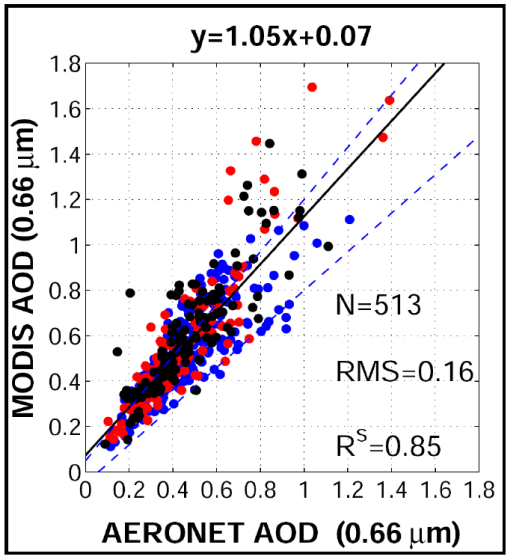
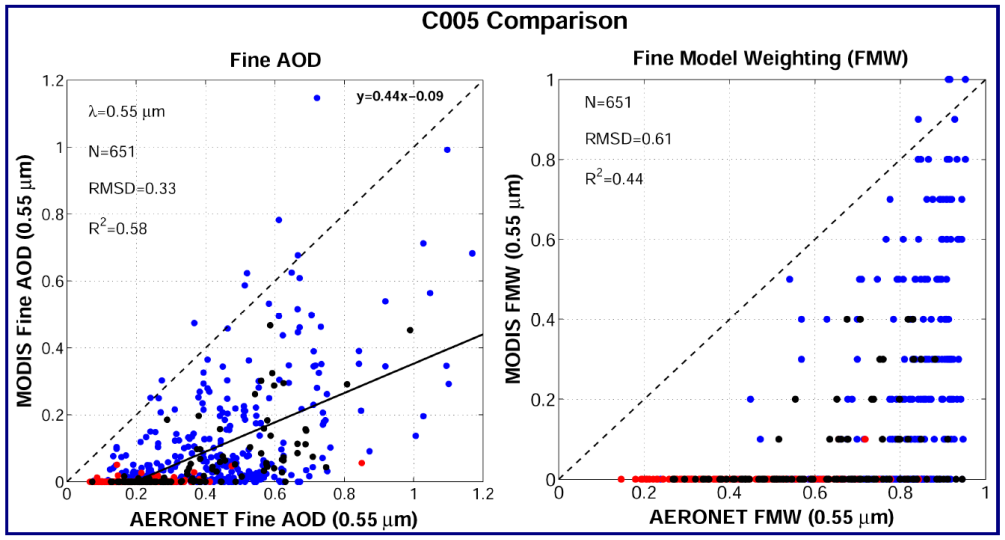
Aerosol Retrieval Experiment

Why retrieval experiment?

MODIS C005 Vs. AERONET





MODIS C005 AODs at 0.66 µm are over-estimated

MODIS C005 Fine AOD and FMW at 0.55 µm are highly biased low.

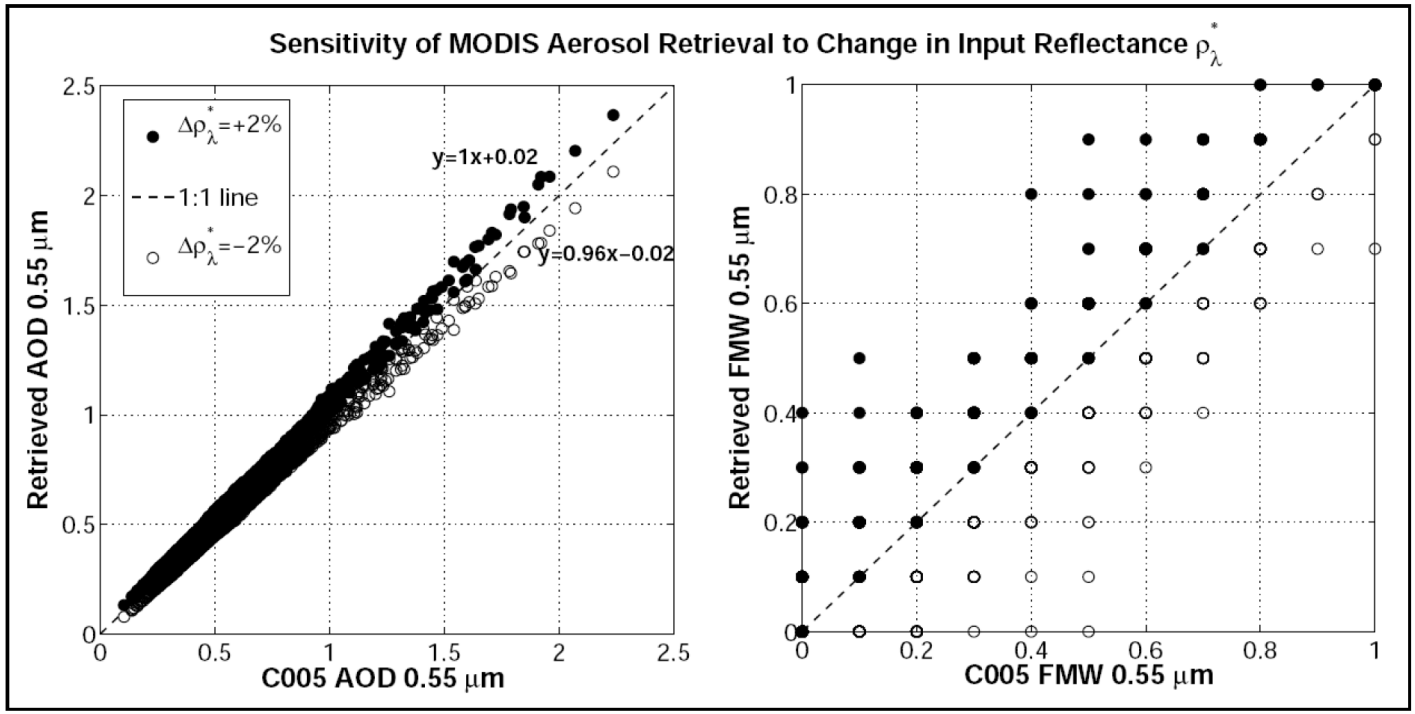
Non-unique inversion?

Aerosol Model?

Surface Reflectance?

Sensitivity of Retrieval to Measurement Error

Change in apparent reflectance $\Delta \rho_\lambda^m = \pm 2 \; percent$



Change in aerosol optical depth

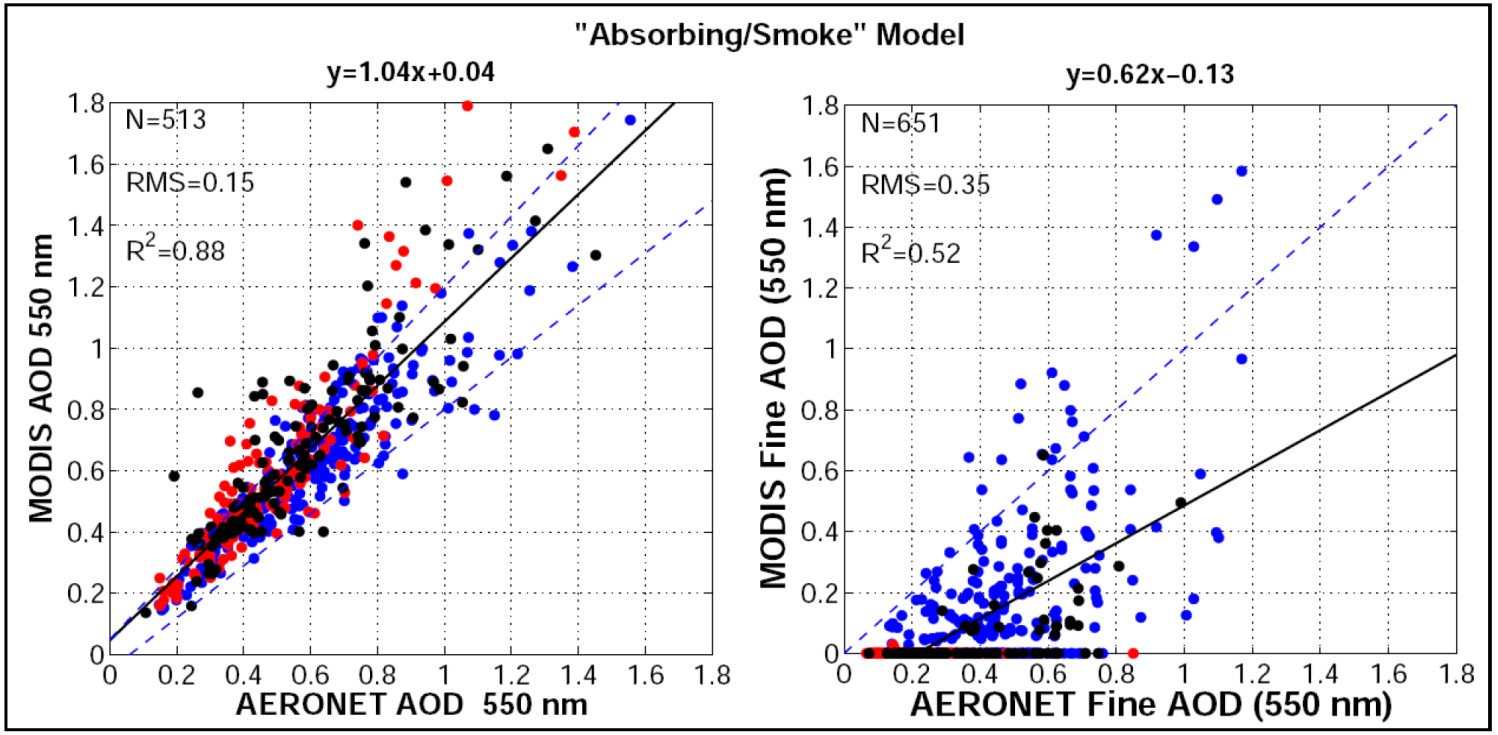
$\Delta \tau \pm 0.02$

Change in FMW

$\Delta \eta \pm 0.6$

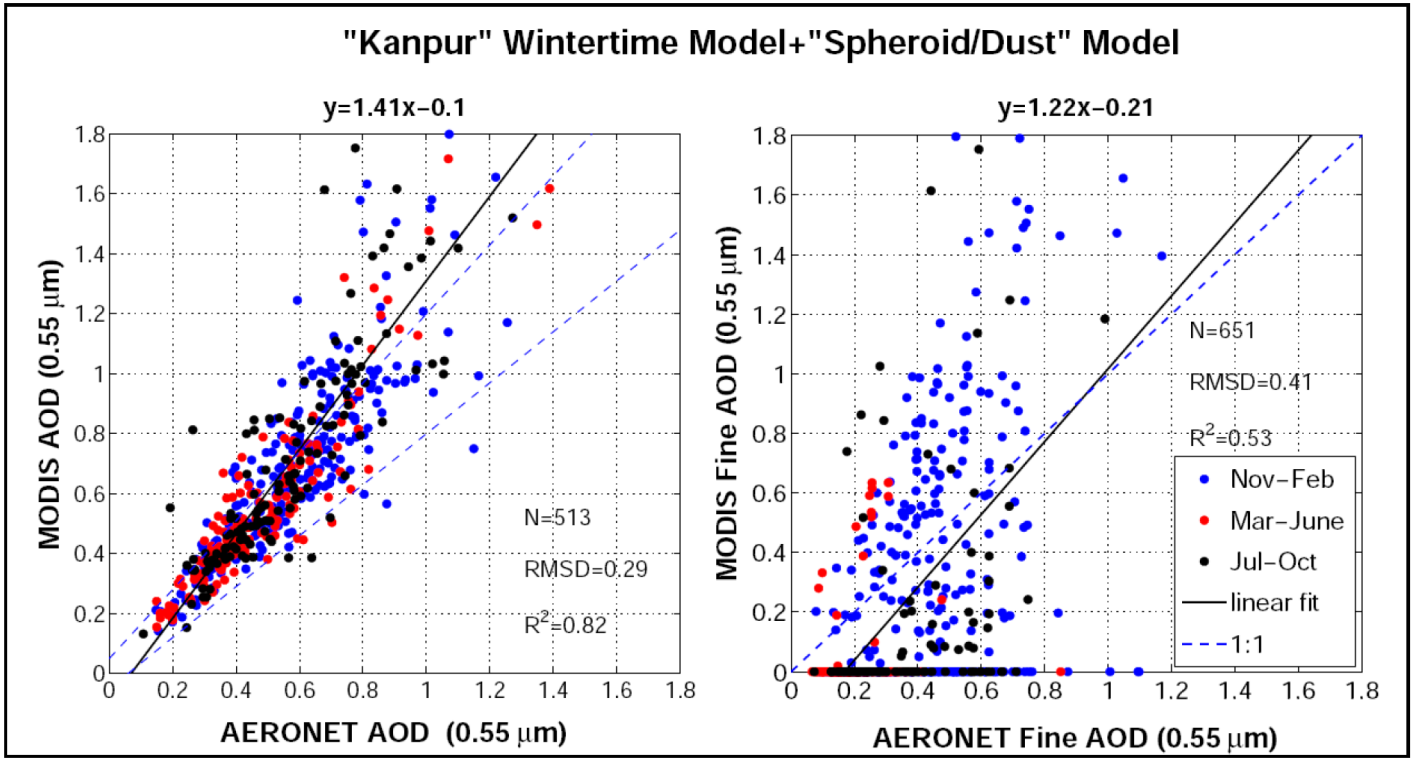
Sensitivity of Retrieval to Aerosol Model

Use of "Absorbing/Smoke" Model as a fine-dominated model



- **No significant change in aerosol retrieval**
- **Retrieval are similar to that provided by MODIS C005**

Use of "Kanpur" Wintertime Model as a fine-dominated model



- Kanpur model over-estimates AOD

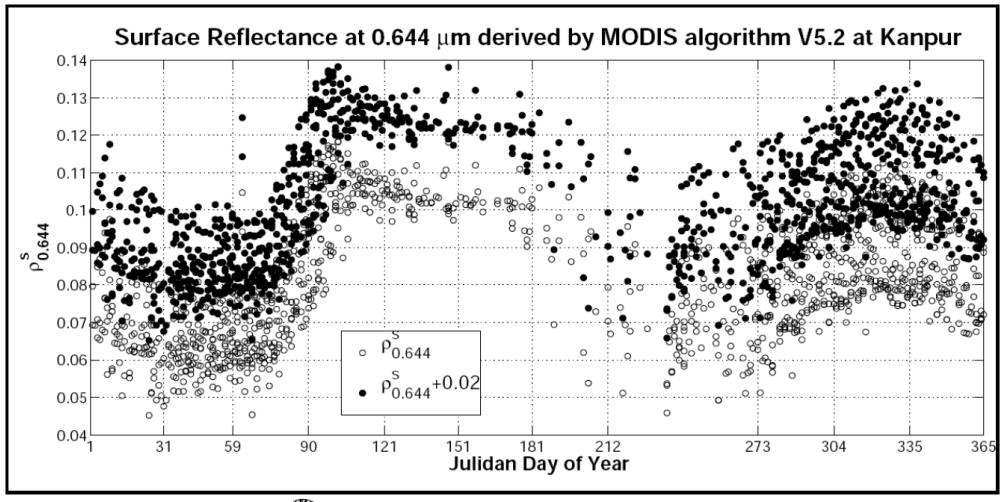
✔ Some improvement in retrieval of FAOD

Sensitivity of Retrieval to Change in Visible Surface Reflectance

Why surface reflectance needs to be changed?

- **Change of aerosol models didn't work much**
- **Derivation of surface reflectance empirical relationships used for aerosol retrieval are based on worldwide MODIS/AERONET data (except India!)**
- **Results from Bangalore surface reflectance experiment suggest that the actual visible surface reflectance differed from that estimated by MODIS**

✔ One can modified existing surface reflectance parameterization by changing it in step



-ve change

$$\rho^{new}_{0.66} = \rho^{MODIS}_{0.66} - 0.025$$

$$\rho^{new}_{0.66} = \rho^{MODIS}_{0.66} - 0.020$$

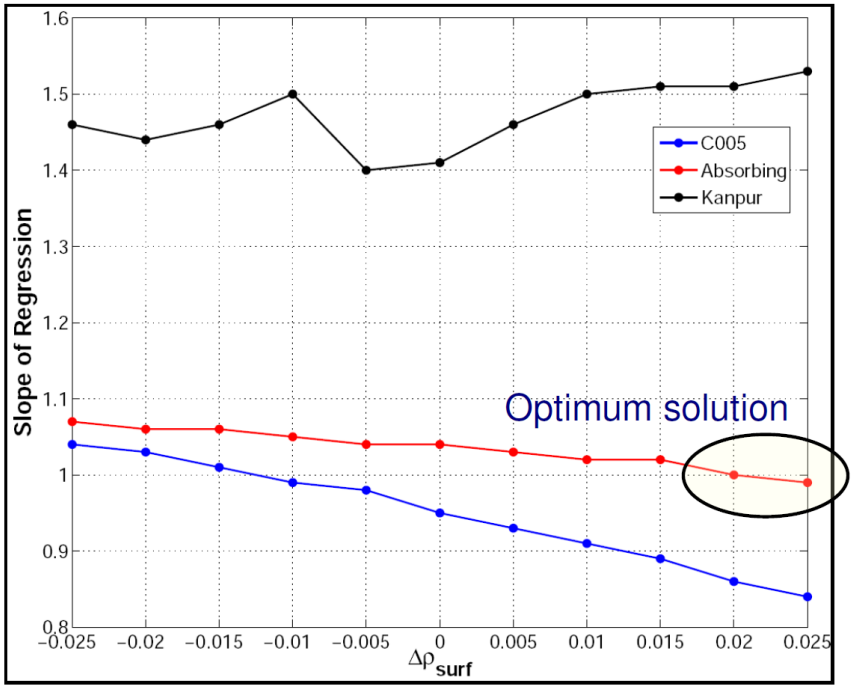
$$\rho^{new}_{0.66} = \rho^{MODIS}_{0.66}$$

+ve change

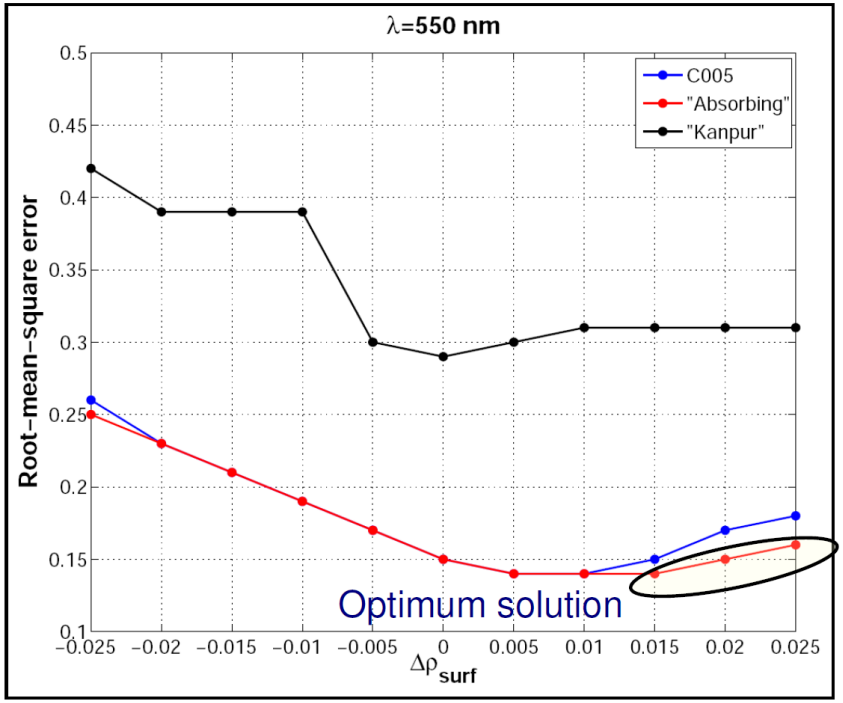
$$\rho^{new}_{0.66} = \rho^{MODIS}_{0.66} + 0.005$$

$$\rho^{new}_{0.66} = \rho^{MODIS}_{0.66} + 0.025$$

Slope of Regression

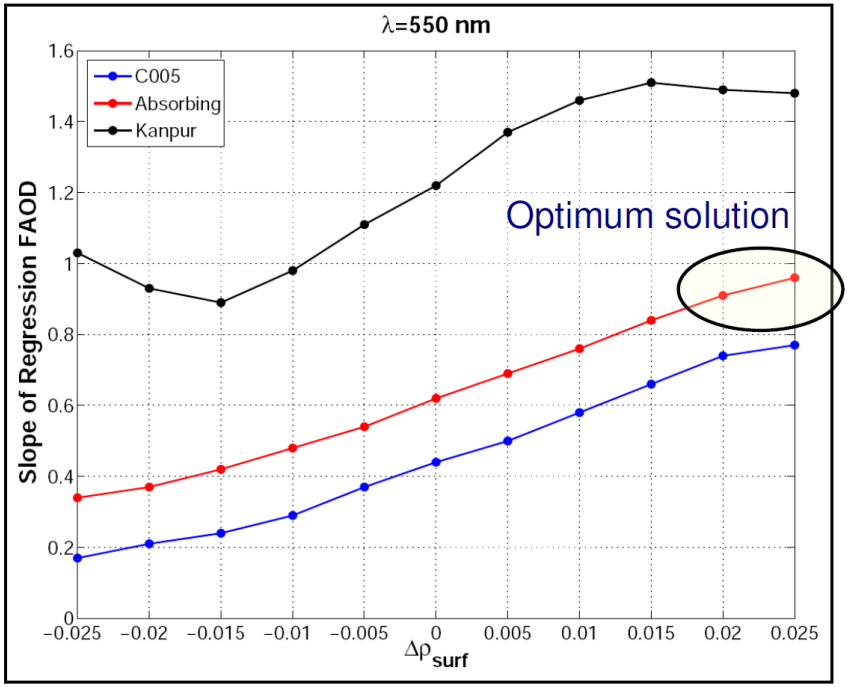


Root-mean-square error

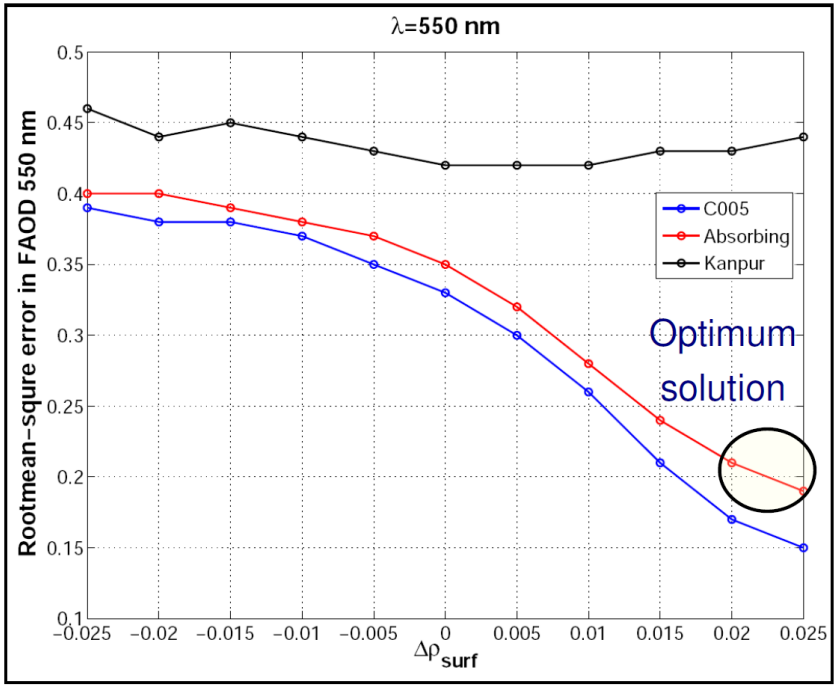


FAOD Comparison

Slope of Regression

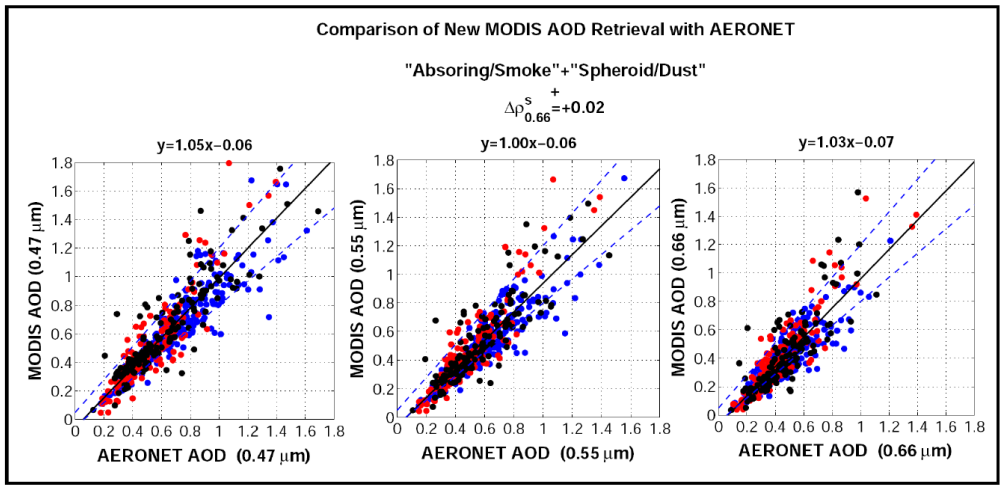


Root-mean-square error



Optimum Solution

Improved Spectral AOD

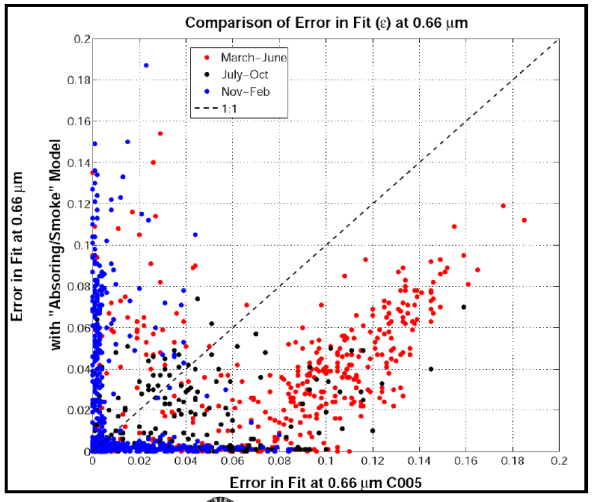


"Absorbing/Smoke" + "Spheroid/Dust"

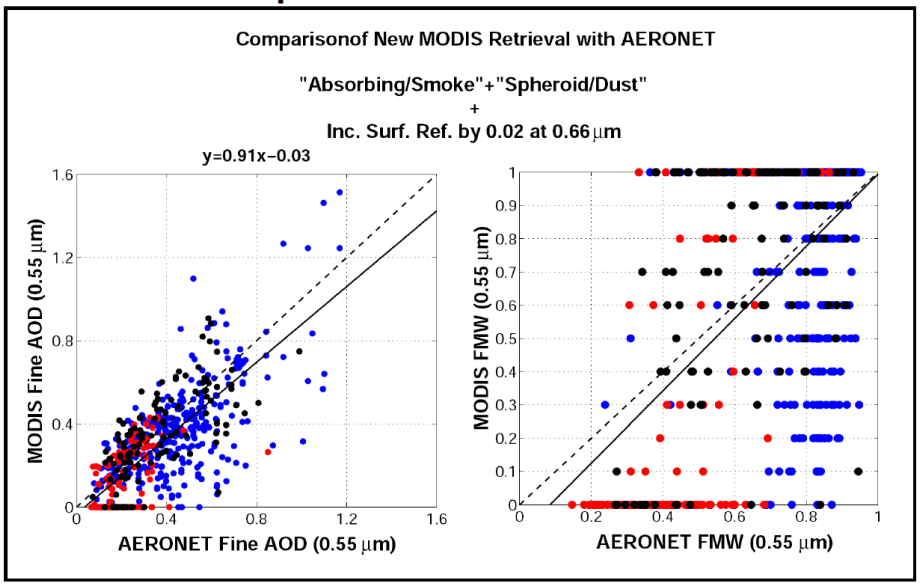
+

$$\Delta \rho^{s}_{0.66} = +0.02$$

Error in spectral fit at 0.66 μm



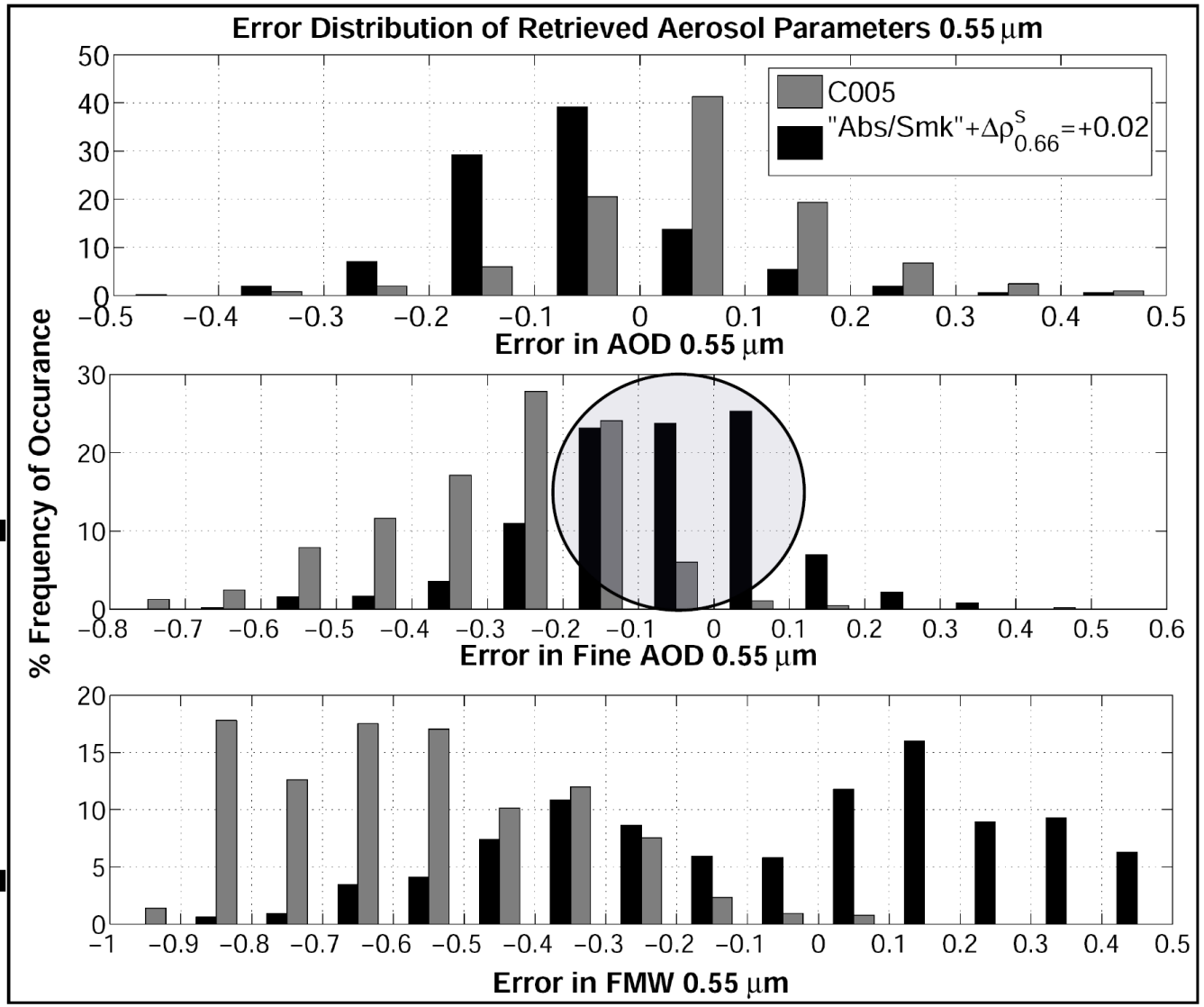
Improved Fine AOD and FMW



Error Distribution

Lessor error is more frequent now!

Large under-estimation is removed now!



Testing Proposed Changes Over Greater India

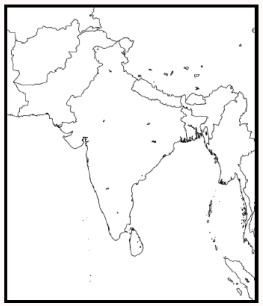
Dataset

December 2005

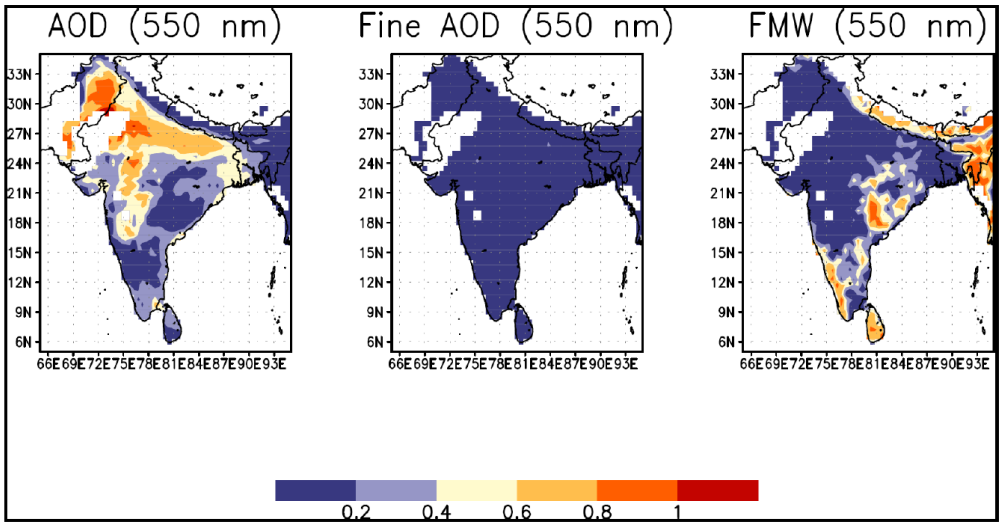
Terra/MODIS

Number of Level-2 Granules :
204 (total land retrieval=**6,21,833**)

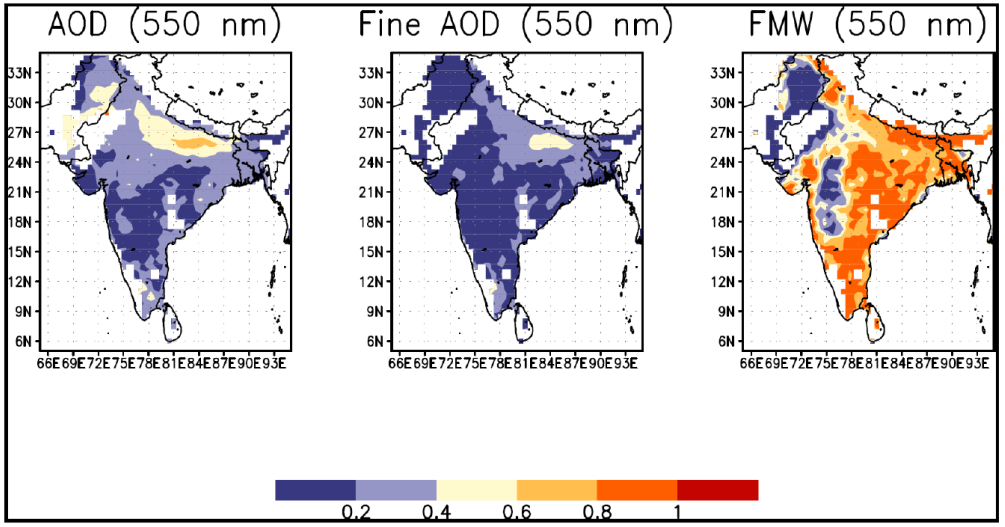
Study Region



C005 Product



"Abs/Smk"+Inc. Surf. Ref. by 0.02 at 660 nm



Re-processed aerosol retrieval

Drastic change in FMW

Testing proposed changes with *In situ* Measurements

ISRO-GBP Land Campaign Results
Moorthy et al. (2005), JGR

Total mass

$$M_t = \sum_{i=1}^{i=10} m_{ci}$$

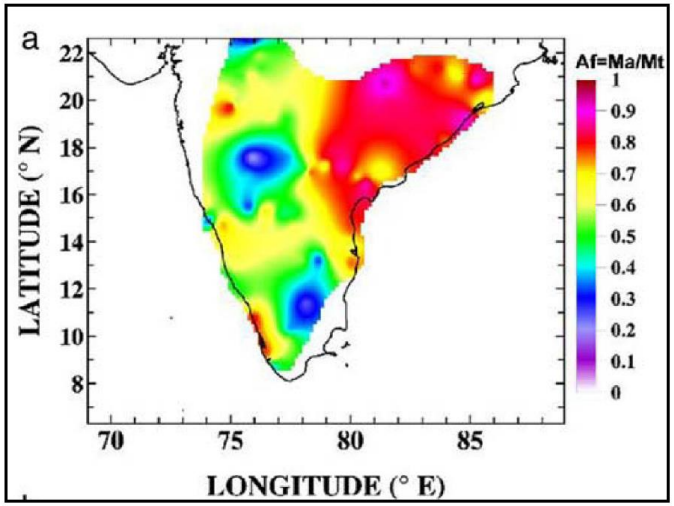
Accumulation mass

$$M_a = \sum_{i=7}^{i=10} m_{ci}$$

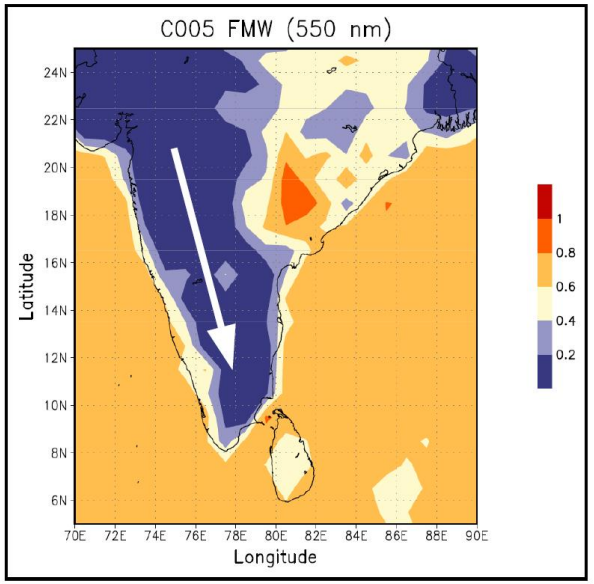
Accumulation mass fraction

$$A_f = \frac{M_a}{M_t}$$

Spatial Composite of Accumulation Mass Fraction
February 2004

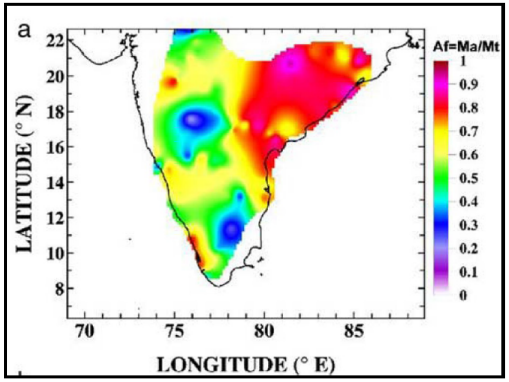


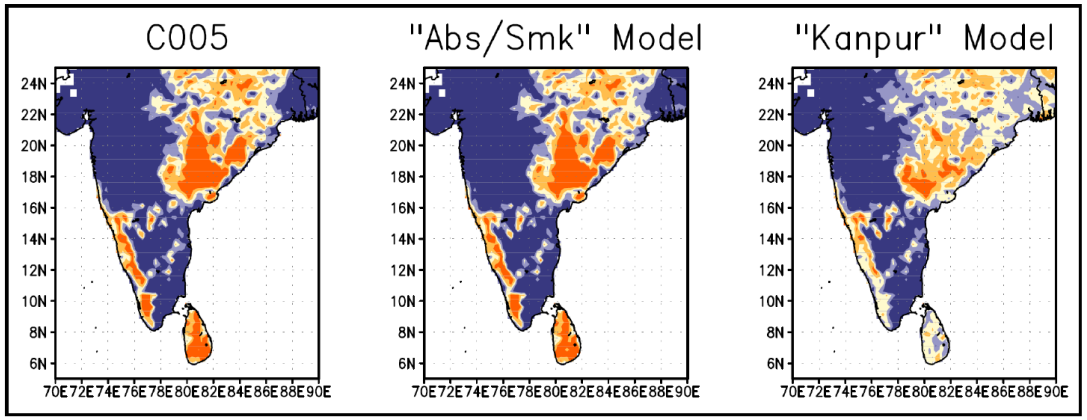
C005-derived FMW is poorly correlated with *in situ* measurements



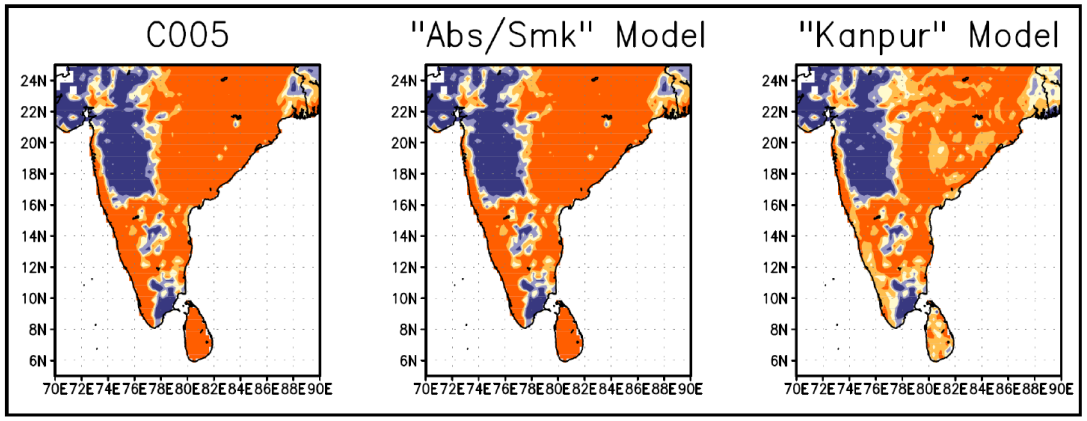
Aerosol Model Sensitivity

➔**Changing aerosol models does not produce observed pattern of accumulation mass fraction**





“Abs/Smk”+Inc. Surf. Ref. by 0.015 at 0.66 µm



➔**C005 and “Abs/Smk” models with increased visible surface reflectance produce observed distribution of measured accumulation mass fraction**