

Speaker : Koichi Unami (Kyoto University), Rasha M Fadhil (University of Mosul)

Title : Multi-state Markov chains applied to drought management in rainfed agriculture

Rainfall is a major component of the natural hydrological cycle responsible for leading extreme hydrological events including droughts, which must be considered in overcoming vulnerability of rainfed agriculture. Dealing with uncertainty of prolonged dry spells is a big challenge particularly in the hot semi-arid regions. Multi-state Markov chains are suitable for developing feasible countermeasures against droughts based on information given at the current time. In this study, focusing on daily rainfall data observed at four stations located in Northern Iraq during different periods from 1975 to 2011, the first order Markov chain of multiple states representing the number of consecutive dry days is adopted with the gamma distribution for daily rainfall depths. The four stations are at Rabia, Sinjar, Tal Afar, and Mosul, with average annual precipitation depths of 299 mm, 314 mm, 291 mm, and 352 mm, respectively. Model parameters are identified from the historical observed data at each station for each month, and the Kolmogorov-Smirnov test compares the gamma distribution with the distribution of the observed data. Several statistical quantities are evaluated, in order to dynamically assess risks of droughts and then to support decision making on exercise of countermeasures such as supplemental irrigation or abandoning cultivation.