

1 **Gradients of Column CO<sub>2</sub> across North America from the**  
2 **NOAA Global Greenhouse Gas Reference Network**

3 Xin Lan<sup>1, 2</sup>, Pieter Tans<sup>1</sup>, Colm Sweeney<sup>1, 2</sup>, Arlyn Andrews<sup>1</sup>, Andrew Jacobson<sup>1, 2</sup>, Molly  
4 Crotwell<sup>1, 2</sup>, Edward Dlugokencky<sup>1</sup>, Jonathan Kofler<sup>1, 2</sup>, Patricia Lang<sup>1</sup>, Kirk Thoning<sup>1</sup>, Sonja  
5 Wolter<sup>1, 2</sup>

6 <sup>1</sup>National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Boulder, 80303,  
7 Colorado, USA

8 <sup>2</sup> University of Colorado, Cooperative Institute for Research in Environmental Sciences, Boulder, 80309, Colorado,  
9 USA

10

11 *Correspondence to:* Xin.Lan (xin.lan@noaa.gov)

12

## Supplement

13 **This document includes:**

14 **Table S1.** Site information from the NOAA/ESRL GGGRN.

15 **Fig. S1.** Time series of detrended partial (red) and total (blue)  $\Delta XCO_2$  at SGP, calculated from each individual  
16 vertical profile.

17 **Fig. S2.** Multi-year (2004-2014) average smooth seasonal curves of CO<sub>2</sub> for different vertical layers for each region.

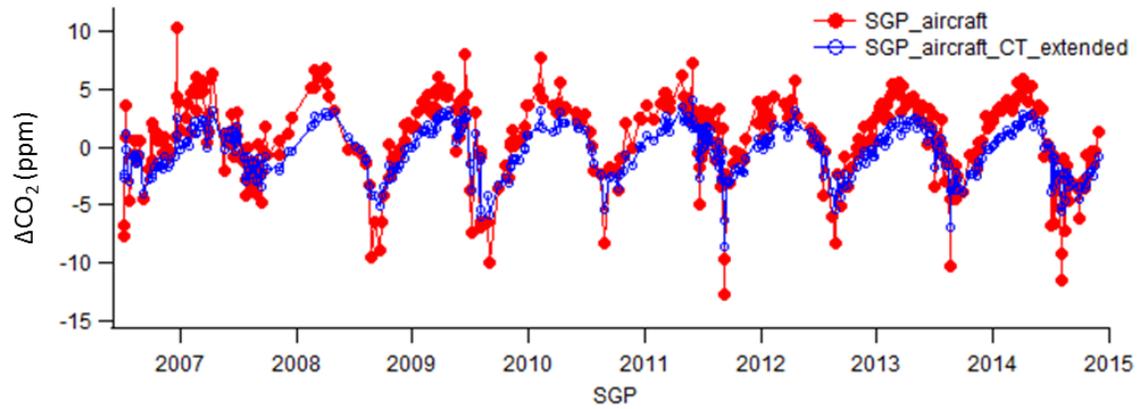
18 **Fig. S3.** Monthly differences of partial column  $\Delta XCO_2$  (modeled - observed) for each month.

19 **Fig. S4.** Uncertainties estimated from ‘bootstrap’ Monte Carlo method for partial column  $\Delta XCO_2$  calculation.

Code	Name	Latitude	Longitude	Site Elevation(masl)*	Top Altitude(masl)	Time start	Time end
AAO	Airborne Aerosol Observatory, Bondville, Illinois	40.050	-88.370	230	4572	06/07/2006	09/18/2009
AMT	Argyle, Maine (Tower)	45.035	-68.682	53+107	NA	09/18/2003	Ongoing
BGI	Bradgate, Iowa	42.820	-94.410	355	7620	09/13/2004	11/18/2005
BNE	Beaver Crossing, Nebraska	40.800	-97.180	466	8120	09/15/2004	05/11/2011
CAR	Briggsdale, Colorado	40.635	-104.327	1488	8410	11/09/1992	Ongoing
CMA	Cape May, New Jersey	38.830	-74.320	0	7620	08/17/2005	Ongoing
DND	Dahlen, North Dakota	47.500	-99.240	472	8131	09/21/2004	Ongoing
ESP	Estevan Point, B C, Canada	49.383	-126.544	7	5695	11/22/2002	Ongoing
ETL	East Trout Lake, SK, Canada	54.350	-104.983	492	7228	10/15/2005	Ongoing
FWI	Fairchild, Wisconsin	44.660	-90.960	334	7620	09/20/2004	11/18/2005
HFM	Harvard Forest, Massachusetts	42.538	-72.171	340	7620	11/11/1999	11/18/2007
HIL	Homer, Illinois	40.070	-87.910	202	8059	09/16/2004	Ongoing
LEF	Park Falls, Wisconsin	45.945	-90.273	472	5060	04/10/1998	Ongoing
LEF	Park Falls, Wisconsin (Tower)	45.945	-90.273	472+396	NA	08/01/2003	Ongoing
NHA	Worcester, Massachusetts	42.950	-70.630	0	7620	09/12/2003	Ongoing
OIL	Oglesby, Illinois	41.280	-88.940	192	7620	09/16/2004	11/19/2005
SCA	Charleston, South Carolina	32.770	-79.550	0	12802	08/22/2003	Ongoing
SCT	Beech Island, South Carolina (Tower)	33.406	-81.833	115+305	NA	08/14/2008	Ongoing
SGP	Southern Great Plains, Oklahoma	36.607	-97.489	314	5330	09/17/2002	Ongoing
TGC	Sinton, Texas	27.730	-96.860	0	8107	09/09/2003	Ongoing
THD	Trinidad Head, California	41.054	-124.151	107	7953	09/02/2003	Ongoing
WBI	West Branch, Iowa	41.725	-91.353	242	8073	09/14/2004	Ongoing
WBI	West Branch, Iowa (Tower)	41.725	-91.353	241.7+379	NA	06/28/2007	Ongoing
WGC	Walnut Grove, California (Tower)	38.265	-121.491	0+483	NA	09/20/2007	Ongoing
WKT	Moody, Texas (Tower)	31.315	-97.327	251+457	NA	07/11/2003	Ongoing
MLO	Mauna Loa, Hawaii	19.536	-155.576	3397	NA	08/20/1969	Ongoing

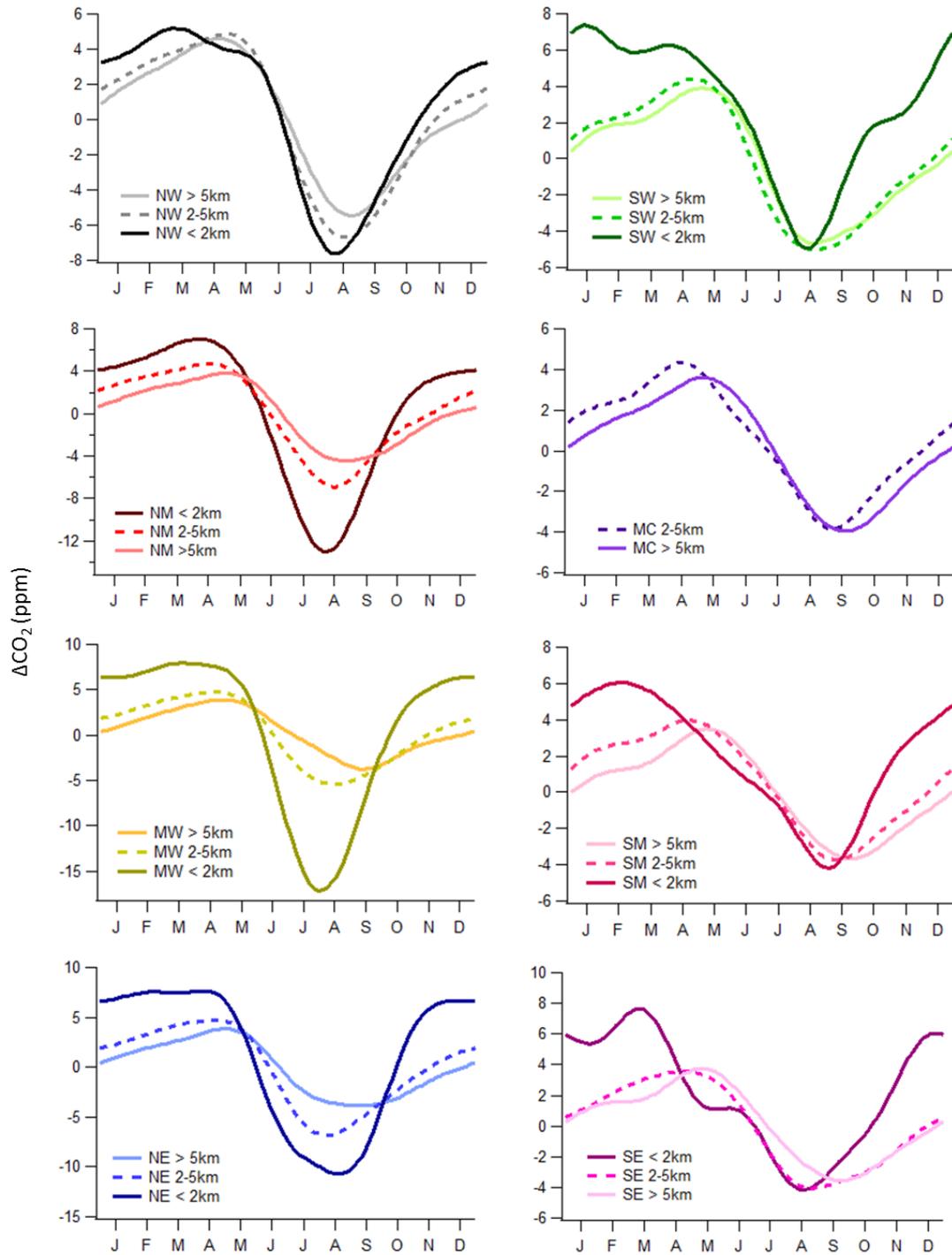
21 \* In this column, number before '+' is the surface elevation, and number after '+' shows the highest intake height for the tall  
 22 tower from which data were used in this study.

23 **Table S1.** Site information from the NOAA/ESRL GGGRN.



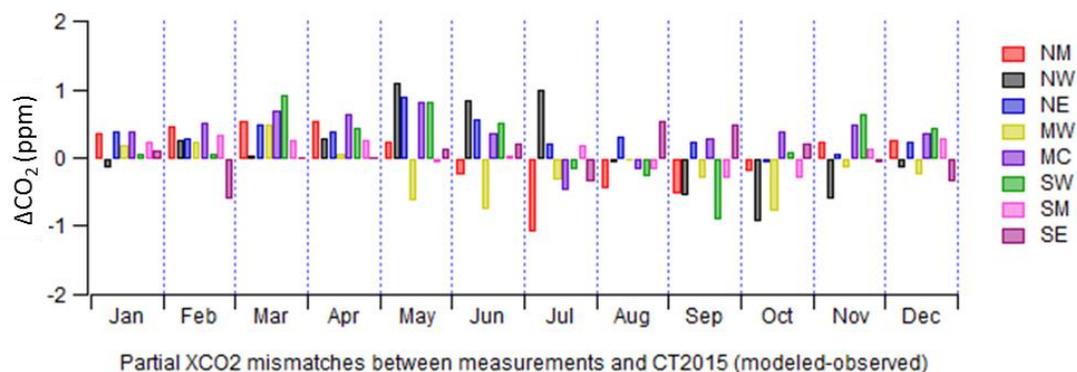
24  
25  
26  
27  
28

**Figure S1.** Time series of detrended partial (red) and total (blue)  $\Delta XCO_2$  at SGP, calculated from each individual vertical profile.  $CO_2$  measurements at MLO were used to subtract the trend. (Note that some sites have lower sampling frequency that may impair their ability to capture the year-to year variation of column  $\Delta XCO_2$ , thus a long-term mean average method is utilized in this study (see Sect. 2.3 and 3.2))

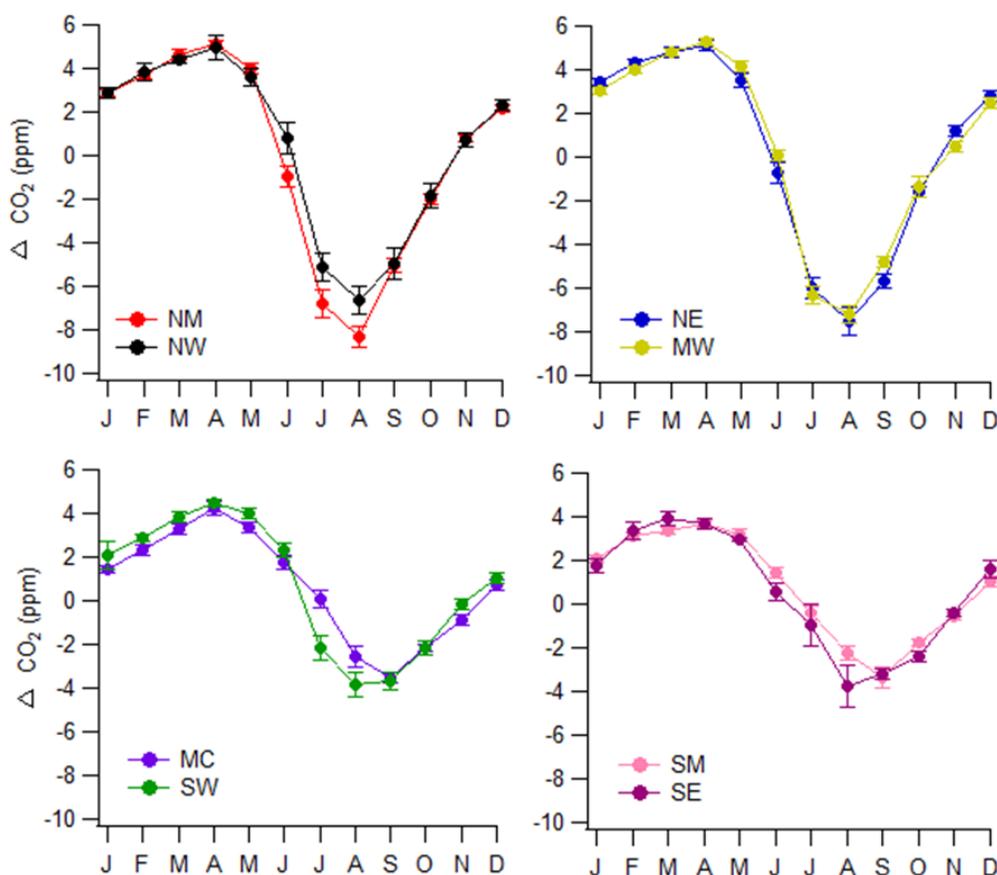


29

30 **Fig. S2.** Multi-year (2004-2014) average smooth seasonal curves of  $\text{CO}_2$  relative to the long-term de-seasonalized  
 31 trend at Mauna Loa for different vertical layers for each region.



**Fig. S3.** Monthly differences of partial column  $\Delta XCO_2$  (modeled - observed) for each month, eight bars represent eight regions.



**Fig. S4.** Uncertainties estimated from 'bootstrap' Monte Carlo method for partial column  $\Delta XCO_2$  calculation using measured vertical profiles (aircraft and tower data). Error bar is the one standard deviation from 100 Monte Carlo runs.