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Validating HYLARSMET: a Hydrologically Consistent Land Surface Model for Soil Moisture and Evapotranspiration Modelling over Southern Africa using Remote Sensing and Meteorological Data

Scott Sinclair (1,2), Geoff Pegram (1,2), Michael Mengitsu (3), and Colin Everson (3)

(1) Pegram and Associates, Durban, South Africa, (2) University of KwaZulu-Natal, Civil Engineering, Durban, South Africa (pegram@ukzn.ac.za), (3) Centre for Water Resources Research, University of KZN, Pietermaritzburg, South Africa

Timeous knowledge 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, since the state of the wetness of the land surface has a major impact on runoff response. Also, the ability to monitor the wetness of the soil and the actual evapotranspiration over large regions, without having to laboriously take expensive samples, is a bonus for agricultural managers who need to predict crop yields.

We present samples of the daily national Soil Moisture and Evapotranspiration estimates on a grid of 7300 locations centred in 12 km squares, then move on to the results of a validation study for soil moisture and evapotranspiration estimated using the PyTOPKAPI hydrological model in Land Surface Modelling mode, a system called HYLARSMET. The HYLARSMET estimates are compared with detailed evapotranspiration and soil moisture measurements made at the Baynesfield experimental farm in the KwaZulu-Natal province of South Africa, run by the University of KZN.

The HYLARSMET evapotranspiration estimates compared very well with the measured estimates for the two chosen crop types, in spite of the fact that the HYLARSMET estimates were not designed to explicitly account for the crop types at each site. The same seasonality effects were evident in all 3 estimates, and there was a stronger ET relationship between HYLARSMET and the Soybean site (Pearson r = 0.81) than for Maize, (r = 0.59). The soil moisture relationship was stronger between the two in situ measured estimates (r = 0.98 at 0.5 m depth) than it was between HYLARSMET and the field estimates (r about 0.52 in both cases). Overall there was a reasonably good relationship between HYLARSMET and the in situ measurements of ET and SM at each site, indicating the value of the modelling procedure.