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Estimation of actual evapotranspiration using remote sensing data for lake-balance modeling in the Suguta Valley, northern Kenya Rift

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For hydrological modeling of paleolakes it is essential to quantify the actual evapotranspiration in the catchment. Traditionally, and in particular in remote areas of Africa, reliable data for evapotranspiration are not available for most basins studied for paleoclimate reconstructions. Thus the actual evapotranspiration of a 12,800 km2 large catchment area of the Suguta Valley, northern Kenya Rift, is determined by remote sensing data. The Suguta Valley was covered by a ca. 2,500 km2 large and almost 300 m deep lake during the so-called African Humid Period (AHP, 14.8 to 5.5 ka BP), which has now virtually disappeared. Using the satellite data we applied the Surface Energy Balance Algorithm for Land (SEBAL) to model spatial and temporal distribution of the actual evapotranspiration. The resulting evapotranspiration values of the Suguta Valley are then integrated into a water balance model in order to reconstruct the precipitation/evaporation balance of the modern Suguta Valley and then modified to estimate the paleoclimate conditions required to achieve the approximately 300 m deep paleolake Suguta. The results suggest a 21 % increase in precipitation as compared with modern values in the basin that is in the same order of magnitude as for other paleolakes in the East African Rift during the AHP.