HYDROCLIMATIC FLOOD TRENDS IN NEW ENGLAND: INSIGHTS FROM ANNUAL AND PARTIAL DURATION FLOOD SERIES AT CLIMATE-SENSITIVE STREAM GAGES WITH LONG RECORDS.

Mathias J. Collins, Hydrologist, National Oceanic and Atmospheric Administration, Gloucester, MA, Mathias.Collins@noaa.gov; William H. Armstrong, Student, Boston College, Department of Geology and Geophysics, Chestnut Hill, MA, armstrwa@bc.edu; Noah P. Snyder, Associate Professor, Boston College, Department of Geology and Geophysics, Chestnut Hill, MA, noah.snyder@bc.edu

Abstract: Long-term flow records for watersheds with minimal human influence have shown upward trends in recent decades at regional and national scales, especially for low flow quantiles like the annual minimum and annual median flows. Trends for high flow quantiles have been less clear, despite recent research showing increased precipitation in the conterminous United States over the last century brought about primarily by an increased frequency and intensity of events in the upper 10th percentile of the daily precipitation distribution – particularly in the Northeast. We investigate trends in 28 long-term annual flood series for New England watersheds with dominantly natural streamflow. The flood series have an average length of 75 years and are continuous through 2006. Twenty-five series show upward trends via the nonparametric Mann-Kendall test, 40% (10) of which are statistically significant ($p < 0.1$). An averaged standardized departures series for 23 of the study gages indicates that increased flood magnitudes in New England occurred as a step change around 1970. The timing of this is broadly synchronous with a phase change in the low frequency variability of the North Atlantic Oscillation, a prominent upper atmospheric circulation pattern known to effect climate variability along the United States east coast. Our analyses of the annual series at these sites suggest that the smaller, relatively higher frequency events have been disproportionally affected by hydroclimatic changes. To better understand high frequency flood trends, we investigated the partial duration series (PDS) for 23 of the 28 gages for which these data are available. Our PDS results support the annual series results and add more information: at nearly all of the gages the number of flood peaks per year has increased over the period of record. Many records suggest step changes in flood frequency around 1970 via the non-parametric Wilcoxon rank-sum test. High frequency floods (1- to 5-year recurrence interval) are "channel forming" flows and increases in their magnitude and frequency have implications for channel geometry, bed sediment grain size distribution, floodplain formation, and thus aquatic and riparian habitat. Hydroclimatic shifts in flood series also affect flood frequency estimates. Special treatment of the flood series can improve the analyses and provide better estimates of flood magnitudes and frequencies under the prevailing hydroclimatic condition.