Dry spell trend analysis in Kenya and the Murray Darling Basin using daily rainfall

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Important agricultural areas in Kenya and the Murray Darling Basin (MDB) in Australia are largely semi-arid to arid. Persistent dry periods and timing of dry spells directly impact the availability of soil moisture and hence crop production in these regions. Most studies focus on the analysis of dry spell lengths at an annual scale. However, timing and length of dry spells at finer temporal scales is more beneficial for cropping when considering a trade-off between the time scale and the ability to analyse dry spell length.

The aim of this study was to analyse the interannual and intra annual variations in dry spell lengths in the regions to inform crop management. This study analysed monthly dry spells based on daily rainfall for 1961-2010 on a limited dataset of 13 locations in Kenya and 17 locations in the MDB. This dataset was the most consistent across both regions and future analysis will incorporate more stations and longer time periods where available. Dry spell lengths were analysed by month and year and trends in monthly and annual dry spell lengths were analysed using Generalised Linear Models (GLM) and the Mann Kendall test (MK).

Overall, monthly dryspell lengths are right skewed with higher frequency of shorter dryspells (3-25 days). In Kenya, significant increases in mean dry spell lengths ($p \leq 0.02$) are observed in inland arid-to semi humid locations but this temporal trend appears to decrease in highland and the coastal regions. Analysis of the MDB stations suggests changes in seasonality. For example, spatial trends suggest a North-South increase in dry spell length in summer (December – February), but a shortening after February. Generally, the GLM and MK results are similar in the two regions but the MK test tends to give higher values of positive slope coefficients and lower values for negative coefficients compared to GLM. This may limit the ability of finding the best estimates for model coefficients. Previous studies in Australia and Kenya have relied on continuous climatic indices based on global climate models and stochastic processes resulting in limited and mixed results. For agronomical purposes, our results show that direct assessment of dry spells lengths from daily rainfall also indicates changes in dry spells trends in Kenya and the MDB and that such an analysis is easy to use and requires limited assumptions.

This initial analysis identifies significant increasing trends in the dry spell lengths in some areas and periods in Kenya and the MDB. This has major implications for crop production in these regions and it is recommended that this information be incorporated in the regions' management decisions.

KEY WORDS: monthly dry spell length; Generalized Linear Models; Mann -Kendall test; month; Kenya, Murray Darling Basin (MDB).