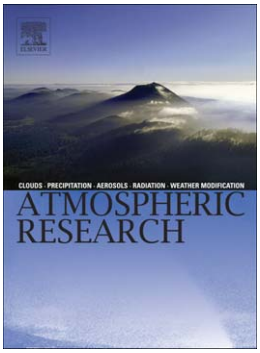

Drought forecasting in eastern Australia using multivariate adaptive regression spline, least square support vector machine and M5Tree model

Ravinesh C Deo, Ozgur Kisi, Vijay P Singh

PII: S0169-8095(16)30450-1
DOI: doi:10.1016/j.atmosres.2016.10.004
Reference: ATMOS 3805

To appear in: *Atmospheric Research*

Received date: 5 July 2016
Revised date: 4 October 2016
Accepted date: 10 October 2016

Please cite this article as: Deo, Ravinesh C, Kisi, Ozgur, Singh, Vijay P, Drought forecasting in eastern Australia using multivariate adaptive regression spline, least square support vector machine and M5Tree model, *Atmospheric Research* (2016), doi:10.1016/j.atmosres.2016.10.004

Drought forecasting in eastern Australia using multivariate adaptive regression spline, least square support vector machine and M5Tree model

Ravinesh C Deo[1 *], Ozgur Kisi[2], Vijay P Singh[3]

[1] School of Agricultural Computational and Environmental Sciences

International Centre of Applied Climate Sciences (ICACS)

University of Southern Queensland, Springfield, AUSTRALIA

*Corresponding Author: ravinesh.deo@usq.edu.au

[2] Canik Basari University, Architecture and Engineering Faculty

Civil Engineering Department, 55080 Samsun, TURKEY

[3] Department of Biological and Agricultural Engineering and Zachry Department of Civil Engineering,

Texas A&M University, 2117 TAMU, College Station, TX 77843-2117, USA

Abstract

Drought forecasting using standardized metrics of rainfall is a core task in hydrology and water resources management. Standardized Precipitation Index (SPI) is a rainfall-based metric that caters for different time-scales at which the drought occurs, and due to its standardization, is well-suited for forecasting drought at different periods in climatically diverse region. This study advances drought modelling using multivariate adaptive regression splines (MARS), least square support vector machine (LSSVM), and M5Tree models by forecasting SPI in eastern Australia. MARS model incorporated rainfall as mandatory predictor with month (periodicity), Southern Oscillation Index, Pacific Decadal Oscillation Index and Indian Ocean Dipole, ENSO Modoki and Nino 3.0, 3.4 and 4.0 data added gradually. The performance was evaluated with root mean square error (*RMSE*), mean absolute error (*MAE*), and coefficient of determination (r^2). Best MARS model required different input combinations, where rainfall, sea surface temperature and periodicity were used for all stations, but ENSO Modoki and Pacific Decadal Oscillation indices were not required for Bathurst, Collarenebri and Yamba, and the Southern Oscillation Index was not required for Collarenebri. Inclusion of periodicity increased the r^2 value by 0.5–8.1% and reduced *RMSE* by 3.0–178.5 %. Comparisons showed that MARS superseded the performance of the other counterparts for three out of five stations with lower *MAE* by 15.0–73.9% and 7.3–42.2%, respectively. For the other stations, M5Tree was better than MARS/LSSVM with lower *MAE* by 13.8–13.4% and 25.7–52.2%, respectively, and for Bathurst, LSSVM yielded more accurate result. For droughts identified by SPI ≤ -0.5, accurate forecasts were attained by