Tropospheric methanol observations from space: retrieval evaluation and constraints on the seasonality of biogenic emissions

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Supplemental Information

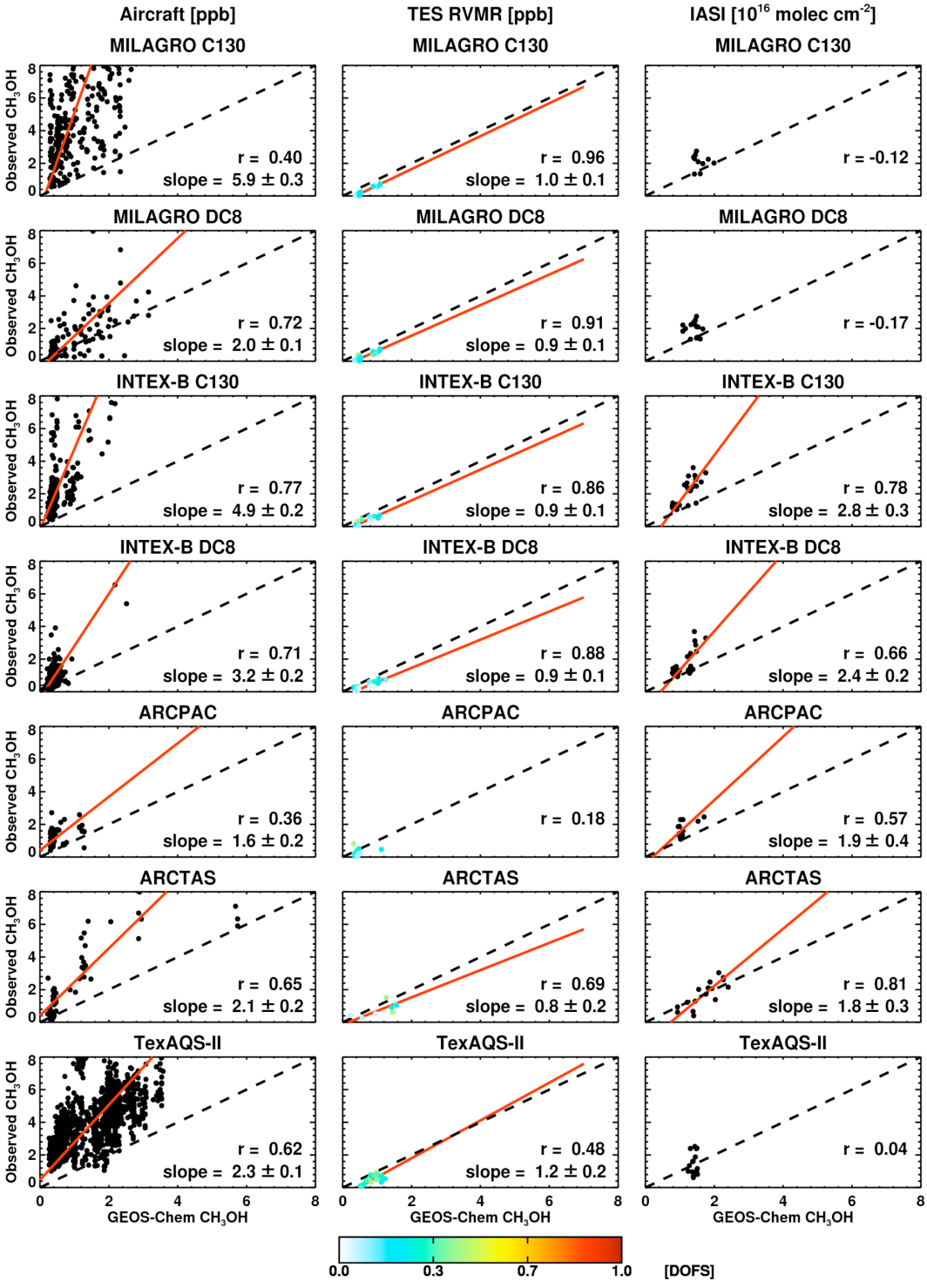


Figure S1. Comparison of TES, IASI and airborne methanol measurements using GEOS-Chem as an intercomparison platform. Methanol abundance as modeled by GEOS-Chem (base-case simulation) is compared to aircraft (left column, ppb), TES (middle column, ppb) and IASI (right column, 10^{16} molec cm^{-2}) measurements for the field campaigns shown in Fig. 2. TES data are colored according to their DOFS; only DOFS < 0.5 are shown. Red lines correpond to a reduced major axis fit to the data (only performed for $r > 0.25$). Uncertainty estimates correspond to the standard error of the regression.

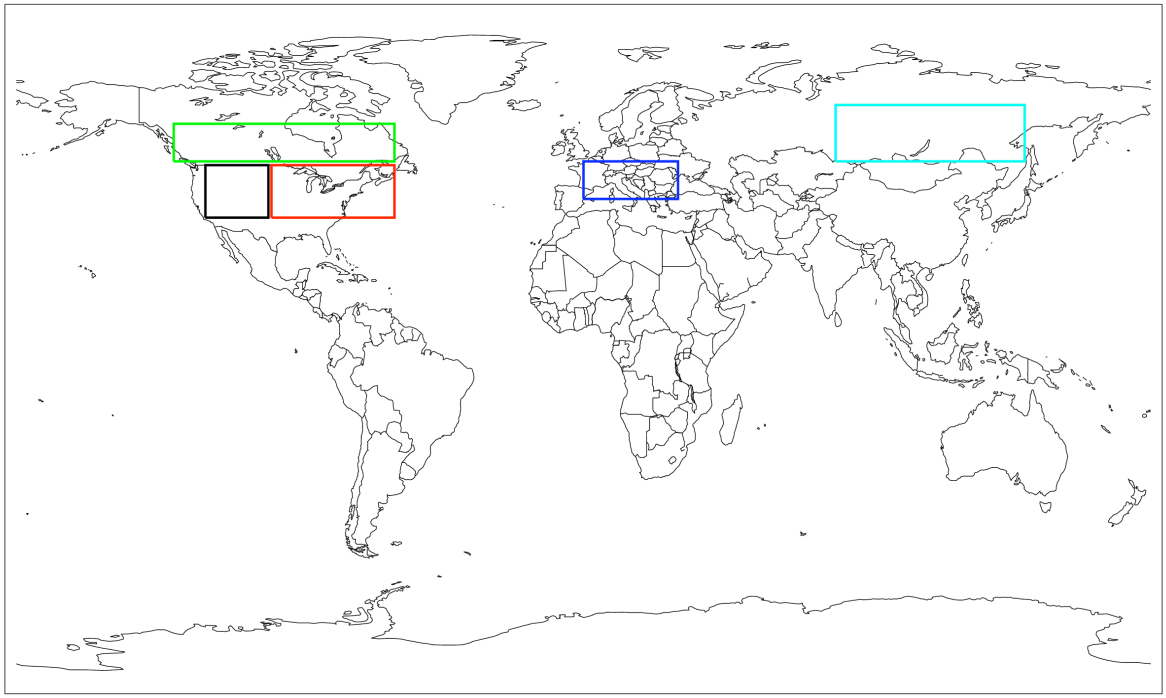
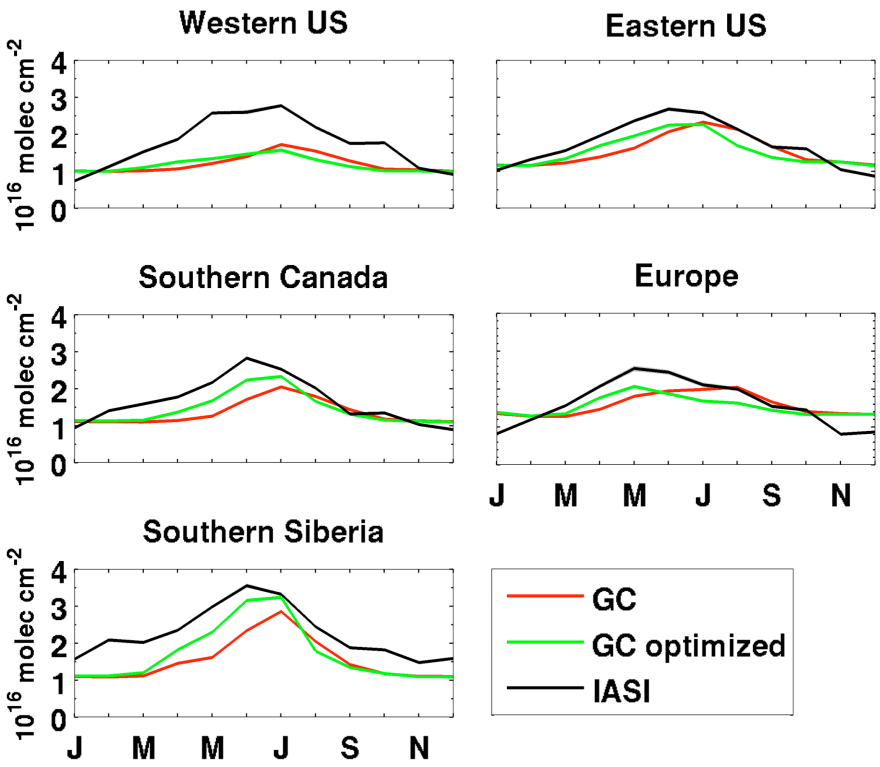


Figure S2. Midlatitude regions considered in this study: Western US (black), Eastern US (red), Southern Canada (green), Europe (blue), and Southern Siberia (cyan).



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3 Figure S3. Seasonal cycle in atmospheric methanol over midlatitude regions as measured by IASI
4 (black) and predicted by the GEOS-Chem base-case (red) and optimized (green) simulations.
5 Data are for 2009. Lines show the mean for each of the midlatitude regions of Fig. S2.

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Table S1. Regional methanol sources and global sinks (Tg yr^{-1}) of methanol in GEOS-Chem for 2006.

		Globe	W. US	E. US	S. Canada	Europe	S. Siberia
Sources	Anthropogenic	6.1	0.02	0.13	0.04	0.52	0.05
	Biogenic	66	1.1	2.8	1.4	1.5	2.4
	Biomass burning	8.7	0.03	0.03	0.12	0.01	0.46
	Photochemistry	37	0.04	0.17	0.08	0.06	0.07
	Ocean biosphere	83					
Sinks	OH oxidation	72					
	Dry deposition	27					
	Wet deposition	12					
	Ocean uptake	88					

Table S2. Correlation coefficients and seasonal model-measurement root mean square differences (RMSD) for IASI, TES, and ground station data (normalized by the annual mean). Values listed are before/after optimization.

Platform	Location	r	DJF RMSD	MAM RMSD	JJA RMSD	SON RMSD
IASI	midlatitude mean	0.85/0.95	0.24/0.23	0.25/0.26	0.11/0.12	0.13/0.17
	W. US	0.80/0.92	0.32/0.32	0.28/0.20	0.21/0.23	0.17/0.17
	E. US	0.86/0.95	0.18/0.17	0.23/0.06	0.15/0.10	0.15/0.14
	S. Canada	0.76/0.93	0.23/0.18	0.27/0.15	0.26/0.12	0.20/0.11
	Europe	0.77/0.90	0.27/0.30	0.33/0.16	0.16/0.23	0.21/0.21
	S. Siberia	0.87/0.96	0.13/0.16	0.19/0.11	0.27/0.30	0.07/0.07
TES	W. US	0.82/0.80	0.19/0.20	0.37/0.12	0.36/0.46	0.16/0.26
	E. US	0.75/0.89	0.12/0.13	0.43/0.29	0.46/0.42	0.27/0.22
	S. Canada	0.80/0.82	0.33/0.33	0.31/0.26	0.37/0.35	0.32/0.43
	Europe	0.44/0.48	0.68/0.67	0.05/0.32	0.54/0.35	0.07/0.11
	S. Siberia	0.84/0.85	0.10/0.09	0.24/0.16	0.55/0.56	0.46/0.59
Ground station	Thompson Farm	0.95/0.90	0.55/0.53	0.36/0.65	0.88/0.88	0.35/0.31
	KCMP Tall Tower	0.91/0.87	0.35/0.38	0.26/0.49	0.90/0.42	0.21/0.22
	Blodgett Forest	0.95/0.91	0.11/0.23	0.17/0.23	0.44/0.35	0.03/0.24