Geophysical Research Abstracts
Vol. 14, EGU2012-8471, 2012
EGU General Assembly 2012

On the relation between soil CO_2 emission and aspects of soil diffuse reflectance

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Carbon dioxide (CO_2) is the greenhouse gas that has shown the most significant increases on its atmospheric concentration during the last years. According to the Intergovernmental Panel on Climate Change (IPCC), increasing of CO_2 atmospheric concentration is the main cause of global warming, corresponding to around 60% of the enhanced greenhouse effect. In the agricultural sector, 22% of CO_2 emissions could be related to land use and land use change, such as deforestation. The process of soil CO_2 emissions, known as soil respiration, is the second largest source of emissions of CO_2 into the atmosphere, following only to burning of fossil fuels. It is known that this process of soil carbon loss to the atmosphere is the result of microbial activity (chemical oxidation) and roots respiration. These processes, in turn, are influenced by several soil properties, which provide spatial and temporal variability to soil CO_2 emission. Therefore, the objective of this study was to investigate the relationship between CO_2 emissions and some properties of a tropical Brazilian Oxisol used for the cultivation of sugarcane. Soil samples were collected at points of intersection of an irregularly gridded, georeferenced with minimum distances of 0,5 m in depth from 0,00 to 0,20 m, covering a total area of 50 x 50 m, totaling 89 points. Those points were measured soil respiration with two portable systems manufactured by LI-8100 LI-COR Company. The spectra were recorded every 0.5 nm in the wavelength range from 380 to 730 nm in a spectrophotometer Lambda 950 UV/VIS/NIR PerkinElmer equipped with an integrating sphere. It was observed that some aspects of the diffuse reflectance spectroscopy were linear correlated with the values of soil respiration measured in the field. The content of the iron oxides hematite and goethite and iron content of the clay, dithionite and oxalate showed a directly proportional relation to CO_2 emission, indicating a complex link between the clay minerals, microbial activity, iron content and soil respiration. The linear correlation between CO_2 emission and the sum of the contents of hematite and goethite was 0.46 ($p < 0.05$). Spectroscopy aspects correlated significantly ($p < 0.05$) also with other soil properties such as total pore volume and porosity-free water. This study indicates that the diffuse reflectance spectroscopy UV/VIS/NIR is an attractive alternative to assist the lifting of CO_2 emissions over large areas, where the acquisition of these readings is difficult, since to perform measurements of soil respiration needs time and high cost. In addition, after calibrations of the spectral information from one place, quantitative information contained in the spectrum can be transferred to similar compartments, identified based on the models of landscape. Thus, one could infer possibly CO_2 emissions anywhere, promoting the transfer of information more efficient for surveys of areas of mitigation and carbon sequestration.