Exceedance Probability Analysis for the Louisiana Rainfall Event, 11-13 August 2016

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The Hydrometeorological Design Studies Center (HDSC) has analyzed annual exceedance probabilities (AEPs) of the worst case rainfall for the Louisiana rainfall event from 11-13 August 2016. AEP is the probability of exceeding a given amount of rainfall for a given duration at least once in any year at a given location. It is an indicator of the rarity of rainfall amounts and is used as the basis of hydrologic design.

For the AEP analysis, we look at a range of durations and select one or two critical durations that show the lowest exceedance probabilities for the largest area, i.e., the "worst case." Since the beginning and ending of the worst case period are not necessarily the same for all locations, the AEP maps do not represent isohyets at any particular point in time, but rather within the whole event. The rarity of this event is illustrated in the figures below.

Figure 1 shows how the maximum observed rainfall amounts compare to corresponding rainfall (precipitation) frequency estimates for AEPs up to 1/1000 (0.1%) for durations from 1 hour to 60 days for the Hydrometeorological Automated Data System's rain gauge in Louisiana: WBHL1, White Bayou at Highway 64 Near Zachary 2SE (30.6361°N, 91.1272°W). The AEPs are estimates from the NOAA Atlas 14 Volume 9 data table (Figure 2) showing frequency estimates with the 90% confidence interval bounds for this location for a range of AEPs and durations. The upper confidence limit for 1/1000 AEP is also shown in the figure to illustrate the uncertainty associated with the AEP calculation (which increases as the AEP becomes smaller). As can be seen from Figure 1, observed rainfall amounts at this location have probabilities less than or equal to 1/1000 for daily durations up to 20 days.

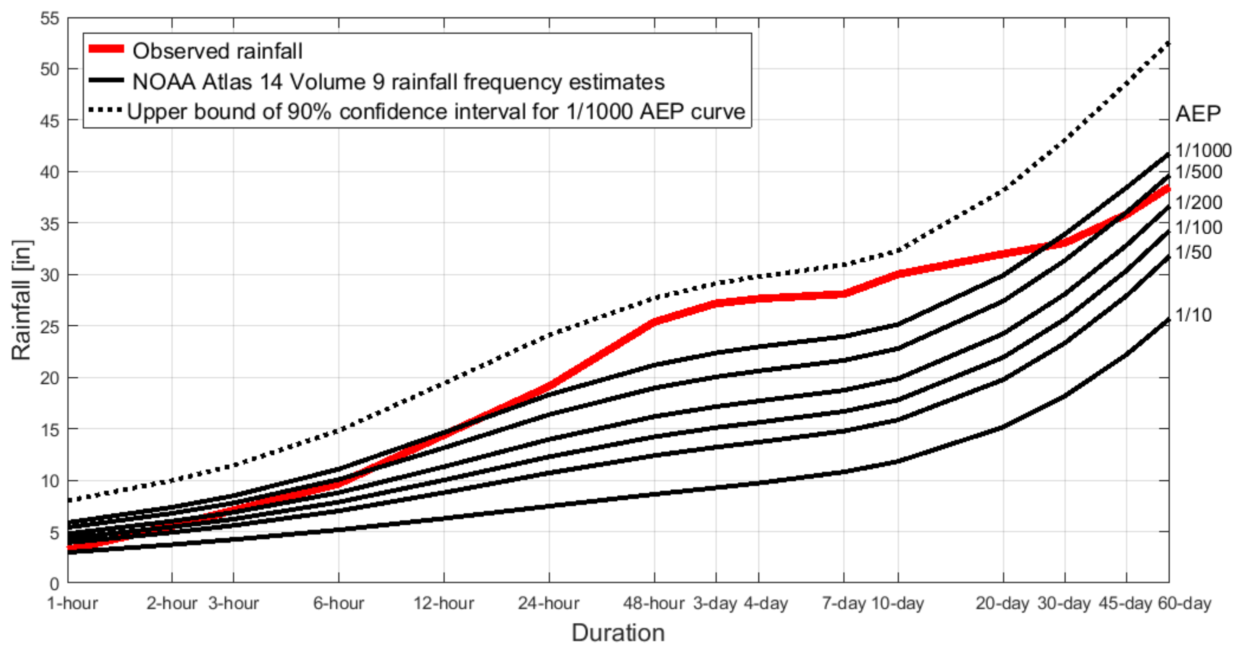
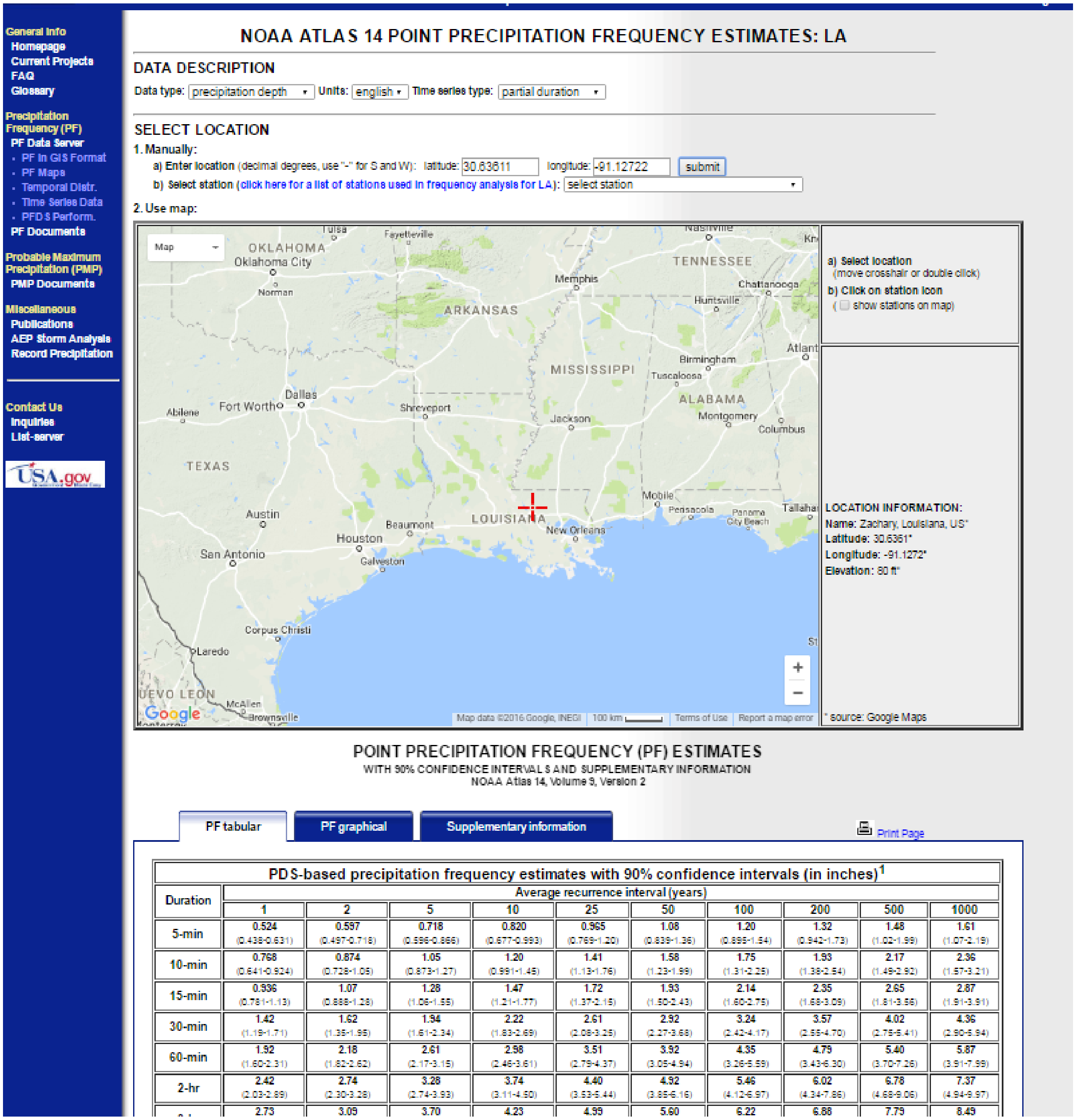


Figure 1. Maximum observed rainfall amounts in relation to corresponding rainfall frequency estimates for the WBHL1 gauge.



Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.524 (0.438-0.631)	0.597 (0.497-0.718)	0.718 (0.596-0.866)	0.820 (0.677-0.993)	0.965 (0.769-1.20)	1.08 (0.839-1.36)	1.20 (0.895-1.54)	1.32 (0.942-1.73)	1.48 (1.02-1.99)	1.61 (1.07-2.19)
10-min	0.768 (0.641-0.924)	0.874 (0.728-1.05)	1.05 (0.873-1.27)	1.20 (0.991-1.45)	1.41 (1.13-1.76)	1.58 (1.23-1.99)	1.75 (1.31-2.25)	1.93 (1.38-2.54)	2.17 (1.49-2.92)	2.36 (1.57-3.21)
15-min	0.936 (0.781-1.13)	1.07 (0.888-1.28)	1.28 (1.06-1.55)	1.47 (1.21-1.77)	1.72 (1.37-2.15)	1.93 (1.50-2.43)	2.14 (1.60-2.75)	2.35 (1.68-3.09)	2.65 (1.81-3.56)	2.87 (1.91-3.91)
30-min	1.42 (1.19-1.71)	1.62 (1.35-1.95)	1.94 (1.61-2.34)	2.22 (1.83-2.69)	2.61 (2.08-3.25)	2.92 (2.27-3.68)	3.24 (2.42-4.17)	3.57 (2.55-4.70)	4.02 (2.75-5.41)	4.36 (2.90-5.94)
60-min	1.92 (1.60-2.31)	2.18 (1.82-2.62)	2.61 (2.17-3.15)	2.98 (2.46-3.61)	3.51 (2.79-4.37)	3.92 (3.05-4.94)	4.35 (3.26-5.59)	4.79 (3.43-6.30)	5.40 (3.70-7.26)	5.87 (3.91-7.99)
2-hr	2.42 (2.03-2.89)	2.74 (2.30-3.28)	3.28 (2.74-3.93)	3.74 (3.11-4.50)	4.40 (3.53-5.44)	4.92 (3.85-6.16)	5.46 (4.12-6.97)	6.02 (4.34-7.86)	6.78 (4.68-9.06)	7.37 (4.94-9.97)
	2.73	3.09	3.70	4.23	4.99	5.60	6.22	6.88	7.79	8.49

Figure 2. NOAA Atlas 14 precipitation frequency depths with lower and upper bounds of the 90% confidence interval for a selected location (not all durations are shown in the figure).

The map in Figure 3 shows the worst case 48-hour rainfall in inches. The map in Figure 4 shows the areas that experienced maximum 48-hour rainfall magnitudes with AEPs ranging from 1/10 (10%) to smaller than 1/1000 (0.1%). Maximum 48-hour rainfall amounts were derived from the National Centers for Environmental Prediction, Environmental Modeling Center's [Stage IV analysis dataset](). Stage IV data is a mosaicked product of regional hourly and 6-hourly multi-sensor (radar + gauges) precipitation estimates produced by the National Weather Service's River Forecast Centers. 6-hourly rainfall grids were aggregated to overlapping 48-hour periods, and the maximum amount of rainfall was extracted for each grid cell inside the area of interest. The maximum 48-hour rainfall grid was then converted to an AEP map by comparing the values to 30 arc-seconds gridded NOAA Atlas 14 Volume 9 rainfall frequency estimates.

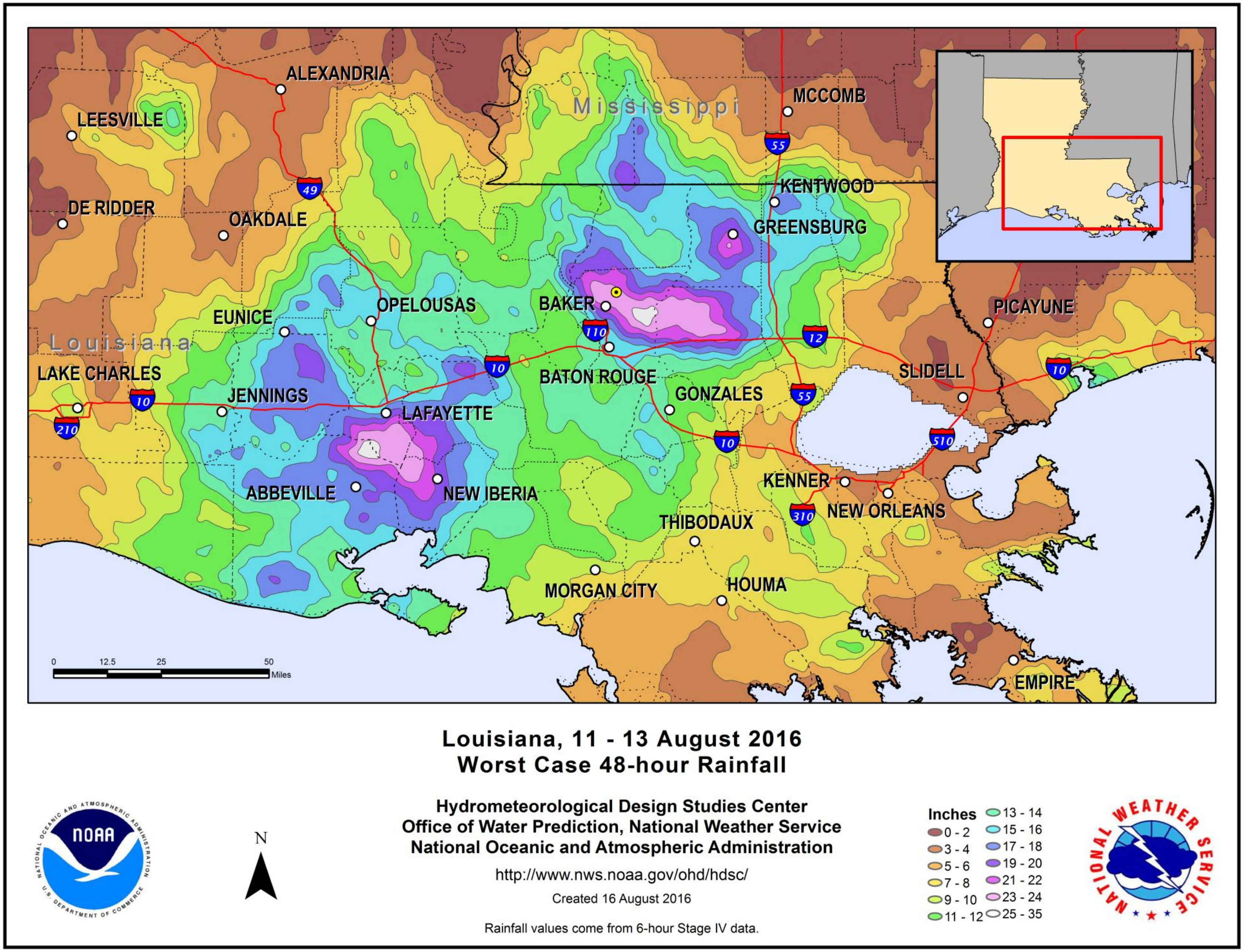


Figure 3. The worst case 48-hour rainfall in units of inches.

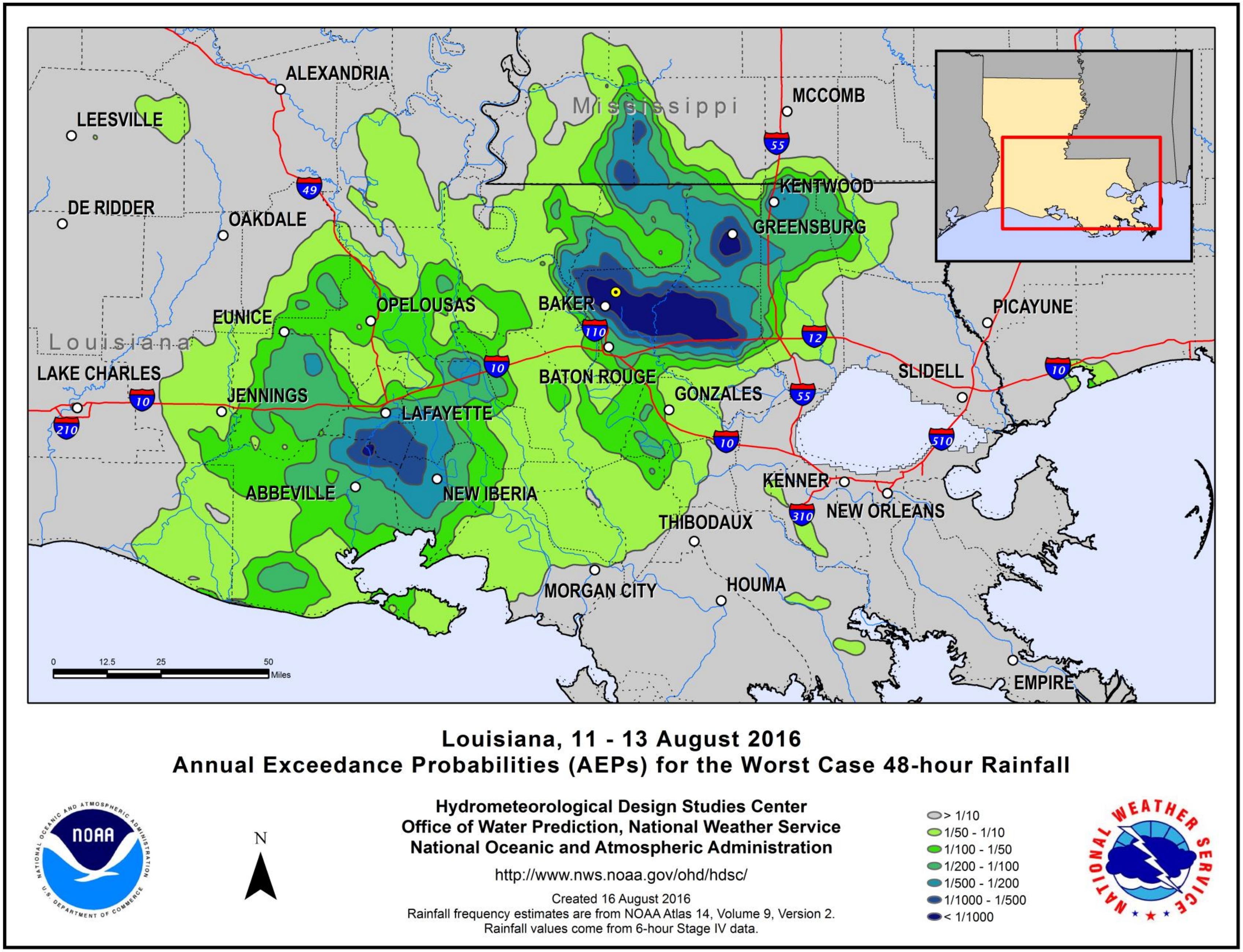


Figure 4. Annual exceedance probabilities for the worst case 48-hour rainfall.