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Fitting rainfall interception models to forest ecosystems of Mexico

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Models that accurately predict forest interception are essential both for water balance studies and for assessing watershed responses to changes in land use and the long-term climate variability. This paper compares the performance of four rainfall interception models––the sparse Gash (1995), Rutter et al. (1975), Liu (1997) and two new models (NvMxa and NvMxb)––using data from four spatially extensive, structurally diverse forest ecosystems in Mexico. Ninety-eight case studies measuring interception in tropical dry (25), arid/semi-arid (29), temperate (26), and tropical montane cloud forests (18) were compiled and analyzed. Coefficients derived from raw data or published statistical relationships were used as model input to evaluate multi-storm forest interception at the case study scale. On average empirical data showed that tropical montane cloud, temperate, arid/semi-arid and tropical dry forests intercepted 14%, 18%, 22% and 26% of total precipitation, respectively. The models performed well in predicting interception, with mean deviations between measured and modeled interception as a function of total precipitation (ME) generally < 5.8% and Nash-Sutcliffe efficiency E estimators > 0.66. Model fitting precision was dependent on the forest ecosystem. Arid/semi-arid forests exhibited the smallest, while tropical montane cloud forest displayed the largest ME deviations. Improved agreement between measured and modeled data requires modification of in-storm evaporation rate in the Liu; the canopy storage in the sparse Gash model; and the throughfall coefficient in the Rutter and the NvMx models. This research concludes by recommending the wide application of rainfall interception models with some caution as they provide mixed results. The extensive forest interception data source, the fitting and testing of four models, the introduction of a new model, and the availability of coefficient values for all four forest ecosystems are an important source of information and a benchmark for future investigations in this area of hydrology.

Biography

Jose Navar has his expertise in Forest Hydrology and Watershed Management. He completed his Ph.D. at the age of 33 years from Oklahoma State University. He has been a professor of Natural Resource Management in Watersheds at the Universidad Autonoma de Nuevo Leon, Institute Politecnico National, Institute Tecnologico de Estudios Superiores de Monterrey and Tecnology National of Mexico. Dr. Navar is a member of the Pi Kappa Pi, Mexican Academy of Sciences, The American Geophysical Union, The International Society of Soil Science, among others. He is a member of The Mexican System of Scientists since 1992 and now he poses level III.

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