Spatial Distribution Characteristics and Influencing Factors of Urban Residents’ Travel Carbon Emissions in Guangzhou

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ABSTRACT

Transportation is an important source of carbon emissions. Since the level of urban traffic motorization enhanced quickly, the problem of carbon emissions derived from transportation has become a significant concern in recent years. It has become a key issue to study how to effectively reduce the carbon emissions of urban residents and to develop low-carbon urban traffic. The authors study 33 communities in Guangzhou city and analyze the characteristics of carbon emissions in each community, where the influence factors of carbon emissions are analyzed by establishing a multiple regression model. Finally, some policy suggestions are accordingly proposed to reduce the carbon emissions of residents.

KEYWORDS

Community, Gini Coefficient, Multiple Regression Model, Travel Carbon Emissions

1. INTRODUCTION

Transportation is an important source of carbon emissions. Since the level of urban traffic motorization enhanced quickly, the problem of carbon emissions derived from transportation has become a significant concern in recent years. Residents’ travel behavior usually plays a key role in the urban transportation. For the development of the urban low carbon transport, there is a need to effectively control the carbon emission produced by residents. Accordingly, it has become a key issue to study how to effectively reduce the carbon emissions of urban residents and develop low-carbon urban traffic.

There has been much research on the characteristics and influencing factors of traffic carbon emissions. The residents’ travel carbon emissions are in accordance with the “60/20 rule”, that is, 20% of people contribute 60% of the total carbon emissions (Brand & Preston, 2010; Ko, Park, Lim, & Hwang, 2011). The studies on the factors of transportation emissions paid more attention to the social and economic attributes and travel preferences of families and individuals. Also, it was found that residents’ carbon emissions are affected by residents’ family characteristics, such as the rate of motor vehicle ownership and utilization, income condition, population size and composition, age structure, education background and occupational differences. Owned car group is not the car population produce more travel times and longer travel distance. Moreover, the relationship between

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family income and household travel way is different, the British 1 / 5 high-income families compared to 1 / 5 of low-income families have 1.3 times and 3 times the number of travel distance (Department for Transport, 2006). The impact of gender on household travel carbon emissions was second only to the level of the household economy (Barla, Miranda-Moreno, & Lee-Gosselin, 2011).

Household car ownership rate has the greatest impact on the residents’ trip carbon emissions (Aamaas, Borken-Kleefeld, & Peters, 2013). The travel distance and the probability of motorized travel have a significant positive effect on the traffic carbon emissions, while the impact of travel frequency is not significant. Meanwhile, the impact of travel structure is much greater than the total amount of travel (Ma et al., 2011). The investigation and research on the Nanjing city as a typical city in China, Ningbo and Changzhou, showed the main effect of the city residents’ daily commuter traffic carbon emission factor for the mode of transportation, travel distance, family income, age, and gender (Xu et al., 2014). Compared with the individual social and economic attributes and the residents’ attitude preferences, the residential space environment variables had more significant impact on the residents’ commuting carbon emissions (Huang et al., 2014).

Some researchers revealed the mechanism of individual trips and their carbon emissions through the study of the relationship between land use and traffic trips, and found the policy options and technological paths of low carbon regulation. Based on the study on the effects of urban space and urban resident travel carbon emissions, it was confirmed that the characteristics of urban space environment such as the use of land, transportation planning and urban form decide the spatial distribution of people living and employment, which affected the residents travel mode, travel direction, travel distance and the changes in travel carbon emissions. The degree of land mixing, the number and concentration of jobs, and the limited expansion of urban boundaries have a great impact on the transportation carbon emissions (Kenworthy, 2003). Multi-center urban morphology is likely to arise or deepen separation of occupation and residence, resulting in an increase in family travel distance and an increase in travel carbon emissions (Buliuang & Kanaroglou, 2006). Tight urban development helps reduce traffic carbon emissions (Ewing & Rong, 2008). By calculating the relationship between the 66 cities with the urban population and energy consumption, expand the city that the growth of population, the city limits will lead to higher levels of carbon emissions, carbon emissions of most of the city center area was significantly lower than that in the outskirts of the city suburbs (Kahn, 2009; Glaeser & Kahn, 2010). When the distance from CBD is fixed, the influence of land use and traffic supply on traffic carbon emission is weak (Barla et al., 2011). Based on the research of residents’ travel behavior, many works show that the choice of residents travel, accessibility of communities and home position are related to Carbon emissions. Improving the accessibility of community transportation can reduce the carbon emissions of residents (Zahabi, Miranda-Moreno, Patterson, Barla, & Harding, 2012). High density, land use, and high accessibility communities do not automatically reduce household vehicle distance (Brand, Goodman, Rutter, Song, & Ogilvie, 2013). The spatial structure of surrounding communities can lead to differences in carbon emissions among residents (Chai, Xiao, & Liu, 2012).

As a big city with a developed coastal economy, Guangzhou has a serious traffic environment problem, which is broadly representative of urban traffic problems in China. The study used different locations consisting of of several communities in Guangzhou as the research object, looking for the travel distribution characteristics of carbon emissions and studying the main influencing factors can provide policy advice or theory for low carbon transport and low-carbon urban construction. It helps to guide the residents to choose low-carbon travel mode from urban construction and transportation policies, which can reduce the urban traffic carbon emissions. The related results of this study can be used as a reference for other cities and urban planners.

The remainder of this paper is organized as follows. Section 2 provides the data sources and related methods to study the carbon emission derived from the real-life problem in Guangzhou. Section 3 analyzes the distribution characteristics of travel carbon emissions in this case study. The influence factors of carbon emission of community residents are also presented in Section 4. Finally, the conclusion, suggestion on current policy, and future research directions are presented in Section 5.
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