Study Pollution Impacts on Upper-Tropospheric Clouds with Aura, CloudSat and CALIPSO Data

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Thank MLS, CloudSat and CALIPSO teams for successful instrument operation and data processing
Pollution in the Upper Troposphere

Heald et al. 2006

MODIS AOD (550nm)

MOPITT CO Column

Hadley et al. 2007

March 2001

April

BC

Fine-mass aerosols
Aura MLS Upper-Tropospheric Observations

July 2006
Tangent Height = 16.5 km

A

B

$D_{mm} = 32 \text{ lm}$

$D_{mm} = 47 \text{ lm}$

$D_{mm} = 60 \text{ lm}$

$D_{mm} = 73 \text{ lm}$

640 GHz $T_{cir}$ (K)

-20

-10

0

10

20

30

40

240 GHz $T_{cir}$ (K)
Small- and Large-$D_{mm}$ Clouds:
from MLS 240:640 GHz Cloud-Induced Radiances ($T_{cir}$)
CloudSat-CALIPSO Data Selection, Averaging, and Collocation:

Nighttime data only;

Along track: 5 km
Height: 0.25 km
Cloud Classification

CALIPSO 532 Per Backscatter

CloudSat Reflectivity

Clear

Thin

Medium

Thick-and-Dense

$10^{-3}$

$10^{-4}$
“Thin Clouds”  “Medium Clouds”  “Thick Clouds”
Cloud Statistics of CloudSat and CALIPSO:

Implication to the Radar-Lidar Retrievals
Summary

• Signatures of pollution impacts on upper-tropospheric clouds in MLS, CloudSat, CALIPSO data.

• Complementary sensitivities of MLS (240:640 GHz), CloudSat and CALIPSO to upper-tropospheric clouds.

• Careful analysis required to sort out microphysical changes from dynamical changes.