HIGH ORDER MARKOV CHAIN MODELS FOR RAINFALL OCCURRENCE

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Markov chain models for rainfall occurrence have been widely used for modelling the chance of rain (e.g. Stern and Coe (1984), Seneviratne (1985). A general framework for fitting these models is possible within a statistical package such as GLIM (Baker and Nelder (1978). The Markov chain models were found to model most characteristics well. These include the probability of dry and wet spells of different lengths occurring within a specified period, percentiles of rainfall totals and the start, length and end of the rainy seasons.

The main limitation of the Markov chain models is their inability to incorporate the long term persistence of dry and wet spells present in daily rainfall records. A family of high order constrained Markov chains which enables such persistence to be modelled is considered here.

The main problem of fitting a standard high order Markov chain is that unless a number of years of daily rainfall data are available, the precision of the resulting estimates is low. However, this can be overcome by the use of a suitable set of constraints imposed on the model. This paper outlines two such families of constraints. It also highlights the ability of these high order constrained Markov chain models to incorporate the long term persistence of wet and dry spells, while maintaining the flexibility of the standard Markov chain models.

References:

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Seneviratne E.K. (1985) A model fitting analysis of daily rainfall data with applications in agricultural planning for Sri Lanka. Unpublished PhD thesis.

Stern, R.D. and Coe, R. (1984) A model fitting analysis of daily rainfall data. J.R.S.S., A 147: 1-34.