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Modeling swelling/shrinkage behaviour of peat soils

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Peatlands respond to natural hydrologic cycles of precipitation/evapotranspiration with manifest reversible deformations (swelling/shrinkage) due to the variations in the soil moisture, mainly in the unsaturated zone. A new model of peat soil volume changes is presented as a relationship between the void ratio and the moisture ratio. The model shows a good agreement with experimental data from laboratory analysis and has been implemented in a numerical finite element code for the solution of the well-known Richards equation for flow in variably saturated porous media. In particular, the storage term has been modified to account for the variations of porosity with the saturation. The application of the modified Richards equation-based numerical code to a column of peat soil subject to rainfall, evapotranspiration and lateral drainage and the comparison of the results with a large set of field data from a monitored peatland south of the Venice Lagoon demonstrate the capability of the swelling/shrinkage model to predict the response of the system to the atmospheric constraints, after an appropriate calibration of the involved parameters.