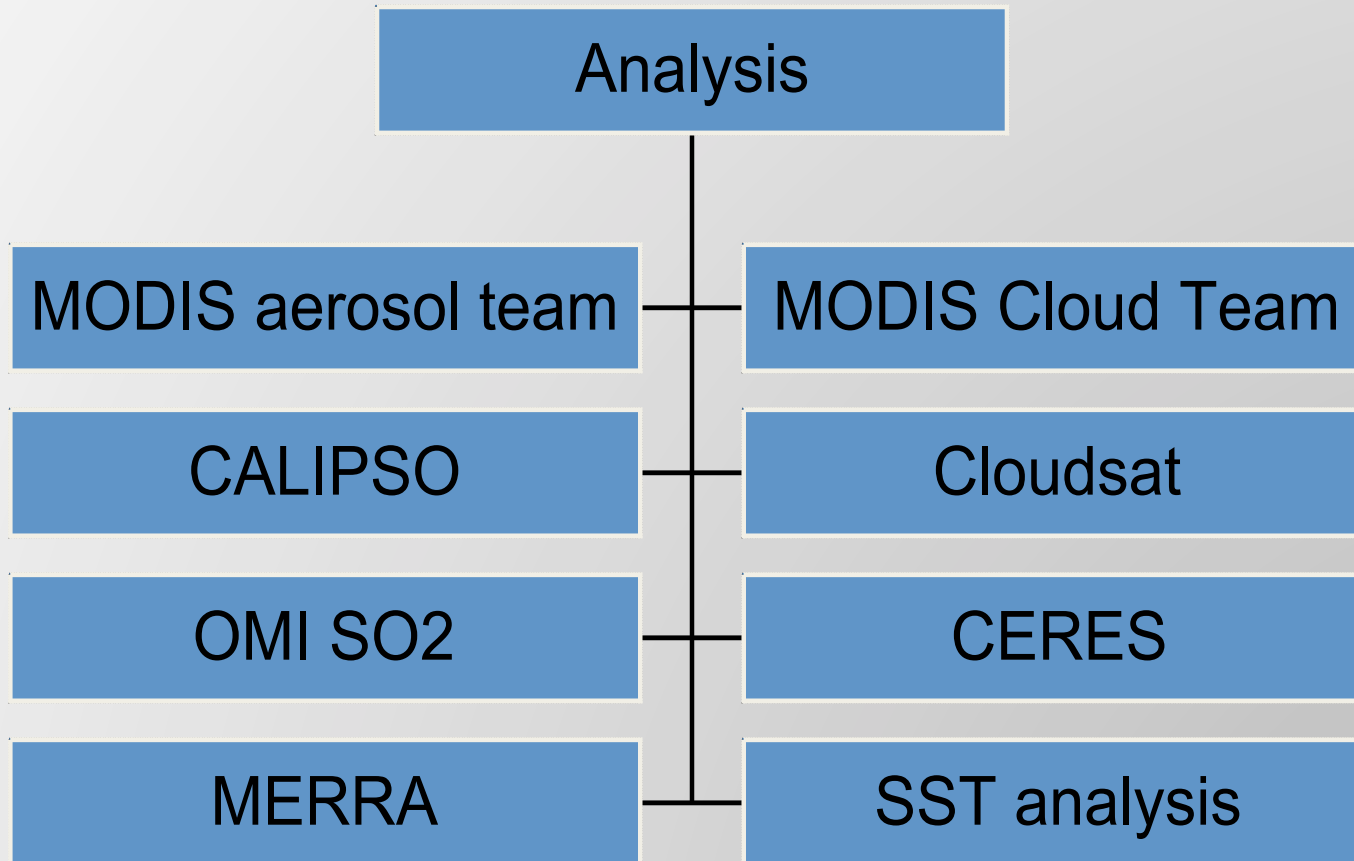# Deep convective cloud properties and aerosol-induced perturbations as revealed by MODIS

Tianle Yuan
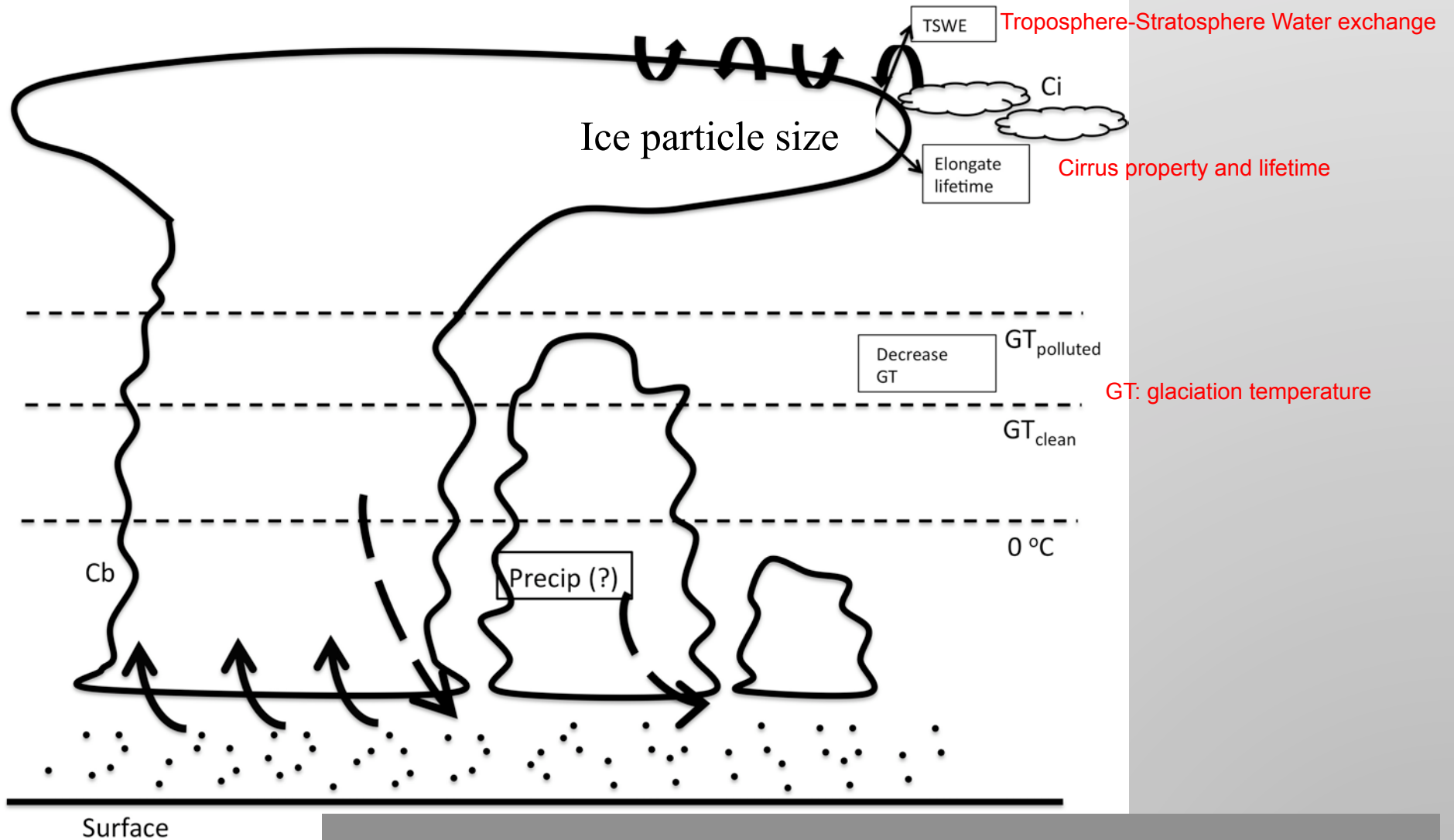
Climate and Radiation Laboratory, NASA/GSFC
UMBC-JCET

Acknowledgement

Deep convective cloud property and aerosol perturbation

TSWE — Troposphere-Stratosphere Water exchange

Ci

Ice particle size

Elongate lifetime — Cirrus property and lifetime

Decrease GT

GT_polluted

GT: glaciation temperature

GT_clean

0 °C

Cb

Precip (?)

Surface

Diagnostics:

ice particle size, cloud top temperature, cloud optical depth, cloud phase vertical structure
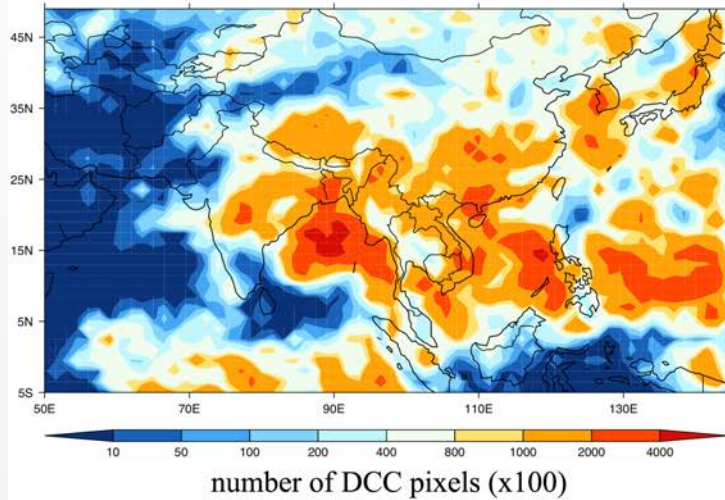
'Deep convective clouds'

- Cloud optical depth no less than 40 (+/- 10)

- cloud top temperature no greater than 245K (or 260K in some cases)

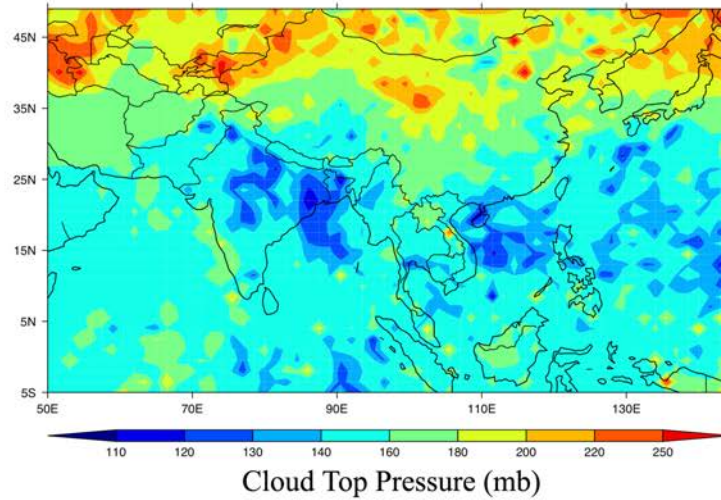- Level 2 MODIS cloud product, check for multi-layer flag and other QA flags

Convective core and thick anvil

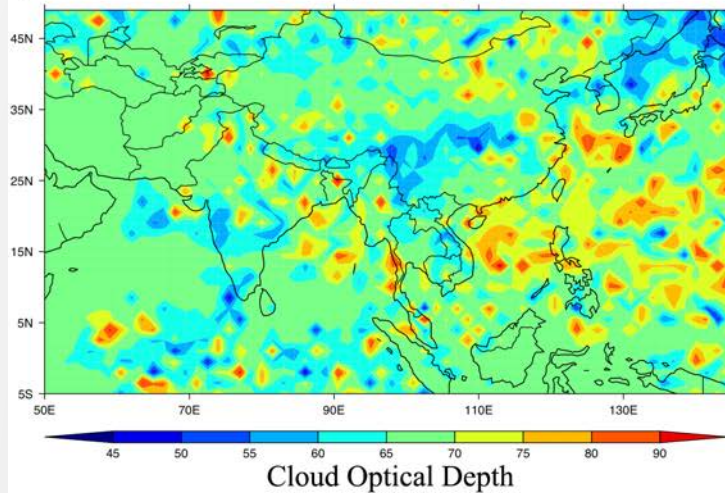# Deep convective cloud property and aerosol perturbation

Yuan and Li (2010, J. Clim)
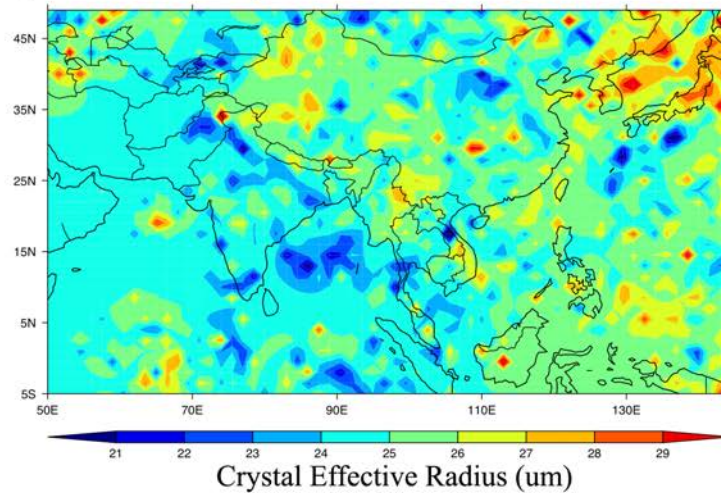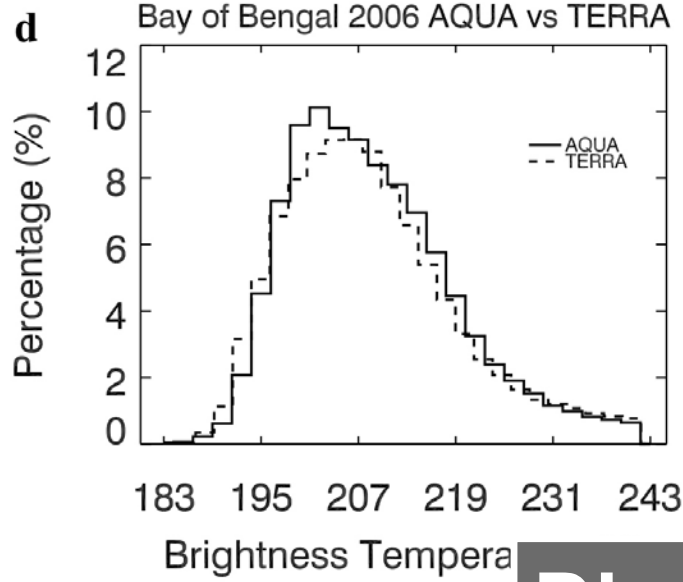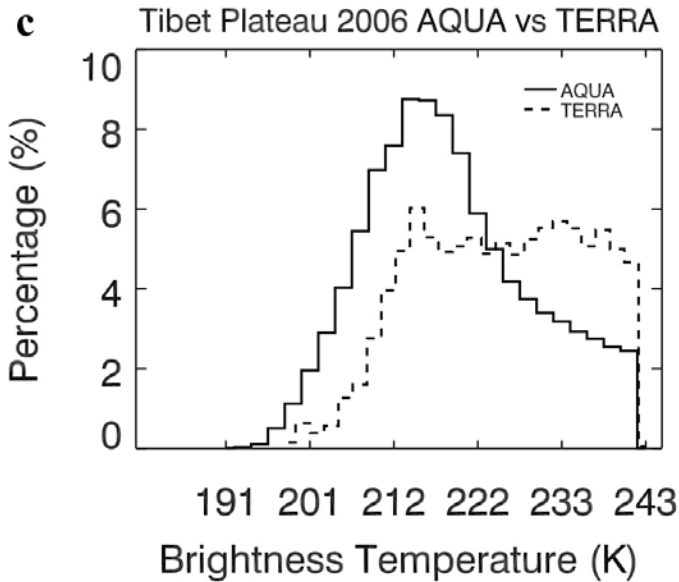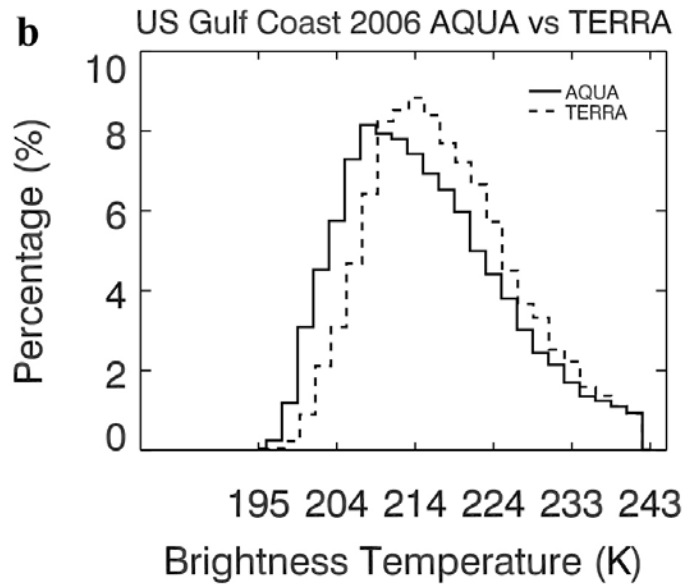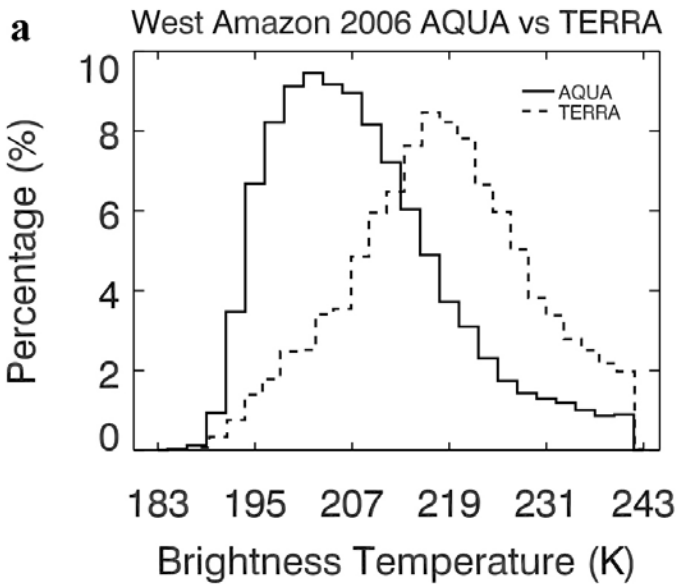
Deep convective cloud property and aerosol perturbation

Diurnal variation
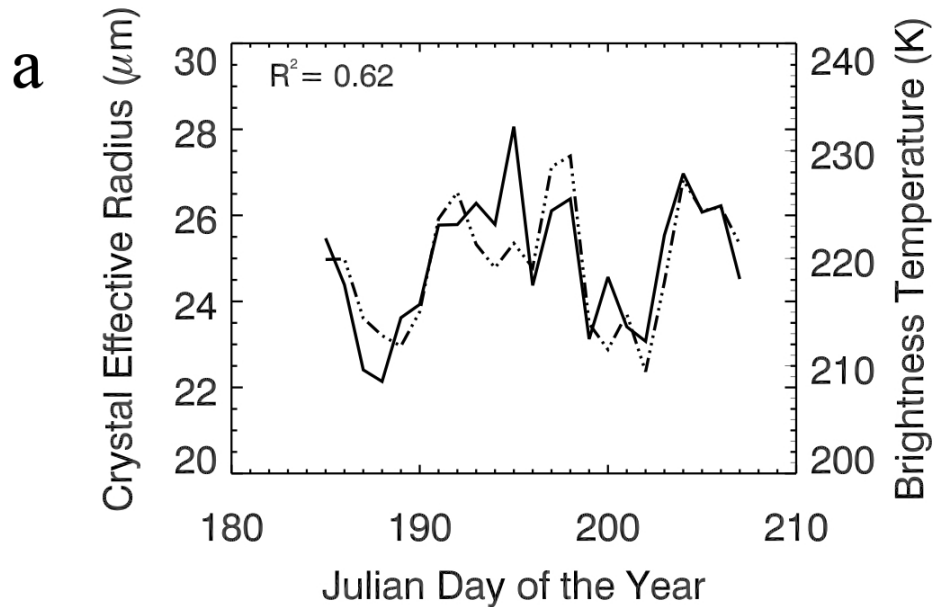
Clouds ice particle size increases with cloud top temperature
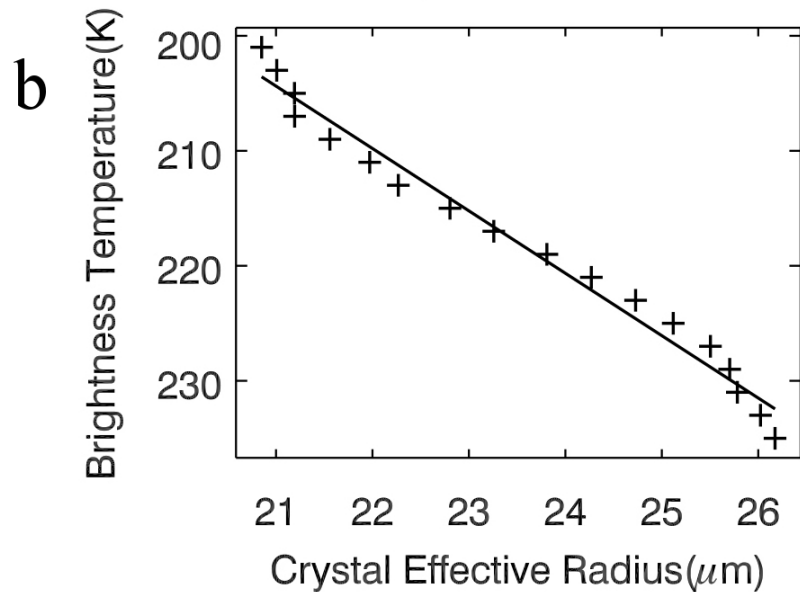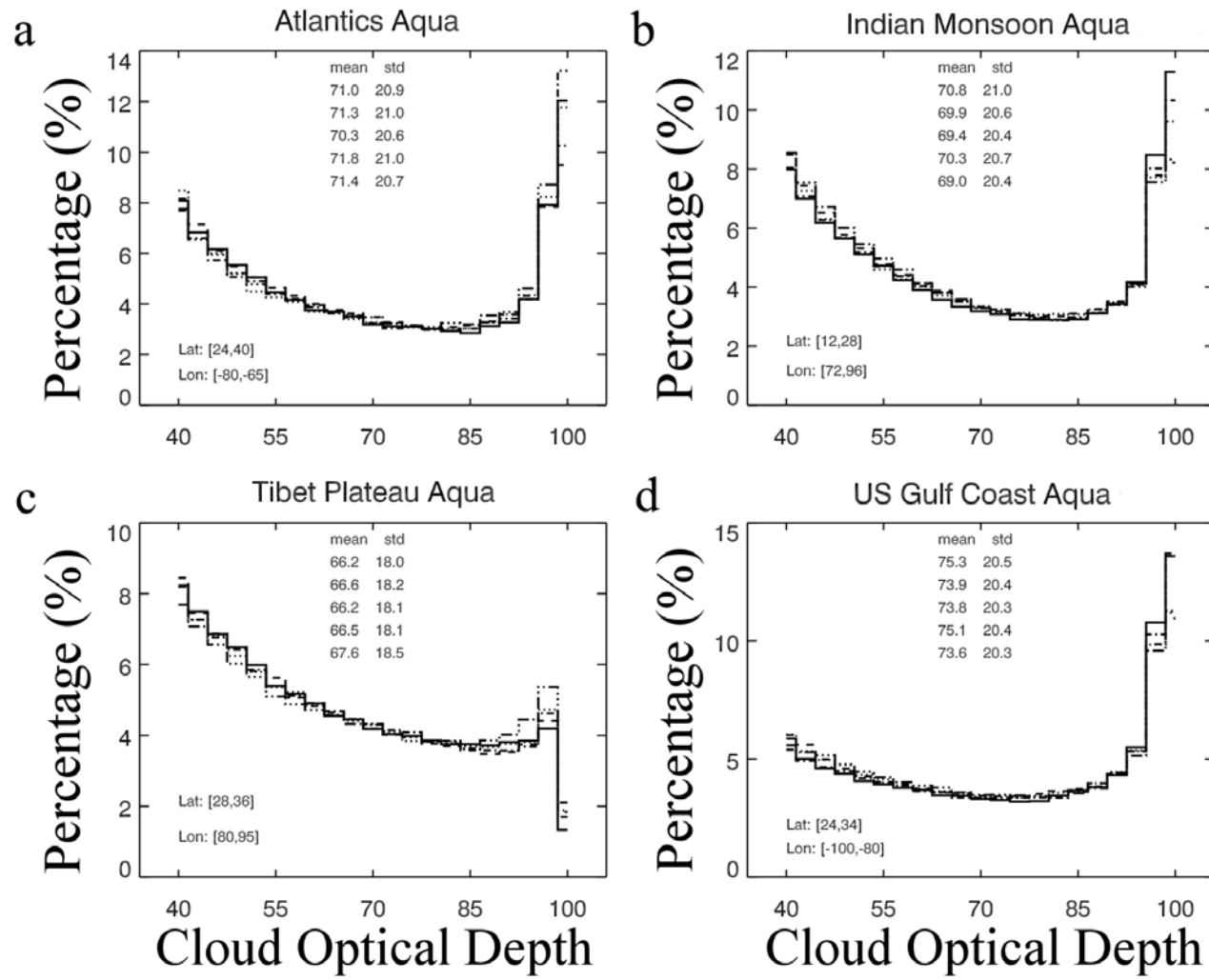
It applies to every region.
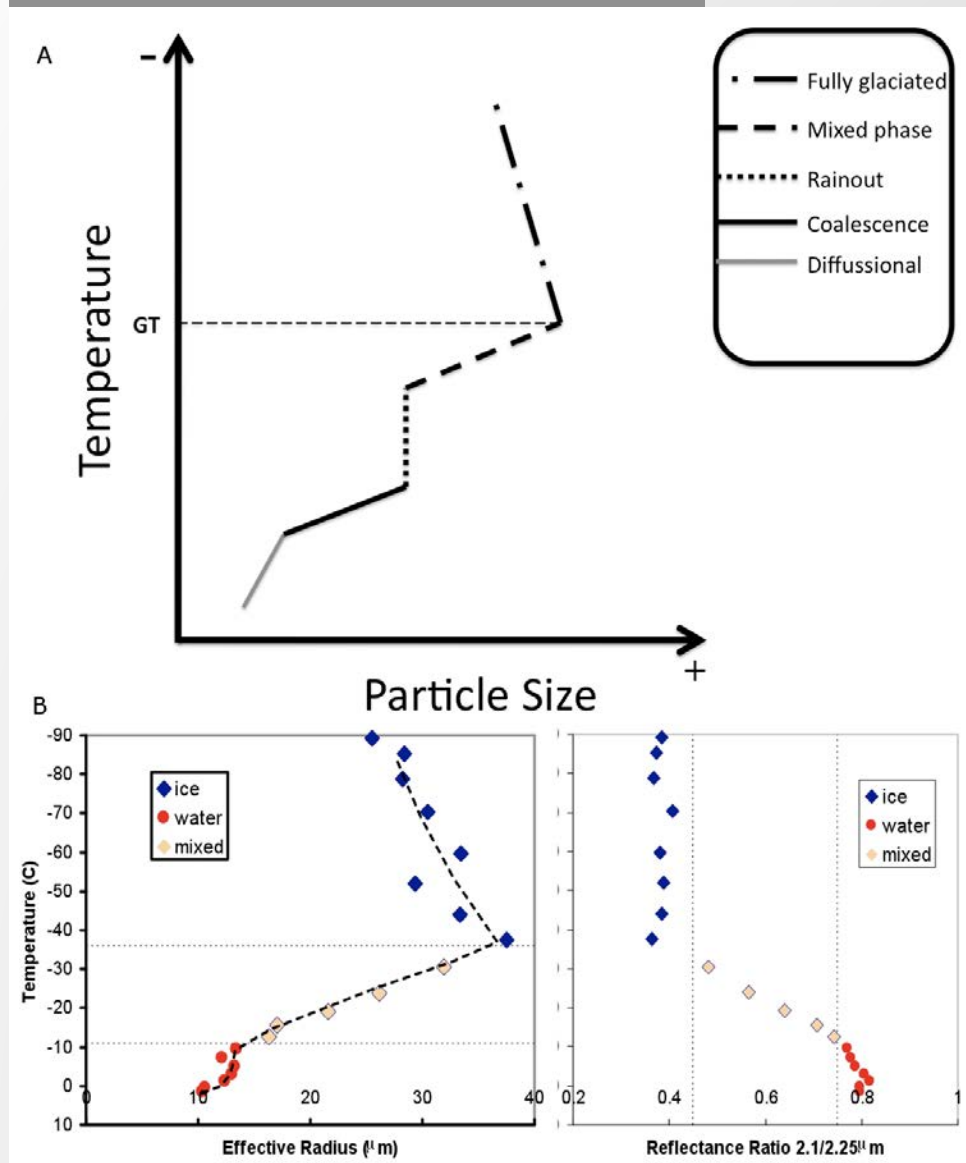
Yuan and Li (2010, J. Clim)
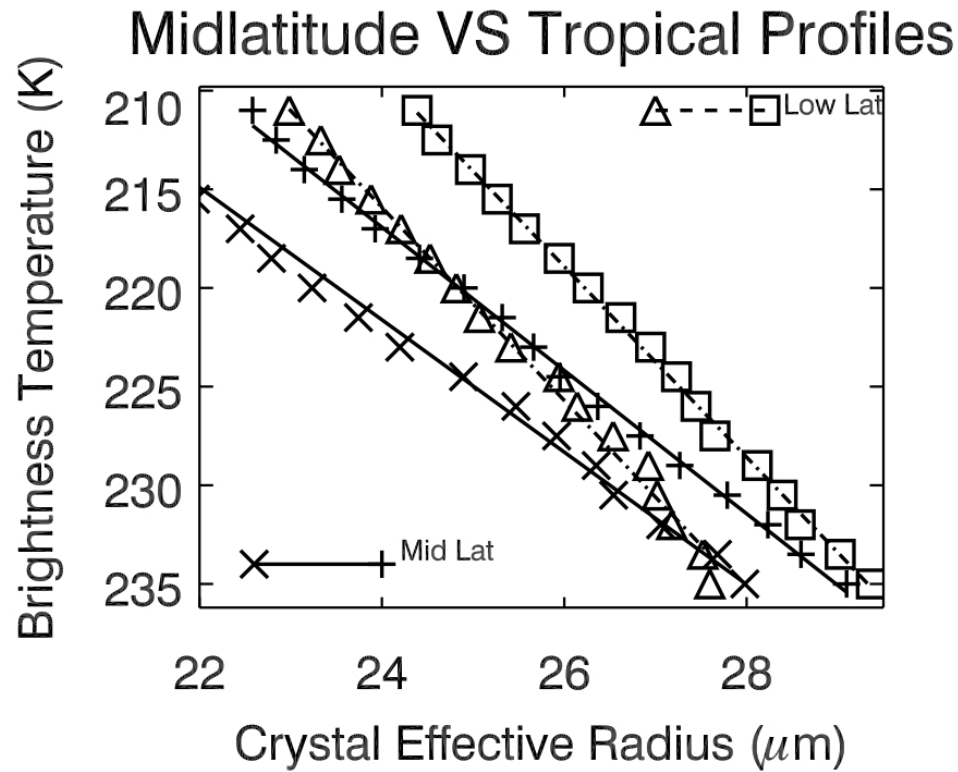
CER-BT profiles systematically change with latitude

Deep convective cloud property and aerosol perturbation
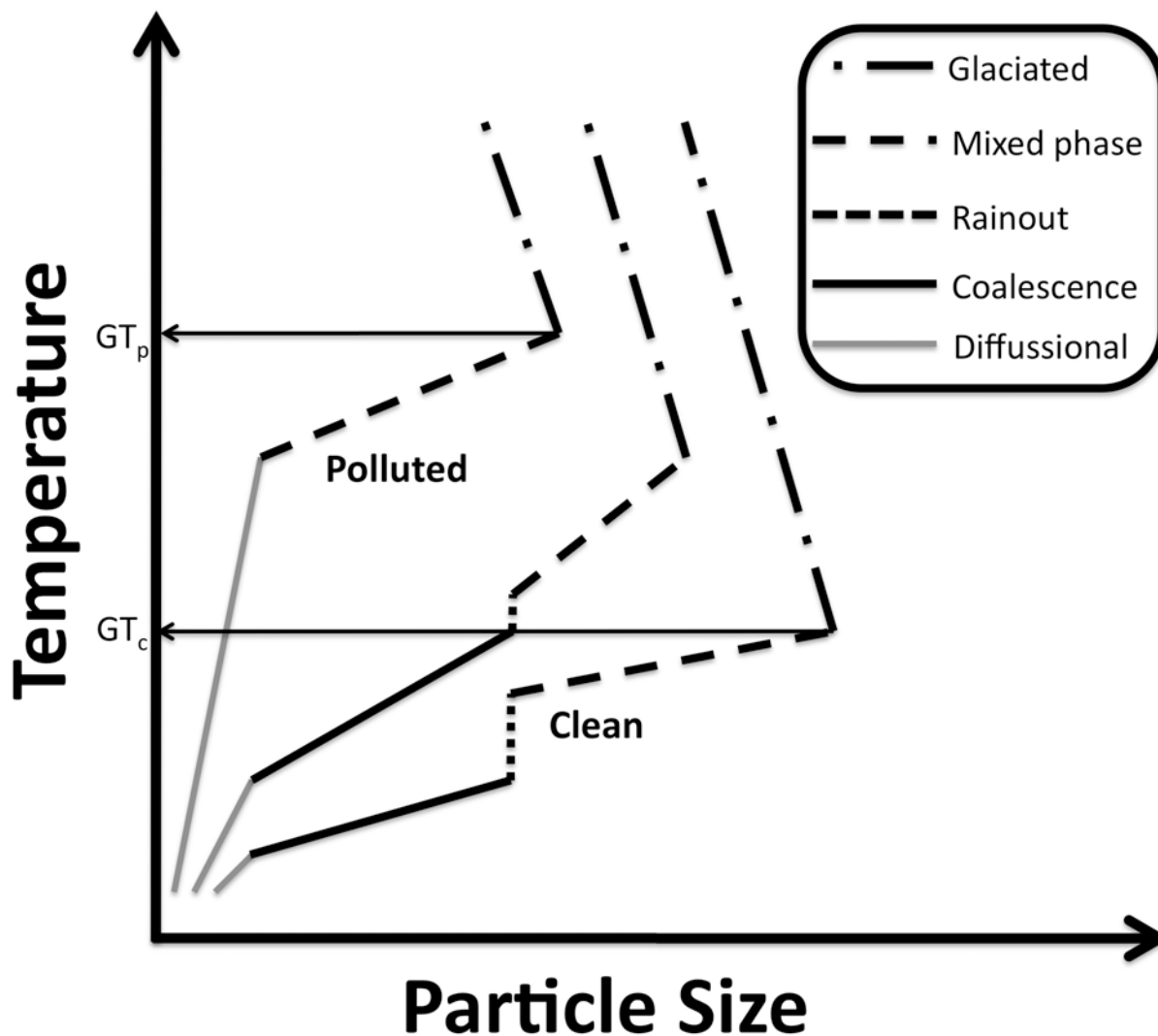

PDF invariant!

Conceptual model

Yuan et al (2011, GRL)

Deep convective cloud property and aerosol perturbation
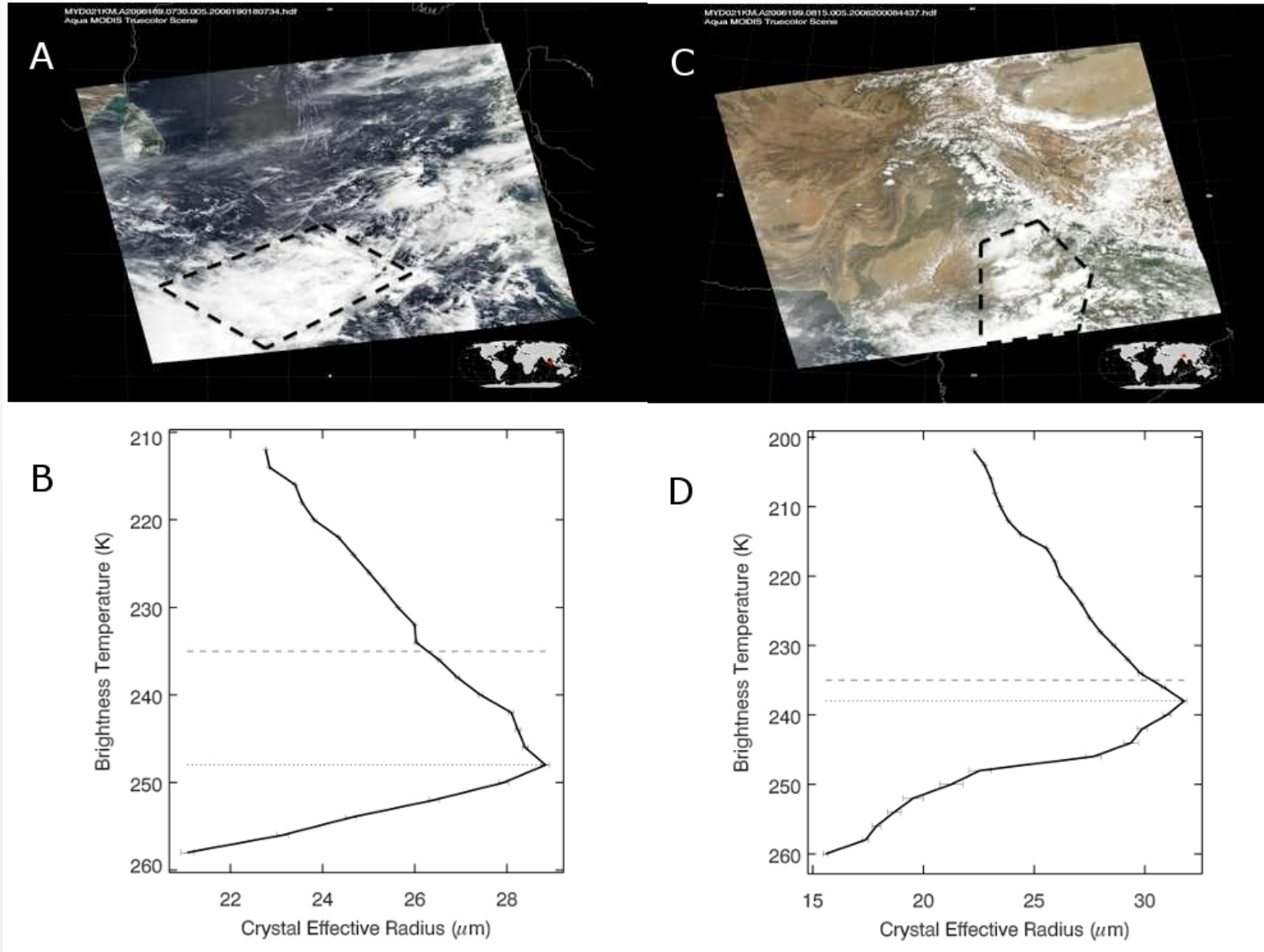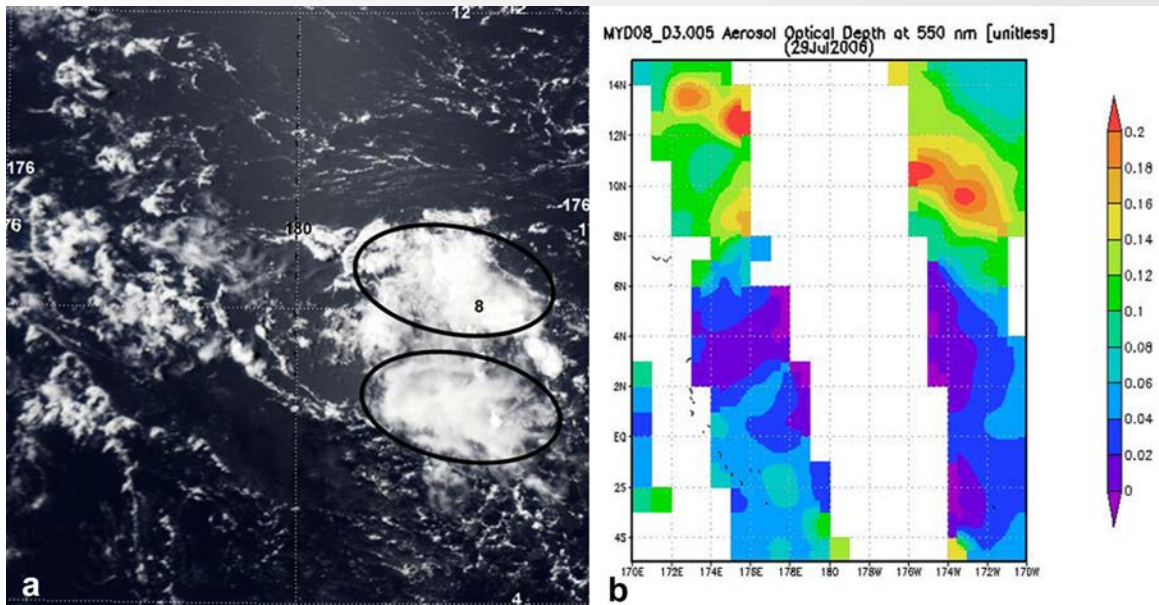
Application
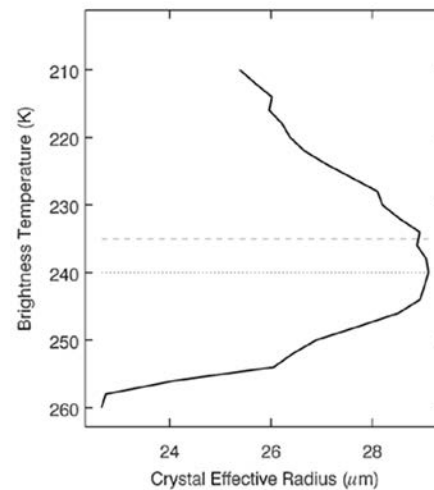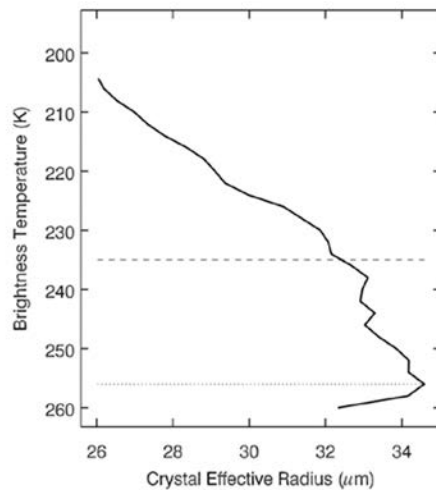
Yuan et al (2011, GRL)
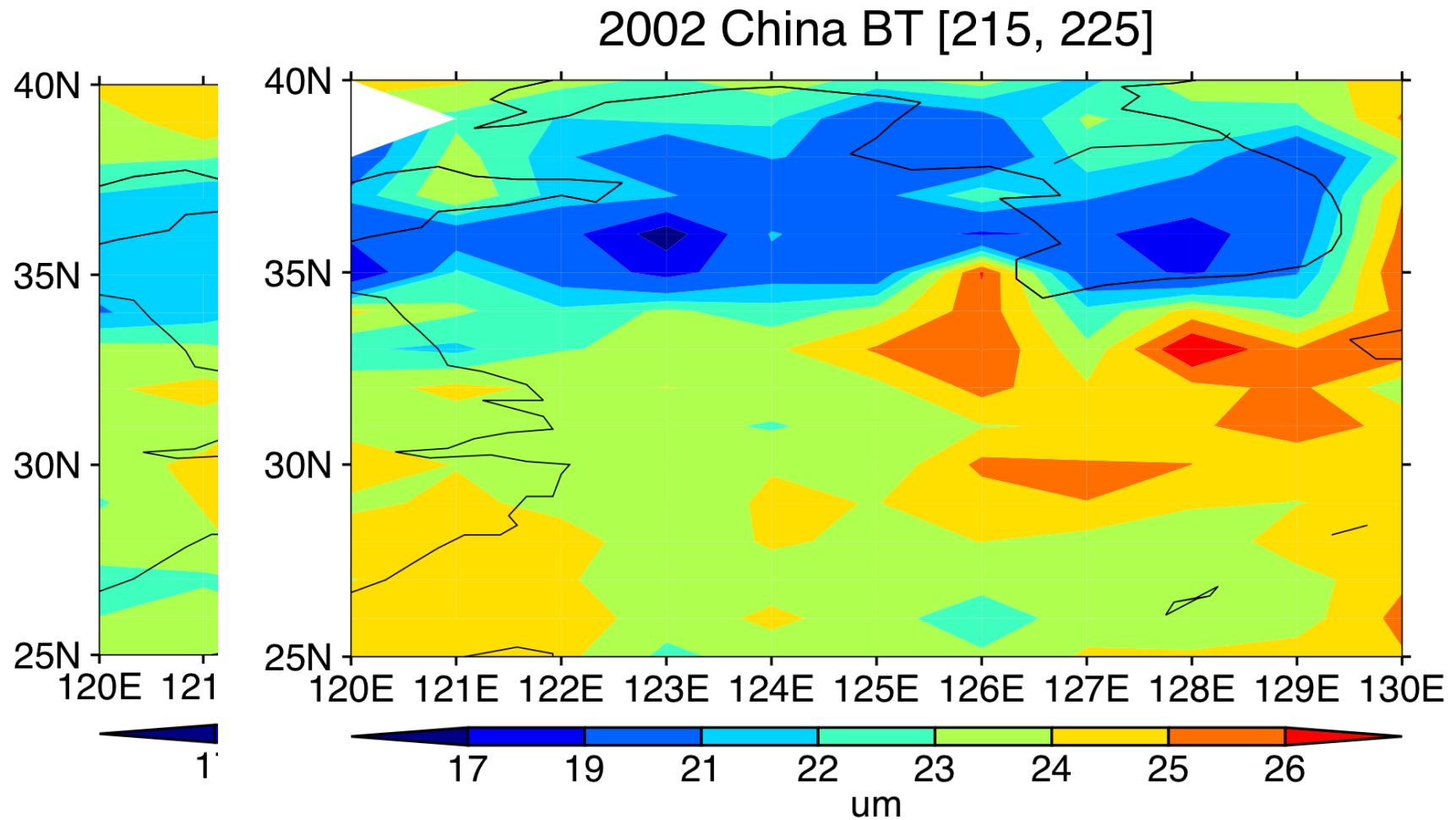
Deep convective cloud property and aerosol perturbation
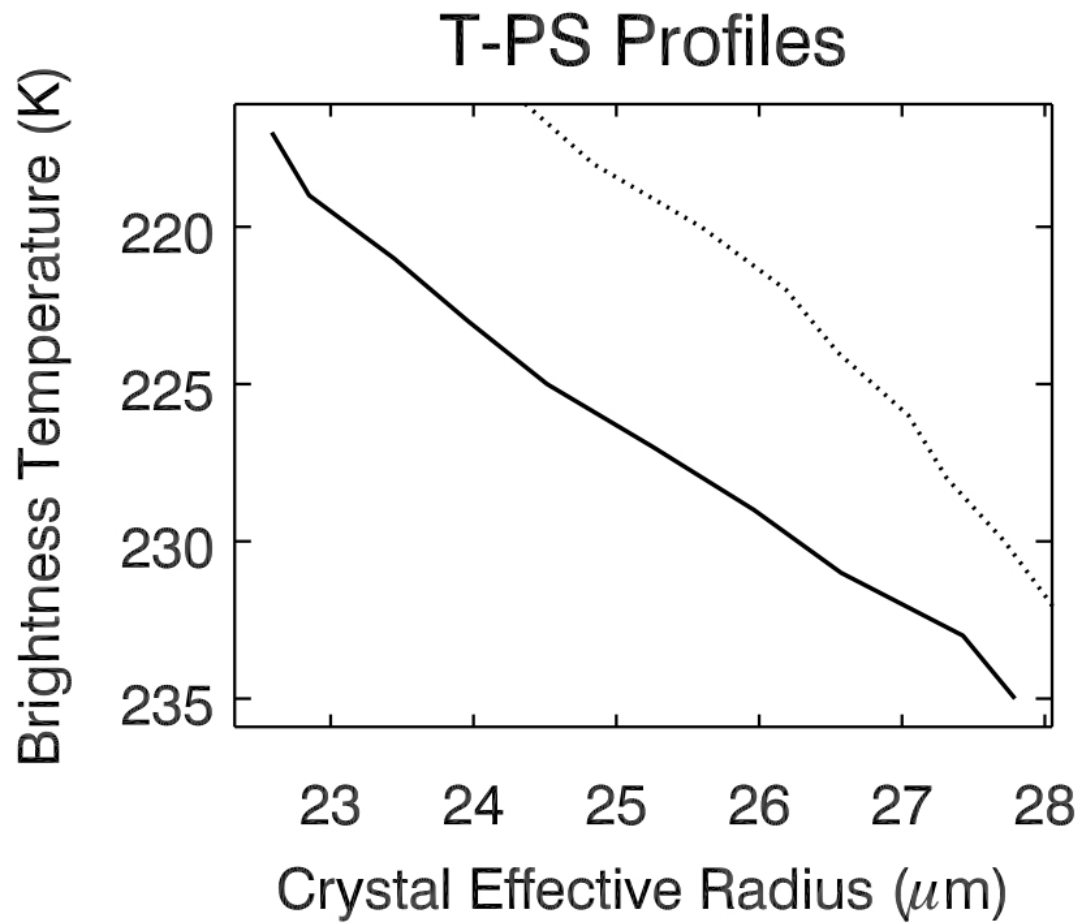

Yuan et al (2012, in preparation)

Very sensitive!

Constrain BT

2002 China BT [215, 225]
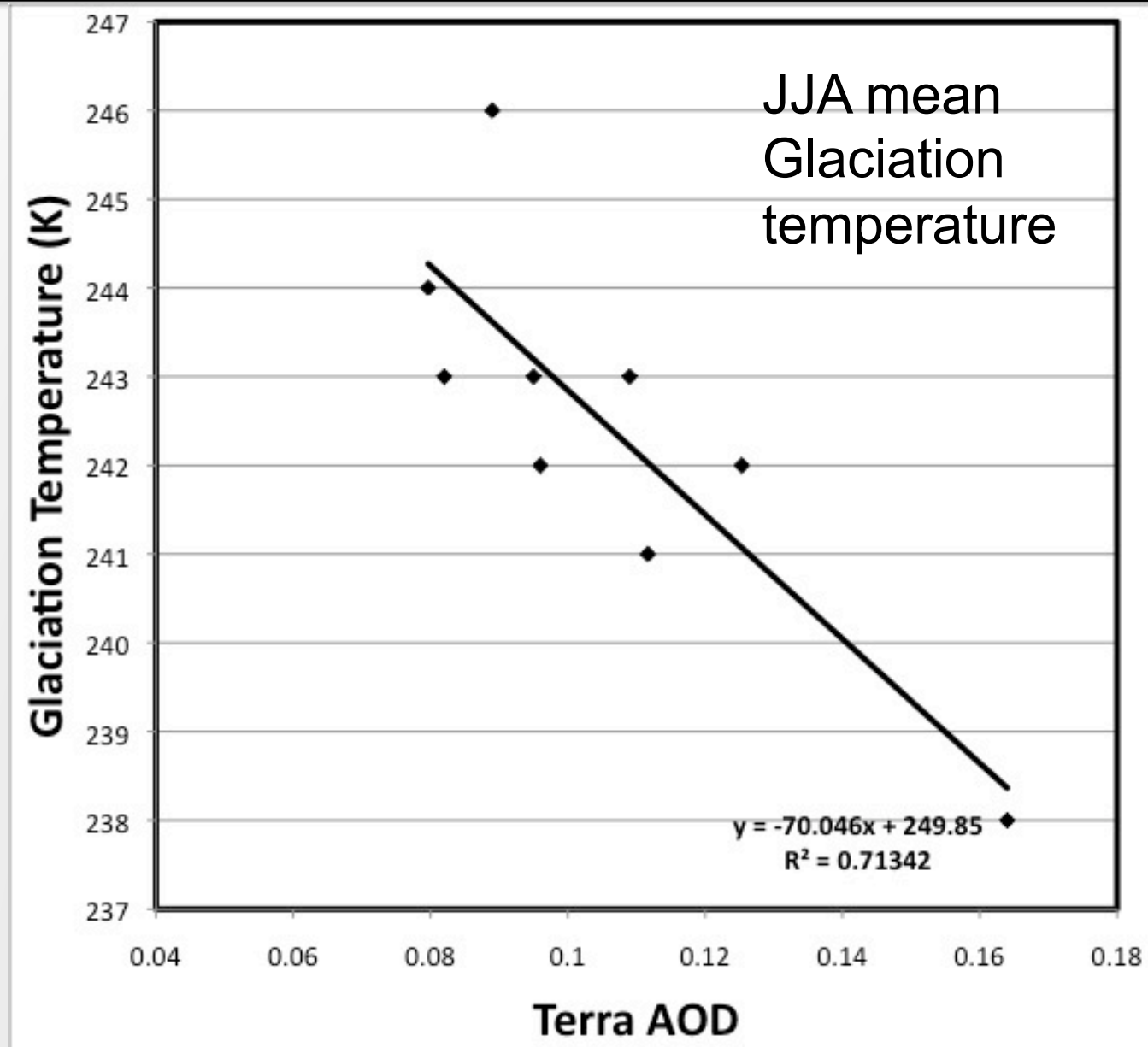
T-PS Profiles

Our experiment

AOD anomaly in JJA 2005

Anatahan

JJA mean Glaciation temperature

$y = -70.046x + 249.85$
$R^2 = 0.71342$
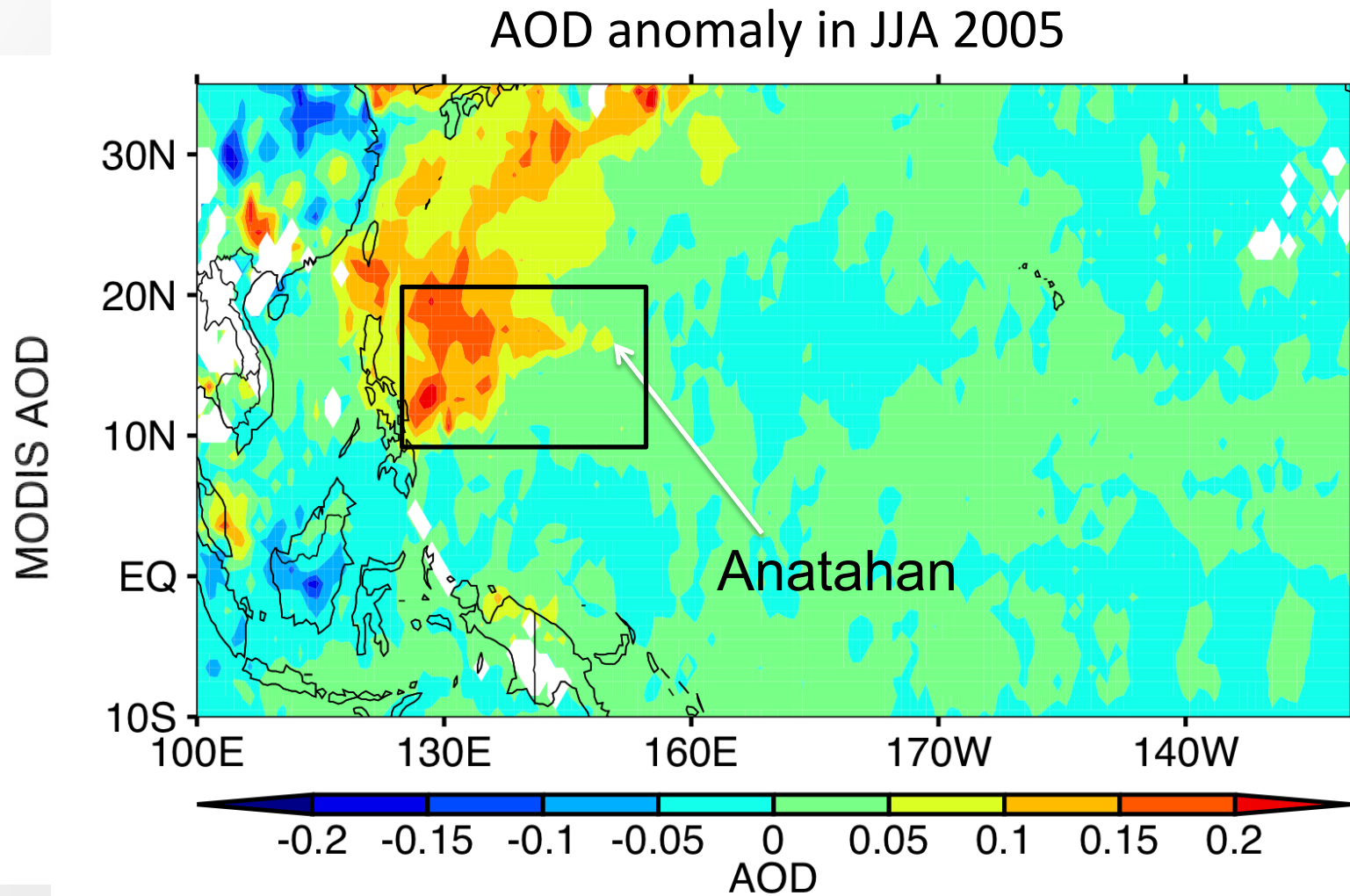
Clouds glaciate at colder temperature

Some discussion

- The BT-CER relationships are useful for parameterization and other applications.

- Implications of the invariant nature of cloud PDFs? How would that change if DCCs are defined differently?

- The global distribution of GT will be helpful for many applications.

- The conceptual model derived from theory and borne out by MODIS data provides a framework to understand clouds and aerosol-cloud interactions