Geographically weighted regression for compositional data

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· Abstract: This study builds a bridge between the literature for geographically weighted regression (GWR) and compositional data analysis (CoDA). GWR allows the modeling of spatial heterogeneity in regression models and is increasingly used in various fields. CoDA provides unique and useful tools for compositional data, which are restricted by a constant-sum constraint. Although compositional data are common in many scientific areas, it is not until recently that increasingly sophisticated statistical methods have been deeply investigated. Many types of spatial models based on geostatistics, spatial statistics, and spatial econometrics have been proposed. However, there is no spatial model that considers both spatial heterogeneity and the constant-sum constraint. In this study, we propose the GWR model for compositional data, which we term GWRcomp. This allows us to model spatially varying relationships while considering the constant-sum constraint. We applied this model to analyze household income compositions at the county level in the US. The results indicate that GWRcomp is superior to a conventional non-spatial (global) regression model in terms of the corrected Akaike's information criterion and adjusted R^2. The spatially varying compositional semi-elasticities are also proposed, and its interpretational usefulness is empirically suggested.