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A SYNOPTIC CLIMATOLOGY OF FLOODING IN NEW ENGLAND

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1. INTRODUCTION

Flooding in New England is a function of latitude, location with respect to storm tracks and interaction with the local topography. There are a number of synoptic and mesoscale weather events which, either alone or more often in conjunction with orographic enhancement produce widespread or localized flooding. Proximity to large moisture sources is also crucial (Capriola, 1992). Existing studies have either focused on specific regions (e.g. Guttman and Ezell, 1979; Dupigny-Giroux and Hanning, submitted) or time periods (Capriola, 1992). Although flooding rains are not unique to the northeast, the relative role of moisture availability, instability and uplift mechanisms differ from the midwest (e.g. Chagnon and Kunkel, 1999) and Front Range of the Rockies, necessitating a thorough understanding as an important step towards enhanced forecasting and mitigation.

This paper presents the results of a subjective typing of conditions in New England that are the most common features associated with flooding in the region. The oral presentation will highlight the underlying causal dynamics of these flooding regimes as well as the modifying influences at both the meso- and local scale the set up preferred geographic regions for severe weather and flooding across New England

2. DATA & METHODOLOGY

The primary data set used in this study was the Northeastern U.S. Heavy Rain Event Precipitation Analyses, which was developed by Warren Snyder of the NWS/Albany office. Using archived data from the Hydrometeorological Prediction Center of NCEP for January 1993 to March 2001, he selected a 50.8 mm threshold of liquid water equivalent in 24 hours to determine which precipitation events should be included in the CSTAR project (Snyder, 2003; personal communication).

From the above analyses, a database was created of the spatial extent and corresponding isopleth values of each event. The Storm Data publication of the National Climatic Data Center was used to extract every account of flooding (coastal, urban/small stream, river) and flash flooding in each New England state. For each of these flooding rains scenarios, the NOAA Daily Weather Maps were examined for the prevailing surface and upper air (500-millibar height contours) features. Other ancillary data examined were temperature, humidity and pressure values.

3. RESULTS & DISCUSSION

From these coincident data sources, five major patterns of flood-related precipitation events emerged. These included synoptic occluded fronts; tropical cyclonic remnants; cold air damming; isolated thunderstorms and coastal fronts. With the exception of the isolated thunderstorms, the other categories mirror Capriola's (1992) findings on flood-producing precipitation in the eastern U.S.

In the case of the occluded fronts and the tropical cyclonic remnants, negatively tilted upper level flow was conducive to the persistence of the systems as well as facilitating moisture advection into the region. In contrast, the isolated thunderstorms that produced flash flooding, were mesoscale events that occurred under zonal upper level flow. Occluded fronts were also the most common cause of flooding in New England and the most widespread in spatial extent.

The seasonality, precipitation totals and temporal distribution of each event type were examined. In terms of overall precipitation characteristics, the hurricane remnants produced the largest totals, followed by coastal fronts and occluded fronts. With the exception of cold-air damming situations which lasted on the order of 2-3 days, the other four types had durations of 1-2 days.

Using the commonly defined meteorological seasons, it was interesting to note that flooding from occluded fronts was most dominant in the spring. There was little difference in the other three seasons, with a slight increase in the winter. Hurricane-related flooding was largely a fall occurrence, while the cold-air damming cases were exclusive to the winter. Moisture excess resulting from coastal cold fronts and isolated thunderstorms were

absent in the winter and roughly distributed over the other three seasons with a slight bias towards the summer.

4. SUMMARY

For the time period of interest, most of the flooding in New England occurs in the spring, largely as a result of the passage of occluded front, but also due to timing of other factors such as snowmelt and the hydrologic characteristics of rivers in the region. Most flooding events are precipitated by mesoscale and synoptic events that last 1-2 days.

5. REFERENCES

Capriola, S.J., 1992: An analysis of synoptic scale flood events in the eastern United State during 1980-1989, Eastern Region Technical Attachment, No. 92-5A.

Chagnon, S.A. and Kunkel, K.E., 1999: Synoptic and mesoscale features (Record Flood-Producing Rainstorms of 17-18 July 1996 in the Chicago Metropolitan Area, Part 1), *Journal of Applied Meteorology*, **38**(3):257-266.

Dupigny-Giroux, L.-A. and Hanning, J.R., Topographic enhancement of frontally-produced flooding in northern Vermont - 14-15 July , 1997, submitted to *Physical Geography*

Guttman, N.B. and Ezell, D.S., 1979: Flash flood climatology for Appalachia, *Bulletin of the American Meteorological Society*, **60**(11):1386.

Snyder, W., 2003: Science Operations Office, National Weather Service, Albany New York.