AN: **H43D-0519**

TI: Two dimensional hydrological simulation in elastic swelling/shrinking peat soils

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AB: Peatlands respond to natural hydrologic cycles of precipitation and evapotranspiration with reversible deformations due to variations of water content in both the unsaturated and saturated zone. This phenomenon results in short-term vertical displacements of the soil surface that superimpose to the irreversible long-term subsidence naturally occurring in drained cropped peatlands because of bio-oxidation of the organic matter. The yearly sinking rates due to the irreversible process are usually comparable with the short-term deformation (swelling/shrinkage) and the latter must be evaluated to achieve a thorough understanding of the whole phenomenon. A mathematical model describing swelling/shrinkage dynamics in peat soils under unsaturated conditions has been derived from simple physical considerations, and validated by comparison with laboratory shrinkage data. The two-parameter model relates together the void and moisture ratios of the soil. This approach is implemented in a subsurface flow model describing variably saturated porous media flow (Richards' equation), by means of an appropriate modification of the general storage term. The contribution of the saturated zone to total deformation is considered by using information from the elastic storage coefficient. Simulations have been carried out for a drained cropped peatland south of the Venice Lagoon (Italy), for which a large data set of hydrological and deformation measurements has been collected since the end of 2001. The considered domain is representative of a field section bounded by ditches, subject to rainfall and evapotranspiration. The comparison between simulated and measured quantities demonstrates the capability of the model to accurately reproduce both the hydrological and deformation dynamics of peat, with values of the relevant parameters that are in good agreement with the literature.

DE: 1805 Computational hydrology
DE: 1829 Groundwater hydrology
DE: 1865 Soils (0486)
DE: 1866 Soil moisture
DE: 1875 Vadose zone
SC: Hydrology [H]
MN: Fall Meeting 2005