FALL 2007 GRADUATE SEMINAR SERIES

Friday, October 12, 2007

4:00 – 4:50 p.m.   MB 0.224

Guest Speaker: Dr. Ni-Bin Chang
U. Central Florida

Ni-Bin Chang received his Master's and Ph.D. degree from Cornell University in 1989 and 1991, respectively. Both are in the field of Environmental Systems Engineering. He is a professor with Civil and Environmental Engineering Department, University of Central Florida (UCF). At UCF, he teaches courses in "Introduction to Environmental Engineering", "Industrial Ecology", "Advanced Hydrology", "Hydraulics", "Fluid Mechanics", and "Environmental and Water Resources Systems Analysis". He has been directing academic research in the field of environmental and water resources engineering over seventeen years. He has acquired almost five million dollars research funding as principle or co-principal investigator in the past ten more years. His area of expertise is environmental systems modeling, remote sensing and environmental informatics. He has developed over 40 different types of simulation and optimization models for a variety of environmental and hydrological systems analyses. Emphasis of remote sensing has been placed on the synergy between optical and microwave remote sensing, artificial intelligence, and hydrological observatory design. He has authored and co-authored over 122 peer-reviewed journal articles, 7 books and chapters, and additional 112 conference papers. Dr. Chang has considerable experience in managing international journals. He was one of the founders of International Society of Environmental Information Management and the former editor-in-chief of Journal of Environmental Informatics. He is associate editor of Journal of Applied Remote Sensing, and board members of 12 international journals, including Journal of Environmental Modeling & Assessment, Journal of Environmental Management, Stochastic Environmental Research & Risk Assessment, Environmental Management, and Journal of Civil Engineering and Environmental Systems.

Soil Moisture Measurements and Water Availability Index Derivation Using Remote Sensing Images

Dr. Ni-Bin Chang
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Abstract

Soil moisture is one of the fundamental hydrologic parameters in terrestrial hydrology. The ecosystem in semi-arid areas is normally driven by soil moisture in most cases. The measurement of soil moisture aids in the prediction of crop yield, plant stress, watershed runoff, and non-point source pollution. Soil moisture obviously varies in space and time. The surface soil moisture is very difficult to measure over an area of large-scale river basin due to the variety of the soil types and their textures. Consistency of measuring in situ soil moisture on site is barely obtainable even in local scale. The soil moisture measurement in the semi-arid Choke Canyon Reservoir Watershed (CCRW), south Texas is of interest in this study since it consists of various types of land use/land cover, such as agriculture, farms, crops/rows and shrub land, and a unique geological setting that heavily influences the hydrological cycle of the watershed. In the upper portion of the watershed the steep slopes and arid terrain of the Balcones Escarpment rise into the Edwards Plateau. These hills, cliffs, crevasses, exposed rock, and clay soils cause rapid runoff resulting in flashfloods during large storm events. Downstream of the Balcones fault zone, the landscape tends to flatten out as the streams flows southward and eastward into the South Texas Brush Country where slopes range from 0 to 10 percent. As the streams cross the Edwards Aquifer Recharge zone they loose a significant portion of their flow through faults and solution cavities in the limestone formations. Placement of USGS Stream Gages helps to quantify this loss and prepare the downstream areas for potential flooding. This study presents soil moisture prediction using RADARSAT-1 Synthetic Aperture Radar (SAR) satellite imagery. Essential radiometric and geometric calibrations to correct the SAR imagery were performed with the aid of Corner Reflectors (CRs). The sensor data obtained after the installation of the corner reflectors in April 2004 showed better spatial accuracy, and consequently improves the correlation between the radar backscatter signals, $\sigma 0$, soil roughness, and the Volumetric Moisture Content (VMC) of the soil in the CCRW. Three prediction models were developed for soil moisture projection, which include simple linear regression, multiple linear regression, and genetic programming models. Ground truth database was collected manually and applied for the calibration and verification of prediction models. Although the genetic programming model exhibits overall advantage of soil moisture estimation, it requires supporting tremendous computational resources. To extend the application potential, a new water availability index to be applied for water infrastructure assessment may be derived based on such a progress.