

Estimation of probable maximum precipitation for dam design in Kenya



Project description

The Met Office was commissioned to carry out a study to estimate the probable maximum precipitation for the Ewaso Ngiro catchment in Kenya. The results of the study were used in the design of the spillway capacities for three new hydroelectric dams on the Ewaso River. The proposed dam sites were at Oletukat, Leshota and Oldorko with catchment areas of 2,900 km², 5,100 km² and 5,800 km² respectively.

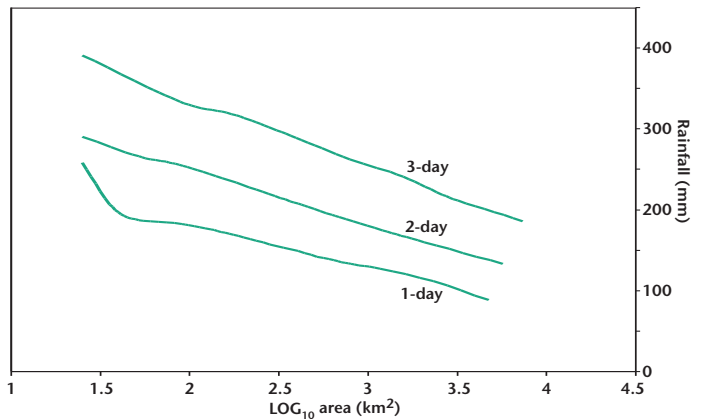
The Ewaso Ngiro catchment is situated on the western side of the Rift Valley in southern Kenya. The Ewaso Ngiro rises in the Mau escarpment and flows south to Lake Natron on the Tanzanian border. The climate is strongly influenced by the inter-tropical convergence zone bringing cloud and rain in April and November.

The probable maximum precipitation (PMP) was estimated using the World Meteorological Organization methodology. A depth-area-duration analysis was carried out for a number of significant storms of 1-, 2- and 3-day durations identified from rainfall records for the period 1950–1997. Maps of isohyets (lines of equal rainfall) were prepared for each storm duration with the rainfall values fitted by the inverse distance squared method using 3D

surface plotting software. The planar area contained within each isohyet was then plotted against average rainfall within the isohyet.

Each of the storms was maximised to estimate the rainfall which would have occurred if the atmospheric moisture with 100-year return period were available. The atmospheric moisture with 100-year return period was found from an analysis of a long series of records from a weather station in the catchment. The PMP for each catchment was then estimated by transposing maximised storms from nearby catchments and upland areas, adjusted for annual average rainfall to remove orographic influences. Finally, various spatial extent and distributions of PMP and non-PMP events were simulated to assess the impact of varying rainfall intensity across the catchment.

PMP curves for the Oletukat catchment.



Map of Kenya showing the Ewaso Ngiro catchment.



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