Hydrology and Earth System Sciences
An Interactive Open Access Journal of the European Geosciences Union

Hydrol. Earth Syst. Sci., 7, 197-211, 2003
www.hydrol-earth-syst-sci.net/7/197/2003/

Modelling persistence in annual Australia point rainfall

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Abstract. Annual rainfall time series for Sydney from 1859 to 1999 is analysed. Clear evidence of nonstationarity is presented, but substantial evidence for persistence or hidden states is more elusive. A test of the hypothesis that a hidden state Markov model reduces to a mixture distribution is presented. There is strong evidence of a correlation between the annual rainfall and climate indices. Strong evidence of persistence of one of these indices, the Pacific Decadal Oscillation (PDO), is presented together with a demonstration that this is better modelled by fractional differencing than by a hidden state Markov model. It is shown that conditioning the logarithm of rainfall on PDO, the Southern Oscillation index (SOI), and their interaction provides realistic simulation of rainfall that matches observed statistics. Similar simulation models are presented for Brisbane, Melbourne and Perth.

Keywords: Hydrological persistence,hidden state Markov models, fractional differencing, PDO, SOI, Australian rainfall

Final Revised Paper (PDF, 625 KB)

Citation: Whiting, J. P., Lambert, M. F., and Metcalfe, A. V.: Modelling persistence in annual Australia point rainfall, Hydrol. Earth Syst. Sci., 7, 197-211, 2003. Bibtex EndNote Reference Manager