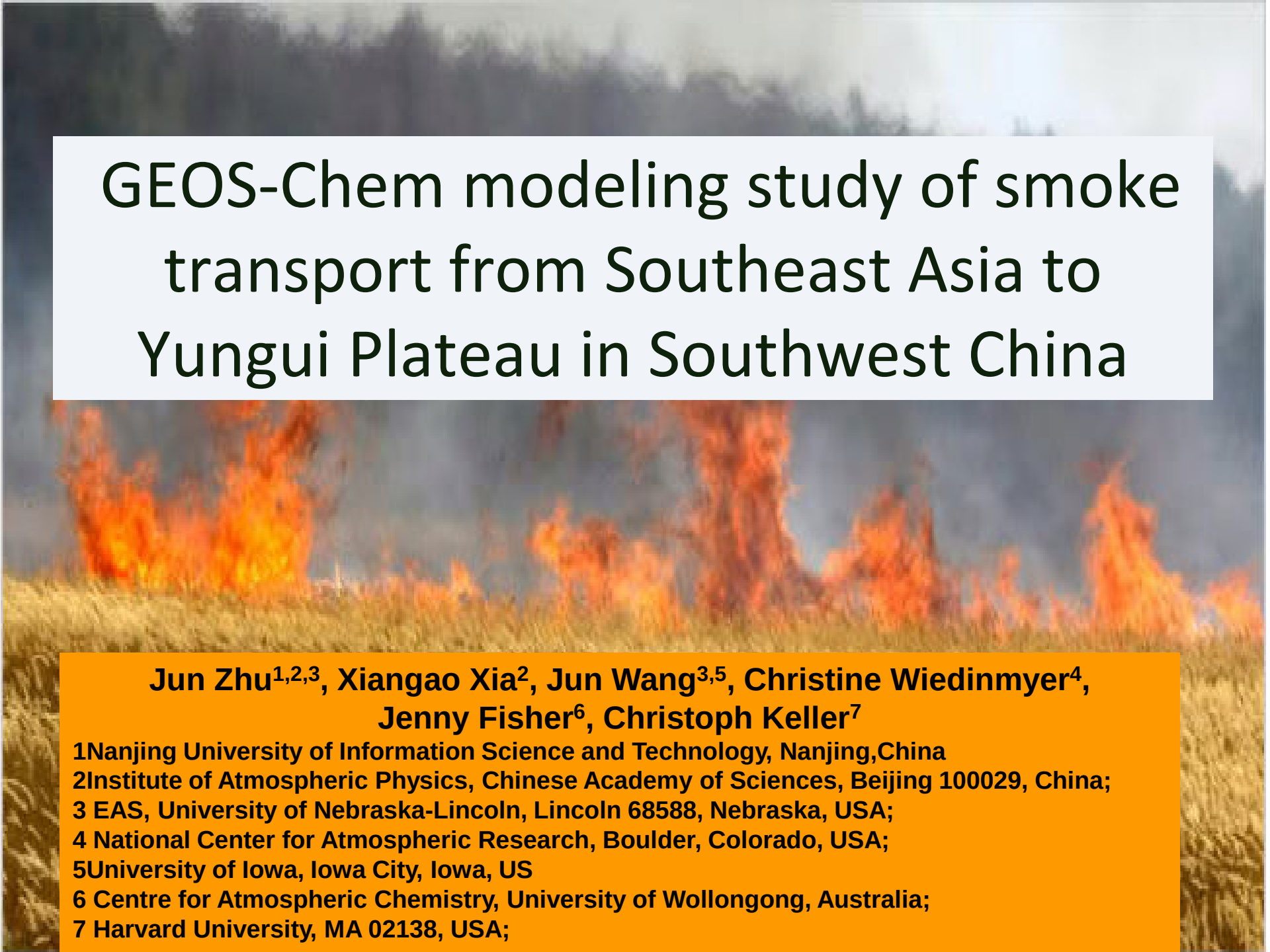

GEOS-Chem modeling study of smoke transport from Southeast Asia to Yungui Plateau in Southwest China

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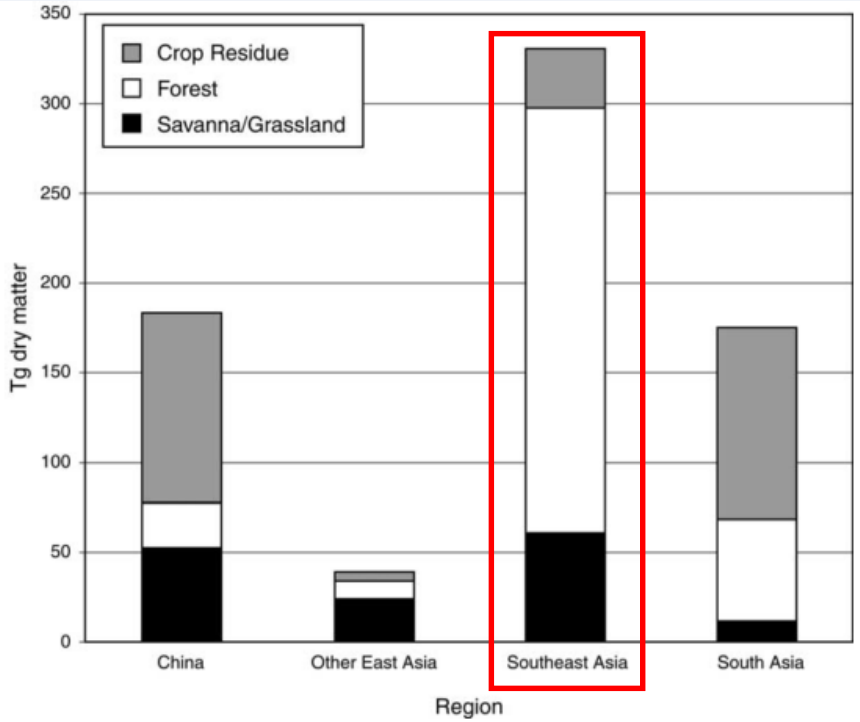
Outline

- Introduction
- Observation sites and data
- Model description
- Results
- Conclusions

Biomass burning in South and Southeast Asia

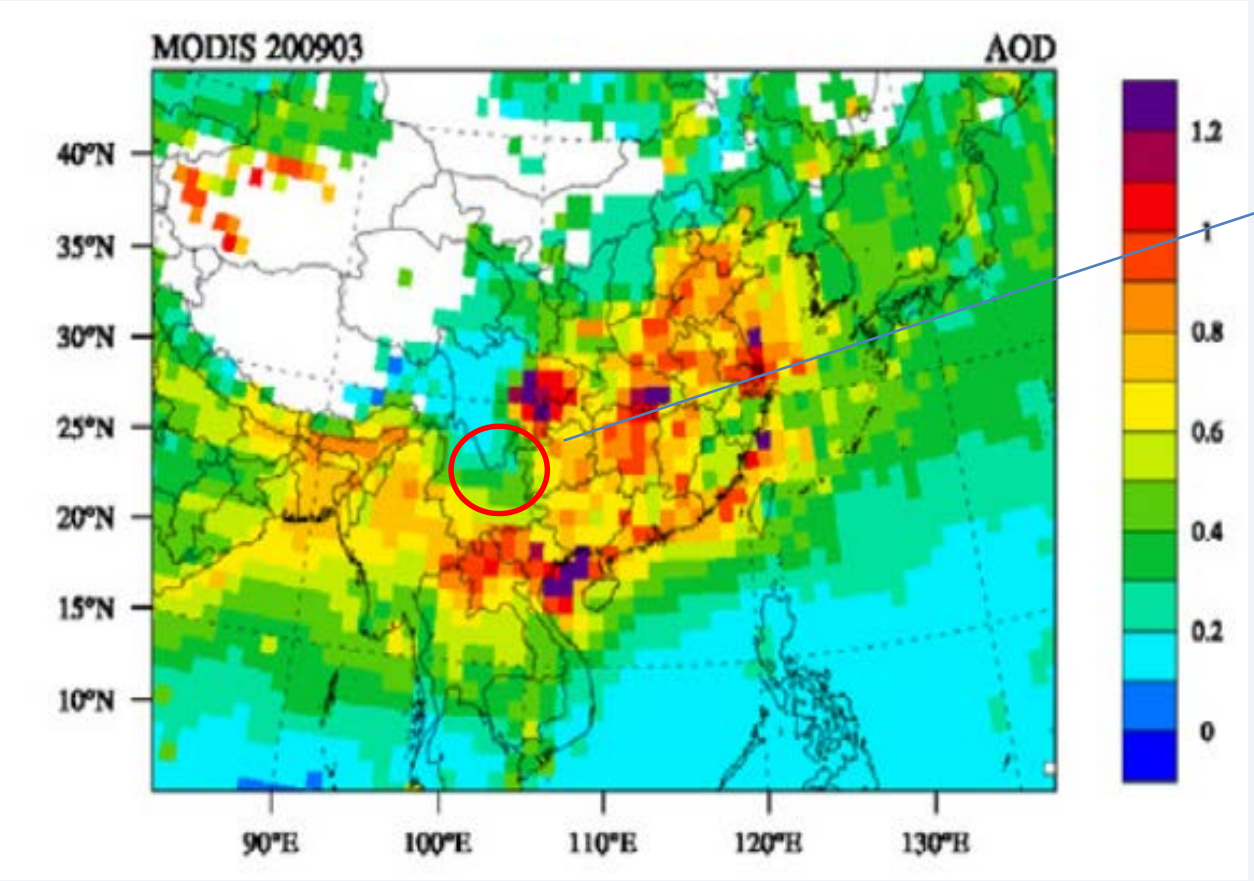


Southeast Asia is largest of biomass burned in Asia [Streets et al. ,2003]

Influence:

- Atmospheric Brown Cloud [Ramanathan et al., 2007; Stone et al., 2007]
- Form a regional-scale haze [Engling and Gelencser, 2010]
- Smoke transport to the northwestern Pacific [Jacob et al., 2003]
- Smoke aerosol transport to South China (Hong Kong) [Chan et al., 2003]

Yungui Plateau in Southwest China



Low AOD in Yungui Plateau

The research of smoke transport from Southeast Asia to this region is limited

Objectives:

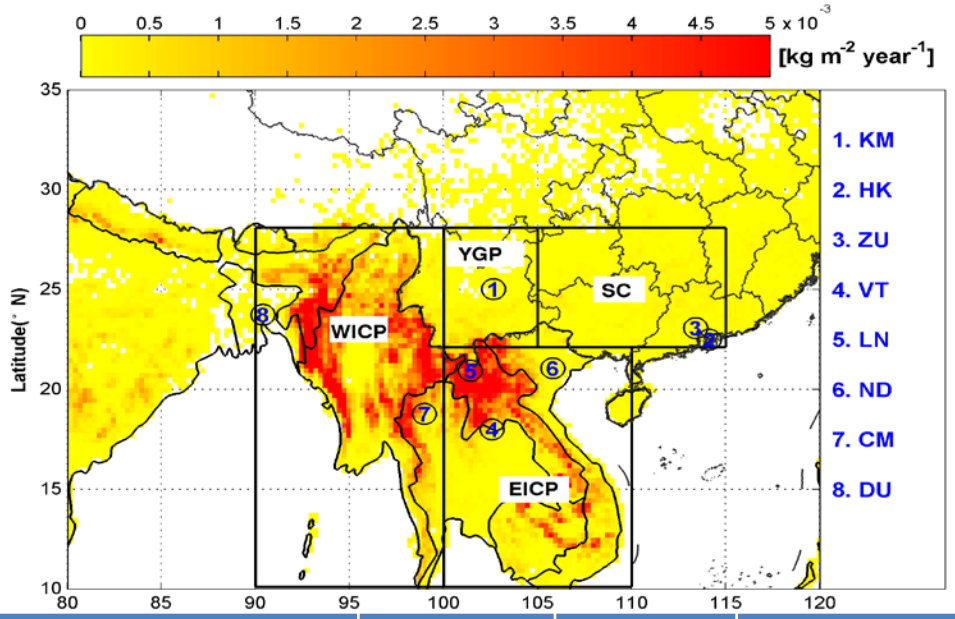
1.Evaluate the model AOD in Southeast Asia and south of China

2.Quantify the smoke transport from different region of Southeast Asia to southwest China

Study region and sites:

YGP: Yungui Plateau
SC: South China
EICP: East of ICP
WICP: West of ICP

ICP: Indo-China Peninsular



Region	Site name	Site location	Lon(ºE)	Lat(ºN)	Height(m)
YGP	KM	Kunming, Southwest China	102.65	25.01	1889
SC	HK	Hong_Kong_Sheung, South China	114.117	22.483	40
	ZU	Zhongshan_Univ, South China	113.390	23.060	27
EICP	VT	Vientiane, Thailand, near Vientiane (Laos)	102.570	17.992	170
	LN	Luang_Namtha, Laos	101.416	20.931	557
	ND	NGHIA_DO, Vietnam	105.800	21.048	40
WICP	CM	Chiang_Mai_Met_Sta, Thailand	98.972	18.771	312
	DU	Dhaka_University, Bangladesh	90.398	23.728	34

Data:

CE318 sunphotometer: AOD and Angstrom Exponent

MODIS: AOD 550nm and fire location products

CALIPSO:
Level 1:attenuated backscattering coefficient profiles at 532 nm
Level 2:particulate extinction coefficient profiles at 532nm
vertical feature mask data products of aerosol subtype

NCEP/NCAR reanalysis daily data:
surface wind and 500mb geopotential height

Descriptions

- GEOS-Chem model v10-1
- GEOS5 meteorological fields on 47 layers.
- NOx-Ox-hydrocarbon-aerosol chemistry
- 0.5x0.667 nest model in East Asia
- BC boundary conditions from 2x2.5 Global model
- Emissions: Fire inventory from NCAR (FINN)

Configurations

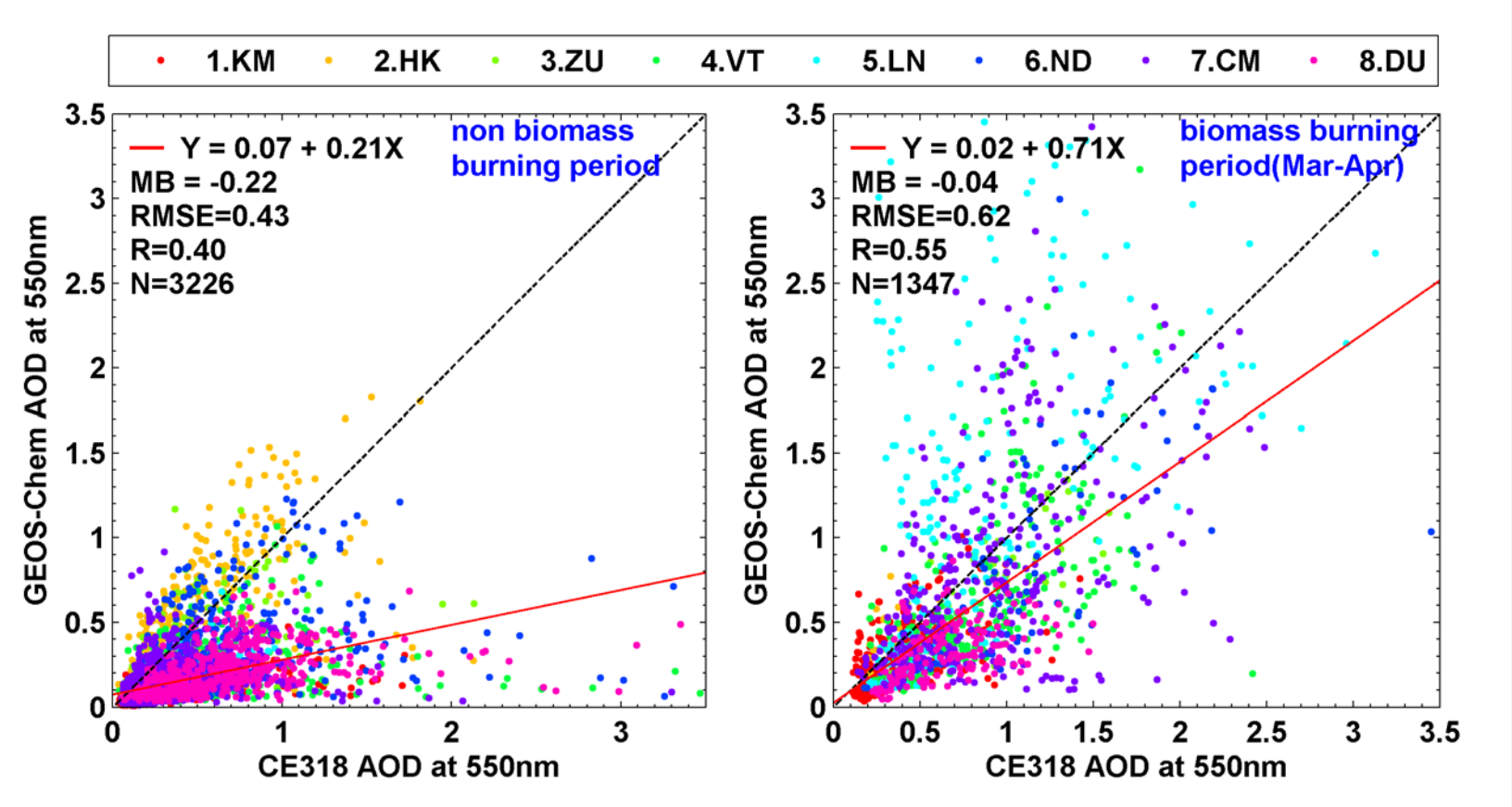
Time period:

- Jan 2012-May 2013 & March-April 2013

Sensitivity experiments:

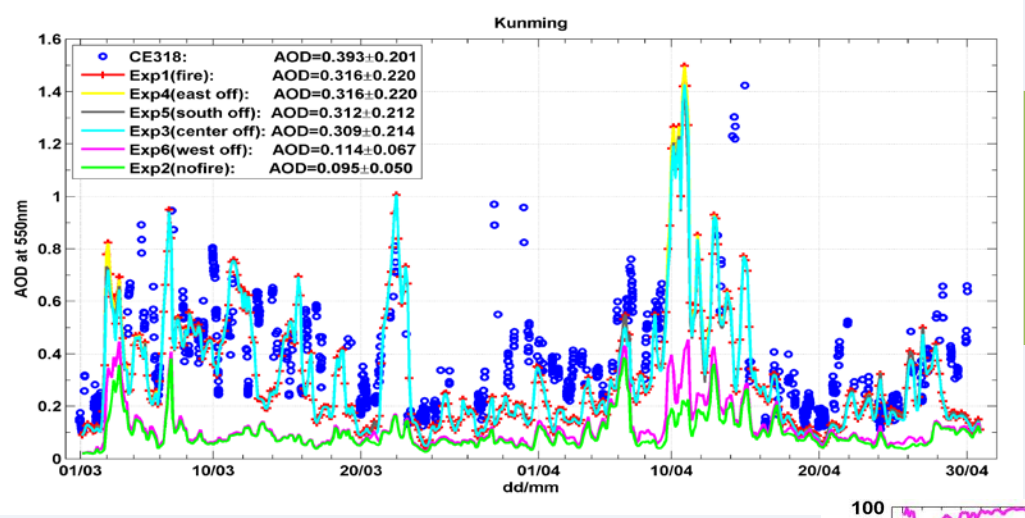
- Experiment-1 (Exp1): turn on global fire emission;
- Experiment-2 (Exp2): turn off global fire emission;
- Experiment-3 (Exp3): turn off fire emission in YGP region;
- Experiment-4 (Exp4): turn off fire emission in SC region;
- Experiment-5 (Exp5): turn off fire emission in EICP region;
- Experiment-6 (Exp6): turn off fire emission in WICP region.

I. Evaluation of model AOD



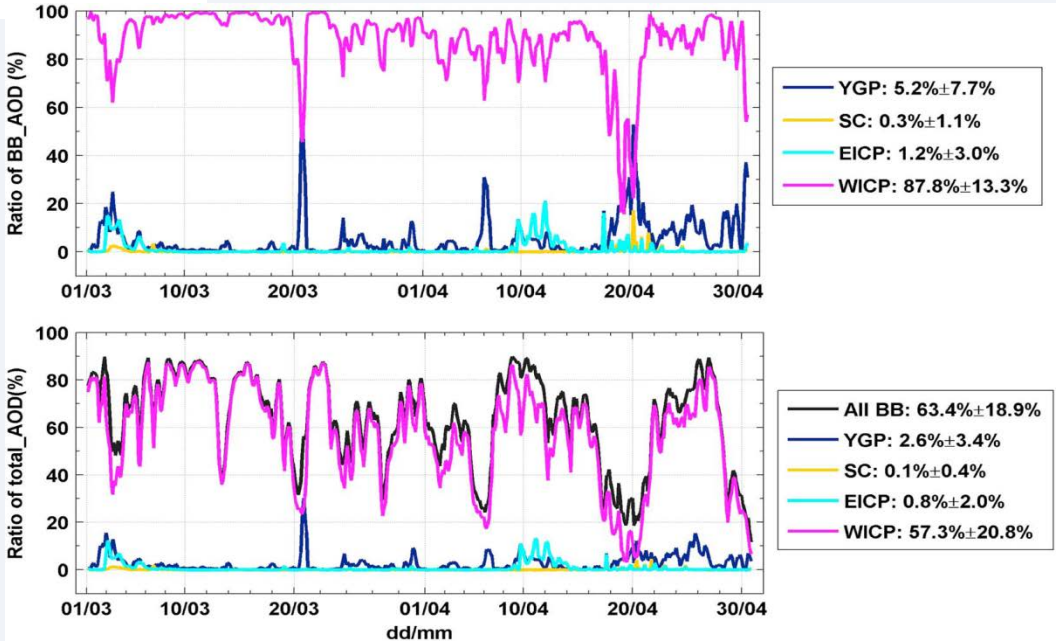
➢ the model perform better in biomass burning period(Mar-Apr).

II. Regional contribution of biomass burning transport to Southwest China

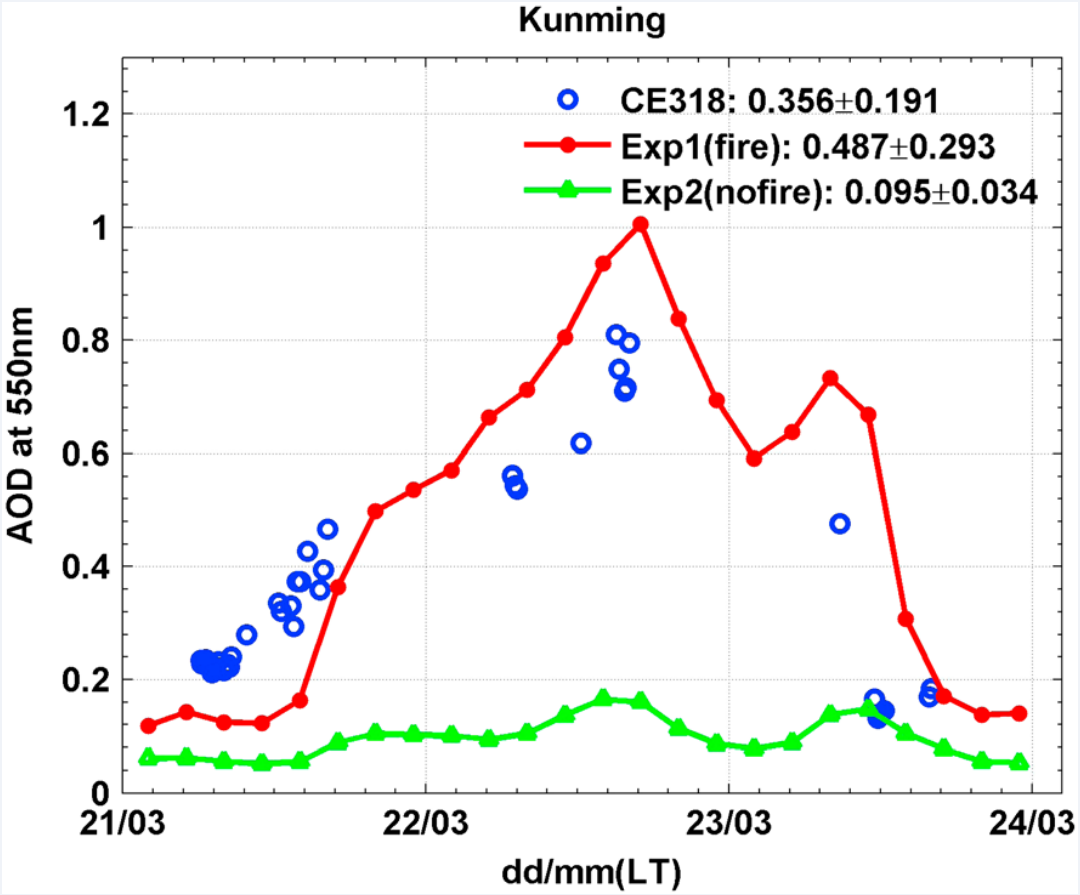


WICP region is the largest contributor of smoke aerosol in Kunming site.

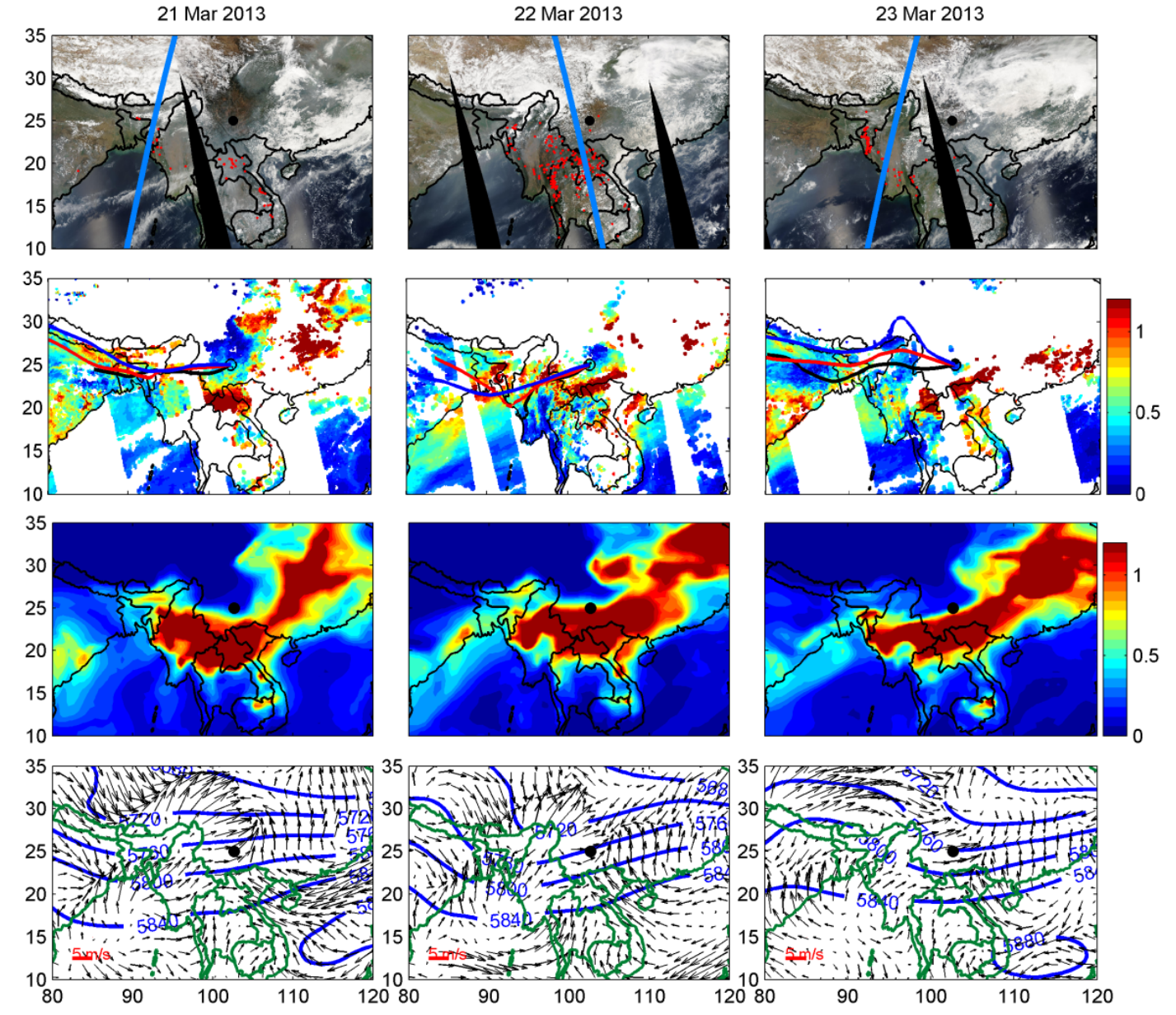
The contribution of BB in WICP to BB_AOD is 88% and to total_AOD is 57% at KM site



III. A case of smoke transport from west to Kunming



The model simulation (Exp1) has well caught the trends of AOD in the three days.

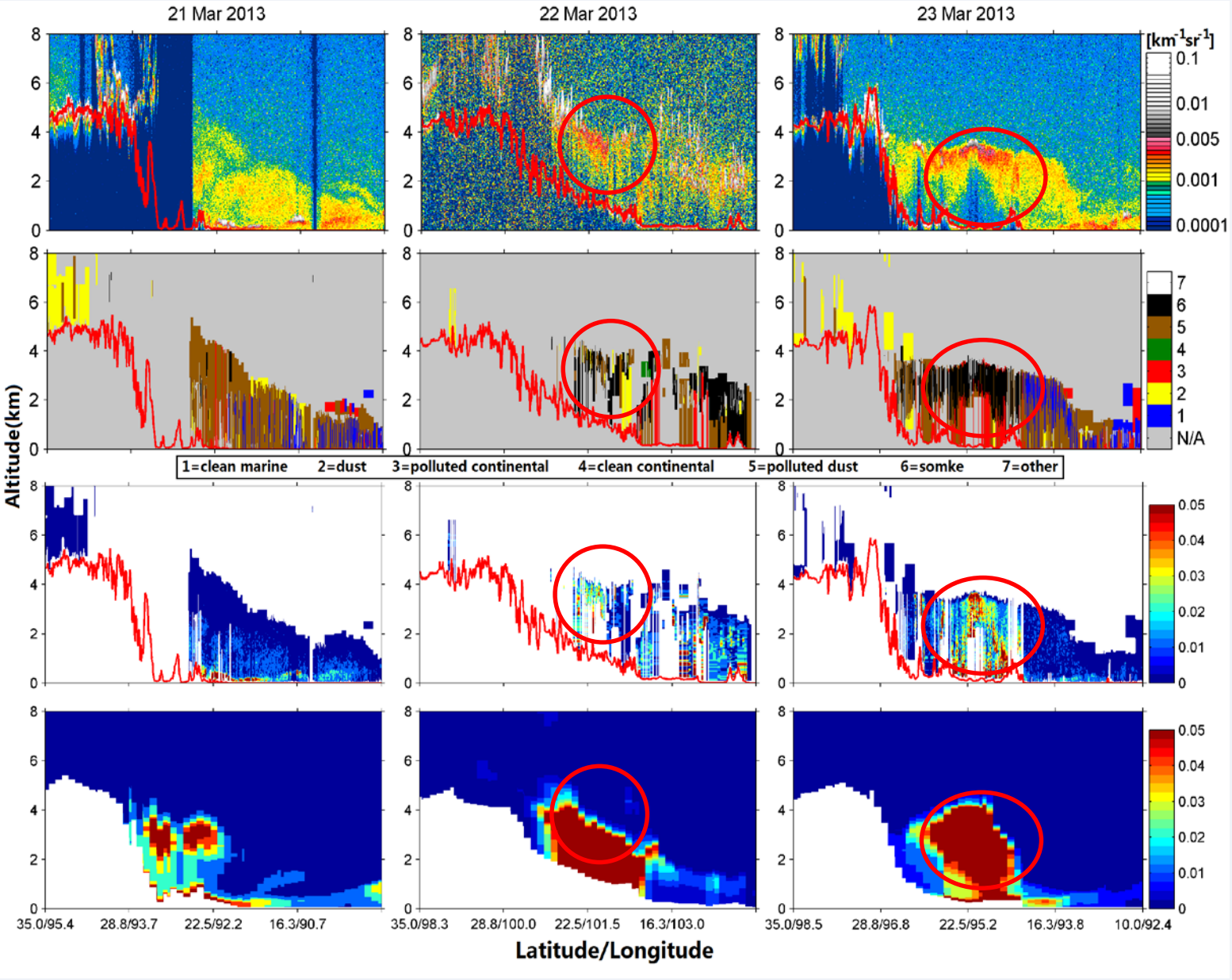


MODIS true-color images, Fire locations, CALIPSO_track

MODIS AOD 550 nm and back trajectory

Model simulated AOD 550nm

500hpa hgt and surface wind



CALIOP total attenuated backscatter at 532nm

CALIOP vertical feature mask of aerosol

CALIOP AOD at 532nm (extinction coefficient × level depth)

Model simulated vertical AOD at 550nm

- GEOS-Chem model simulation underestimates the AOD value of 0.16 during Jan 2012-May 2013 but performs better in biomass burning months March –April with a bias only of -0.04. And in biomass burning season, the model AOD often captures the trends of AOD observed by CE318 with a correlation coefficient of 0.55.
- The regional sensitivity experiments reveal that the biomass burning in WICP region (mainly Northeast India and Burma) is the largest contributor of BB_AOD (~88%) and total_AOD (~57%) to Southwest China site Kunming.
- A case study of smoke transport on 21-23 March 2013 shows that the model simulated spatial distribution of AOD and vertical distribution of aerosols are consistent with their respective counterparts retrieved from MODIS and CALIPSO. The smoke in Burma can be lifted to 4km and then transported to YGP by prevailing west wind.

Thank You!