Development of HCHO algorithm for GEMS

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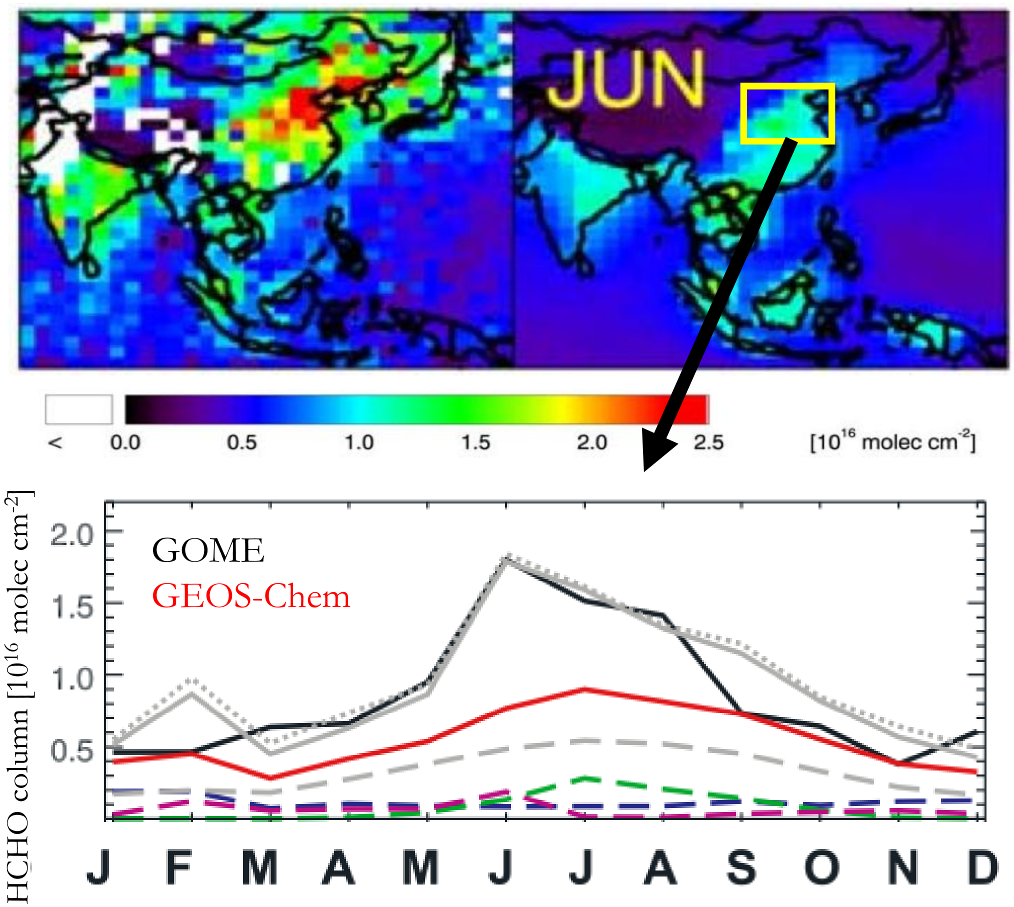
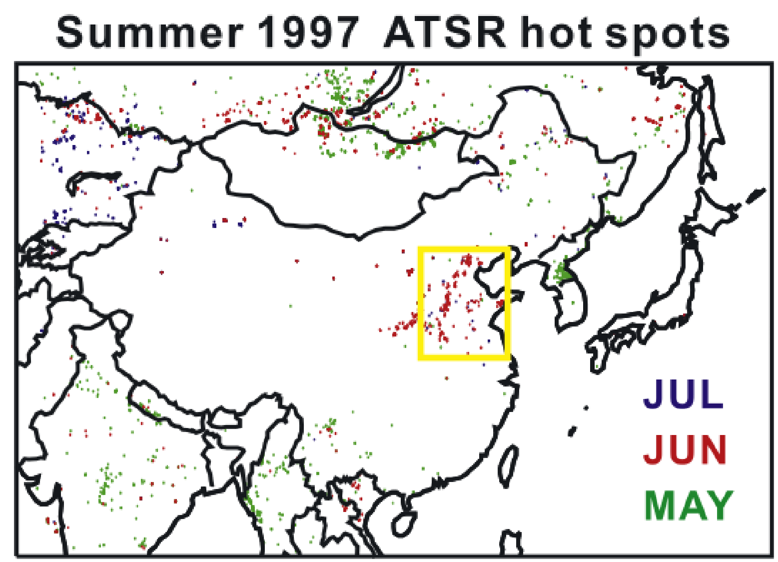
Missing HCHO sources from agricultural burning over the North China Plain in GEOS-Chem

Fu et al. (JGR, 2007) showed a large HCHO source from agricultural burning in the North China Plain in June missing from current inventories

GOME GEOS-Chem





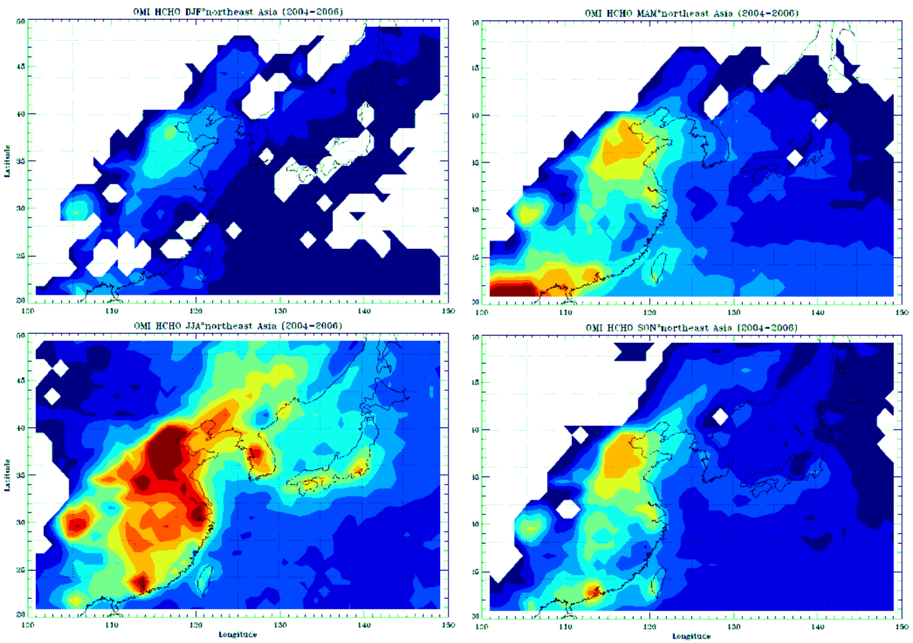
Large missing HCHO sources from anthropogenic activities over North China in GEOS-Chem

Previous literature (Shim et al., 2005; Fu et al., 2007) suggested that biogenic activity and biomass burning are the main sources for HCHO over East Asia.

OMI

DJF

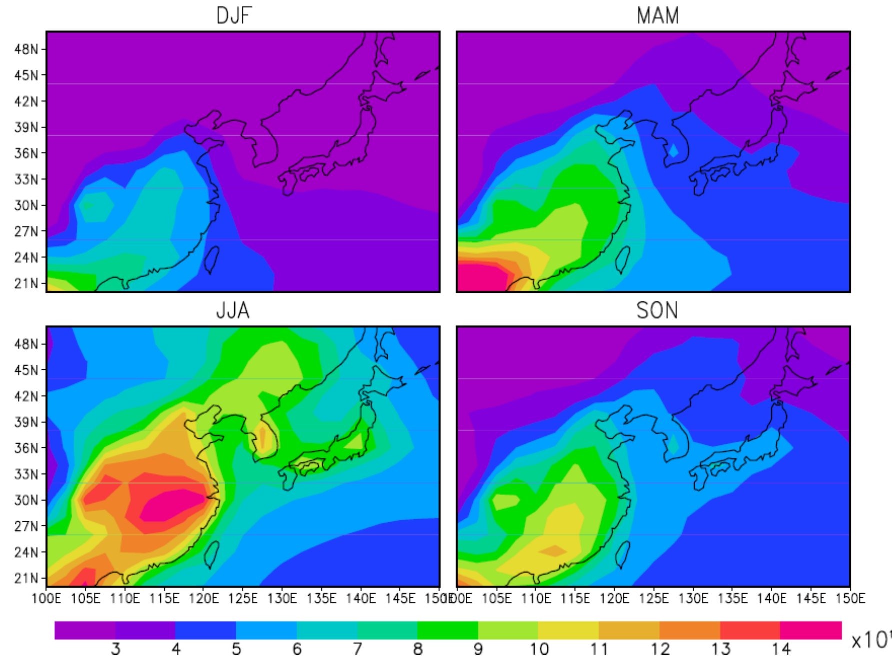
MAM



JJA

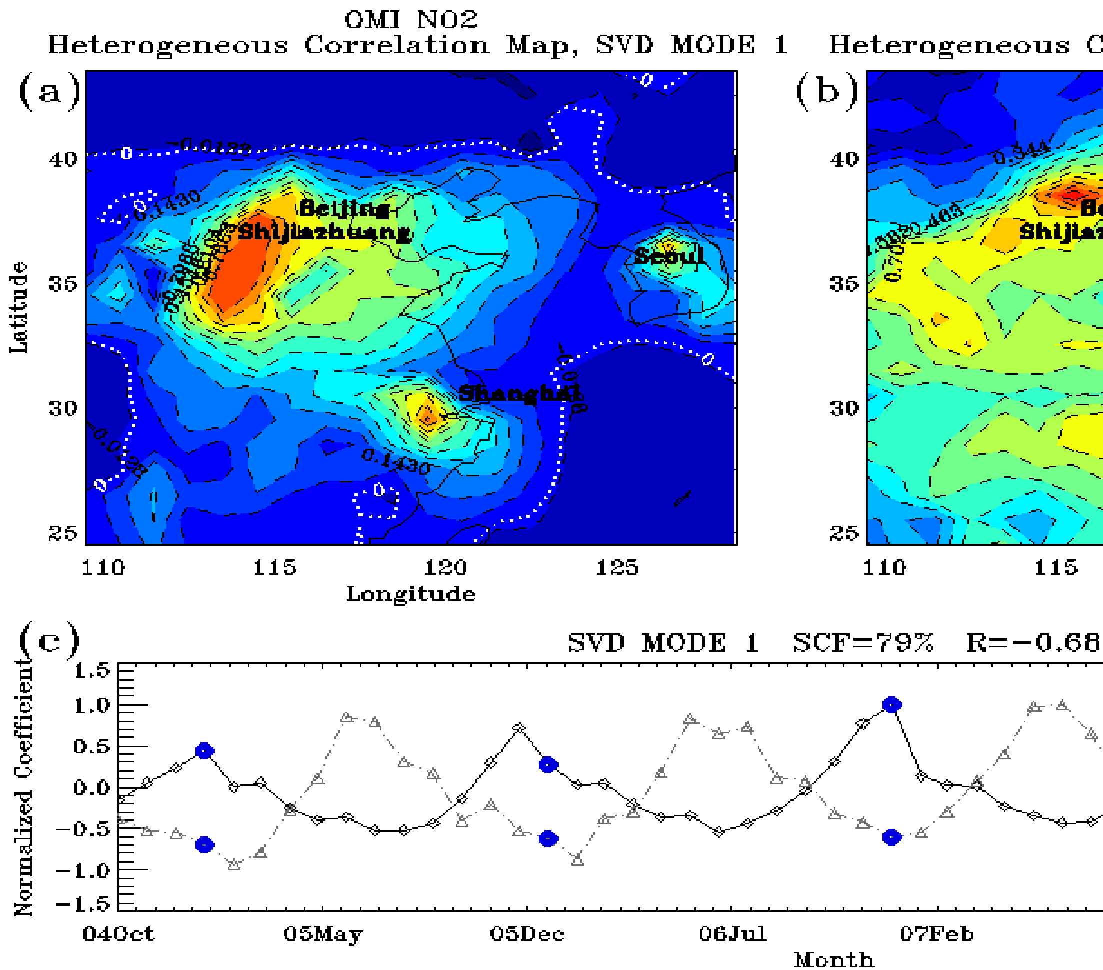
SON

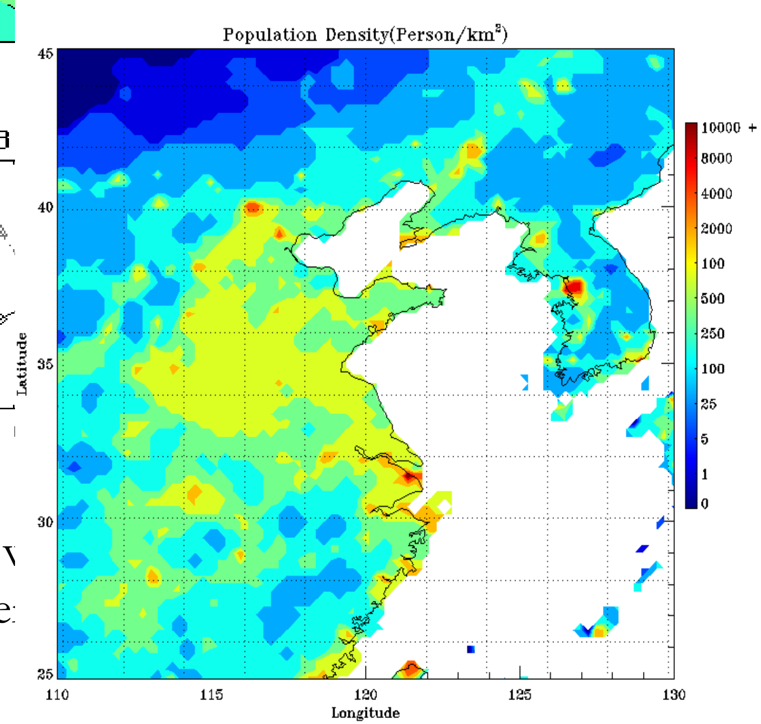
GEOS-Chem



Kim et al. (2012, in review) showed high HCHO column concentrations in northeast Asia from OMI that are not shown in model simulations.

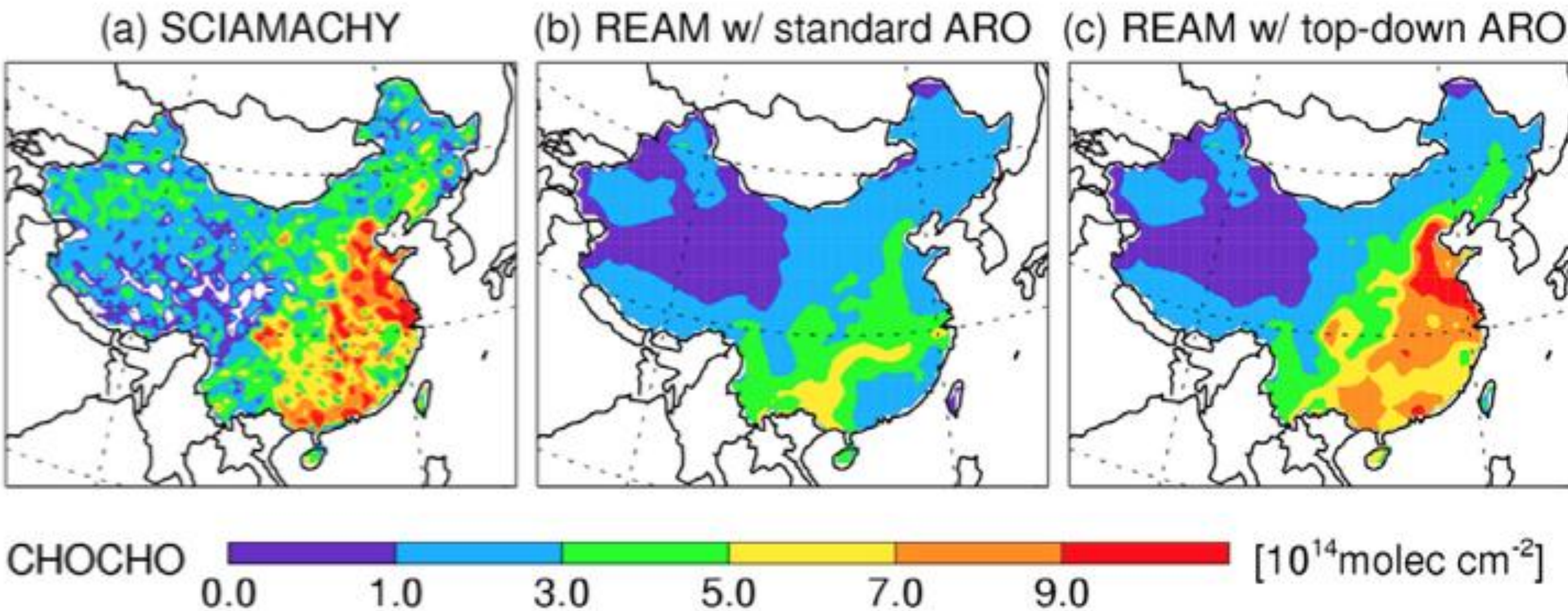
Correlation between observed HCHO and NO2 column concentrations over northeast Asia



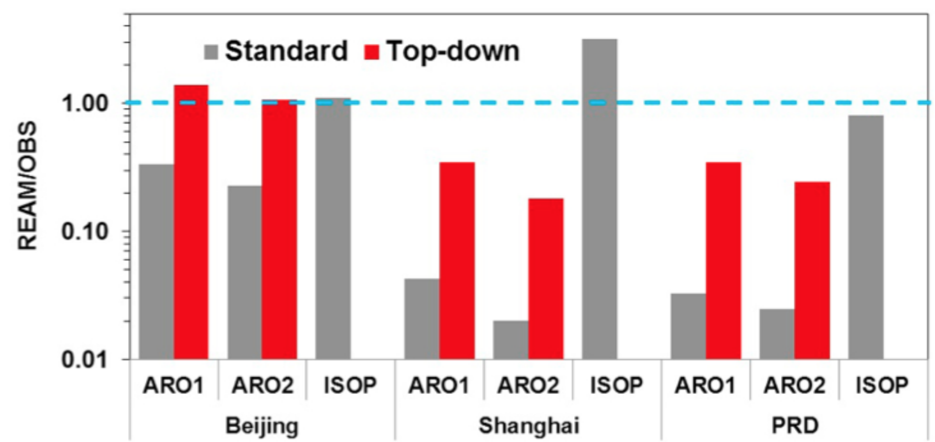


The spatial pattern of observed NO2 is highly correlated v
distribution in East Asia, indicating significant anthropoge

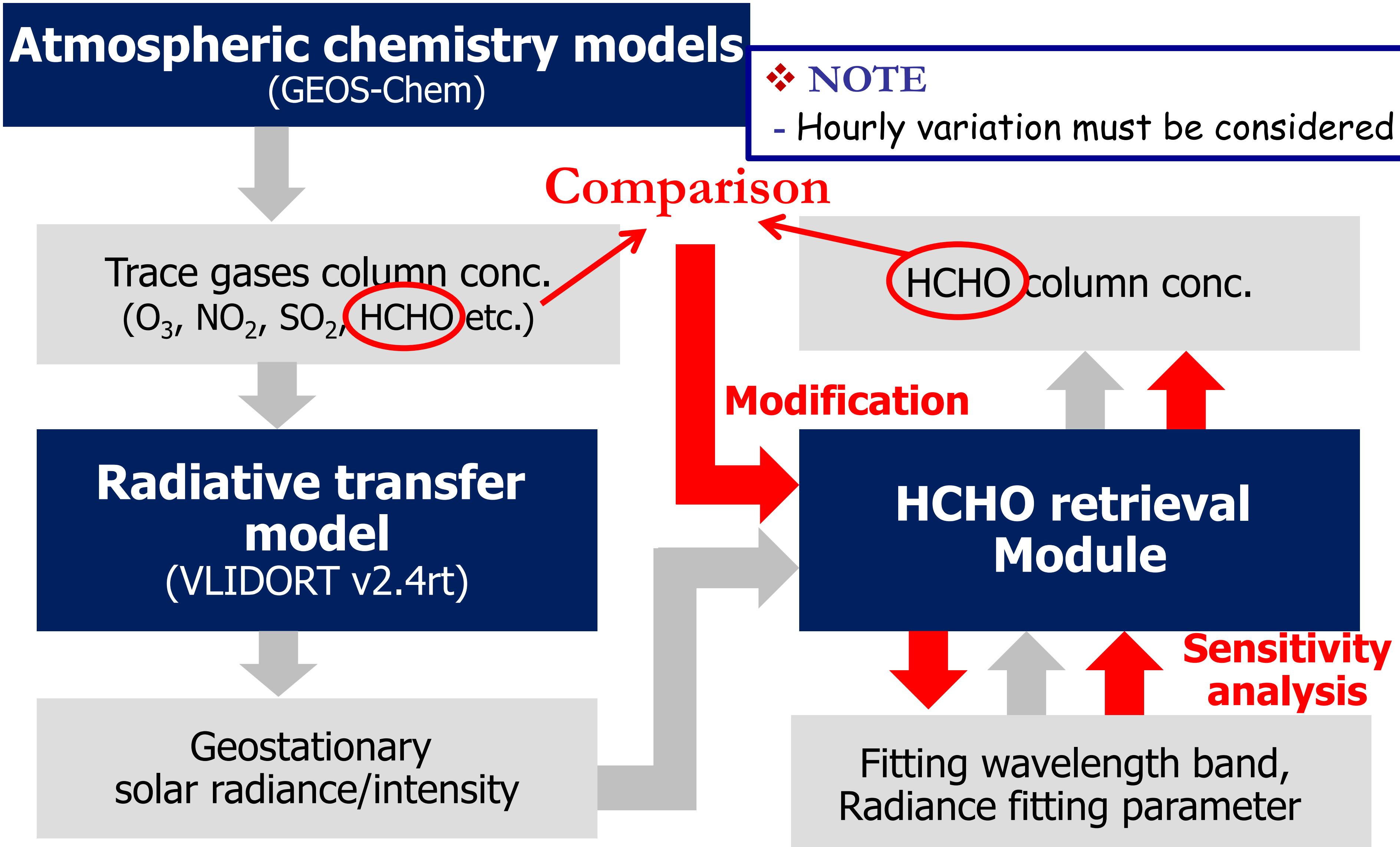
MONTHLY MEAN CHOCHO IN EAST ASIA FOR AUGUST 2007 : SCIAMACHY VS. MODEL



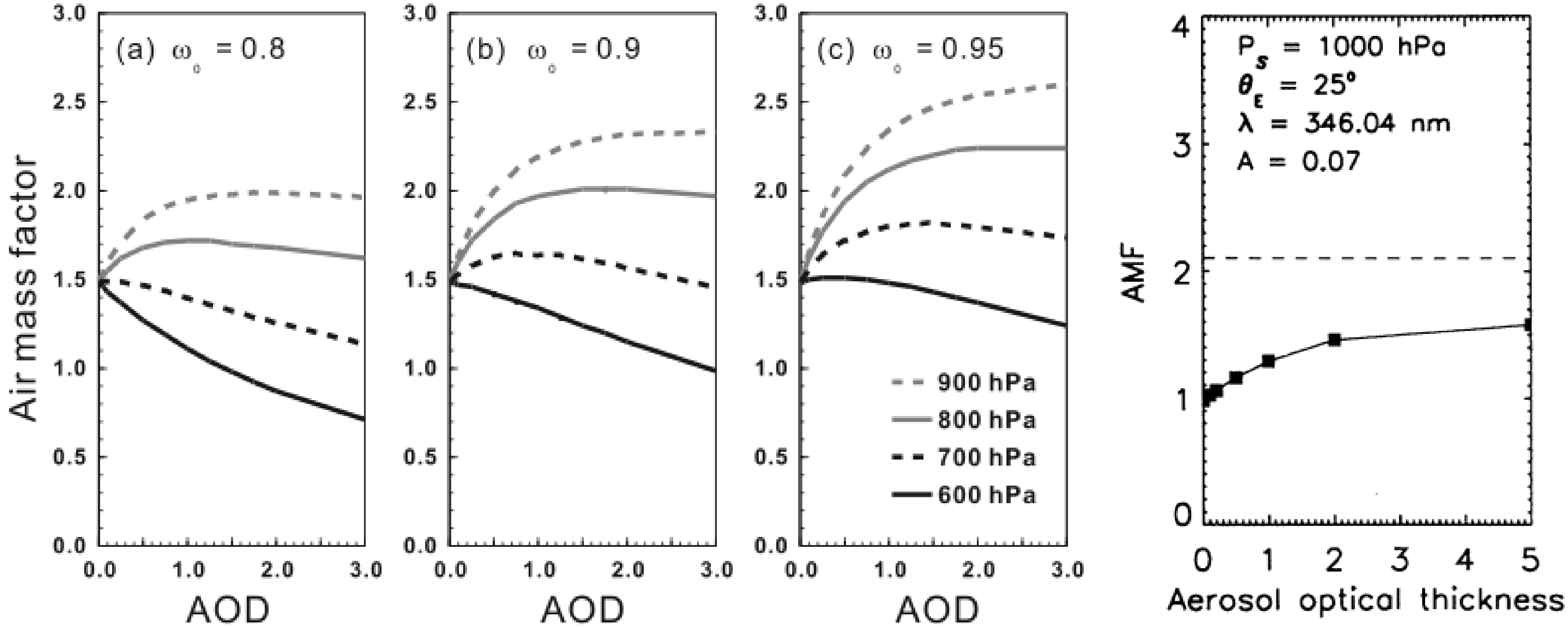
Liu et al. (GRL, 2012) suggested that VOC emission inventory over China underestimates aromatics sources by factors of 4-10, having important implications for ozone and organic aerosol formation.



Synthetic Simulations of HCHO retrieval



Sensitivity of the HCHO AMF to aerosol

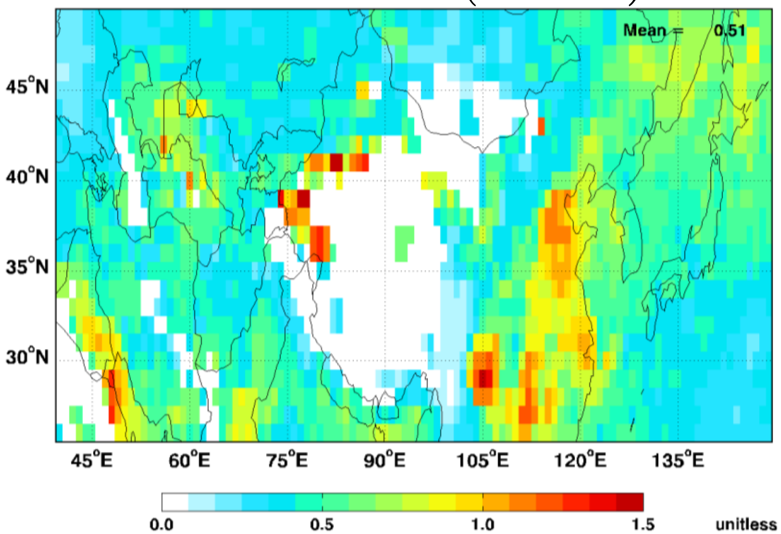


Fu *et al.* (JGR 2007) Palmer *et al.* (JGR 2001)

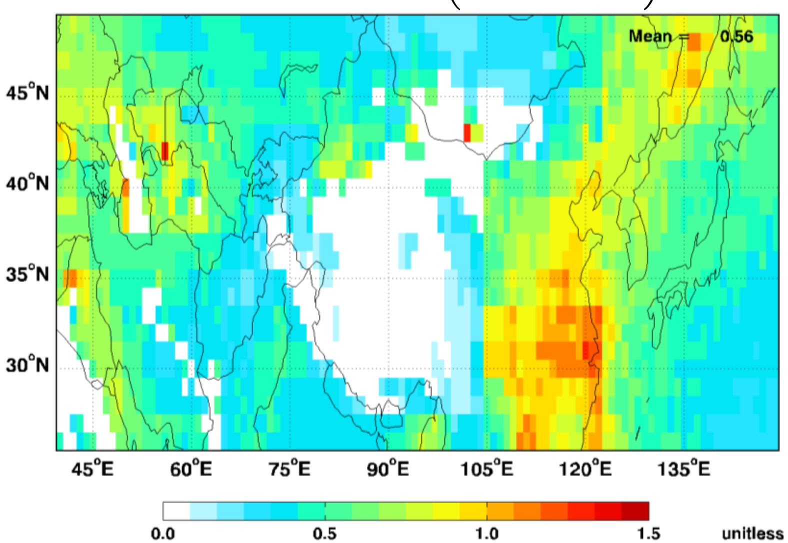
AMF is moderately sensitive to AOD, single scattering albedo but highly sensitive to the differen tial altitude between HCHO and aerosols [Fu et al., 2007].

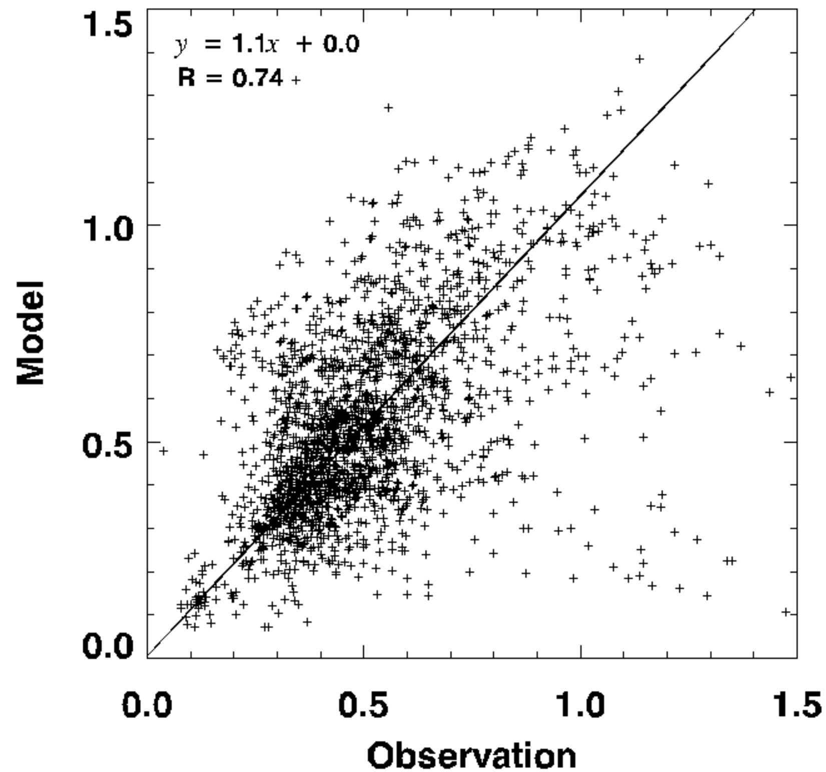
Monthly mean Aerosol Optical depth: GEOS-Chem vs. MODIS

AOD at 550nm (MODIS)



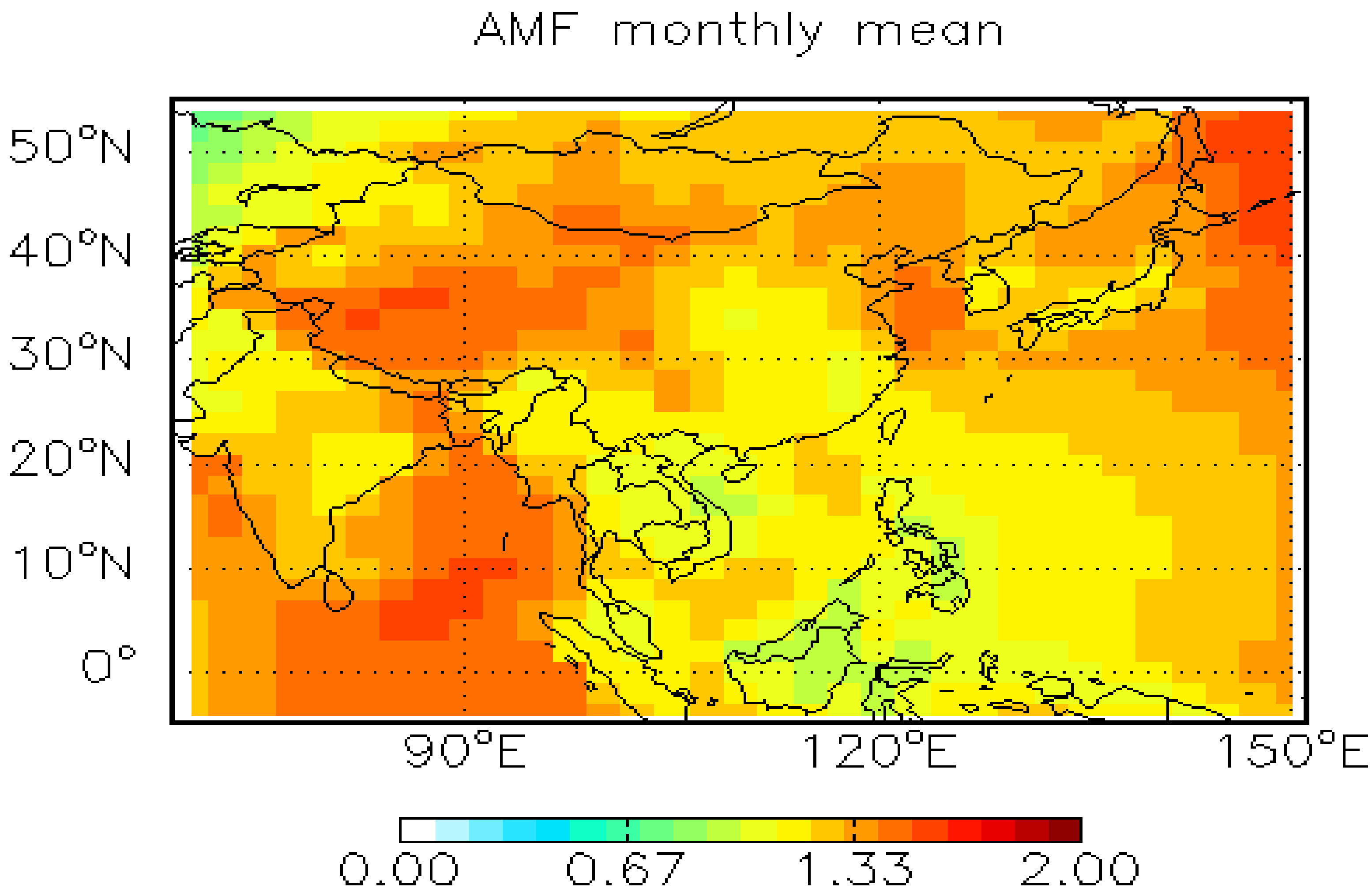
AOD at 550nm (FlexAOD)



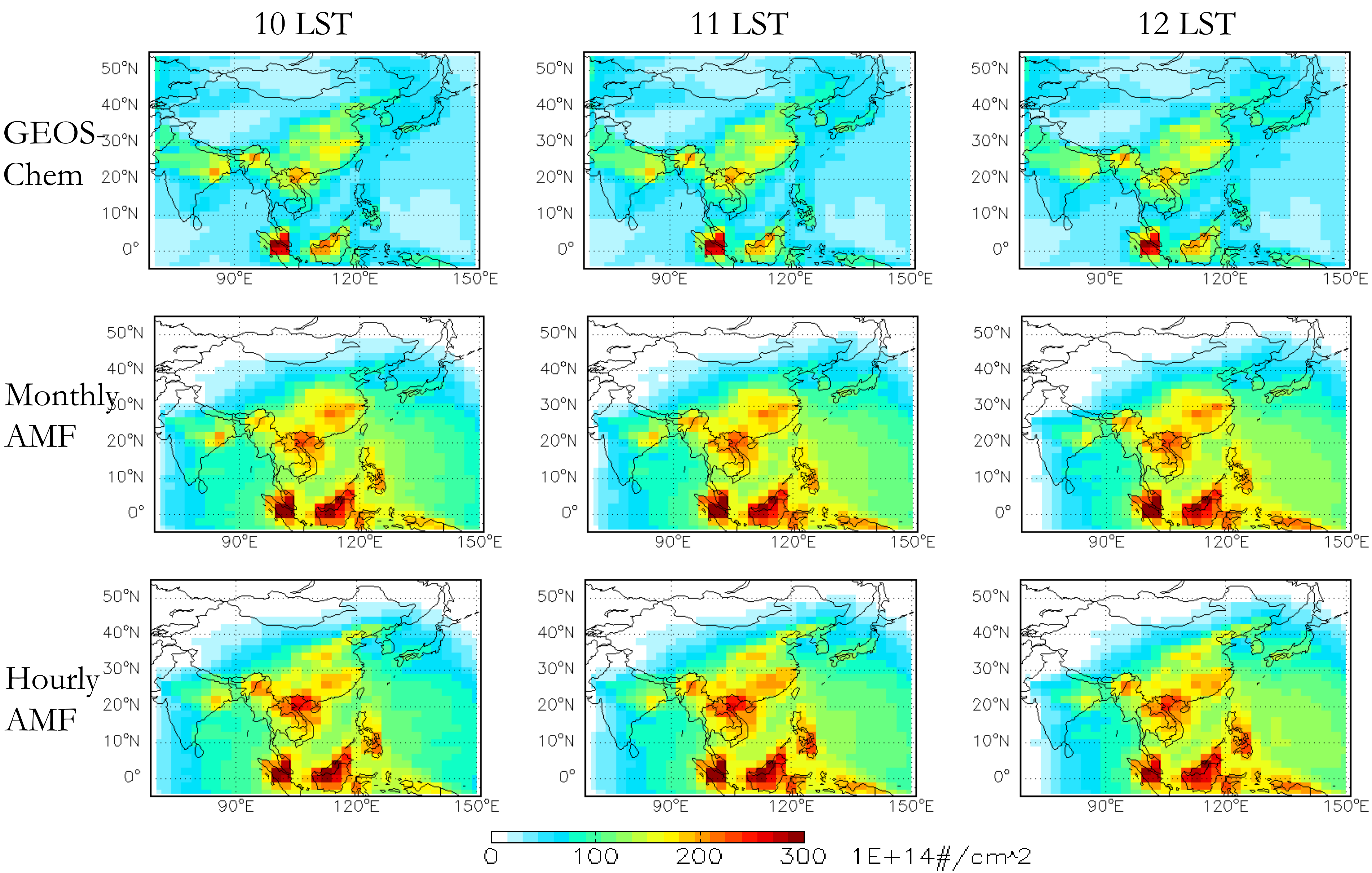


The model captures the spatial pattern of observed AOD with R=0.7 and regression slope of 1.1 but shows substantial discrepancy in East China.

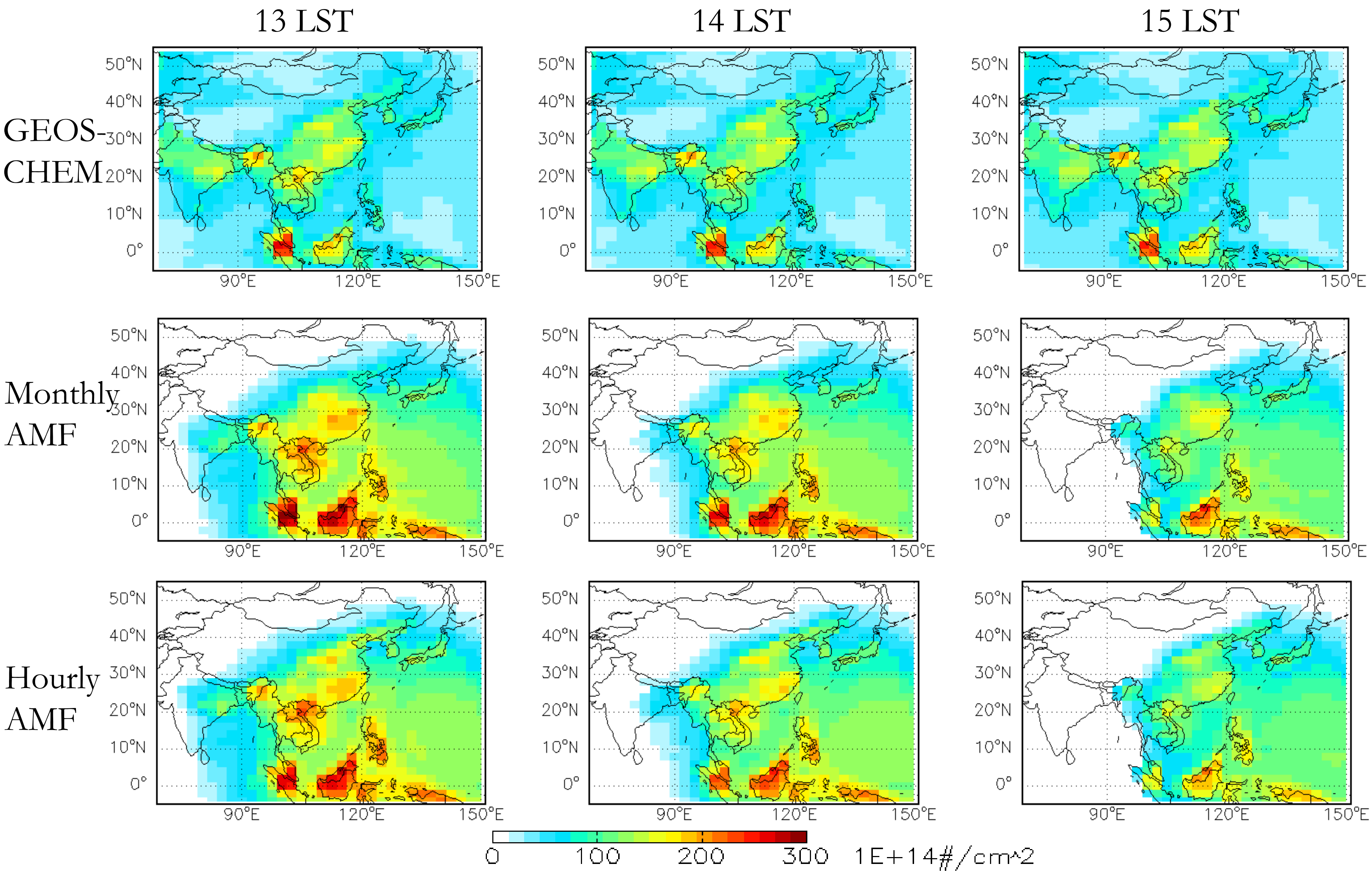
AMF_Monthly mean



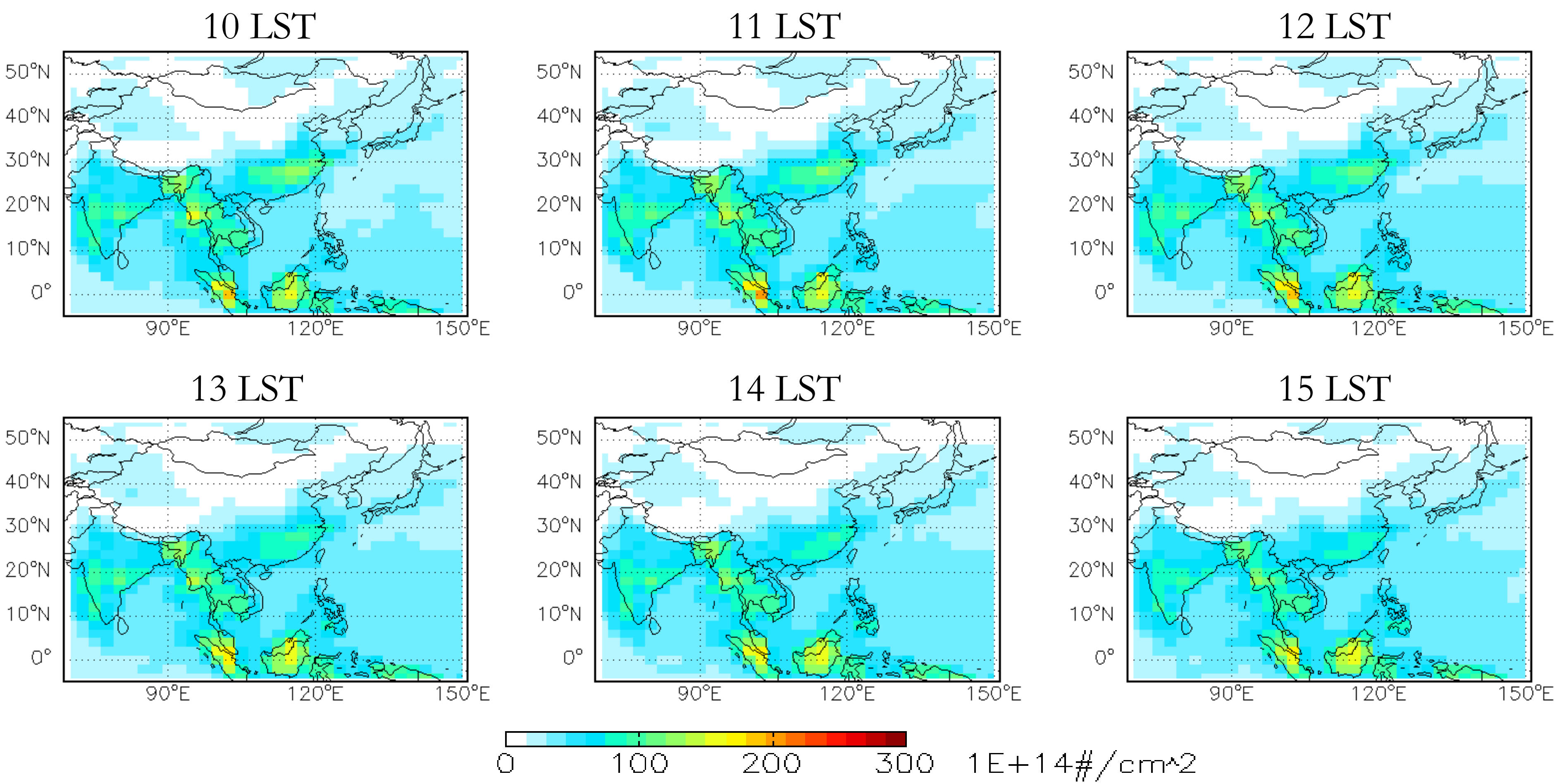
Comparison of the input and retrieved HCHO VCD at the summer solstice: retrieval sensitivity to AMF



Comparison of the input and retrieved HCHO VCD: retrieval sensitivity to AMF (monthly vs. hourly)



Hourly variation of HCHO column concentration simulated with GEOS-Chem at the winter solstice

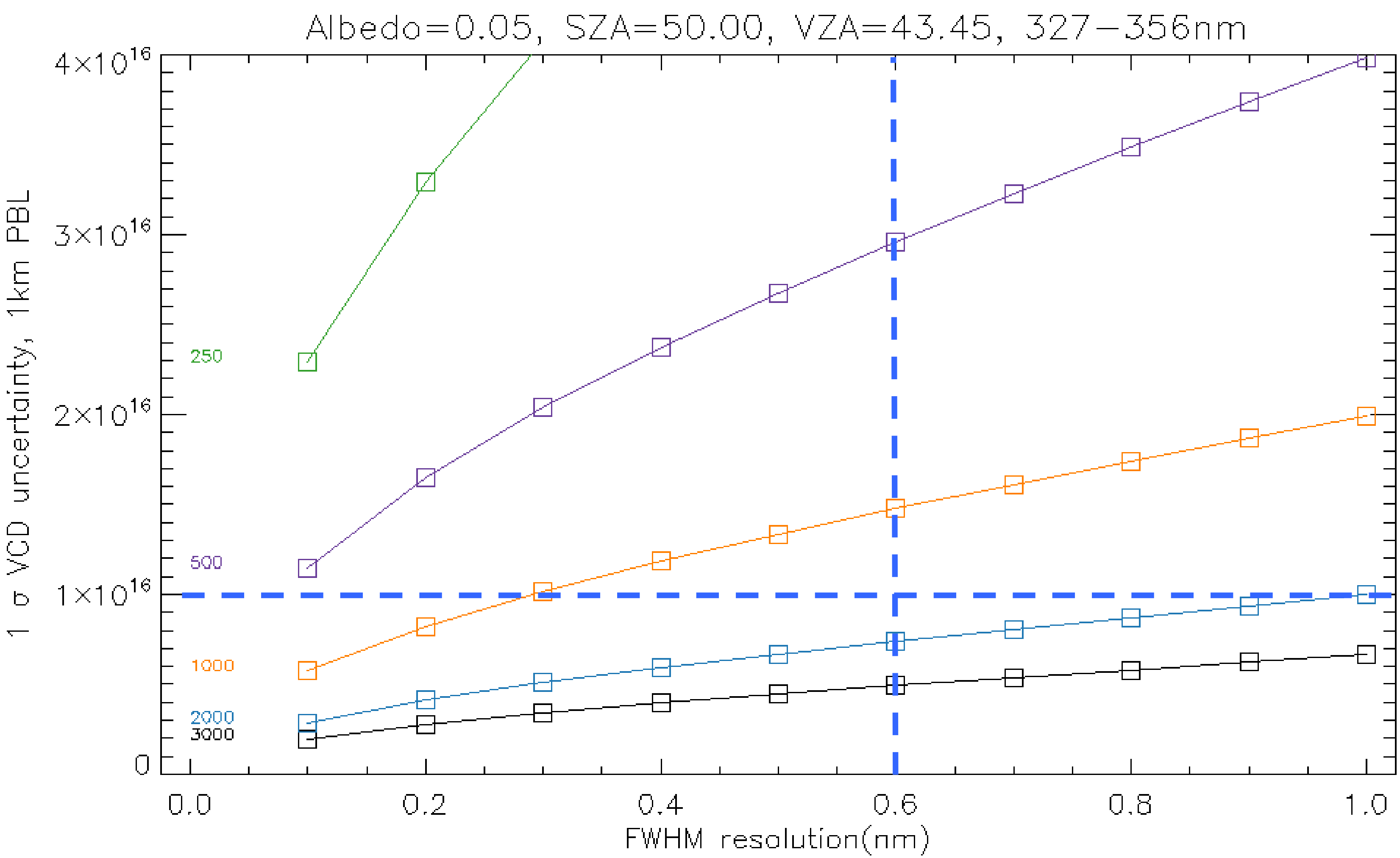


Hourly variation of solar zenith angle and azimuth angle on the spring/autumn equinox and the summer/winter solstice

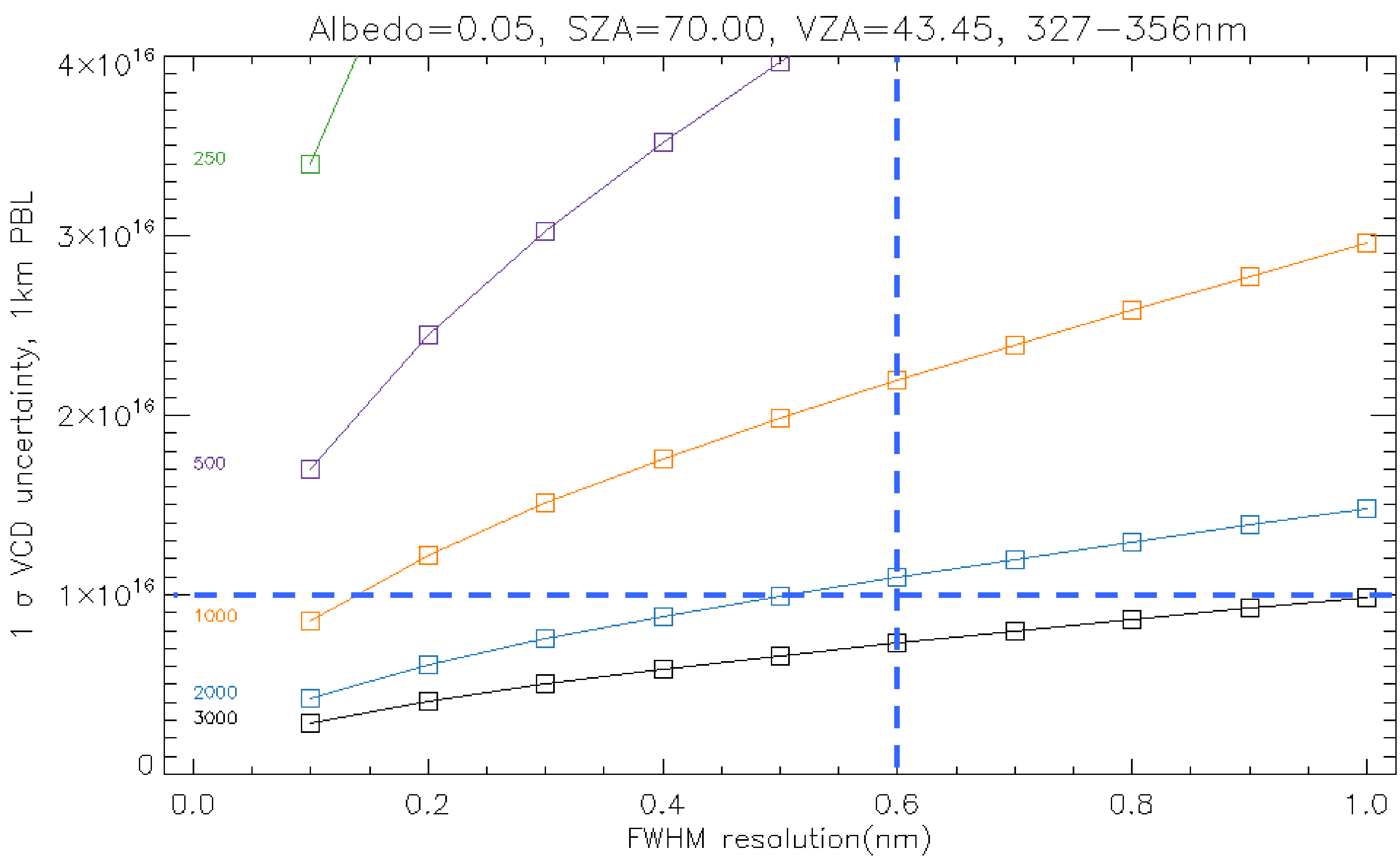
Time(hour)	Spring Equinox		Summer Solstice		Autumn Equinox		Winter Solstice	
	μ_o†	φ_o‡	μ_o	φ_o	μ_o	φ_o	μ_o	φ_o
06	91.18	88.83	76.20	70.82	88.16	91.06	103.68	109.21
07	79.46	98.05	64.76	78.89	76.60	100.40	92.68	117.69
08	67.92	108.00	52.99	87.20	65.19	110.70	82.65	127.12
09	57.05	119.68	41.12	96.76	54.61	123.01	73.95	137.95
10	47.53	134.39	29.57	109.80	45.62	138.73	67.01	150.54
11	40.49	153.55	19.33	132.57	39.45	159.06	62.50	164.91
12	37.43	177.02	14.13	178.45	37.60	183.07	60.98	180.43
13	39.30	201.11	18.85	225.62	40.67	206.44	62.67	195.92
14	45.50	221.47	28.95	249.30	47.71	225.54	67.33	210.20
15	54.52	237.18	40.48	262.64	57.21	240.23	74.39	222.70
16	65.12	249.48	52.34	272.32	68.07	251.90	83.17	233.44
17	76.54	259.77	64.12	280.66	79.61	261.85	93.29	242.79
18	88.10	269.11	75.58	288.73	91.35	271.07	104.30	251.25

† Solar Zenith Angle
‡ Solar Azimuth Angle

Required SNR for HCHO measurements in winter (SZA 50)



Required SNR for HCHO measurements in winter (SZA 70)



Future plans

❖ Examine the sensitivity of simulated HCHO to anthropogenic emissions of aromatic species in East Asia

❖ Examine the sensitivity of simulated AOD to anthropogenic emissions of aromatic species especially focusing on anthropogenic SOA.

❖ Continue to improve retrieval algorithm suited for GEMS observations considering chemical environment in East Asia by integrating other in-situ observations.