



Drought Modelling in Small Island Developing States: A Case Study in Fiji

Anshuka Anshuka (1), Floris Ogtrop (2), and Willem Vervoort (3)

(1) Masters of Philosophy (Science) Student, University of Sydney, Faculty of Science, Camperdown, Australia (anshuka92@gmail.com), (2) Senior Lecturer, School of Life and Environmental Science, Faculty of Science, University of Sydney, (3) Associate Professor, School of Life and Environmental Sciences, Faculty of Science, University of Sydney

Hydro-metrological hazards are a prevalent issue in the Pacific. Although hazards are inevitable, proactive approaches to efficiently manage its consequences can significantly alleviate risks. The cognizance of climate change has raised a serious need for further modelling, risk management discussions and tools, as it can potentially exacerbate weather related natural disasters. Drought is one of the most complex and abstruse natural hazard. A significant number of studies in Fiji have focused on risk and trend analysis on droughts in the region. However, there is a paucity of studies that attempt to forecast drought as a risk reduction approach towards disaster management. Therefore, this paper explores (1) the plausibility of developing an efficient early drought warning system for Fiji, (2) and identifying principle climate drivers of precipitation, which are associated with drought events in Fiji. Initially, the Standardized Precipitation Index (SPI) was calculated from monthly rainfall data for a number of stations in Fiji. Hereafter, an ARIMA model, which accounts for potential correlations between SPI and exogenous variables, was used to forecast SPI at a lead time of one, three and six months. Sea Surface Temperature Anomalies (SSTA), Southern Oscillation Index (SOI), Madden Julian Oscillation (MJO) and Pacific Decadal Oscillation (PDO) were considered as exogenous predictor variables and the performance of each of the combinations were evaluated using the Root Mean Square Error (RMSE), Mean Absolute Error (MAE) and the coefficient of determinant (R^2). Model improvements were noted when exogenous variables were included as opposed to predictions that did not incorporate exogenous variables. Accordingly, the best performing model utilized a validation dataset with three-month lagged SOI as was determined by the correlation analysis. These results highlight the usefulness of incorporation of climate indices in drought forecasting. Ultimately, the model can be used to implement an operational early warning/forecasting system by disaster management bodies in Fiji to accomplish risk reduction plans as a proactive measure. The application of the paper is not limited to the Fiji region, and therefore, research of this nature opens avenues to potential expansions in the area of drought modelling, which will be applicable to the broader Pacific region. Thus, it is vital to represent SIDS in such areas to enhance the capacity in order to manage droughts effectively.