Hydrology and Earth System Sciences
An Interactive Open Access Journal of the European Geosciences Union

Hydrol. Earth Syst. Sci., 12, 239-255, 2008
www.hydrol-earth-syst-sci.net/12/239/2008/

Assessment of impact of climate change on water resources: a long term analysis of the Great Lakes of North America

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Abstract. In the threshold of the appearance of global warming from theory to reality, extensive research has focused on predicting the impact of potential climate change on water resources using results from Global Circulation Models (GCMs). This research carries this further by statistical analyses of long term meteorological and hydrological data. Seventy years of historical trends in precipitation, temperature, and streamflows in the Great Lakes of North America are developed using long term regression analyses and Mann-Kendall statistics. The results generated by the two statistical procedures are in agreement and demonstrate that many of these variables are experiencing statistically significant increases over a seven-decade period. The trend lines of streamflows in the three rivers of St. Clair, Niagara and St. Lawrence, and precipitation levels over four of the five Great Lakes, show statistically significant increases in flows and precipitation. Further, precipitation rates as predicted using fitted regression lines are compared with scenarios from GCMs and demonstrate similar forecast predictions for Lake Superior. Trend projections from historical data are higher than GCM predictions for Lakes Michigan/Huron. Significant variability in predictions, as developed from alternative GCMs, is noted.

Given the general agreement as derived from very different procedures, predictions extrapolated from historical trends and from GCMs, there is evidence that hydrologic changes particularly for the precipitation in the Great Lakes Basin may be demonstrating influences arising from global warming and climate change.

Final Revised Paper (PDF, 1023 KB) Discussion Paper (HESSD)

Citation: McBean, E. and Motiee, H.: Assessment of impact of climate change on water resources: a long term analysis of the Great Lakes of North America, Hydrol. Earth Syst. Sci., 12, 239-255, 2008. Bibtex EndNote Reference Manager