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Establishing the Cathedral Peak Research Catchments, South Africa as a living laboratory

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The need for quality, long-term datasets has become more important with the current impacts of anthropogenic activities on the environment. These long-term datasets can only be obtained through establishing suitable, sustainable hydrological monitoring networks that adequately characterize the properties, distribution, and circulation of water in the atmosphere, on the land, and in surface waters. The Cathedral Peak research catchments (29° 00' S; 29° 15' E) located in the northern part of the uKhahlamba Drakensberg, South Africa, are ideal as a long-term monitoring site for global change as they are remote, high altitude catchments, that have catchments both in pristine and damaged condition (previously afforested catchments) with different fire treatments, have a long historical record (although interrupted) and are an important water generating region for South Africa. A hydrological monitoring network, which is comparable with the historical network to benefit from the historic data for change detection and identification of drivers of change as well as being relevant for monitoring changes and thresholds in system behaviour into the future, has been designed for the catchments. The monitoring network was designed with catchment wide climatological monitoring, streamflow monitoring in key catchments and then focused, detailed monitoring in a selected catchment with the full array of evaporation, soil moisture and groundwater monitoring.

The Cathedral Peak catchments are made up of 10 catchments, ranging in size from 0.265 km2 to 1.9 km2, covering a total area of 8.1 km2. Over the catchment area two full automatic weather stations (AWS), which are supplemented by an array of 24 raingauges on various slopes and aspects, are installed. In addition, a ground level raingauge and a shielded raingauge are being used to investigate raingauge accuracy. Fog gauges are installed at the two AWS sites. Given the inaccessibility of the sites streamflow monitoring needed to be rationalised, thus the flows at the outlets of six catchments are monitored with sampling linked to changes in flows at three sites. In the pristine catchment, a full open path eddy covariance system and linked soil moisture sensors have been installed, as well as a Licor 8100 system for measuring long term soil gas flux. In combination, these systems allow for detailed in situ measurements on various components of the carbon cycle. In addition, the catchment is being used to test a cosmic ray soil water probe to evaluate surface soil water across extensive areas. To support the testing a large aperture scintillometer has been installed to estimate across the catchment. This network has been gradually installed over the past four years. The catchments are being extensively used as an open air laboratory for student training as well as training of technicians. To date the data has been used to monitor the recent drought, improve the spatial understanding of rainfall across the region and make recommendations for high altitude raingauge networks in South Africa.