# TECHNIQUES FOR MAPPING HYDROMETEOROLOGICAL AND ECOLOGICAL INTERACTIONS AT VARYING SCALES IN THE DRAKENSBERG MOUNTAIN RANGE OF SOUTH AFRICA

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The Drakensberg mountain range in the Province of KwaZulu-Natal, 200km inland from the Indian Ocean and rising from plains at 1,200m through foothills at 1,800m to the high Drakensberg escarpment at 3,000m dividing Lesotho and South Africa, is a major source of runoff in a generally water scarce region. The complexities of physiography, including steep gradients of topography and variations in dominant aspect have produced complex attendant precipitation, radiation, temperature, and ecological and hydrological responses on both meso (1-10km) and local (0.1-1km) spatial scales.

The paper describes various digital elevation-based techniques used to map hydrometeorological and ecological interactions. Three, four, and five dimensional Trend Surface Analysis (TSA) applied to a grid is used to illustrate practical considerations in mapping rainfall in mountainous terrain, including problems associated with the use of higher order polynomials in TSA. Relationships between annual and monthly rainfall are established to map daily rainfall, numbers of raindays, rainfall erosivity, and extreme (design) rainfall amounts. Using data from 16 streamflow gauges, curvilinear rainfall-runoff relationships are established for mapping purposes, showing mean annual runoff generation to range from under 100mm/pa to over 1,000mm/pa within a space of 30km.

On a local scale, a 100m digital elevation model RADSLOPE is used to model topographical controls of the surface energy balance, including incoming solar radiation, temperature, and potential evaporation on sub-daily and daily time

scales. This model is used to explain striking differences in vegetation on north and south aspects at different altitudes, e.g., evergreen forest vs protea savanna on cool and warm slopes respectively at 1,200-1,700m; or macchia type vegetation vs temperate grasslands on cool vs warm aspects at 1,800-2,300m; or more subtle variations of grassland species with aspect.

The paper concludes with some thoughts as to where ecohydrological models should be headed in the future, also addressing the problem of the degree to which spatial disaggregation should take place.