# Special Climate Summary

# Blocking Conditions and Excessive Rainfall in New England during 12-15 May 2006

Record rainfall fell over portions of northeastern Massachusetts, southern New Hampshire and southern Maine during 12-15 May 2006, resulting in flooding in the region comparable to the most extreme events during the last 70 years. Rainfall totals in Essex county Massachusetts exceeded 12" at Salisbury, Rockport and Topsfield. (For a complete summary of the storm and rainfall totals throughout southern and central New England see:
http://www.erh.noaa.gov/box/displayazone.php?product=BOSPNSBOX&version=0

This special climate summary focuses on features of the large-scale circulation pattern that contributed to this extreme event.

The mean mid-level (500-hPa) height and height anomaly patterns for the period 12-15 May 2006 (**Fig. 1**) show a deep trough over the Great Lakes and Ohio Valley, a strong ridge over eastern Canada and another trough over the east-central North Atlantic. The mean 500-hPa wind over central New England was from the southeast (white arrow in **Fig. 1**). The structure of the 500-hPa flow over the Atlantic and eastern North America has characteristics of a blocking pattern (strong ridge flanked by two closed cyclonic circulation systems or troughs). In regions where blocking occurs, synoptic systems (fronts, lows and highs) tend to move more slowly or are nearly stationary. Blocking conditions can last for several days or more, resulting in persistent wet conditions in the vicinity of the troughs (especially along the eastern flank) and dry conditions in the vicinity of the ridges. The low-level (850-hPa) wind during this period (**Fig. 2**) shows a cyclonic circulation covering the entire eastern United States, with a center of circulation over southern Michigan. The persistent very strong southeasterly flow of moist Atlantic air over central New England, with precipitable water values of 20-25 mm (**Fig. 2**, right panel), contributed greatly to the excessive rainfall totals observed in the region (**Fig. 3**). Situations like this one often feature a "training" effect in which precipitating clouds move over the same area along the direction of the mean flow, resulting in excessive rainfall and flooding.

Blocking conditions over the Atlantic are most frequently observed during winter and spring (**Fig. 4**). In the beginning of May 2006 a block formed in the vicinity of Scandinavia (**Fig. 5**). As is quite often the case, the blocking ridge shifted westward with time (retrograde motion) at high latitudes, passing over Greenland (20ºW-50ºW) during 6-12 May and over eastern Canada (60ºW-90ºW) during 12-15 May, setting the stage for the extreme precipitation event over New England. The position of the blocking ridge over the Maritime Provinces of eastern Canada in combination with the nearly stationary low pressure system over the lower Great Lakes produced a strong fetch of moist Atlantic air into central New England, leading to the exceptional rainfall totals observed during

12-15 May 2006. Subsequently, the blocking ridge continued to move westward across central Canada and by 17 May was located over western North America, contributing to excessive warmth and dry conditions over the western United States.

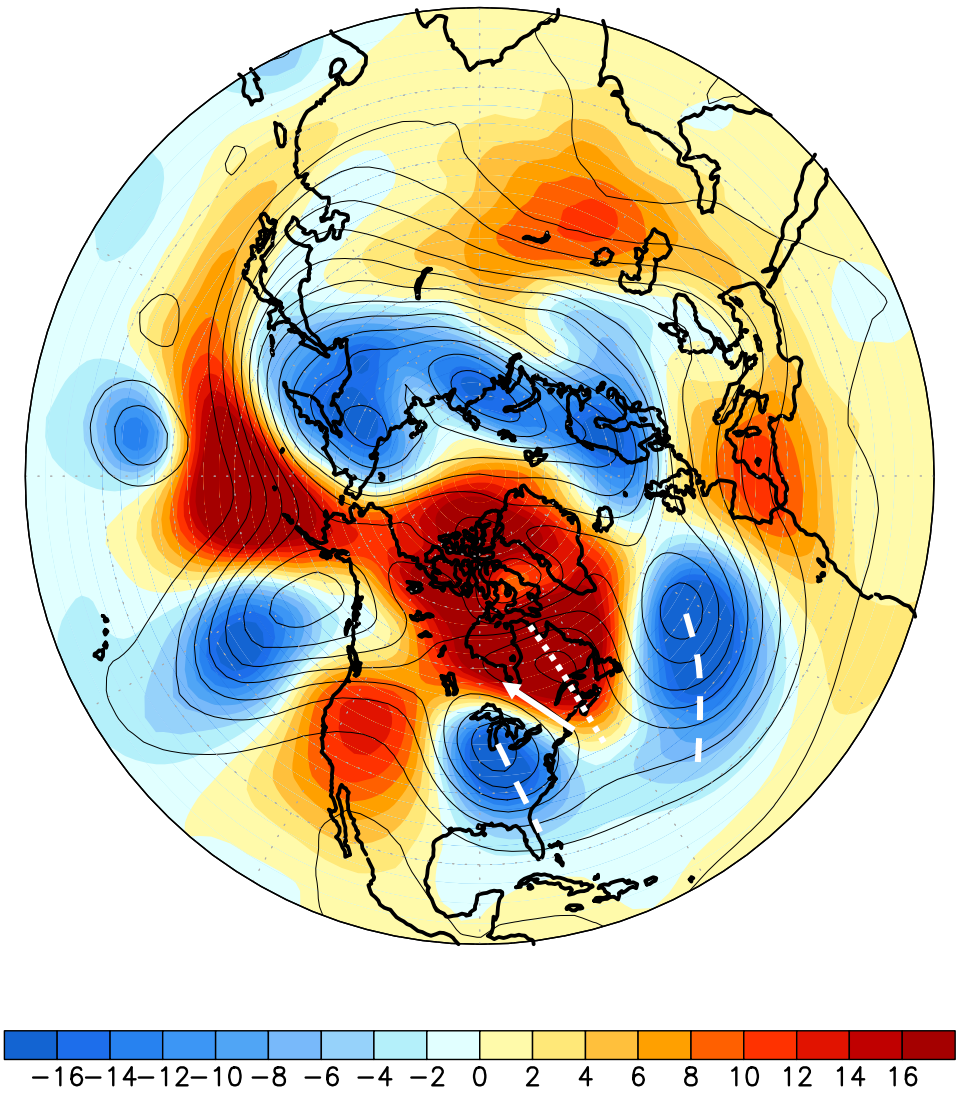


Figure 1. Mean 500-hPa height (contours, contour interval 60 m) and height anomalies (shading, units are decameters) for 12-15 May 2006. Anomalies are departures from the 1979-1995 base period means. The blocking ridge axis is indicated by the dotted white line, and the flanking trough axes are indicated by dashed white lines. The direction of the 500-hPa wind over central New England is indicated by the white arrow.

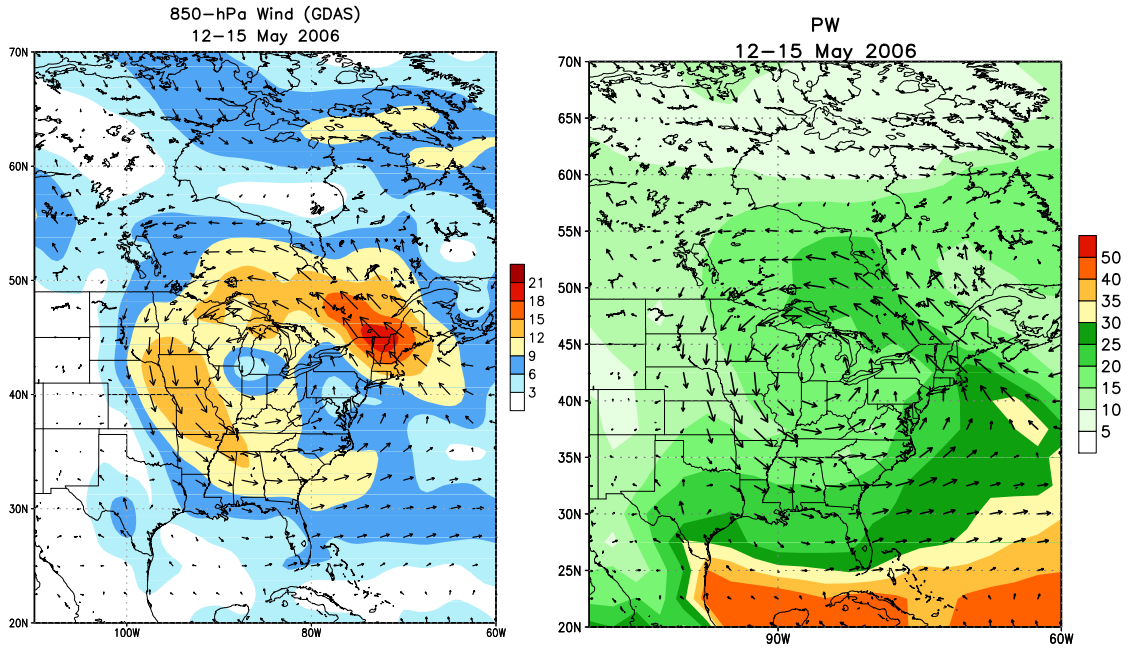


Figure 2. Mean 850-hPa wind (vectors in both panels), wind speed (shading in left panel) and total precipitable water (shading in right panel). Units are m $s^{-1}$ for wind speed and mm for precipitable water.

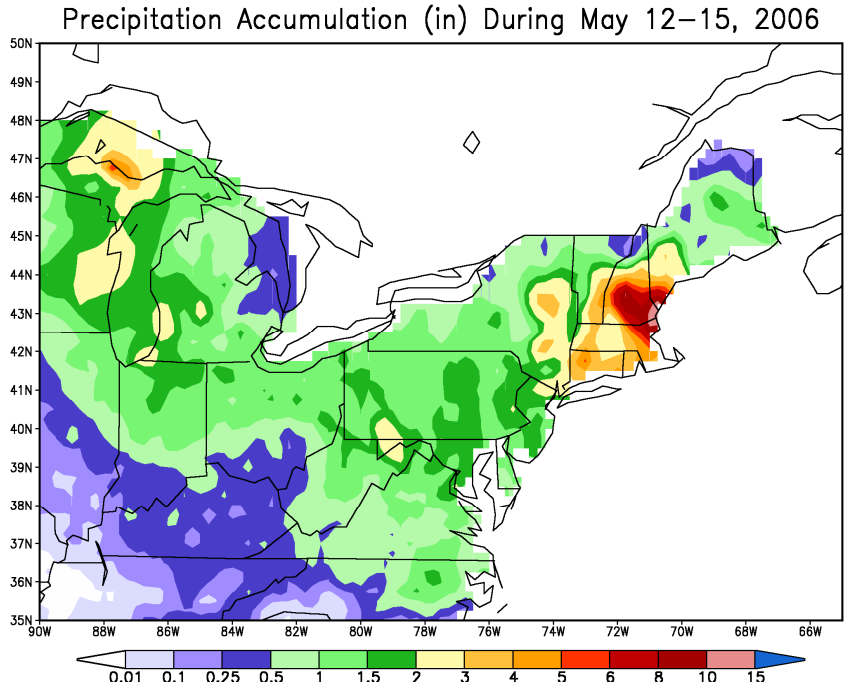


Figure 3. Total precipitation (inches) for the period 12-15 May 2006. Totals are computed from the CPC gridded daily analyses.

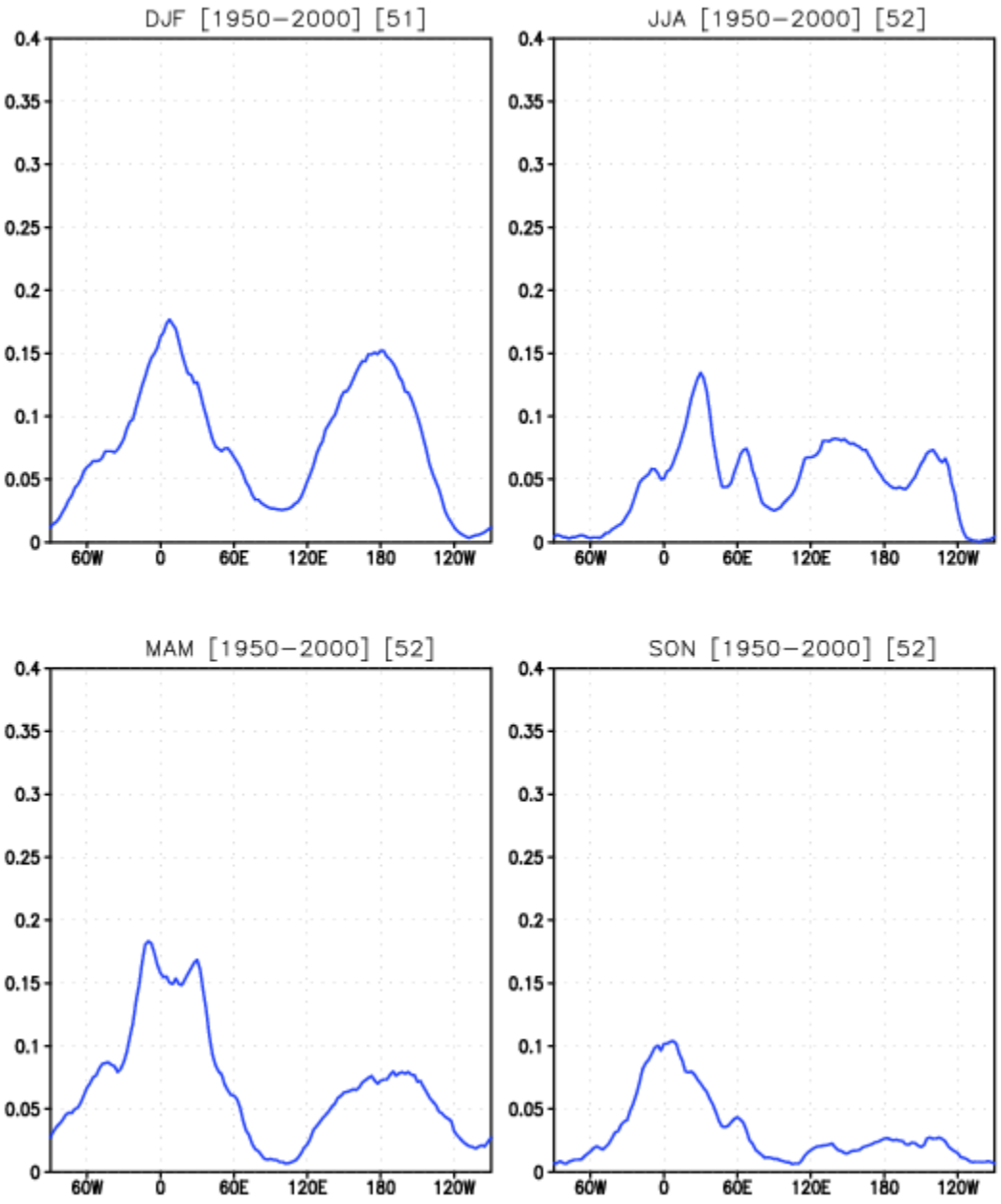


Figure 4. The frequency of "blocked days" in the Northern Hemisphere in each of the four traditional seasons (DJF, MAM, JJA, SON), based on the blocking index of Tibaldi and Molteni (1990). The results were computed using the NCEP/NCAR CDAS/reanalysis archive for the period 1950-2000.

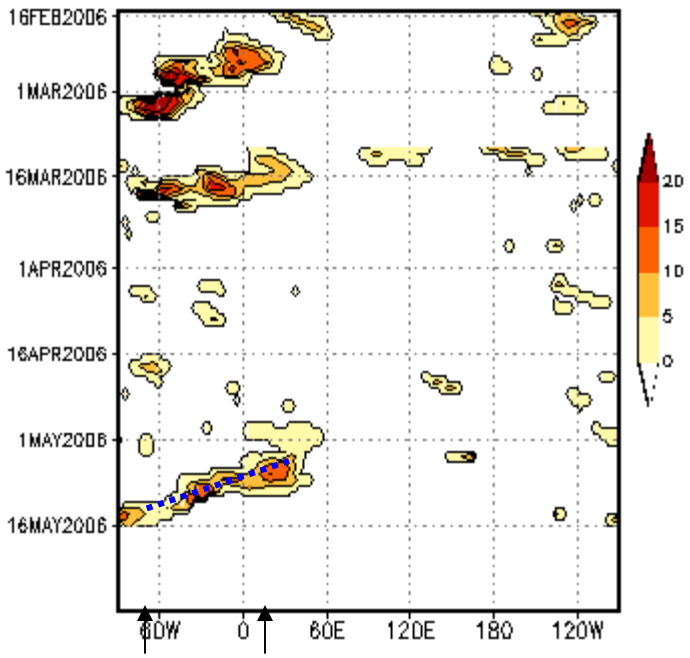


Figure 5. Time (increasing downward) versus longitude plot of the blocking index described by Tibaldi and Molteni (1990). The westward moving (retrogressing) blocking pattern is indicated by the dotted blue line. The longitude of Scandinavia is ~20ºE and the longitude of eastern North America is ~70ºW are indicated by the two arrows at the bottom of the figure. This figure (updated on 16 May 2006) was taken from the CPC web site at: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/block.shtml