Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10398, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10398
EGU General Assembly 2008

Effects of sample moisture in the estimation of the maximum temperature reached on burned soils using near-infrared spectroscopy

V. Arcenegui, C. Guerrero, J. Mataix-Solera, R. Zornoza, J. Mataix-Beneyto, F. García-Orenes and I. Gómez

GEA- Grupo de Edafología Ambiental – Environmental Soil Science Group. Department of Agrochemistry and Environment. University Miguel Hernández. Avda. de la Universidad s/n. 03202, Elche, Alicante, Spain, Tel: +34-966658336, Fax: +34-966658532)
v.arcenegui@umh.es

Forest fire is one of the major disturbances in Mediterranean ecosystems and can start degradation processes of soils. Most of these processes are associated with fire severity. Thus, the development of tools to estimate with precision and accuracy the temperature reached on soils during wildfires is of great interest to improve the selection of intervention areas and the selection of rehabilitation techniques.

Fire affects on soil physical, biological and chemical properties, such organic matter quantity and quality. In a previous study (under laboratory conditions) we observed that the maximum temperature reached (MTR) in heated soils was related with changes in NIR spectra. But fire also affects the moisture content in samples. After a wildfire, the burned soils could be partially or totally re-hydrated by hygroscopic water or by rainfall events. These changes in water content could affect the finger print related with MTR in the NIR spectra.

The objective of this study was to evaluate the effects of the different sample moisture content on the estimation of the MTR using NIR.

For this purpose, soil samples were heated at different temperatures, and the moisture content of these heated samples was modified (simulating different post-fire scenarios) using four different pre-treatments (A, B, C and D). Different models relating MTR

and NIR (using PLS-regressions) were calibrated (and cross-validated) on each of these scenarios (A to D).

The first pre-treatment applied to heated samples was air-drying, allowing the recovery of the hygroscopic water in samples (pre-treatment A). This procedure was tested because is the easiest pre-treatment. But the heating temperature could affect the hygroscopic re-hydration, and not all the samples had the same moisture after heating and air-drying. Thus, the same samples were oven-dried to eliminate most of the water and to evaluate if the oven-drying pre-treatment of samples enhances the prediction of the MTR using NIR (pre-treatment B). After that, these samples were air-dried (allowing the reestablishment of hygroscopic water) to check if it is necessary maintain the oven-drying moisture conditions of the samples once most of the moisture was removed (pre-treatment C). Finally, the samples were gently rewetted by water addition, and then they were oven-dried and air-dried (pre-treatment D).

Models developed with spectra of samples in the different conditions (pre-treatments A, B, C and D) were successfully calibrated and validated with r^2 greater than 97.61 and RMSECV less than 32ºC. These models were used to estimate the MTR on other set of soil samples heated at seven temperatures (100, 200, 300, 400, 500, 600 and 700ºC). The moisture of this set of samples was also modified using similar pre-treatments.

Accurate estimations of MTR were obtained when the pre-treatment of samples was the same as the set of samples used in model calibration.

If the burned samples to be evaluated were not rewetted (i.e. sampled before a rainstorm), the air-dried was the easiest pre-treatment. But if the burned samples were rewetted (i.e. sampled after a rainstorm), the highest accuracy was obtained with oven-dried and air-dried pre-treatment (D).

Although moisture content of burned soils can affect MTR estimations, it could be estimated using NIR with high accuracy.

Acknowledgements: This research was supported by the CICYT co-financed FEDER project REN2003-08424-C02-01, and the Generalitat Valenciana project (GV05/018). V.Arcenegui and R. Zornoza acknowledges the grants from “Caja de Ahorros del Mediterráneo” and the Ministry of Education and Science of the Government of Spain, respectively.