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Soil Moisture and Evapotranspiration Determination in Fine Detail over the SADC Region at 3-hour intervals

Geoff Pegram (1) and Scott Sinclair ()

(1) University of KwaZulu-Natal, Civil Engineering, Durban, South Africa (pegram@ukzn.ac.za), (2) University of KwaZulu-Natal, Civil Engineering, Durban, South Africa (sinclaird@ukzn.ac.za)

Timeous and routine monitoring of the spatial distribution of Soil Moisture and Evapotranspiration over a large region in fine detail has great value for coping with two weather extremes: Flash Floods and Droughts. The current state of soil moisture conditions has a major impact on the runoff response of a catchment to heavy rainfall; and monitoring the wetness of the soil in detail over large regions, without having to laboriously take expensive samples, is a bonus for agricultural managers who continuously need to understand the status of crop growth potential. This is particularly relevant in the southern and central African countries in the Southern African Development Community (SADC) region which contribute importantly to the food basket of Africa. The project had two thrusts.

The first was to extend coverage of near real-time Soil Moisture (SM) and Evapotranspiration (ET) monitoring over the SADC region using the existing methodology of operating the PyTOPKAPI hydrological model in Land Surface Modelling mode (as proven in RSA), which we called HYLARSMET in the previously completed WRC project K5/2024. This EXSMET outreach project is likely to be beneficial in many ways, not only technically and socially, but also to help cement other forms of collaboration within the region. The second thrust was to develop powerful computing techniques that will make it feasible to drive the modelling procedure for the vastly increased number of 1 km cells required to cover the SADC region.

The presentation summarises answers to the following important research questions, i.e. how we:
• ascertained what rainfall data are available in the SADC countries outside our borders and perform checks on their suitability for modelling
• obtained suitable ground cover and soil maps over the whole SADC region (e.g FAO and others), for comparison with those already available in RSA
• exploited the sensitivity calculations performed on the RSA data-set under HYLARSMET
• determined the best way to compare FAO sets of ground-based data with our RSA sets
• determined if there are better alternative rainfall inputs to TRMM, for near real-time precipitation data input. If not, exploit bias adjustment of the TRMM product
• exploited the Soil Moisture estimates of the European Space Agency's SMOS [Soil Moisture & Ocean Salinity] mission when ready for use in model inter-comparisons
• determined how to best cope with the uncertainties associated with input parameters and forcing variables [TRMM in particular] when computing ensembles of historical and forecast data streams
• devised means of increasing computing capacity and the speed of calculations by refining key parts of the code and employing parallel [or High Performance] computing power
• determined the best ways of cold-starting calculations [model initialization] for both gauged and ungauged catchments.
Reference: Pegram, Geoffrey and Scott Sinclair (2018) , EXSMET: A Model for Soil Moisture and Evapotranspiration Determination in Fine Detail over the SADC Region, Report Ref K5/2312 to the Water Research Commission, Pretoria, South Africa.