A Web-Database of Soil Physical Properties for Crop and Environmental Modeling

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Introduction

Soil physical properties are needed for various environmental studies, including crop simulation where the intended users are agronomists, consultants, and growers. However, acquiring and tabulating a complete set of soils analysis data for a particular region is expensive and laborious. This newsletter introduces a web-based soil physical properties database to meet data requirements of specific crop growth models, i.e. cotton and soybean crops (GOSSYM and GLYCIM, respectively), in addition to providing a generic soil physical properties data files for environmental modeling. The database is comprised of undisturbed samples of 1074 soil horizons (or about 300 sample sites) collected from farmers' fields using a tractor mounted hydraulic probe. Standard laboratory analyses were performed to determine the various soil physical properties. The geographic area represented is the Southeast U.S. Cotton Belt, specifically encompassing the states of Alabama, Arkansas, Florida, Georgia, Louisiana, and Mississippi.

Specific Description of Database

The database includes soil physical properties like soil bulk density, saturated hydraulic conductivity, soil texture (sand and clay content), soil moisture retention data at _0.001, _0.01, _0.033, _0.067, _0.1, _0.5, and _1.5 MPa pressure heads. An Oracle8 Relational Data Base Management System (RDBMS) was designed and implemented to store and deliver the soil physical properties.

The general use data is in simple comma-separated zip format. The file contains all measured soil parameters for each horizon and is viewable in any DOS or WINDOWS text editor. The crop specific data like GOSSYM hydrology file include soil series name, sampling location, and sampling year. Soils data are arranged according to the number of horizons sampled, and include the maximum depth of the horizon (cm), volumetric water content at saturation (cm3 cm-3), volumetric water content at field capacity, volumetric water content at permanent wilting point, bulk density (g cm-3), percent sand content and percent clay content.

A typical GLYCIM hydrology file is similar to that of GOSSYM with data arranged according to the different horizon depths sampled from the surface (cm). The variables for each horizon include hydrologic diffusivity at -1.5 MPa (cm2 d-1), volumetric water content at -1.5 MPa, slope of log (hydraulic diffusivity) vs. volumetric water content, saturated water content, volumetric water content at field capacity, volumetric water content of air dry soil, bulk density (g cm-3), the exponent in the water retention curve equation, saturated hydraulic conductivity (cm d-1), water potential of air entry (MPa), percent sand content and percent clay content. Both the GOSSYM/COMAX data file (*.hyd extension) and GLYCIM data file (*.soi extension) are in a format consistent with the respective crop model, and include parameter estimates for any functional relationship between soil and water variables presently appropriate for each model. The user must have the model's soil editor installed and executed on their machines in order to upload and view the GOSSYM (*.hyd) and GLYCIM (*.soi) files.

Accessing the Database

A data entry Graphical User's Interface has been developed for additions or modifications to the data. The database accepts queries on several attributes, including sampling location, soil series name, state, county, farm etc. This web-based soils physical properties database was successfully implemented and tested, and is available online at http://www.msstate.edu/~ia3/ without any restriction of ID or password.

For More Information

The database web site has links to related information, technical references, and a help menu. In addition, please contact any of the authors listed at the beginning of this document to learn more about potential database applications, or in accessing or using the information.