

Supplementary Materials: Spatial Statistical Prediction of Solar-Induced Chlorophyll Fluorescence (SIF) from Multivariate OCO-2 Data

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S1. Fitted Model Parameters

All fitted parameters of the bivariate spatial models for February, April, July, and October 2021 are available in a dataset archived on Zenodo: <https://doi.org/10.5281/zenodo.8078560>

S2. Uncertainty Reduction

Table S1 shows the coSIF data product to have reduced the uncertainty in the gridded and averaged OCO-2 SIF data by about a factor of four.

Table S1. For each of the four months considered in 2021: Average ratio of the coSIF RMSPE (see Equation (14)) to the measurement error standard deviation given by the square root of the variances as described for Equation (1).

February	April	July	October
0.29	0.27	0.25	0.25

S3. The coSIF Data Product for February, April, and October 2021

Section 3.2 in the main text shows the coSIF data product (cokriging predictions and corresponding RMSPEs) for July 2021. Here we offer the same for the other three months in 2021. As discussed in the main text, the coSIF data product is produced by kriging (a special case of cokriging) for these months since SIF activity is not prominent (Figure 1) and there is little dependence in the corresponding empirical cross-semivariograms (Figure 5).

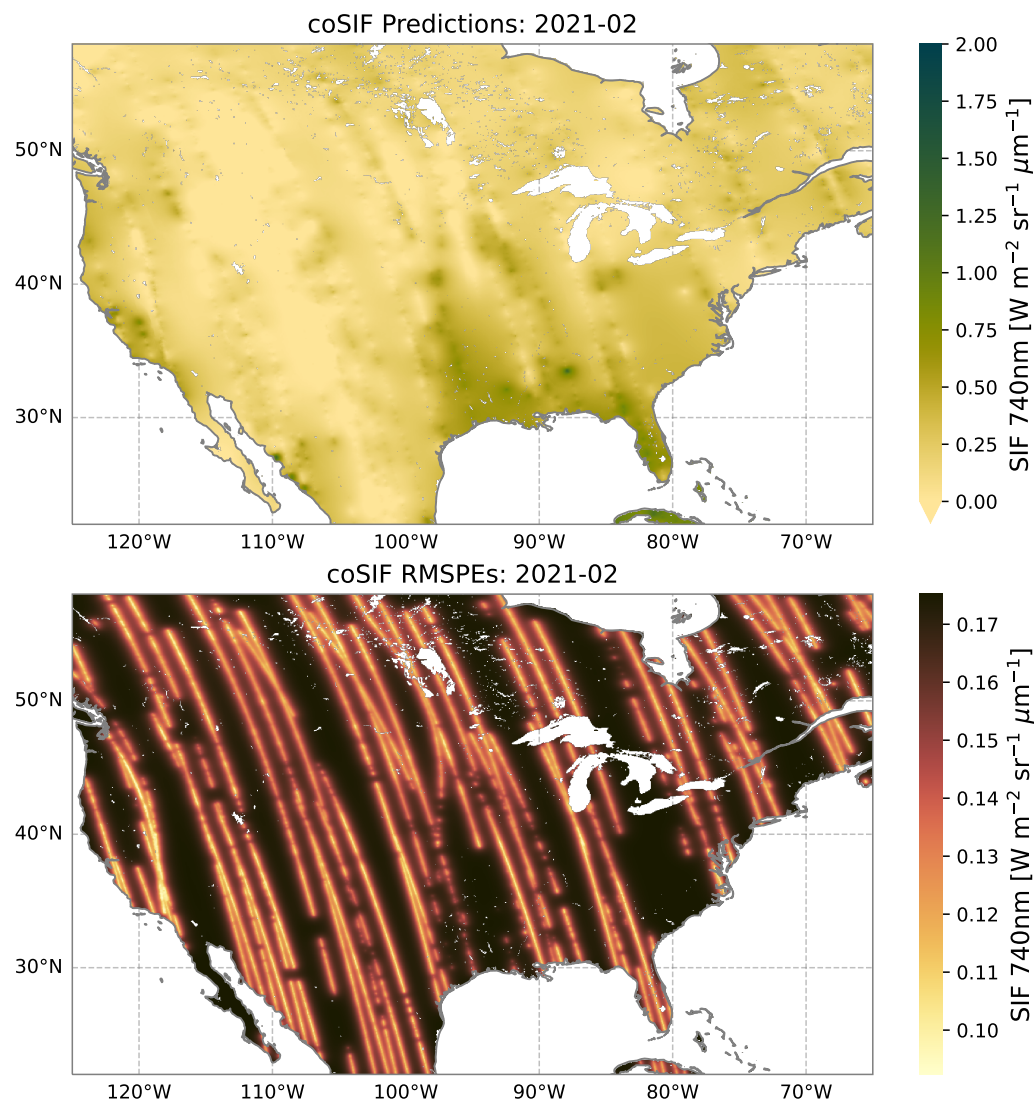


Figure S1. The coSIF data product for February 2021 at 0.05-degree resolution. **Top:** The coSIF (kriging) predictions. **Bottom:** The corresponding root-mean-squared prediction errors. All units are $\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$. The color white indicates the absence of predictions over large bodies of water.

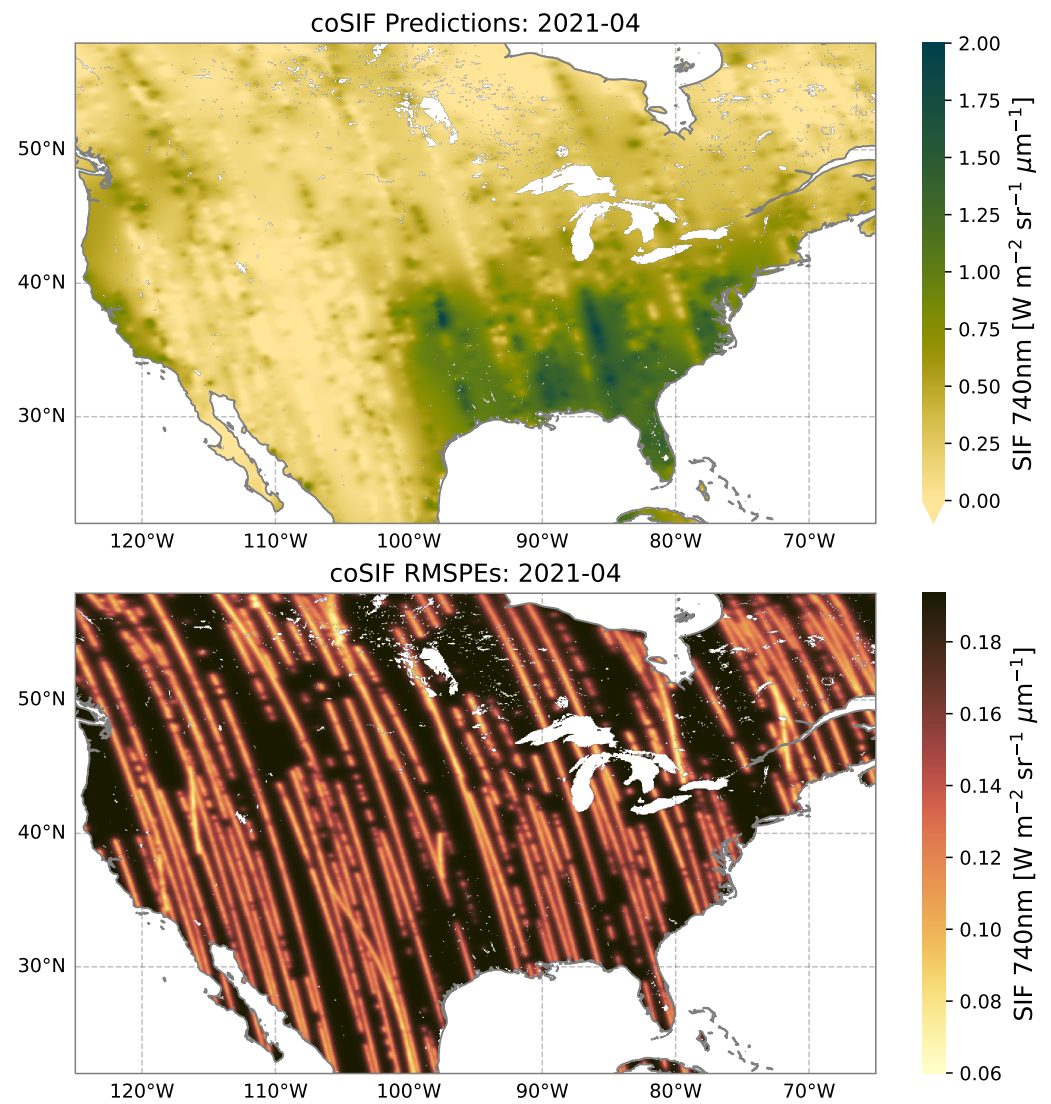


Figure S2. The coSIF data product for April 2021 at 0.05-degree resolution. **Top:** The coSIF (kriging) predictions. **Bottom:** The corresponding root-mean-squared prediction errors. All units are $\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$. The color white indicates the absence of predictions over large bodies of water.

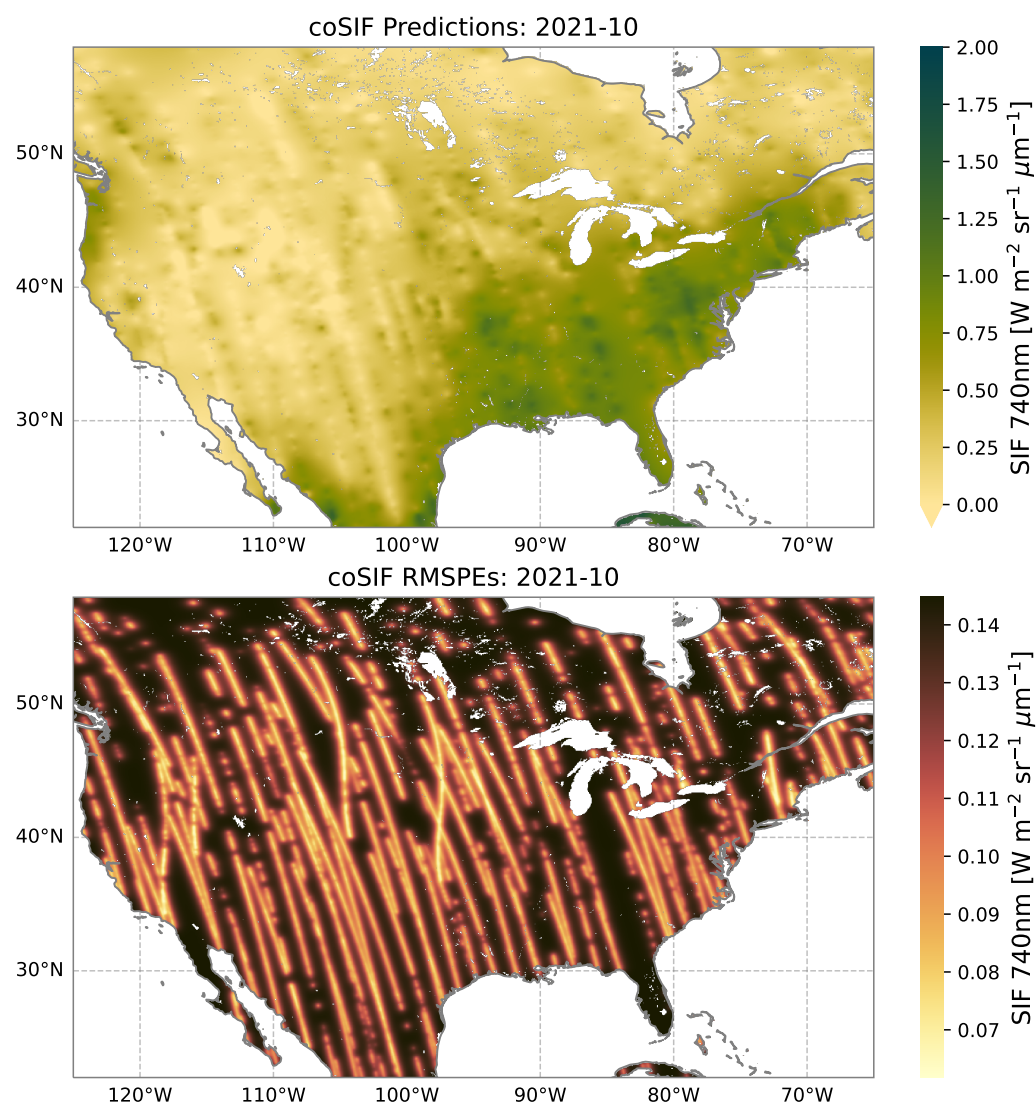


Figure S3. The coSIF data product for October 2021 at 0.05-degree resolution. **Top:** The coSIF (kriging) predictions. **Bottom:** The corresponding root-mean-squared prediction errors. All units are $\text{W m}^{-2} \text{sr}^{-1} \mu\text{m}^{-1}$. The color white indicates the absence of predictions over large bodies of water.

S4. Validation Metrics for February, April, and October 2021

Section 3.3 in the main text gives validation metrics for cokriging, kriging, and trend-surface-only predictions in July 2021. Here we offer the same for the other three months in 2021.

Table S2. Validation metrics for the Corn Belt and Cropland $5^{\circ} \times 5^{\circ}$ validation blocks in February 2021. Bold typeface indicates the best performing method according to each metric.

Block	Method	BIAS	RASPE	INT	DSS	MDSS
Corn Belt	Cokriging	−0.12	0.51	2.86	−0.34	− 286.08
	Kriging	−0.12	0.51	2.86	−0.33	−285.80
	Trend surface	− 0.10	0.52	2.83	− 0.35	−237.14
Cropland	Cokriging	0.05	0.27	1.71	−1.42	−823.63
	Kriging	0.04	0.27	1.71	−1.42	−823.59
	Trend surface	0.07	0.28	1.62	− 1.51	− 837.88

Table S3. Validation metrics for the Corn Belt and Cropland $5^{\circ} \times 5^{\circ}$ validation blocks in April 2021. Bold typeface indicates the best performing method according to each metric.

Block	Method	BIAS	RASPE	INT	DSS	MDSS
Corn Belt	Cokriging	−0.01	0.37	1.97	− 1.03	−634.60
	Kriging	0.00	0.37	1.97	− 1.03	− 634.61
	Trend surface	0.03	0.38	1.93	−1.01	−569.48
Cropland	Cokriging	0.10	0.37	1.97	−0.96	− 664.41
	Kriging	0.10	0.37	1.97	−0.96	−664.26
	Trend surface	0.10	0.37	1.88	− 1.01	−599.19

Table S4. Validation metrics for the Corn Belt and Cropland $5^{\circ} \times 5^{\circ}$ validation blocks in October 2021. Bold typeface indicates the best performing method according to each metric.

Block	Method	BIAS	RASPE	INT	DSS	MDSS
Corn Belt	Cokriging	0.03	0.32	1.65	−1.34	−1078.50
	Kriging	0.02	0.32	1.65	−1.34	− 1082.24
	Trend surface	0.02	0.32	1.62	− 1.38	−949.96
Cropland	Cokriging	0.06	0.29	1.55	−1.44	−1106.32
	Kriging	0.05	0.29	1.56	−1.44	− 1110.20
	Trend surface	0.05	0.29	1.50	− 1.50	−1062.25