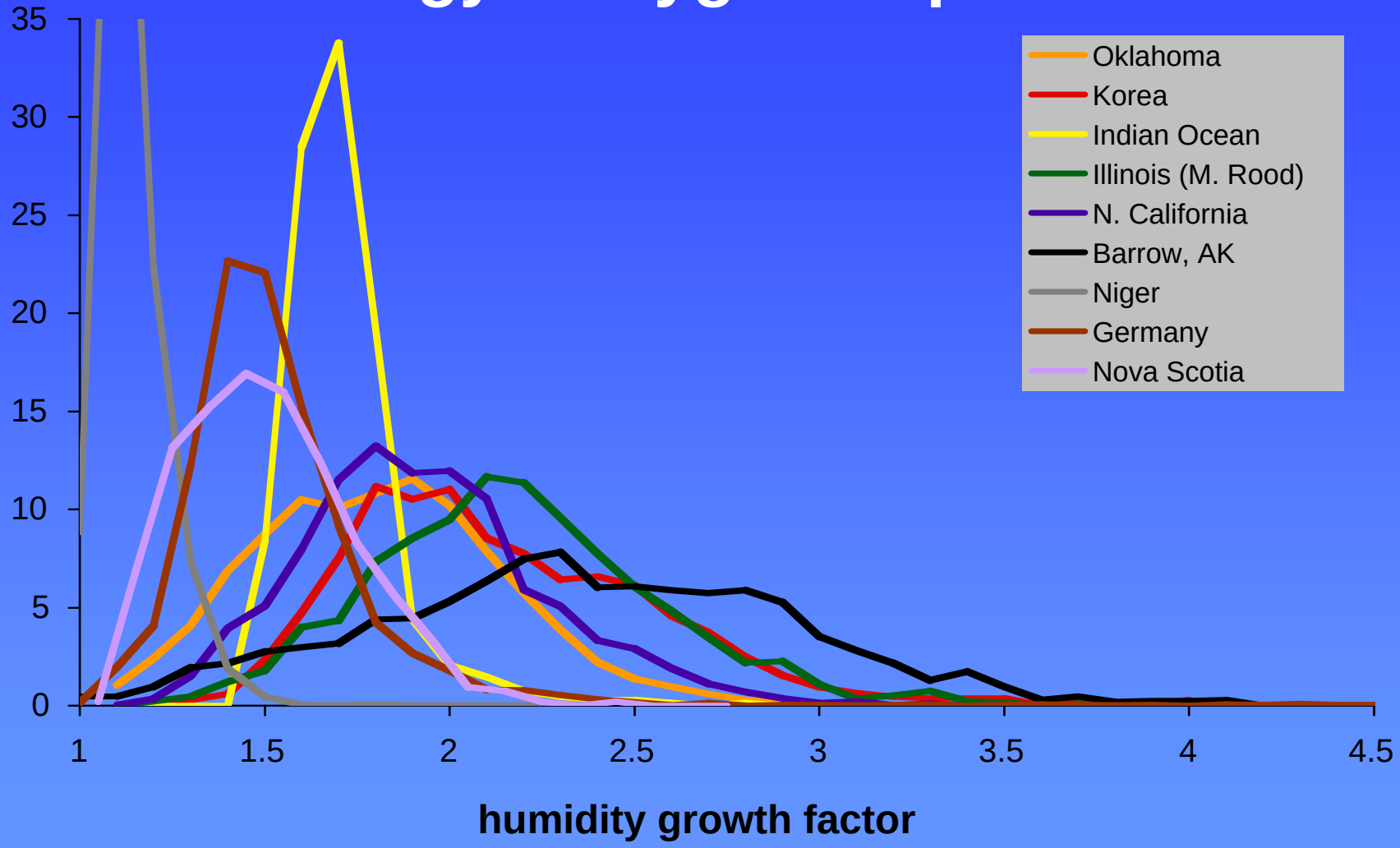
MFRSR v.s. AERONET: R_{eff}

Alexandrov et al. JGR accepted Nov 2007



Daily mean **fine mode effective radius** from SGP C1 MFRSR and AERONET almucantar scan retrievals for year 2000.

Climatology of Hygroscopic Growth



Climate models must represent water uptake by aerosols to calculate radiative forcing. ARM and NOAA long-term measurements allow evaluation of model performance for a wide range of conditions.

In situ Aerosol Profiles 2000-2007

Cessna 172 (2000-2005)

Cessna 206 (2006-2007)

Andrews, Jefferson, Ogren, Sheridan, Torn

In situ Aerosol Profiles 2000-2007

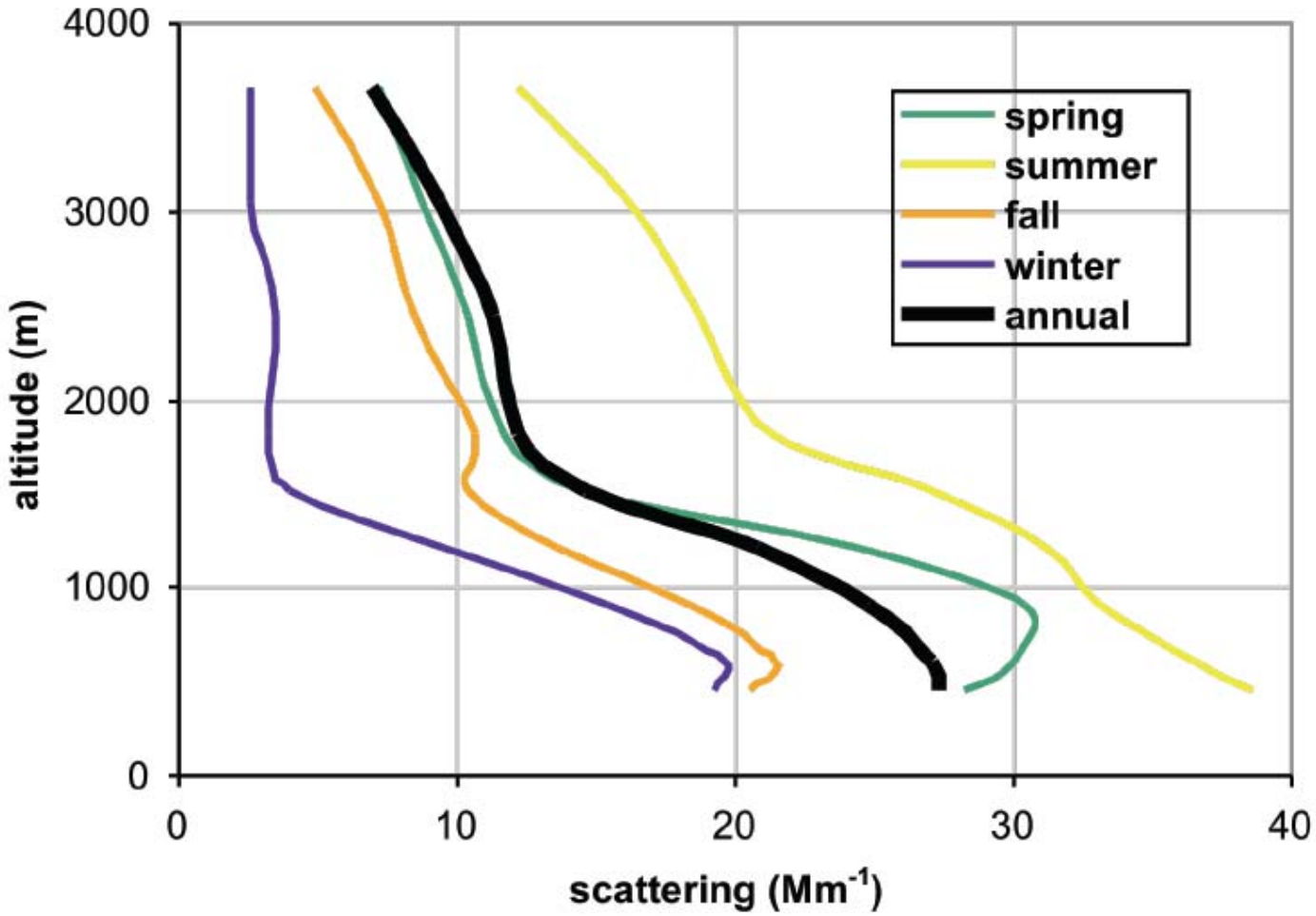


Figure 3: Seasonal variability of vertical profile of aerosol light scattering (550 nm). Altitudes are given in meters above mean sea level.

In situ Aerosol Profiles 2000-2007

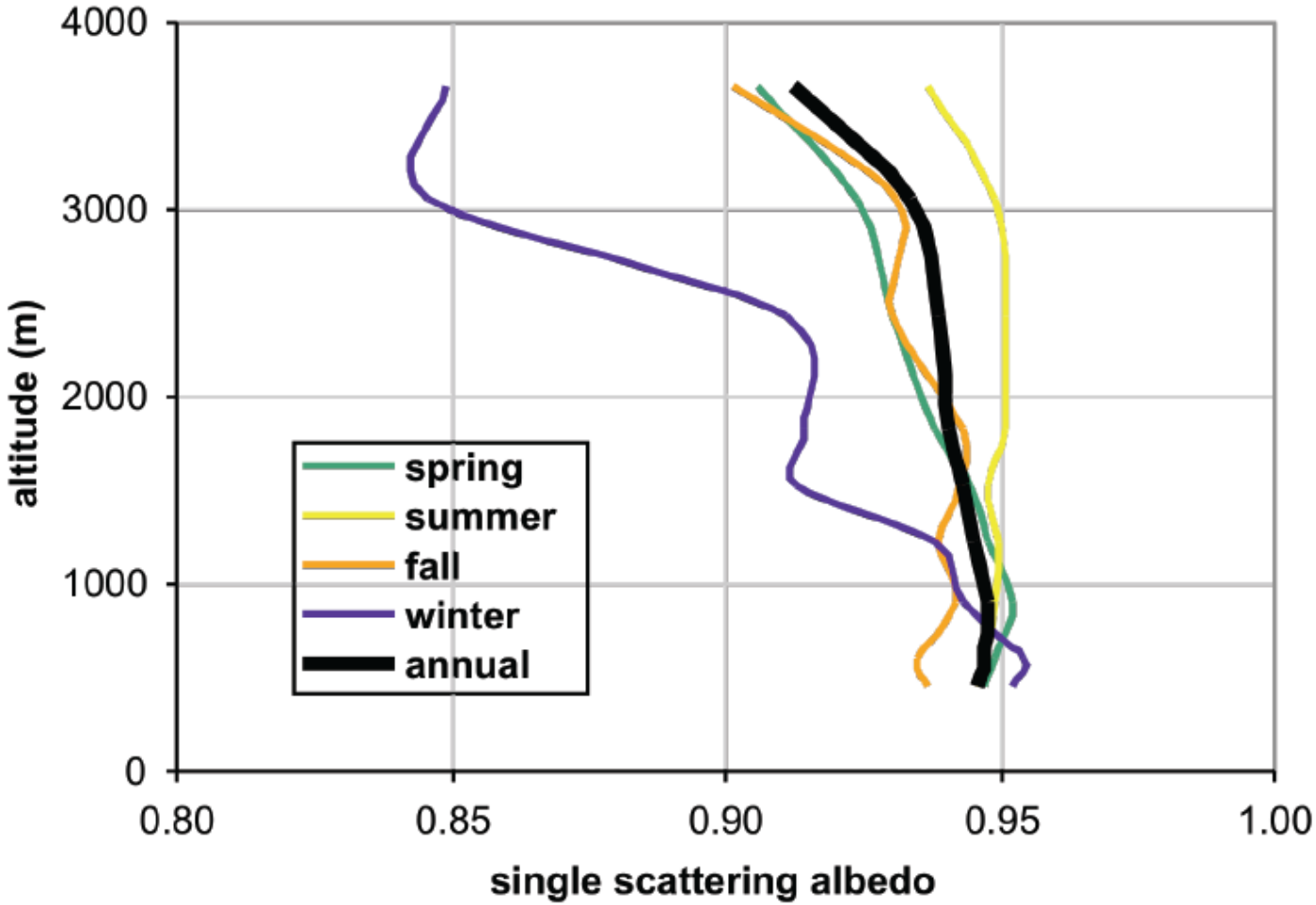


Figure 5: Seasonal variability of vertical profile of aerosol single-scattering albedo (550 nm). Altitudes are given in meters above mean sea level.

In situ Aerosol Profiles 2000-2007

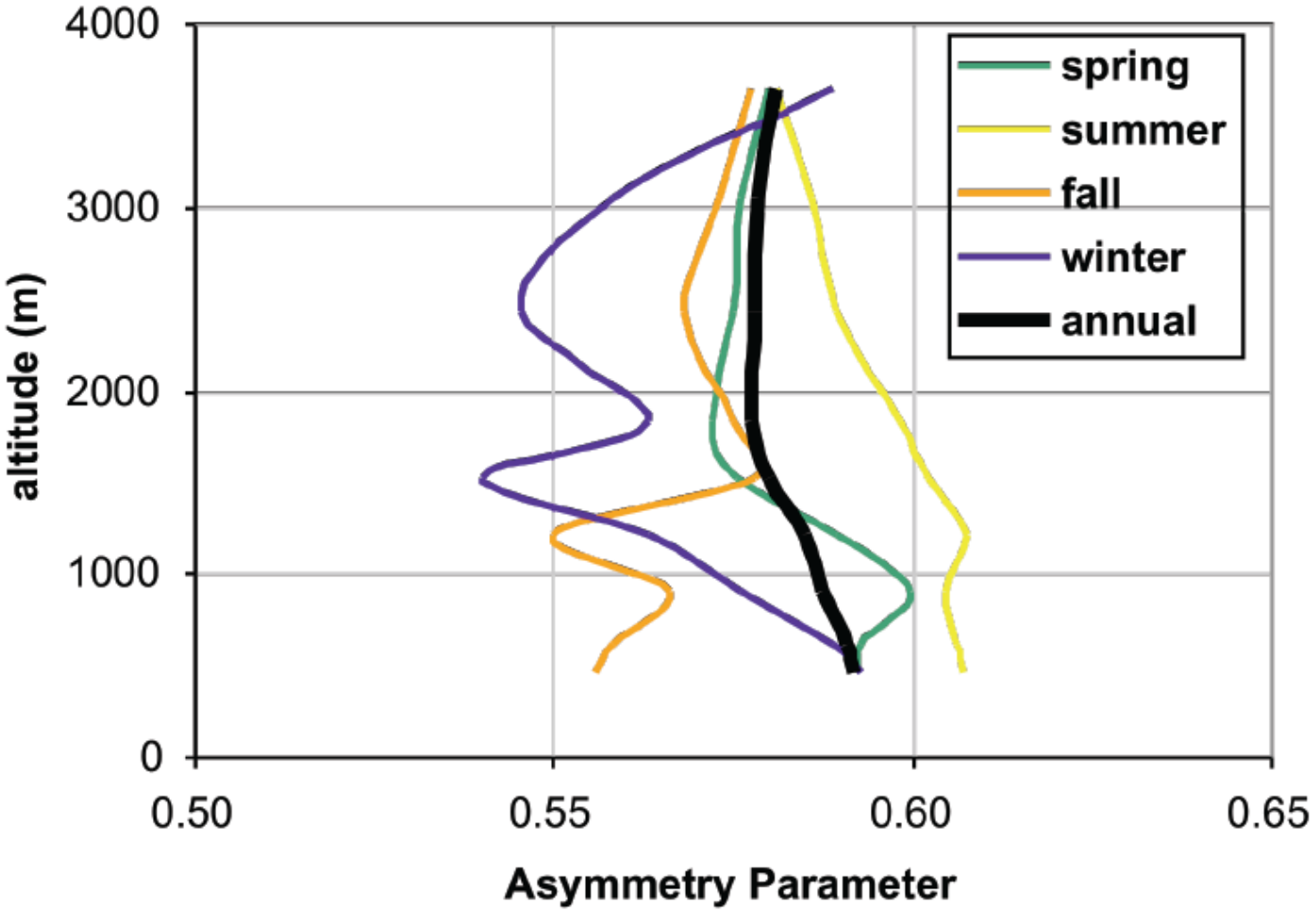
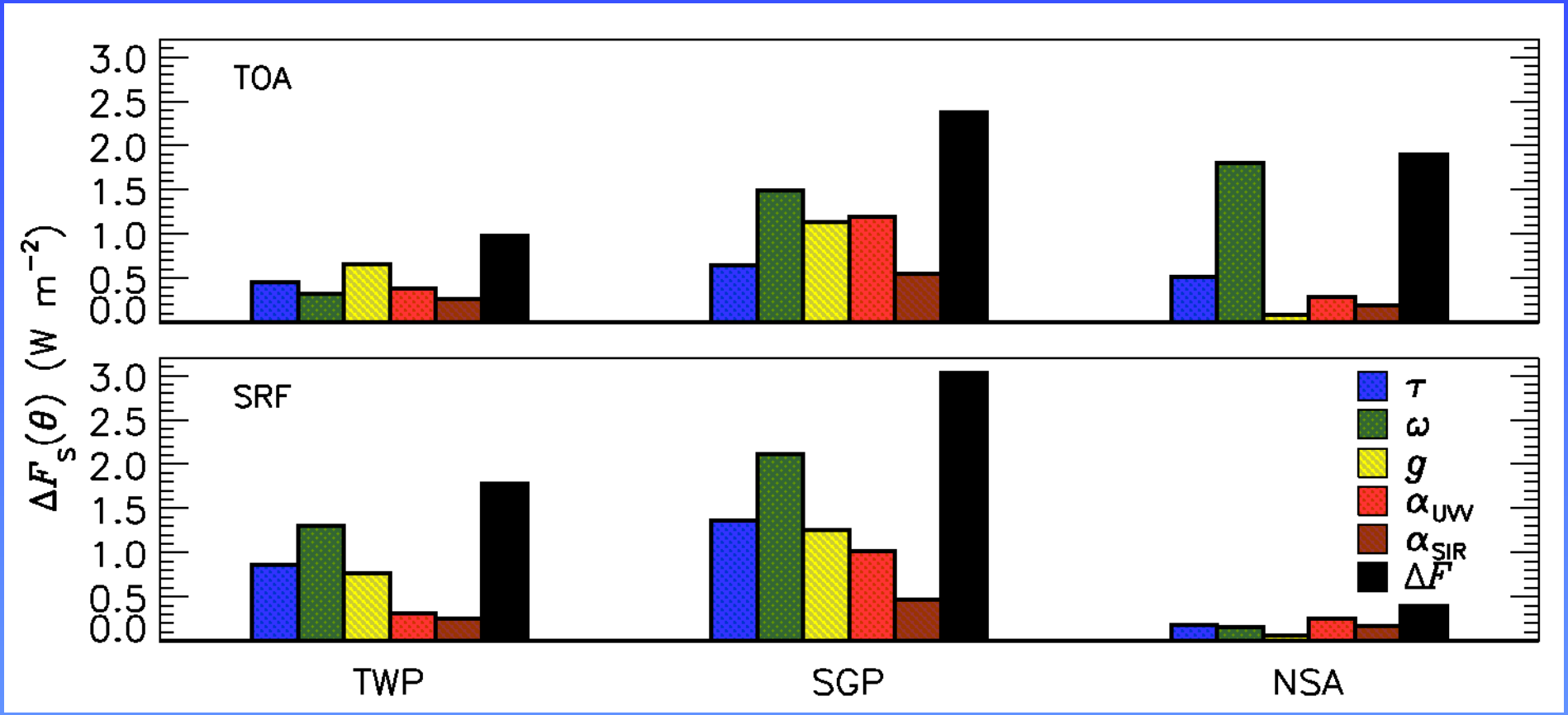


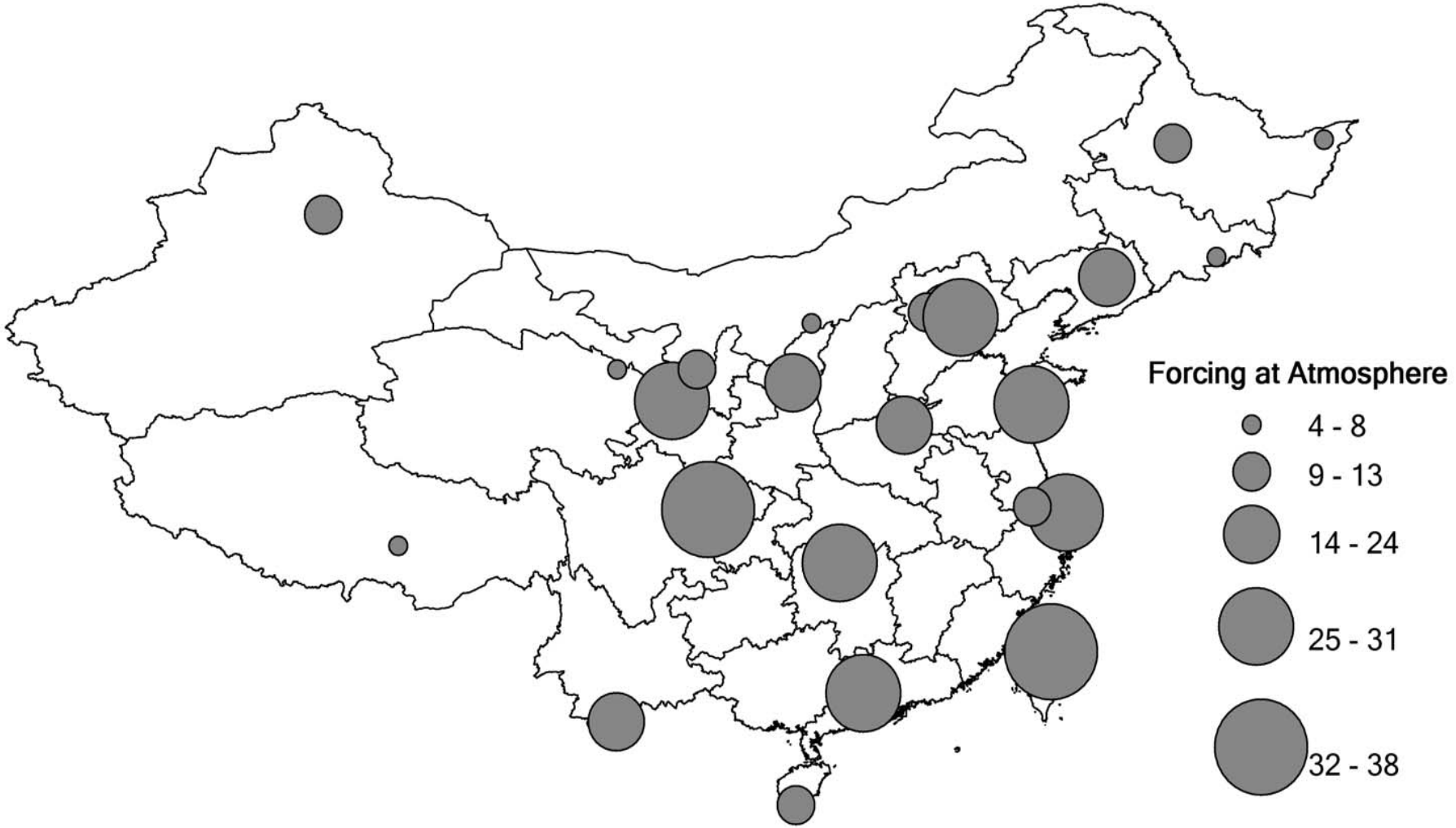
Figure 6: Seasonal variability of vertical profile of aerosol asymmetry parameter (550 nm). Altitudes are given in meters above mean sea level.

Direct Aerosol Forcing: Calculation from Observables and Sensitivities to Inputs.



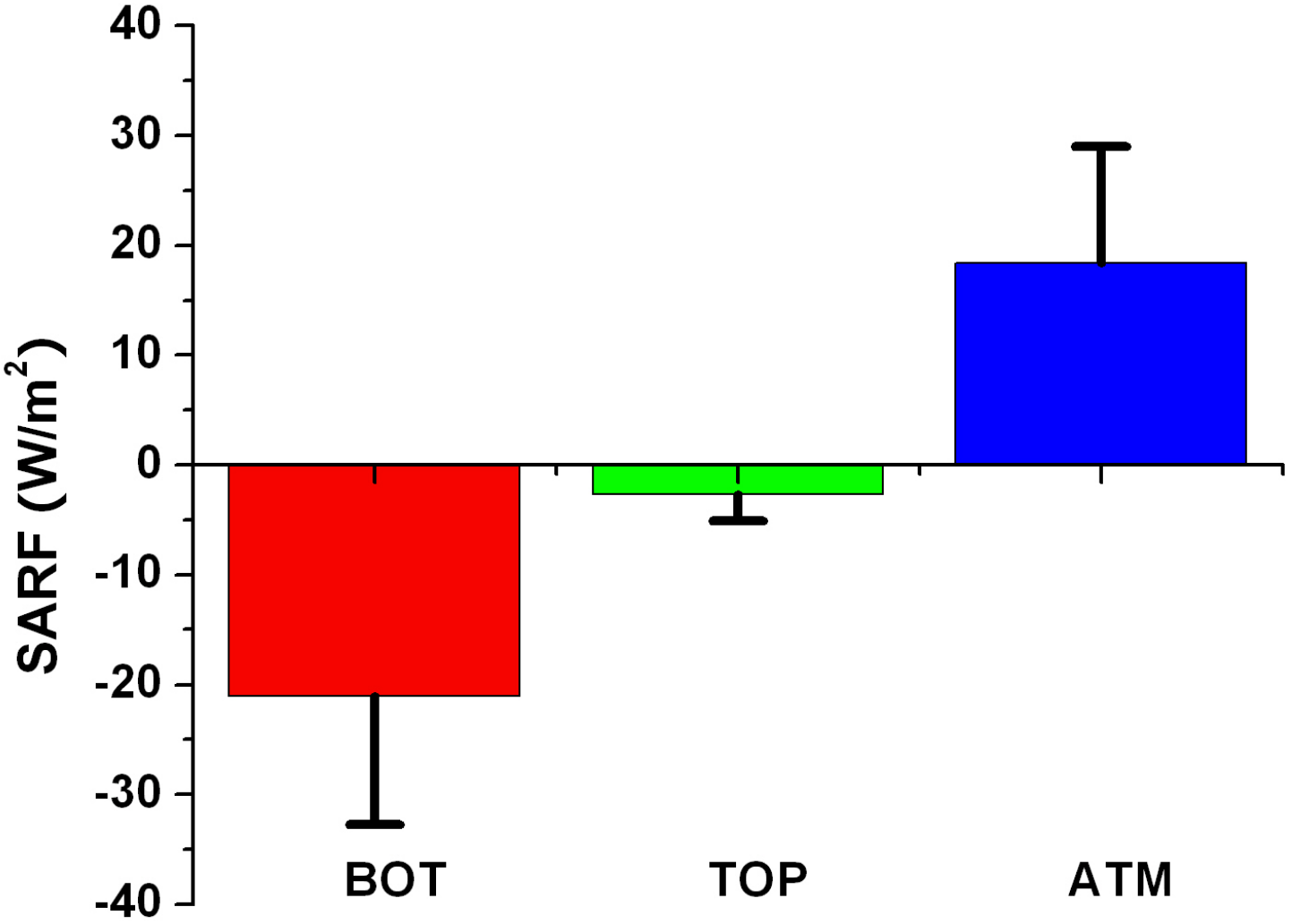
McComiskey A., S. E. Schwartz, B. Schmid, H. Guan, E. R. Lewis, P. Ricchiazzi, J. A. Ogren. Direct Aerosol Forcing: Calculation from Observables and Sensitivities to Inputs. *J. Geophys. Res.*, accepted 11/7/2007

Aerosol radiative forcing in the atmosphere



Slide provided by Z. Li

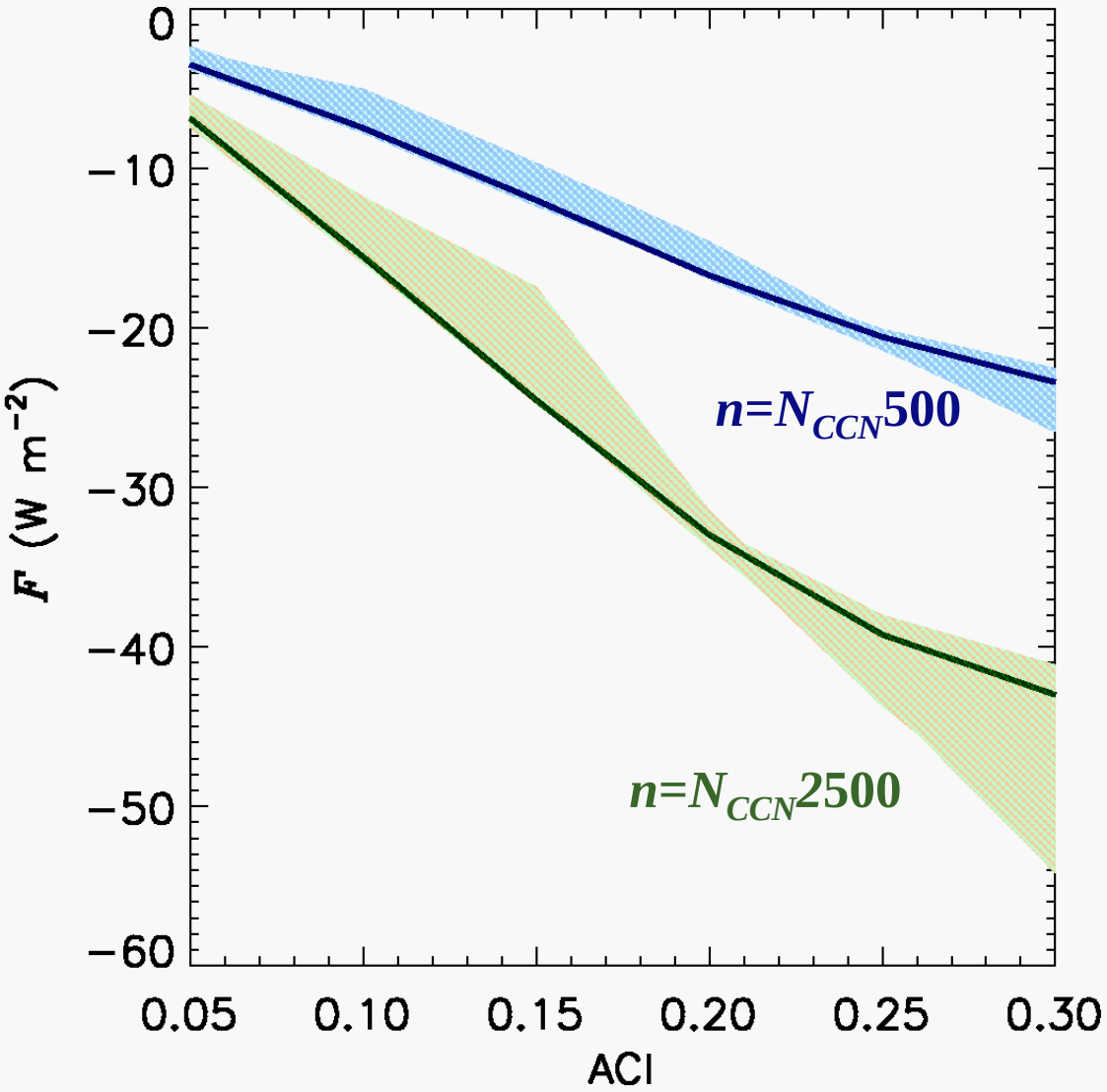
National Mean of Aerosol Radiative Forcing at the TOA, Surface and inside the Atmosphere



Slide provided by Z. Li

Quantifying Error in the Radiative Forcing of the First Aerosol Indirect Effect

McComiskey and Feingold, *GRL*, 2008

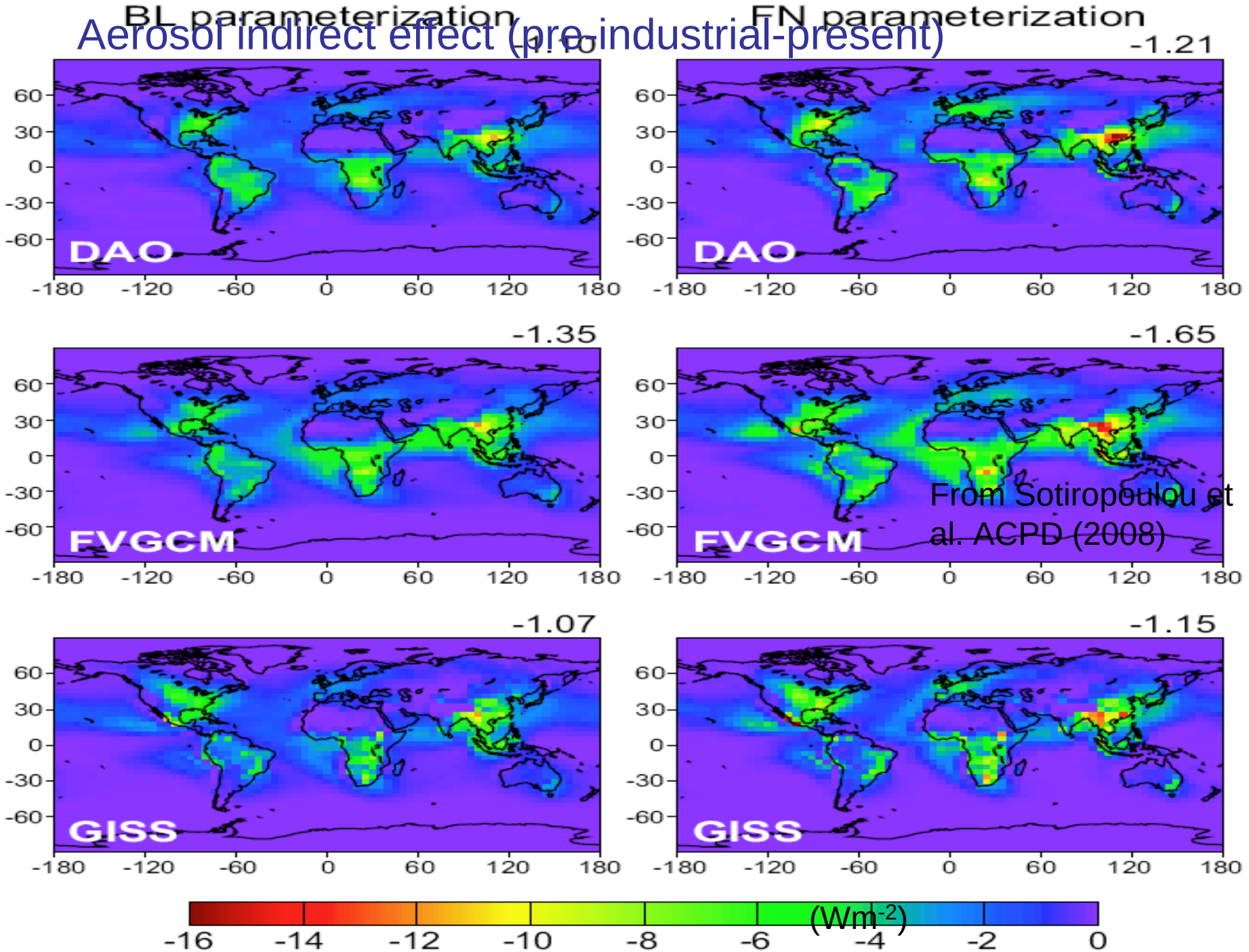


TOA Radiative Forcing

$F = f(n) - f(N_{CCN}100)$

$$ACI = \frac{\partial \ln \tau_d}{\partial \ln N_{CCN}}$$

Aerosol indirect effect (pre-industrial-present)



From Sotiropoulou et al. ACPD (2008)

G-1

CLASIC/CHAPS 2007 in situ

CIRPAS Twin Otter

C206

CLASIC/CHAPS 2007 Remote Sensing

Indirect and Semi-Direct Aerosol Campaign (ISDAC)

PI: S. Ghan

NSA: April 2008

Convair

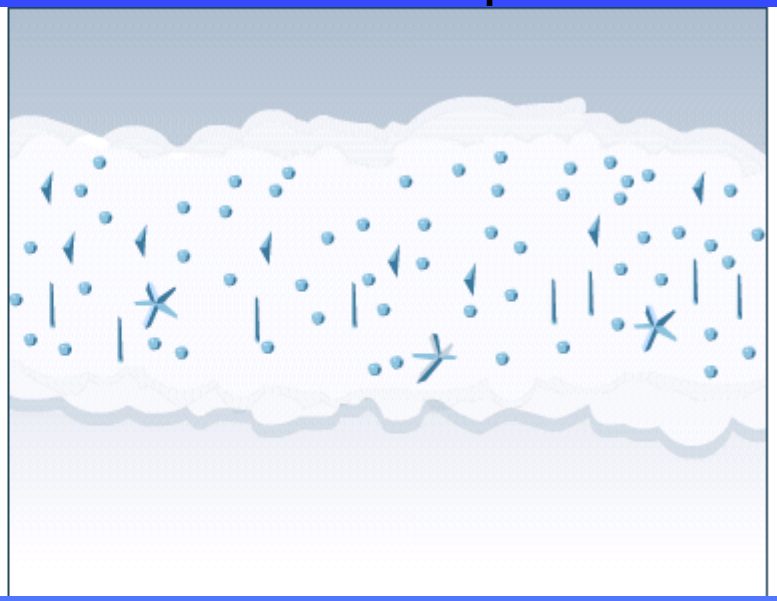
Also:

- **NASA ARCTAS**
- **NOAA ARCPAC**

M-PACE Oct. 2004

- Pristine Conditions
  - Open ocean
  - Few cloud droplets
  - Ice multiplication
  - Precipitation
- Measurements by ~10 instruments
  - aerosol properties
  - cloud microphysics
  - atmospheric state.

ISDAC Apr. 2008



- Polluted Conditions
  - Sea Ice
  - Many cloud droplets
  - Ice nucleation
  - Little precipitation
- Measurements by ~40 instruments
  - aerosol properties
  - cloud microphysics
  - radiative energy
  - atmospheric state.