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Quantification of Fossil Fuel CO_2 Emissions on the Building/Street Scale for a Large U.S. City

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Outline

- 1. Introduction
- 2. Methods
- 3. Results and Discussion

1. Introduction

- Carbon dioxide (CO_2) emissions from fossil fuel combustion are the largest net annual flux of carbon to the atmosphere.

- 51% of the world's population resided in cities in 2010 and that share is projected to grow to 68% by 2050.

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1. Introduction

- This study aims to establish an approach to quantify high-resolution on-site fossil fuel CO_2 emissions across an entire urban landscape that can be reproduced across the U.S.

2. Methods

（1）Study area：Indianapolis (Marion), IN.

（2）Data source：generated by the Vulcan Project in Marion County for the data-rich year 2002.

（3）Sector：

Nonpoint Residential and Commercial Buildings.

Industrial Nonpoint Buildings.

Industrial, Commercial, and Electricity Production Point Sources.

Transportation.

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2. Methods

Table 1. Fossil Fuel CO_2 Emissions Categorized by Data Source, Sector and Fuel for Marion County, IN, 2002 (units of Mt C/yr)

data source	monpoint NEI[a]									point NEI						point NEI/point CAMD[b]			NMIM NCD[c] transportation		airport NEI
sector	industrial			commercial			residential			industrial			commercial			electricity production			on road	non road	airport
fuel	coal	petrol	NG	coal	petrol	NG	coal	petrol	NG	coal	petrol	NG	coal	petrol	NG	coal	petrol	NG	petrol	petrol	petrol
emissions	0.10	0.05	0.19	0	0.06	0.27	0.004	0.009	0.35	0	0.017	0.092	0	0.003	0.018	1.0	0.008	0.030	1.07	0.13	0.17

NEI refers to the United States Environmental Protection Agency National Emissions Inventory CO emissions reporting. CAMD refers to the United States Environmental Protection Agency Clean Air Markets Division. NMIM NCD refers to the National Mobile Inventory Model National County Database.

3. Results and Discussion

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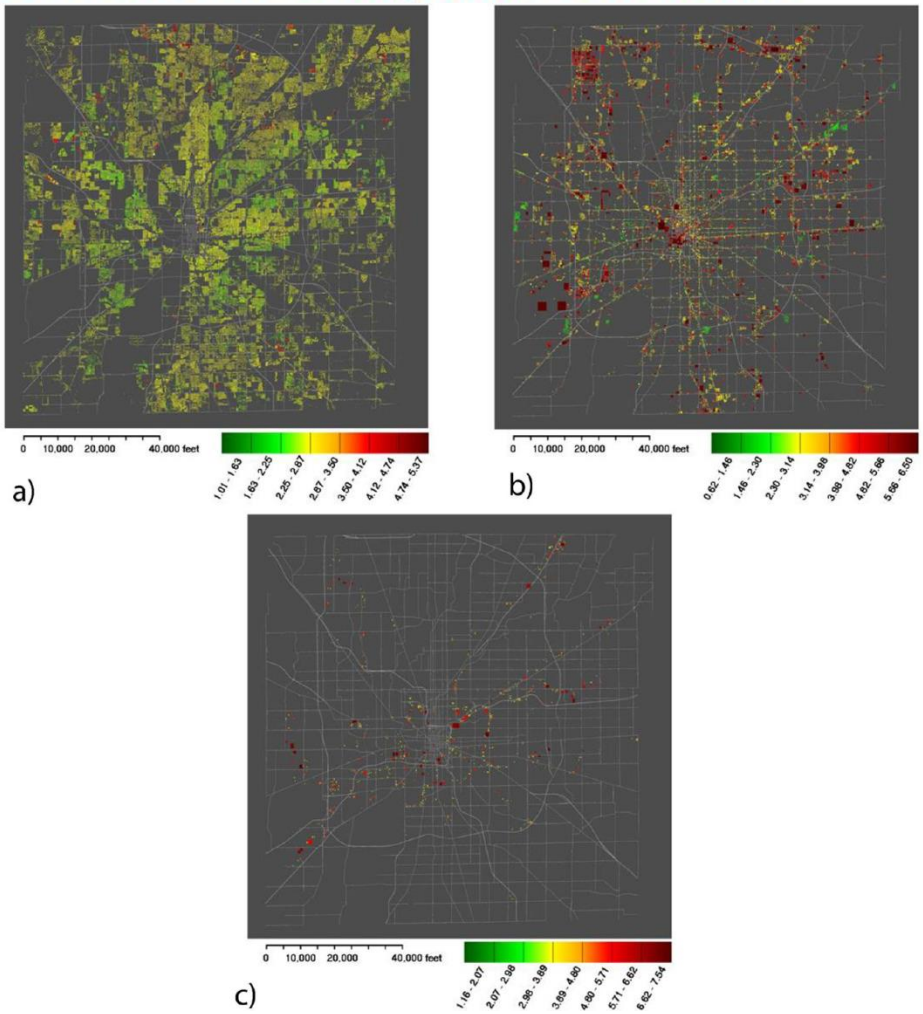

Figure 1. Annual fossil fuel CO_2 emissions for the (a) residential, (b) commercial, and (c) industrial sectors in Marion County, IN. Note the different scale in each panel. Units: log10 kg C/yr.

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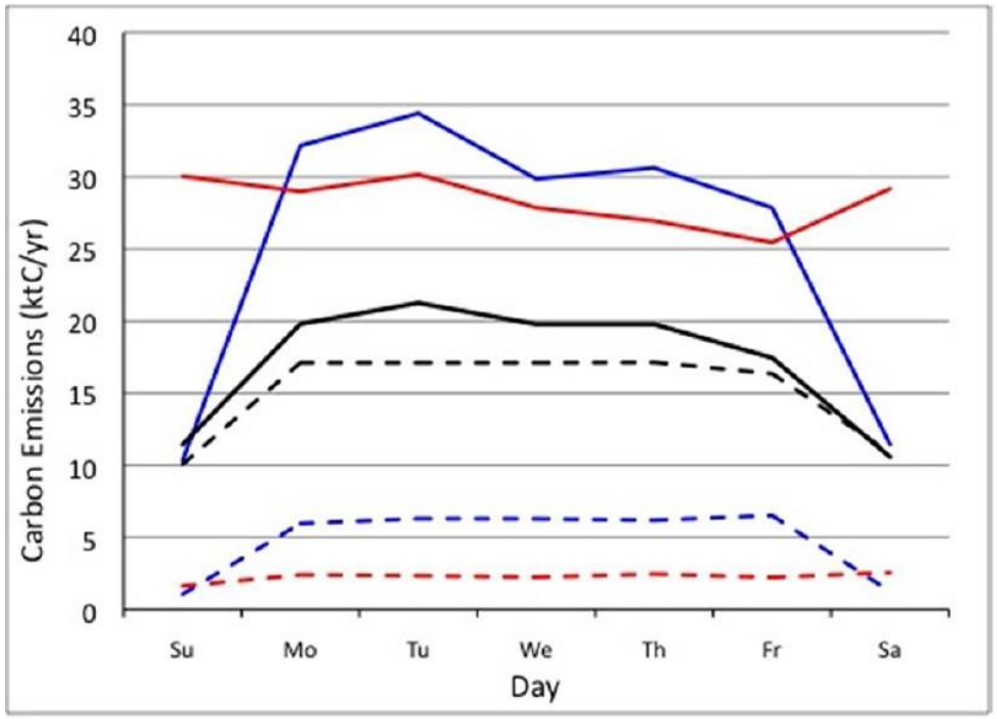
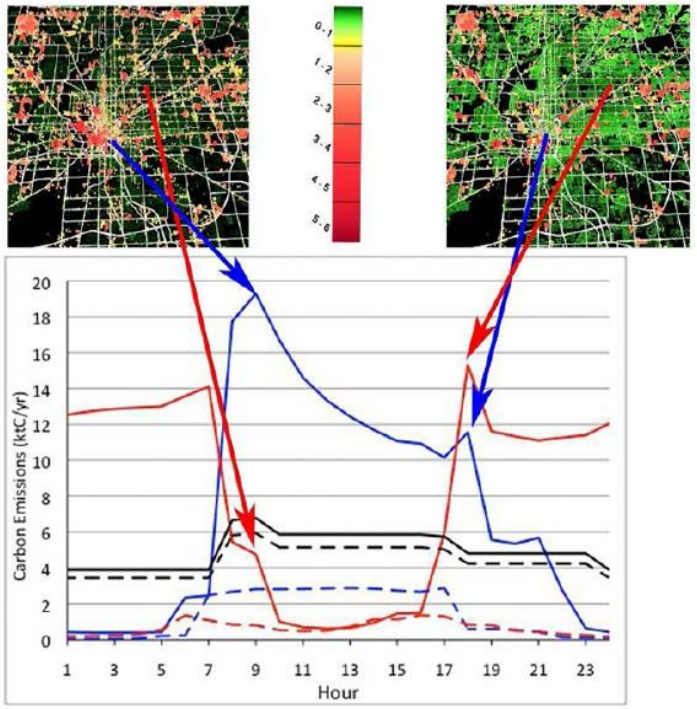


a)



b)

Figure 2. Seasonal fossil fuel CO_2 emissions for buildings in Indianapolis, IN. (a) Weekly temporal profiles for the residential, commercial, and industrial sectors; (b) diurnal temporal profiles for the residential, commercial, and industrial sectors. Key: industrial (black), commercial (blue), residential (red), summer (dashed), winter (solid). The insets in part b show commercial (downtown) and residential sectors at 9 a.m. and 6 p.m. Units: kt C/yr.

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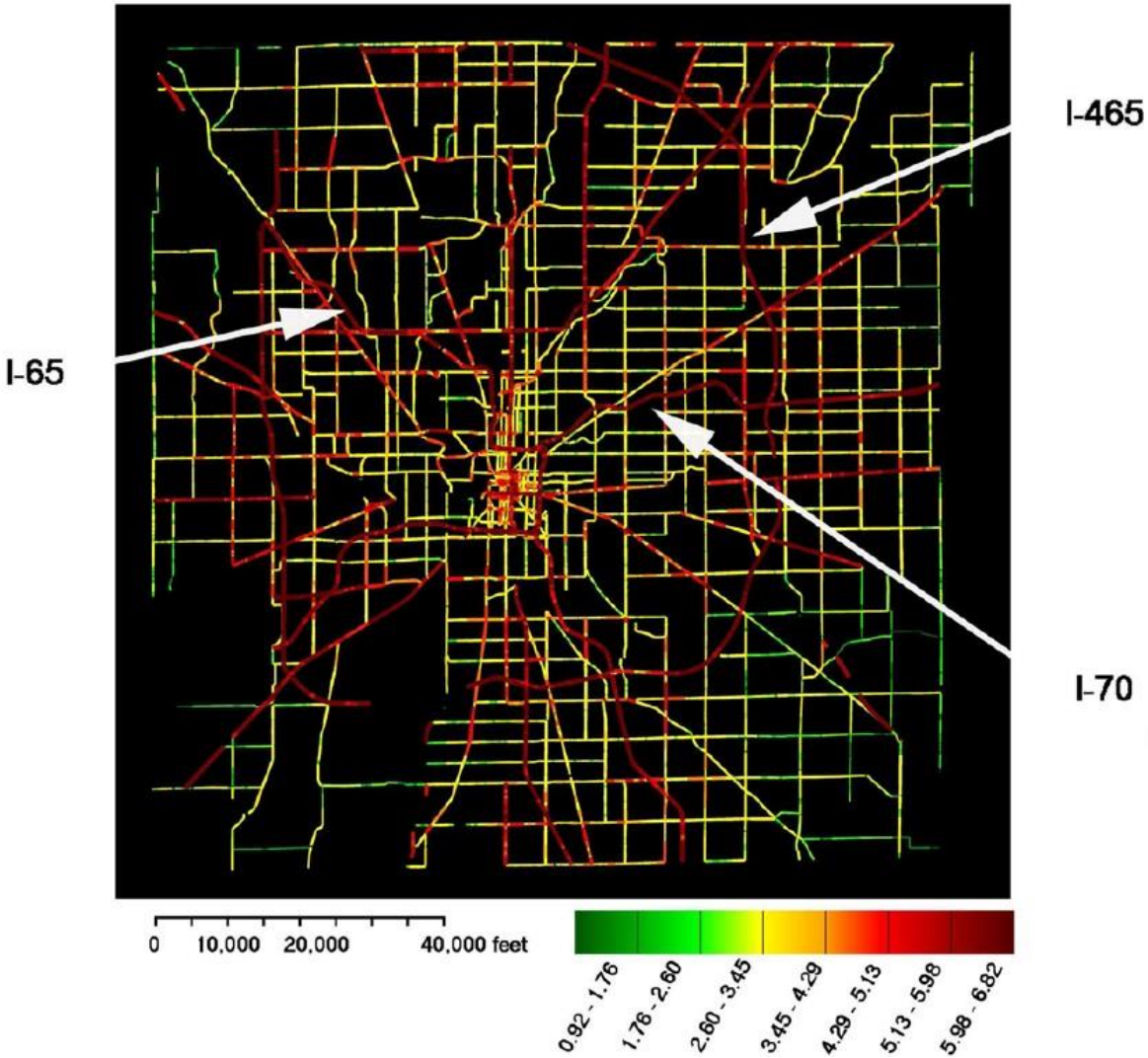

Figure 3. Annual on road CO_2 emissions for Marion County, 2002. Major interstates are noted. Units: log10t C/yr.

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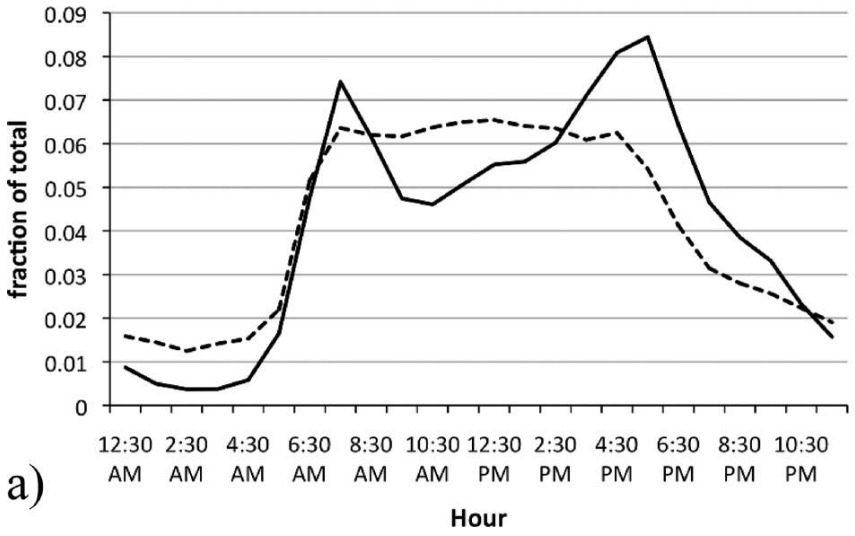

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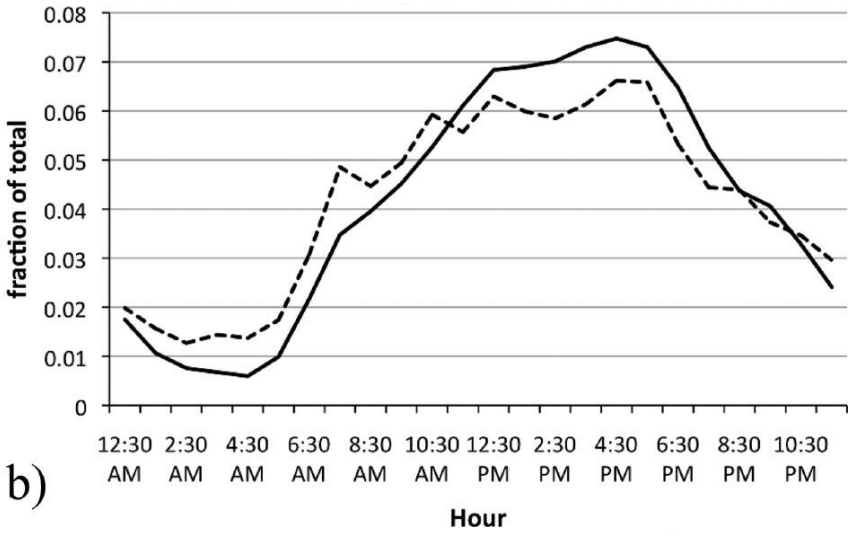

b)

Figure 4. On road transportation annual mean diurnal fossil fuel CO_2 emissions hourly fraction for light-duty (solid) and heavy-duty (dashed) vehicle class aggregates: (a) weekday emissions and (b) weekend emissions. Units: fraction of daily total.

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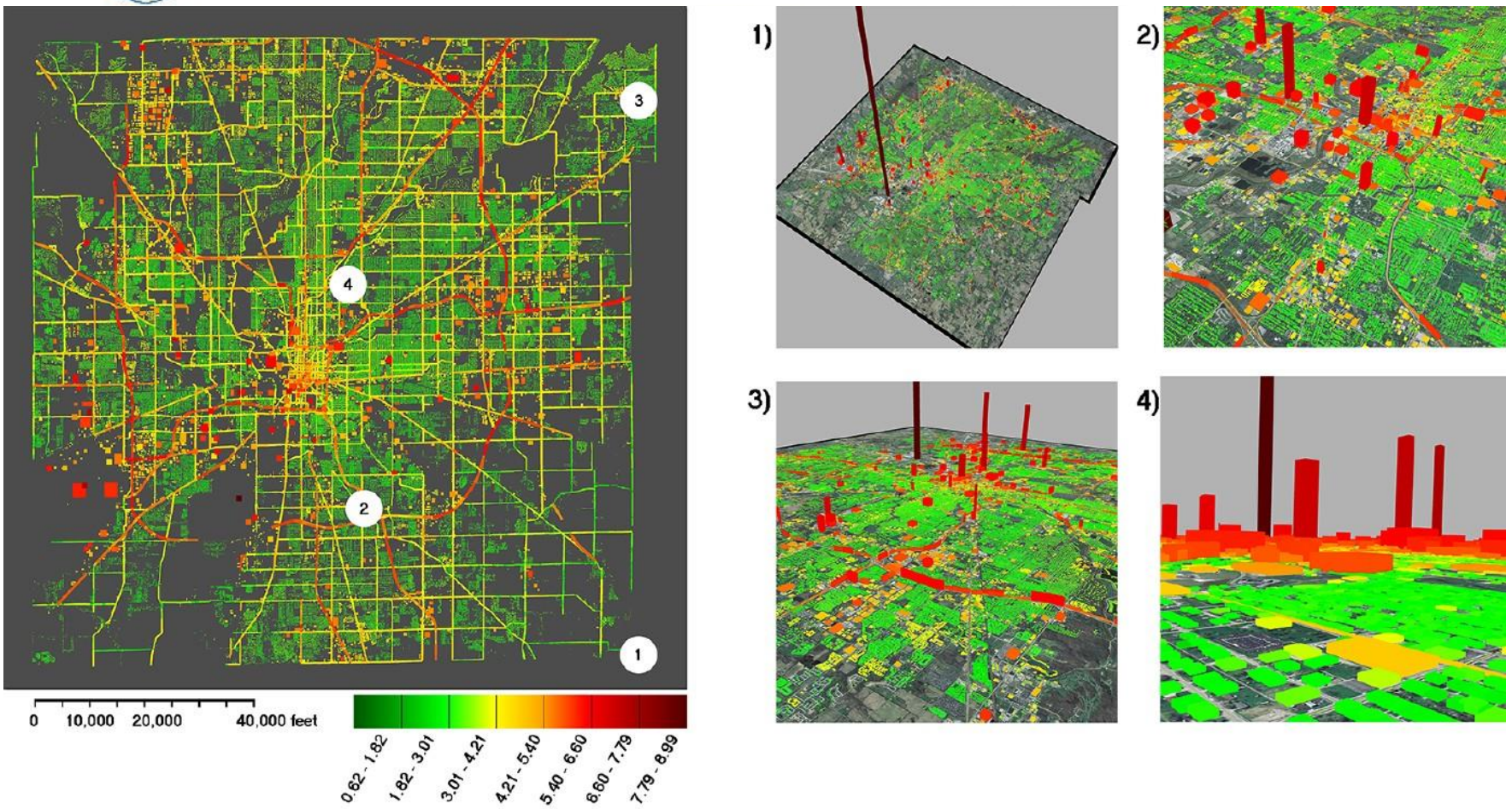

Figure 5. Total fossil fuel CO_2 emissions for Marion County, IN, for the year 2002: (a) top view with numbered zones and (b) blowups of the numbered zones. Color units: $\log_{10}$ kg C/yr. Box height units: linear.

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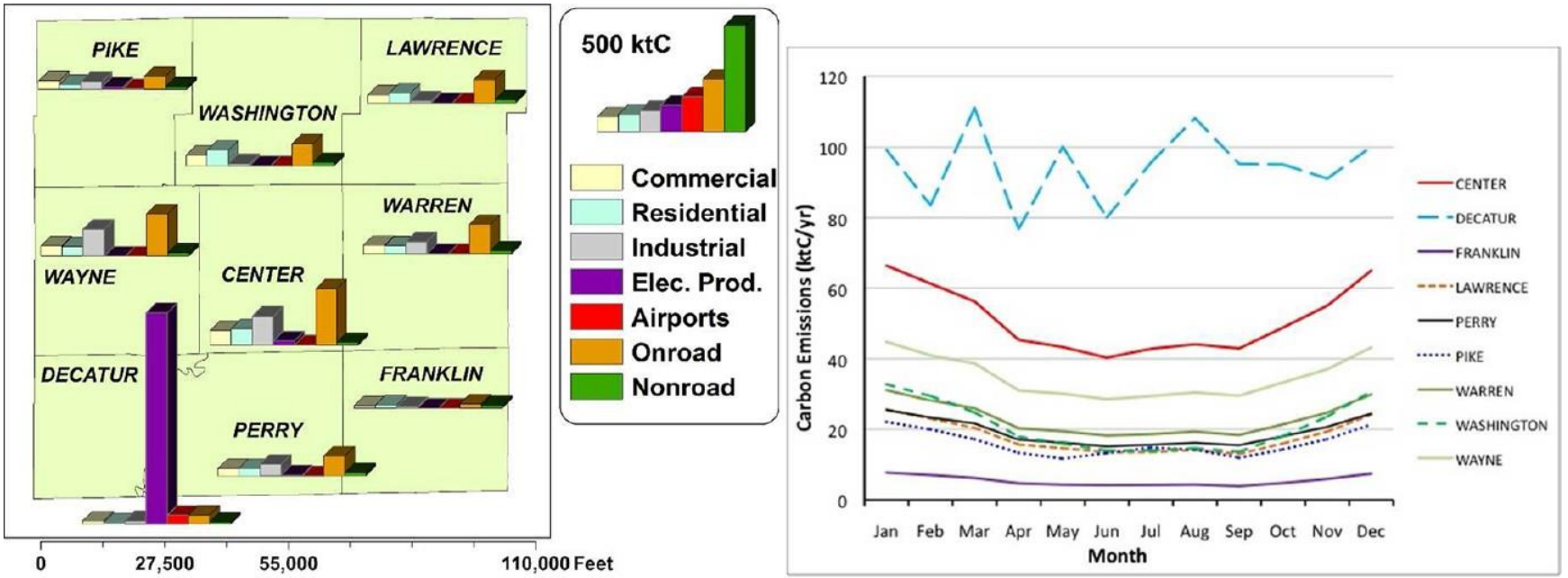

a) b)

Figure 6. 2002 Fossil fuel CO_2 emissions for Marion County, IN: (a) by sector for the nine townships and (b) monthly profile by township.

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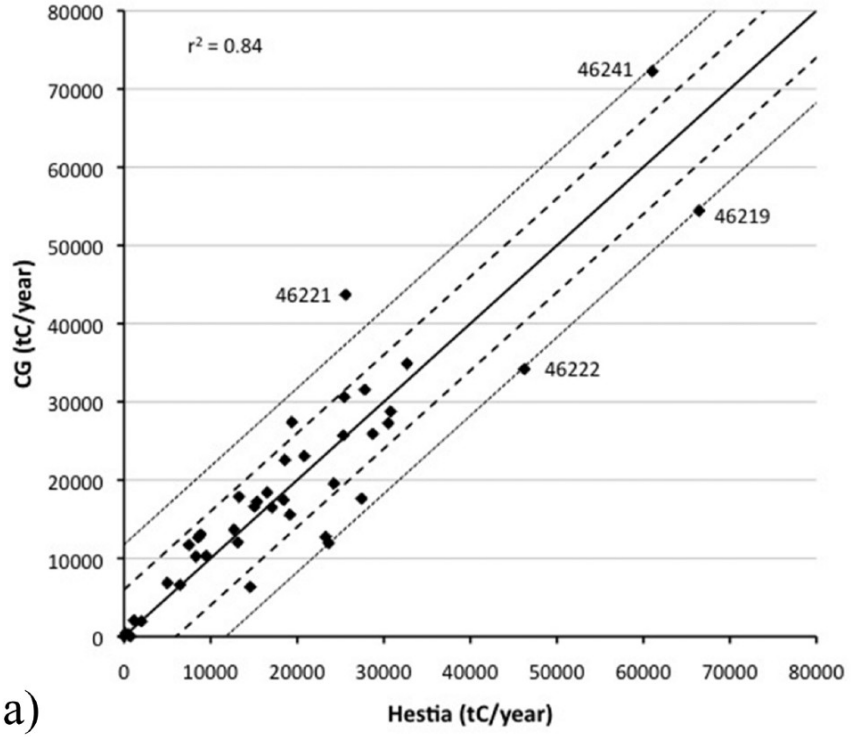

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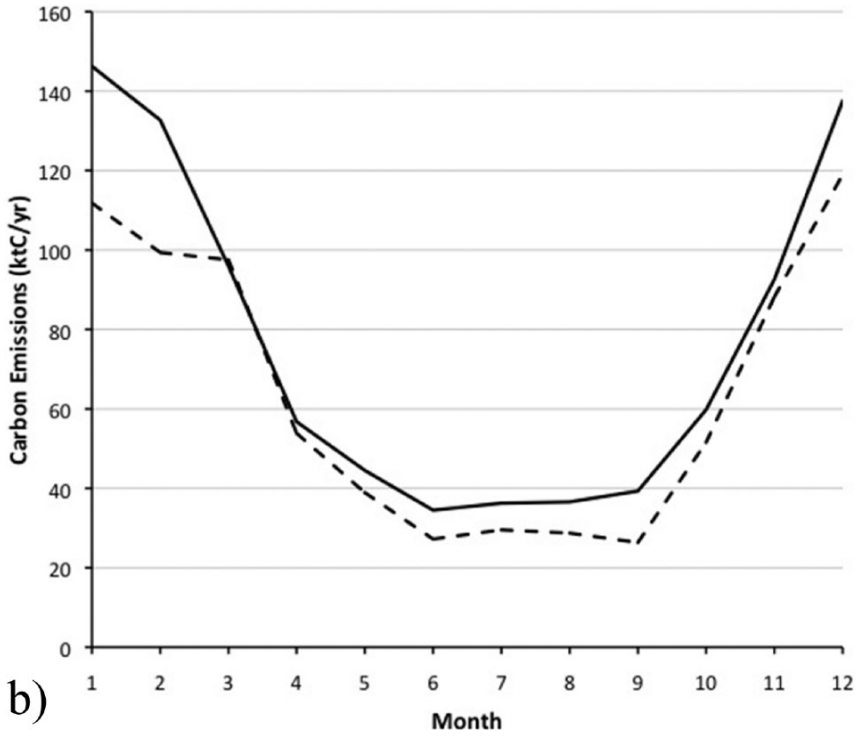

b)

Figure 7. Comparison of the summed residential, commercial, and industrial building CO_2 emissions from Citizen's Gas versus this study due to natural gas consumption in Marion County. (a) Annual zip code comparison. Hestia values have been bias-adjusted. Also shown: 1:1 line (solid), one standard deviation (dashed), two standard deviations (dotted). Outlier zip codes are noted. (b) Monthly, county-total comparison: this study (solid), Citizen's Gas (dashed). No bias adjustment was made.

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Thank you ！