

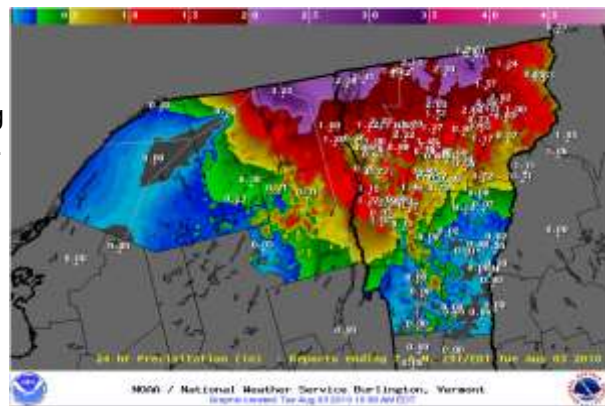
Heavy Rainfall and Flooding of 2-4 August 2010

Overview

During the afternoon and overnight hours from August the 2nd to the 3rd, the portions of far northern New York and the northern counties of Vermont were affected by two discrete rounds of heavy rainfall, the second of which produced considerable flooding. During this period a nearly stationary warm frontal boundary was oriented northwest to southeast across the region along with an anomalously moist airmass. With a fast moving upper jet stream in a position to provide favorable lift for the development of showers and thunderstorms the stage was set for heavy to excessive rainfall. This setup closely mimics conditions identified by the National Weather Service in Burlington during the significant flooding event across northeastern Vermont on 12 June 2002, though as with any case there were some differences. In particular, this most recent event was characterized more by discrete convective elements as opposed to a heavier stratiform rainfall which occurred in the 2002 case. Regardless of these differences however, two of the most important factors leading to flooding were present in this most recent case. These were 1) the slow moving nature of the precipitation over the same areas on consecutive days, and 2) antecedent moist ground conditions (Jessup et al. 2006).

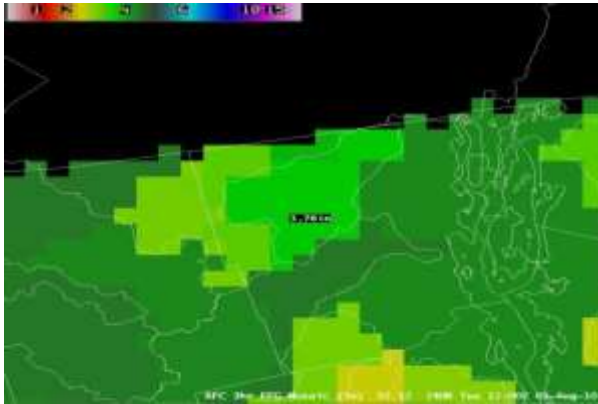
August 2-3 Antecedent Rainfall

The first round of heavy rainfall developed across the northern Champlain Valley during the early to mid-afternoon hours on August 2nd and gradually grew in intensity and areal coverage as the evening progressed into the early morning hours on the 3rd. By Tuesday morning on the 3rd, widespread 1 to 3 inch totals were observed at many locales from Clinton County, New York eastward across northern Vermont with isolated totals around 3.5 inches noted in the Ellenburg Depot, NY and Newport, VT areas (Figure 1). The Northeast Regional Climate Center defines 3.2 inches of rain in 6 hours at Ellenburg Depot NY as having a 2 percent chance of occurrence in any given year (50 year recurrence interval). Scattered reports of wind damage and large hail were also received with this first round of convection, though with antecedent conditions being quite dry no major flooding problems were observed despite sharp rises in numerous small streams.

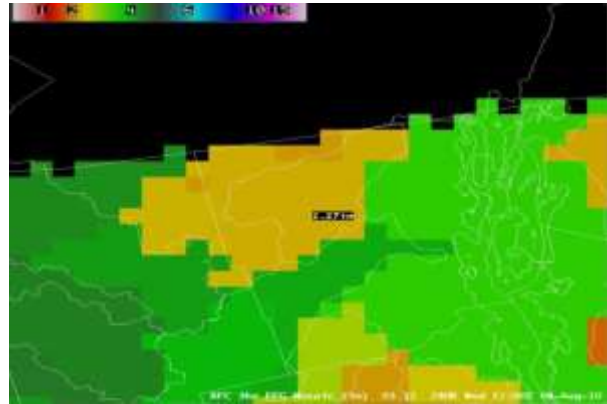


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The NWS Northeast River Forecast Center issues Flash Flood Guidance twice daily, and is an estimate of the rainfall required to cause small streams to flood. During dry periods Flash Flood Guidance for a given area is relatively higher than it is in wet periods, indicating it would take more rain to cause flash flooding in a dry period than a wet period. This was true leading up to the August 2-3 rain, when Flash Flood Guidance for northern Clinton County was relatively high. Following the rainfall, Flash Flood Guidance lowered in response to the rainfall. Flash Flood guidance issued at 1200 UTC on August 2 indicated 3.76 inches of rain was needed in 3 hours to generate flooding in the Great Chazy River basin (Figure 2), while guidance issued at 1200 UTC on August 3 following the rain suggested only 2.27 inches of rain was required in a 3 hour period to cause flooding (Figure 3). Although the rainfall did not cause flooding, soil conditions across northeastern New York and northern Vermont became saturated. Rivers and streams were also running full of the previous day's runoff, and the stage was set for flooding when the next night's rainfall occurred.



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August 3-4 Flooding

During the late afternoon and evening hours of Tuesday, August 3 additional heavy shower and thunderstorm activity developed across nearly the same areas affected by the prior night's rainfall. This was likely due in part to a subtle low level surface boundary left across the area from the prior night's convection. These low level boundaries are often difficult to diagnose using traditional surface observations and satellite data is typically used in combination with other model data to boost forecaster confidence of an existing feature. With the semi-stationary boundary in place, a [Flash Flood Watch](#) was issued around noon on the 3rd highlighting the potential for flash flooding across the threat area from northeastern New York east across northern Vermont.

One additional feature of many flash flooding events is a phenomenon known as training. Essentially when certain parameters are in place thunderstorms form and repeatedly track, or "train" across the same area during a several hour period often leading to excessive rainfall amounts (Figure 4). This was certainly the case across northeastern New York and northern Vermont during the evening hours on the 3rd when showers and thunderstorms moved repeatedly over the same areas of northern New York and Vermont (Figure 5).

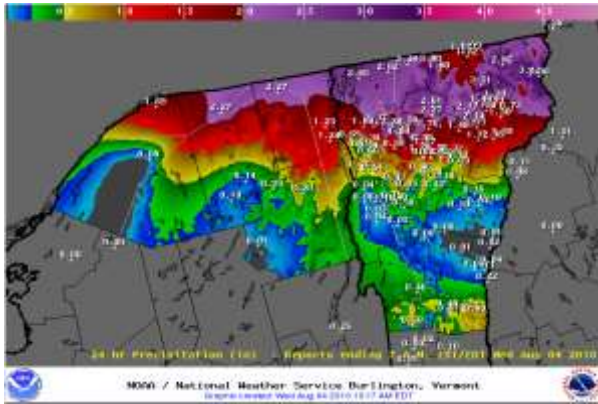


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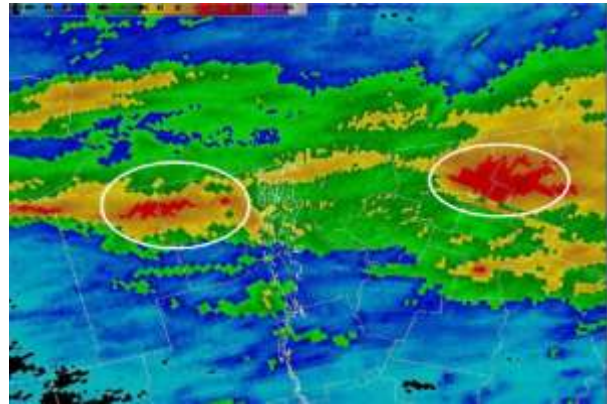


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Additional rainfall totals of between 1 and 4 inches were observed (Figures 6 and 7). These amounts proved more than enough to spark sharp rises on many rivers and smaller streams from Clinton County, New York eastward across Franklin, Chittenden, Lamoille, Orleans, Caledonia and Essex Counties in Vermont (Figure 8).

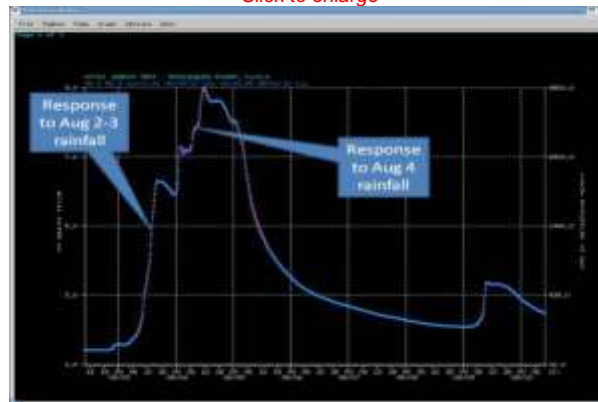


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One of the hardest hit areas was in northern Clinton County, New York near the town of Ellenburg Depot where two day rainfall totals exceeding 5 inches were observed. This pushed local streams as well as the North Branch of the Great Chazy River out of their banks during the early morning hours on August 4th. For Ellenburg Depot, 3.25 inches of rain was reported the morning of August 3 for the previous day's rainfall, and an additional 2.27 inches was reported on the morning of August 4.

The [Northeast Regional Climate Center](#) provides analyses of precipitation frequency for various rainfall durations. For the August 2-3 rainfall, the 3.25 inches at Ellenburg Depot had a probability of occurrence of 2 percent (50 year recurrence interval), while the next day's 2.27 inch rainfall had a 10 percent chance of occurrence (10 year recurrence interval). Interestingly, the heavier and more rare rainfall produced no flooding on August 2-3, while lesser amounts produced significant flooding the following day. This illustrates the significance of the previous day's rainfall in creating wet antecedent conditions and setting the stage for flooding.

Numerous roads and several locations were inundated by high water including La Barre's Corner Store along Route 11 along with the Blue Haven and the Ranch Side Park campgrounds. At the latter site several campers were perilously trapped by the quickly rising water, eventually requiring rescue by local safety volunteers (Figure 9). Another area affected by the excessive rainfall across portions of northeastern Vermont, particularly in the Orleans town of Westmore where several summer camps were affected by high water requiring evacuations (Figure 10).

Videos of the flood rescue from Home Town Cable can be found [here](#), and a full length version is [here](#). A video of the flood's aftermath is available [here](#). (Linked with permission)



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The threat of additional flooding ended as drier weather returned by later on the 4th into the 5th and water began to recede. This latest event once again brings awareness to the threat flash flooding poses to the North Country each summer, and the potentially serious consequences should anyone become trapped by fast flowing high water. The National Weather Service in Burlington has responsibility for all hydrologic forecasts and warnings for northern New York and most of Vermont, and will continue to strive for timely and accurate forecasts of flooding across these areas.