

Hydrologic modeling of a small ungauged basin in the Sahel: calibration and results

Mikell P. Warms and Jorge A. Ramirez

Department of Civil and Environmental Engineering, Colorado State University

Abstract. The Sahelian region of Africa is a geographic belt directly south of the Sahara, connecting the desert to the wetter Sudanian and Guinean savannas to the South. The region is semi-arid, receiving only 300-600 mm of precipitation on average annually. In addition, the Sahel experiences severe dry seasons (7-9 months) with little to no rain. Measurement stations in the region are scarce and reliable data is often difficult to obtain. It is common for drainage basins throughout many parts of the world to be ungauged or gauged but deteriorating. Conventional hydrologic modeling techniques to calibrate and verify basin parameters are rarely applicable in these cases. This problem is exacerbated when human-induced changes to the land surface and climate change impacts lead to increased uncertainty. A recent hydrologic regime shift in parts of the Sahel has been observed and is the basis for this study. Traditionally, a lack of perennial water sources in the region limited settlement, and only seasonal grazing was commonplace. However, many of the previously ephemeral lakes in the region have become perennial or less drastically ephemeral, and settlements have begun to appear in these locations. Hypotheses of how this regime shift occurred, or whether this trend will continue were tested with a calibrated hydrologic model. This talk will: (1) address briefly the difficulty in calibrating hydrologic models in ungauged basins; (2) share the results of a unique calibration procedure; and (3) test project hypotheses using the calibrated hydrologic model in a case study of a small lake basin in Northern Mali.