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Observation of swelling/shrinking phenomena in a natural peat soil sample

S. Ferraris (1), M. Putti (2), P. Teatini (2), D. Canone (1), M. Previati (1), L. Salvai (1), I. Bevilacqua (1)

(1) Dipartimento di Economia e Ingegneria Agraria, Forestale e Ambientale, Università di Torino,

(e-mail: stefano.ferraris@unito.it , Ph. +39 011 6708616, Fax +39 011 6708619)

(2) Dipartimento di Metodi e Modelli Matematici per le Scienze Applicate, Università di Padova,

(e-mail: putti@dmsa.unipd.it)

In 2003 a 1-meter cube peat soil sample has been collected from an experimental area located in the Zennare basin (part of basin located in the sud zone of the Venice lagoon between the rivers Brenta and Adige). In the last century, this zone has been characterized by swamps and grove of reeds. After reclamation, it has become an extensive agricultural area, characterized by a present day average elevation of about 4 meters below the mean sea level, suffering of strong subsidence due mainly to bioxidation processes, and accompanied by swelling/shrinking phenomena that occur even for small water content changes. To study the functional relationships between swelling/shrinking, subsidence, matric potential, soil water content, and temperature the sample has been taken to the laboratory and equipped with probes for thermal, hydrological and morphological monitoring.

The peat soil has been subjected to water table variation to investigate its hydrological behavior under wetting and draining conditions, and to verify the response of the soil sample to very shallow water level, a situation that cannot be easily maintained in the field. The sample was initially maintained at constant humidity and temperature for three years, reaching a water content profile characterized by surface values close to zero and changing with depth to 14, 34 and 27% (vol.) at 15, 30 and 50 cm from the surface. For the same depths, the matric potential was about 6, 5 and 3 meters of water

column, respectively. In this first three years a 90 mm loss of surface elevation was observed.

The water table was then progressively increased (150 mm three times per day). During this wetting phase, the monitoring has shown a morphological modification very similar to the field situation, with a maximum swelling of 15- 20 mm, corresponding with saturation conditions of 0.54 $m^3/m^3$for the 30 cm depth horizon and 0.70 m^3/m^3 for the 50 cm depth horizon. These values are lower than the corresponding *in situ* data of 2-13 percent.

The drying phase, currently still undergoing, is showing a thermal profile characterized by a temperature difference of 2 degrees between the sample surface and its bottom. The soil water content is showing a progressive decrease, but with a noticeably different behaviour of the 15 and 30 cm depth horizons. At these depths, in fact, a lower reactivity is observed, with only a 0.07- 0.08 m^3/m^3 of water content decrease (after two months from the end of the water table increase) as compared to the mean data of the other horizons falling in the range between 0.25 and 0.30 m^3/m^3. Finally, matric potential are only now beginning to show a certain characteristic behavior for the different horizons and it will be essential to continue the monitoring effort to obtain more exhaustive information in comparison with the water retention curves observed in field.