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Spatial variability structure of soil CO_2 emission and soil physical and chemical properties characterized by fractal dimension in sugarcane areas

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Soil CO_2 emission (FCO_2) is influenced by chemical, physical and biological factors that affect the production of CO_2 in the soil and its transport to the atmosphere, varying in time and space depending on environmental conditions, including the management of agricultural area. The aim of this study was to investigate the structure of spatial variability of FCO_2 and soil properties by using fractal dimension (DF), derived from isotropic variograms at different scales, and construction of fractograms. The experimental area consisted of a regular grid of 60 $\times$ 60 m on sugarcane area under green management, containing 141 points spaced at minimum distances ranging from 0.5 to 10 m. Soil CO_2 emission, soil temperature and soil moisture were evaluated over a period of 7 days, and soil chemical and physical properties were determined by sampling at a depth of 0.0 to 0.1 m. FCO_2 showed an overall average of 1.51 μmol m-2 s-1, correlated significantly ($p < 0.05$) with soil physical factors such as soil bulk density, air-filled pore space, macroporosity and microporosity. Significant DF values were obtained in the characterization of FCO_2 in medium and large scales (from 20 m). Variations in DF with the scale, which is the fractogram, indicate that the structure of FCO_2 variability is similar to that observed for the soil temperature and total pore volume, and reverse for the other soil properties, except for macroporosity, sand content, soil organic matter, carbon stock, C/N ratio and CEC, which fractograms were not significantly correlated to the FCO_2 fractogram. Thus, the structure of spatial variability for most soil properties, characterized by fractogram, presents a significant relationship with the structure of spatial variability of FCO_2, generally with similar or dissimilar behavior, indicating the possibility of using the fractogram as tool to better observe the behavior of the spatial dependence of the variables along the scale.