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Methane emissions from China: a high-resolution inversion of TROPOMI satellite observations

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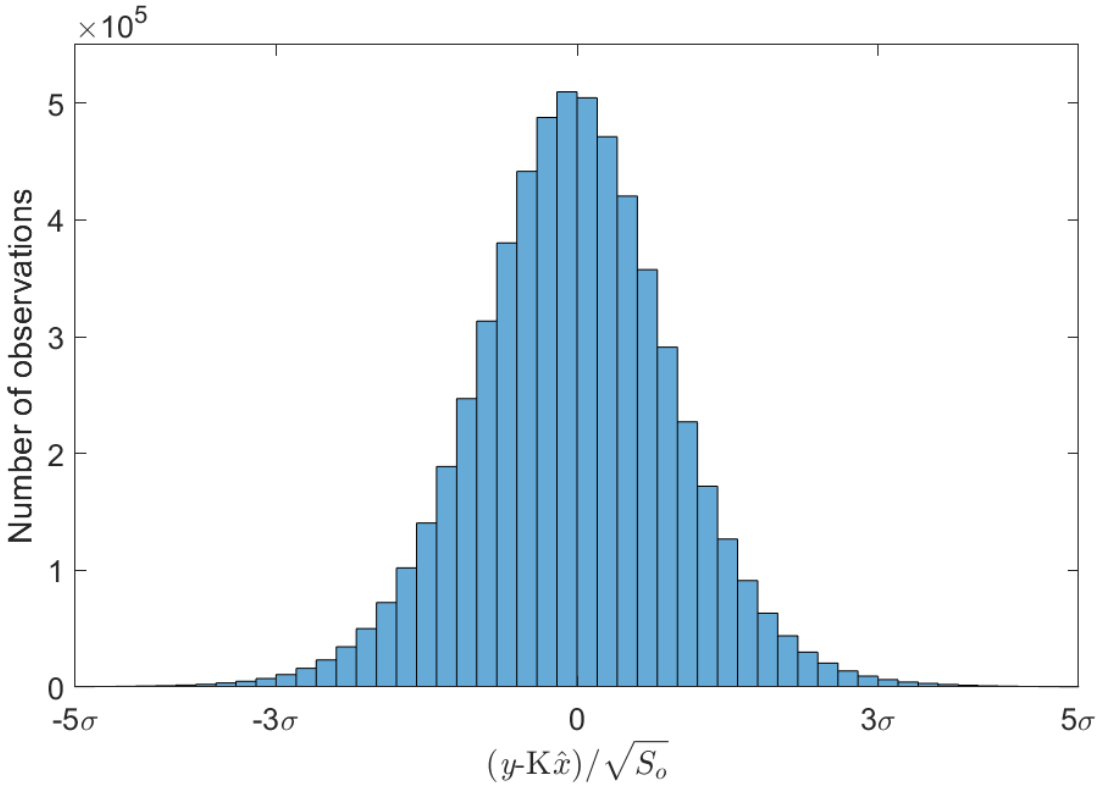

Figure S1. The histogram distribution of $\boldsymbol{y} - \mathbf{K}\hat{\boldsymbol{x}}$.

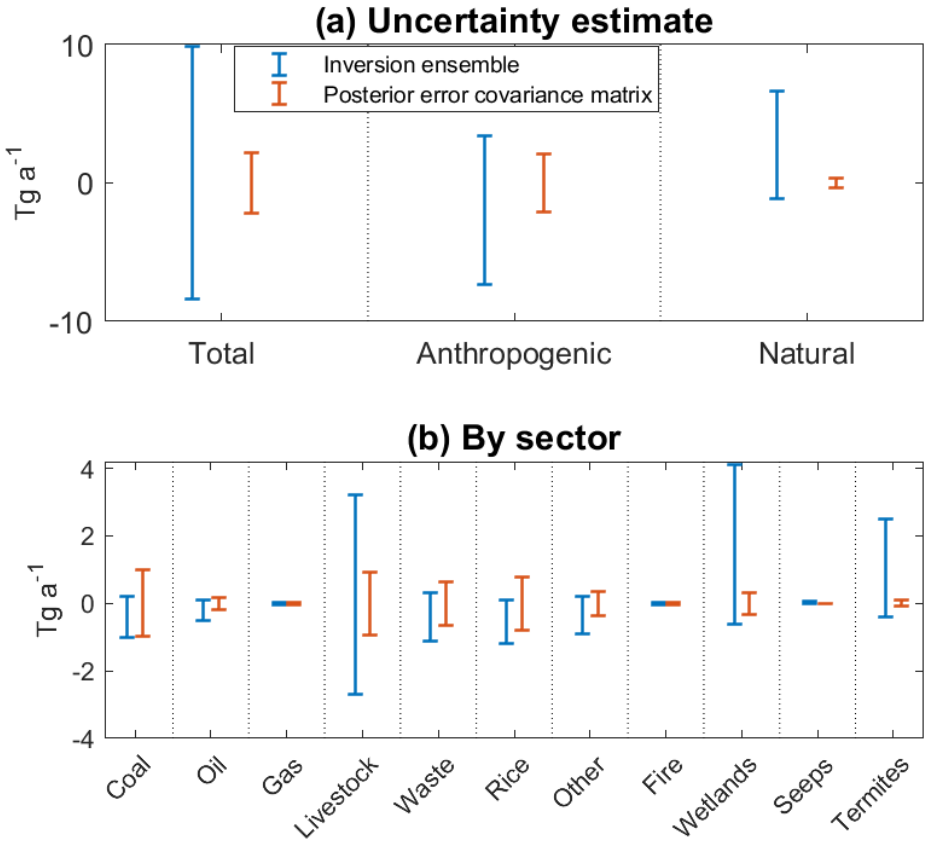

Figure S2. Comparison of uncertainty estimates in the posterior emissions over China from the inversion ensemble and 2-sigma error derived from the diagonal of the posterior error covariance matrix $\hat{\mathbf{S}}$. The top panel compares the uncertainties in the national total, anthropogenic, and natural emissions, and the bottom panel displays the uncertainties by sector.

Table S1. Boundary condition corrections in the inversion.

ppb[a]	North	South	West	East
Winter (December-February)	-9.7	1.1	-3.8	-0.9
Spring (March-May)	-6.0	-3.6	-2.7	-11.6
Summer (June-August)	-2.5	-6.3	-2.8	+22.7
Fall (September-November)	-4.0	+1.9	-3.8	+19.5

[a]All the state vector elements for boundary conditions have corresponding averaging kernel sensitivities close to 1.

Table S2. Surface measurement sites.

Site code	Location	Longitude	Latitude	Elevation (masl.)	Number of observations in 2019	Measurement Type
AMY	Anmyeon-do, Korea	126.3	36.5	47	38	Surface flasks
DSI	Dongsha Island, China	116.7	20.7	3	51	
LLN	Lulin, China	120.9	23.5	2862	55	
UUM	Ulaan Uul, Mongolia	111.1	44.5	1007	47	
WLG	Mt. Waliguan, China	100.9	36.3	3810	45	

Table S3. Anthropogenic total and sectoral emissions compiled from recent studies.

Tg a^{-1}	Study year(s)	Coal	Oil/gas	livestock	waste	rice	Other	Anthropogenic
Our work[a]	2019	16.6	2.59	17.8	9.30	11.9	6.7	65.0
UNFCCC reports	2014	19.5	1.1	13.0	6.60	8.9	4.6	53.6
EDGAR432	2012	17.6	6.8	11.7	11.0	14.3	6.1	67.5
EDGAR6	2018	20.4	3.4	8.2	14.1	15	3.9	65.0
Peng	2010	17.7	1.6	11.4	4.30	7.4	2.5	44.9
Janardanan	2011-2017							45.7
Qu	2019							56.0
Lu	2010-2017	10.5	0.72	11.5	7.3	9.5	3.48	43.0
Y. Zhang	2010-2018							47.0
Wang	2014-2018							62.2
Worden	2019	10.1	1.21	6.6	3.7	29.6	0.29	51.5
Deng	2010-2017							52.0
Miller	2010-2015	17.5	5.5	12.5	7.5	12.0		

[a]We compile a range of studies including EDGAR v4.3.2 and v6, national inventory reported to UNFCCC, *Peng et al*., (2016), *Janardanan et al*., (2020), *Qu et al*., (2021), *Y. Zhang et al*., (2021), *Lu et al*., (2021), *Wang et al*., (2021), *Worden et al* (2022), *Deng et al* (2022), and *Miller et al*., (2019).

Blank boxes indicate emissions that are not studied or not explicitly described in those literature.