A Homogeneous Record (1896–2006) of Daily Weather and Climate at Mohonk Lake, New York*

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(Manuscript received 12 March 2009, in final form 8 October 2009)

ABSTRACT

Reliable, long-term records of daily weather and climate are relatively rare but are crucial for understanding long-term trends and variability in extreme events and other climate metrics that are not resolvable at the monthly time scale. Here, the distinct features of a continuous, long-term (1896–2006) daily weather record from Mohonk Lake, New York, are highlighted. The site is optimal for daily climate analyses, since it has experienced negligible land-use change, no station moves, and has maintained methodological and instrumental consistency over the entire period of record. Unlike many sites, the site has always used maximum/minimum thermometers rather than shifting to the automated Maximum/Minimum Temperature Sensor. Notable results from the analysis of this record include 1) a warming trend driven largely by trends in maximum temperatures, especially during summer, 2) increasing diurnal temperature range during summer, and 3) a reduction in the number of freeze-days per year with little change in the length of the freeze-free season. These findings deviate from some regional level trends, suggesting there may be value in revisiting selected, consistently monitored, and maintained stations similar to Mohonk for focused analyses of regional climate change.

1. Introduction

Over the last several years, potential errors and biases in the instrumental records of land and ocean temperatures have highlighted the difficulty in accurately and precisely measuring variability in surface climate. Known challenges include station microclimate and siting (Pielke et al. 2002; Gallo 2005; Vose et al. 2005b), land-use/land-cover changes (Bonfils et al. 2008), bias introduced by instrumentation (Quayle et al. 1991; Lin and Hubbard 2004; Hubbard et al. 2004), and discontinuities in merged data products (Thompson et al. 2008). These persistent issues are unsettling, given that the instrumental record is used extensively in studies of climate change and variability. A brief examination of station histories from the U.S. Historical Climatology Network (USHCN) highlights potential sources of these problems—station moves (documented and undocumented), changes in instrumentation, and general lack of oversight or consistency among observers (Daly et al. 2007). One of the major problems has been the shift in the last few decades by the National Weather Service (NWS) to replace maximum/minimum thermometers with the automated Maximum/Minimum Temperature Sensor (MMTS; Quayle et al. 1991). In theory, the goal was to reduce observer bias and allow for continuous recording. Measurements from the MMTS, however, suffer from major errors and biases unrelated to temperature, making them difficult

* Lamont-Doherty Earth Observatory Contribution Number 7324.

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DOI: 10.1175/2009JAMC2221.1

to compare with measurements from other sites or even maximum/minimum temperature measurements from the same sites (Hubbard et al. 2004; Lin and Hubbard 2004). In fact, the USHCN states explicitly in their metadata for the network that MMTS measurements are largely unsuitable in analyses of daily data (Williams et al. 2006):

> Unfortunately, because large samples of side-by-side overlapping measurements are not available, site-specific corrections cannot yet be derived and only large-scale temperature changes can be corrected. Furthermore, daily biases, which are likely to be dependent on synoptic conditions, are unlikely to be the same from day to day. Thus, to date there has been no attempt to adjust the daily temperature data from the HCN/D for these instrument-induced biases.

Correcting errors in the instrumental record is an active area of research, with some mixed success (Peterson 2003; Allard and Keim 2007). Temporal and spatial averaging, compositing, and adjusting of these records can help to reduce some of these problems but often lead to a loss of spatial and temporal resolution. It can therefore be difficult to find data suitable for investigating trends and variability in meteorological and climate events at finer resolutions over long time scales. There are, however, some station records that are consistently monitored and maintained to the extent that we have a high level of confidence in the fidelity of their daily-resolution data. Analysis of these stations may provide further insight into how climate and weather events at a finer time scale have changed over time and provide points of comparison for nearby, potentially less reliable, records. Here we examine one such meteorological record from Mohonk Lake, New York (USHCN substation 305426; National Climatic Data Center station identifier 20019566). This site is unusual in many respects, primarily in that it explicitly avoids many of these same errors plaguing other stations in the United States and the world. For this study, we reexamined the Mohonk Lake records of daily precipitation and temperature including variables dependent on data at finer temporal resolutions, and place this record within the context of regional climate change and variability.

2. Data and methods

a. Site description and station history

The Mohonk Preserve Daniel Smiley Research Center is located in New York 135 km north of New York City near the Hudson Valley village of New Paltz (Fig. 1). The preserve sits 380 m above sea level on a quartzite conglomerate ridge above the Hudson River Valley and

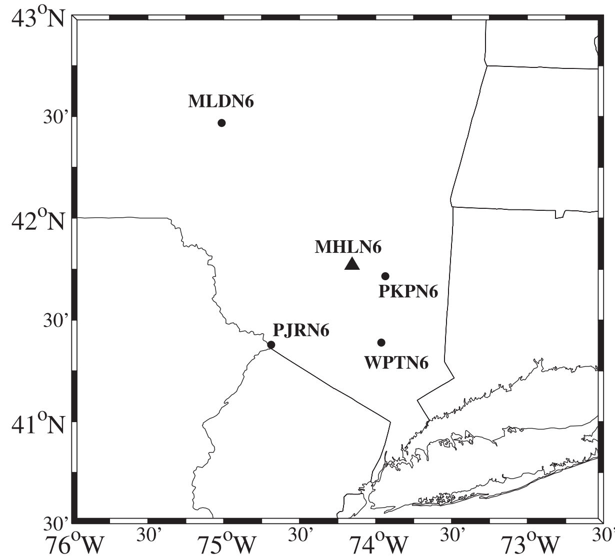

FIG. 1. Map of station location for Mohonk Lake, NY, as well as nearby stations used for comparison in Fig. 2. Stations are marked using their NWS station identifier: MHLN6 = Mohonk Lake, MLDN6 = Maryland, PJRN6 = Port Jervis, PKPN6 = Poughkeepsie, and WPTNN6 = West Point.

is far from the influence of any urban heat island effects or large water bodies (other than the small, 4.5-ha Mohonk Lake and the Hudson River, about 10 km to the east). The Mohonk Cooperative weather station was established by Albert Smiley in 1896, under guidance and direction from the U.S. Weather Bureau (USWB), which would later become the NWS. Official siting guidelines from the USWB at the time advised the following (Huth and Smiley 2007):

> The main requirements as to the exposure of the instruments are: That the thermometers be located where they will not be affected by any artificial heat, and so that neither the thermometers nor their immediate surroundings are heated by the direct rays of the sun . . . The rain gauge should be placed in an open spot, as far as possible from high buildings and trees.

Following these guidelines, Albert Smiley installed the Stevenson box 6.2 m from a field house (used for equipment storage) on the property, under an open-canopy chestnut oak tree, with several other open-canopy trees surrounding the site (both the house and trees predated the installation of the Stevenson box by at least 20 years). The rain gauge was placed at the end of the Mohonk boat wharf, 46 m from the shore; the rain gauge did not and does not use any wind shelter.

The Stevenson screen thermometer shelter and rain gauge have never been moved from their original locations. The rain gauge is the same gauge installed in 1896, and the maximum/minimum thermometers have been periodically replaced with comparable thermometers issued by the NWS. Two major environmental changes have been made to the site of the Stevenson screen. In the 1960s, the field house was renovated and fitted for internal heating. On 9 November 1983, the chestnut oak tree sheltering the Stevenson screen was cut down, although a 7-ft-tall stump (1 ft ≈ 30.5 cm) and the surrounding trees were left in place to help to preserve the original environment. The only significant (significance level $p < 0.05$) discontinuity in the temperature record associated with the tree removal was for maximum temperatures during June–August (JJA), based on the Chow break-point test. The detection of the break-point, however, is caused by a change in the slope of the trend, a change that begins around 1970, over 10 years prior to the removal of the tree. It is not a discontinuous step change in the mean that would be expected if an abrupt change in site characteristics affected the temperature record. The trend change appears to reflect a real change in climate at Mohonk Lake, and we conclude that the tree removal had no significant effect on the Mohonk Lake temperature record.

An MMTS system, operating in parallel with the maximum/minimum thermometer measurements, was installed in 1991 but was discontinued soon thereafter because of numerous operational problems. The local area has not changed extensively with regard to urbanization, deforestation, or other land-use changes. Over the entire period of record (1896–present) there have been six primary observers, all of whom had multiple years of overlap assisting their predecessors. All of these factors help substantially to reduce both observer errors and contamination of the regional climate signal by local factors, making the observations more likely to reflect local manifestations of large-scale climate variability. Data from the Mohonk meteorological record have already been used for climatic and ecological applications, with good success and minimal corrections or processing (e.g., Abrams and Orwig 1995; Cook et al. 2008).

b. Data description

All meteorological records (temperature and precipitation) were digitized and transcribed from the original notecard observations by employees at the Daniel Smiley Research Center at the Mohonk Preserve. The only missing values are for precipitation (37 total days missing from 3 years: 1901, 1908, and 1909). All of the original hard-copy records were visually inspected and were corrected for errors related to transcription.

Within the record, the largest and most significant outliers are minimum temperatures during the summer of 1920 (JJA). Recorded monthly average minimum temperatures during these months in 1920 are 7.15°, 9.01°, and 10.07°C, for June, July, and August, respectively. Climatological monthly average minimum temperatures for the same months during the same period (24 yr before and after, 1896–1944, excluding 1920) are 14.02°, 16.79°, and 15.60°C, respectively. The magnitude of the difference between summer 1920 minimum temperatures and the climatological values, as well as the lack of similar anomalies at nearby stations, suggests that these recorded temperatures are a nonclimatic aberration in the record. Based on a suggestion by a reviewer, a revisit of the original records suggests that the most likely source of the error was incorrect reading of the minimum temperature off the indicator bar (or "dumbbell") in the thermometer—a problem that is not unique to the Mohonk Lake record. Depending on the length of the indicator bar, incorrect reading can result in the recording of minimum temperatures that are 6°–9°C too low. Other months and seasons appear to be free from this error and show no outliers even approaching the magnitude of the 1920 summer minimum temperatures. To correct for the summer of 1920, we replace the mean monthly minimum temperature for this month with the aforementioned climatological mean temperature from the first part of the record. The correction had a negligible impact on our statistical analyses.

As a point of initial reference, we compared annual temperatures at Mohonk with nearby stations in the USHCN network: Maryland, Poughkeepsie, Port Jervis, and West Point, New York (Fig. 2). For a series of homogeneous stations, we would expect differences among stations related to location but that these differences would be near constant over time. Instead, all stations, when compared with Mohonk Lake, show marked variability in the offset over time, suggesting inhomogeneities in either Mohonk or these other stations. This can be seen regardless of whether one examines the TOBS (gray) or FILNET (black) corrected records (see Fig. 2 caption for explanation of terms). As we noted in the site desciption, the Mohonk Lake record is remarkably homongeneous with respect to siting, methods, and instrumentation. A closer look at the histories for the comparison stations shows that several of these discontinuities or inconsistencies are coincident in time with station moves at the comparison sites (marked by triangles) and the shift to the MMTS (marked by diamonds). There are also discontinuities and jumps in the records not marked by any event or change in the station record, suggesting the potential for undocumented changes in instrumentation, instrument locations, or microsite characteristics at these other sites.

For our analysis here, we examine seasonal temperature (averages) and precipitation (sums) data first and

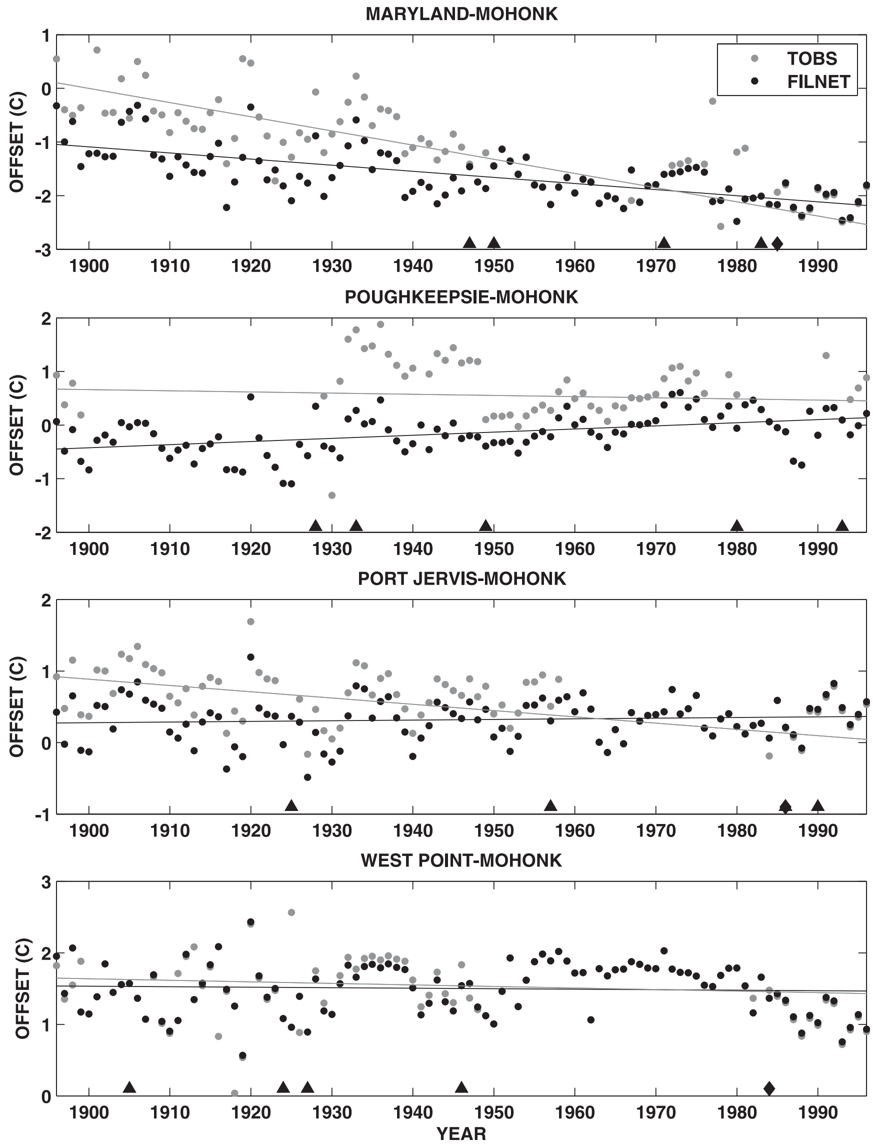

FIG. 2. Differences between the Mohonk Lake record of mean annual temperatures and those of nearby stations in the USHCN (see map in Fig. 1 for station locations relative to Mohonk Lake). Time of Observation (TOBS) data have been adjusted to remove the time of observation bias. FILNET indicates TOBS data that contain estimated values for missing data and outliers and that have also been adjusted for the MMTS bias and station moves and changes. Documented station moves and the transition to MMTS instruments are indicated by triangles and diamonds, respectively.

then explore finer-scale variables only recoverable because of the homogeneity of the record. These latter records include freeze-days and days of extreme temperature and/or precipitation. For seasonal temperature and precipitation, we calculate temporal trends initially using linear least squares. We repeat the trend test using Spearman rank correlations, which is a statistically more robust method that is resistant to outliers. In the case of extreme events, we expect the data and residuals to deviate significantly from a normal distribution, making it impossible to apply standard parametric methods, such as linear least squares, for trend testing. Instead, we use the Mann–Kendall tau statistic, a nonparametric trend test statistic. Values of tau that are greater than 0 indicate a positive trend, 0 indicates no trend, and values of less than 0 indicate a negative trend; statistical significance is also calculated. The Mann–Kendall test has been used extensively in

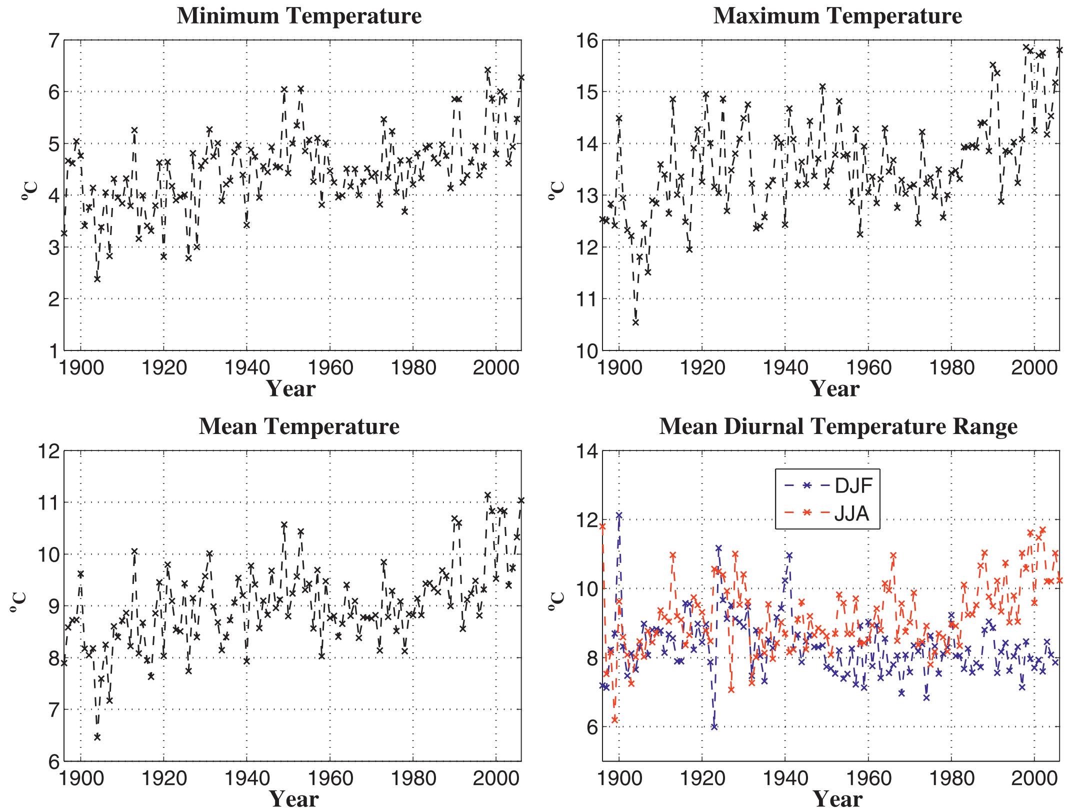

FIG. 3. Annual temperatures and diurnal temperature range from the Mohonk Lake record (1896–2006).

meteorological and climate studies, including in analyses of station data. Readers are referred to the broader literature for examples and further details. In all cases and for all data, we quantify trends over the entire period of record (1896–2006) as well as over more recent decades (1970–2006).

3. Results

a. Temperatures

Annual temperatures at Mohonk Lake [minimum/mean/maximum temperatures and diurnal temperature range (DTR)] are summarized in Fig. 3. The climate history at Mohonk is characterized by warming from the turn of the twentieth century through the 1940s, cooling into the 1950s and 1960s, and then a strong warming trend from 1970 to the present. This pattern is remarkably similar to other records and is also reflected in global and hemispheric anomalies (e.g., Hansen et al. 2006; Vose et al. 2005b). Positive trends in mean temperature are significant for all seasons, whether calculated over the entire period of record (1896–2006) or over the most recent decades (1970–2006; Table 1). These trends are driven primarily by trends in the maximum temperatures, especially during the summer season (JJA); in some cases maximum temperature trends are greater than 4 times the minimum temperature trends. This is contrary to the majority of studies of the instrumental record, which show that the strongest temperature trends are in minimum temperatures (Easterling et al. 1997; Vose et al. 2005a). The strong warming in maximum temperatures, coupled with only moderate trends in the minimum temperatures, has the effect of also driving a strong trend toward increased DTR during summer that is not seen in other seasons, including winter. This result appears to be at odds with studies of other records and regions, which show, almost uniformly, long-term trends toward decreasing DTR (Easterling et al. 1997; Karl et al. 1984; Vose et al. 2005a; Alexander et al. 2006).

Although it is difficult to attribute definitively the recent positive trends in DTR and maximum temperature to any specific cause, these trends do fit well with recent observations that show a reversal of global "dimming" (Wild et al. 2005; Wild 2009). Dimming refers to reductions in surface solar radiation (SSR), driven primarily by the direct and indirect effects of anthropogenic aerosols and pollutants. Because SSR primarily influences maximum temperatures rather than minimum temperatures, dimming has the effect of dampening trends in maximum

TABLE 1. Trends (linear least squares), including significance, in seasonal temperatures (mean, minimum, and maximum). Trends that are also significant at $p < 0.10$ or $p < 0.05$, based on a Spearman rank-correlation trend test, are indicated by one or two asterisks, respectively.

Quantity tested	1896–2006 slope (°C yr^{-1})	Significance (p value)	Tot change (°C)	1970–2006 slope (°C yr^{-1})	Significance (p value)	Total change (°C)
Mean Temperatures						
DJF	0.013**	0.009	1.479	0.066**	0.008	2.447
MAM	0.013**	0.000	1.488	0.036*	0.042	1.317
JJA	0.017**	0.000	1.838	0.054**	0.000	1.999
SON	0.009**	0.001	1.043	0.037**	0.015	1.353
Min temperatures						
DJF	0.017**	0.001	1.871	0.068	0.008	2.499
MAM	0.009**	0.004	1.035	0.023	0.140	0.838
JJA	0.010**	0.000	1.140	0.019*	0.072	0.706
SON	0.011**	0.000	1.191	0.022	0.125	0.799
Max temperatures						
DJF	0.010	0.065	1.086	0.065**	0.010	2.395
MAM	0.017**	0.000	1.942	0.049**	0.017	1.796
JJA	0.023**	0.000	2.536	0.089**	0.000	3.292
SON	0.008**	0.022	0.896	0.052**	0.003	1.908
Diurnal temperature range						
DJF	−0.007**	0.006	−0.785	−0.003	0.723	−0.103
MAM	0.008**	0.002	0.908	0.026**	0.005	0.959
JJA	0.013**	0.000	1.140	0.070**	0.000	2.586
SON	−0.003	0.367	−0.295	0.030**	0.001	1.108

temperatures, thus reducing DTR (Makowski et al. 2008, 2009; Wild et al. 2005). The global dimming trend, and its effect on DTR, have been well documented for many regions (Wild et al. 2005; Wild 2009). Recent work, using updated SSR and DTR datasets, however, has shown a reversal of the dimming and DTR trends since the 1980s for many areas, including the United States and North America (Wild et al. 2005; Wild 2009). This has been attributed to reductions in anthropogenic aerosol pollutants, something that has been happening throughout Europe and North America (Lehmann et al. 2007; Shannon 1999). Although we are unable to directly attribute changes in DTR at Mohonk Lake to changes in SSR or aerosol loads, our DTR trends are largely consistent with trends in aerosols and trends in DTR from North America and other regions (Wild et al. 2005; Wild 2009).

b. Precipitation

There are two issues with the daily precipitation data prior to the 1930s, after which Daniel Smiley took over as primary observer. Prior to this transition, observers generally ignored trace precipitation amounts (precipitation <1 mm). In addition, prior to the 1930s, precipitation was collected at the end of individual storm events (which can span up to several days), rather than at the end of every day. After 1940, sampling changed to record daily precipitation, rather than storm totals, as well as trace precipitation. These issues have little effect on annual or seasonal precipitation totals, but they do lead to an underestimate of the number of days with recorded precipitation in the earliest part of the record, making it difficult to determine changes in daily rainfall characteristics over the entire time period. For this reason, we only investigate trends and variability in precipitation occurrence and intensity for the period 1940–2006, after which trace precipitation amounts were consistently and uniformly recorded.

In general, there are few significant trends in the precipitation data, either in bulk amount or in event occurrence. The most significant ($p < 0.05$) trend in precipitation amount (Fig. 4) is during autumn [September–November (SON)], when precipitation increases by approximately 100 mm over the century. The positive precipitation trend during SON continues for the latter period (1970–2006), but loses its significance (Table 2), likely because the trend over this period is anchored by several wet years toward the end of the record. Autumn precipitation trends at Mohonk Lake are consistent with more general observations that increases in autumn precipitation are driving annual trends in the eastern United States (Henderson and Shields 2006; Karl and Knight 1998; Small et al. 2006). In the Mohonk Lake record, the SON trend in precipitation appears to be driven by marginally significant (1940–2006 $p = 0.056$, based on Mann–Kendall trend test) positive trends in precipitation occurrence rather than by changes in precipitation intensity, consistent with previous studies (Henderson

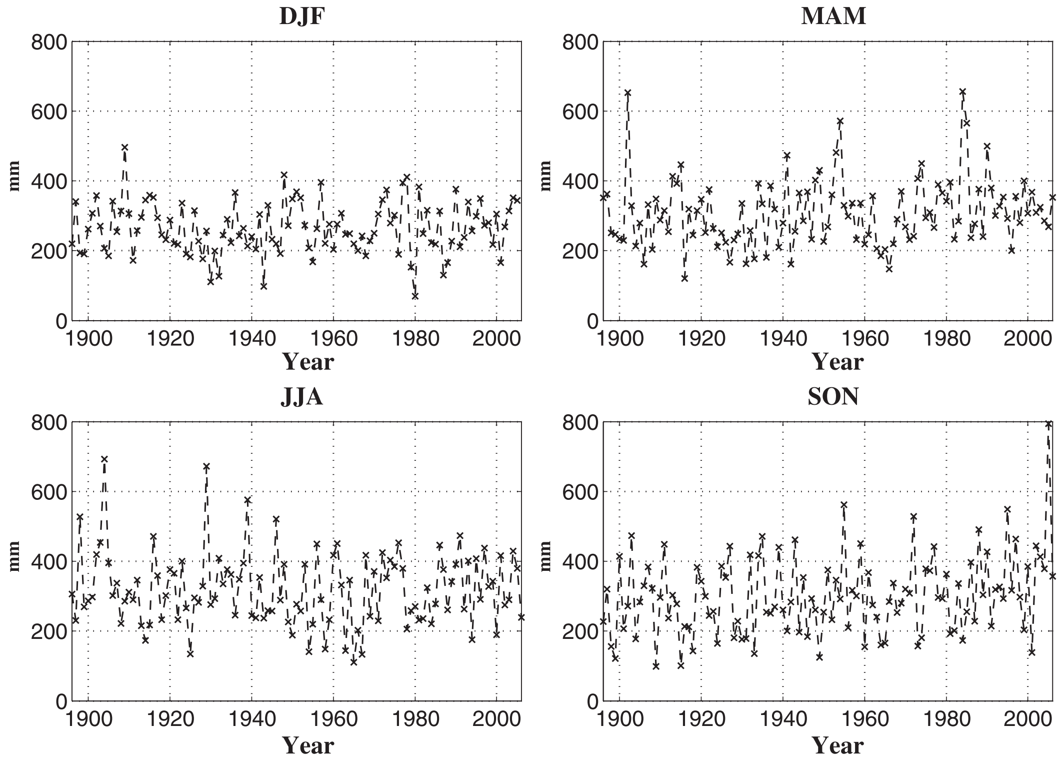

FIG. 4. Seasonal precipitation totals from the Mohonk Lake record (1896–2006).

and Shields 2006). The Northeast drought of the 1960s is reflected in precipitation reductions for all seasons, but especially during spring [March–May (MAM)]. There is no detectable change in the seasonality of the precipitation (not shown).

There is large interannual variability in the number of days with rain for all seasons, ranging from as little as 15 days per 3-month season to almost 60 days (Fig. 5). There are no significant trends in rainfall occurrence during any season (except for a marginal trend in SON, noted previously), as determined by a Mann–Kendall trend test, and this mirrors a similar lack of trend in the precipitation intensity (total precipitation divided by the number of daily precipitation events). This result appears to be at odds with many other records, in which significant changes in amount and intensity can be seen (Alexander et al. 2006; Karl and Knight 1998).

c. *Freeze-days*

Freeze-days (defined as days on which the minimum temperature is less than or equal to 0°C) are especially relevant for ecosystem functioning, because they often affect the beginning and end of the growing season. Figure 6 shows time series for last spring freeze, first autumn freeze, and change in the total number of freeze-days per year. Trends in the onset and termination of the freeze season are small. Changes in first autumn freeze are insignificant, and there is only a weakly significant trend toward earlier last spring freeze (-0.051 days yr^{-1} for 1896–2006). Despite little shift in the onset or termination of the freeze-free season, there is a strong trend toward reduced numbers of freeze-days per year (-0.167 days yr^{-1} for 1896–2006) that has accelerated in recent decades (-0.594 days yr^{-1} for 1970–2006). The

TABLE 2. Trends (linear least squares), including significance, in seasonal precipitation totals. Trends that are also significant at $p < 0.10$ or $p < 0.05$, based on a Spearman rank-correlation trend test, are indicated by one or two asterisks, respectively.

Precipitation	1896–2006 slope (mm yr^{-1})	Significance (p value)	Tot change (mm)	1970–2006 slope (mm yr^{-1})	Significance (p value)	Tot change (mm)
DJF	0.055	0.806	6.098	0.107	0.932	3.952
MAM	0.447**	0.123	49.653	−0.366	0.804	−13.542
JJA	−0.177	0.575	−19.599	−0.192	0.885	−7.086
SON	0.892*	0.008	99.058	3.129	0.117	116.779

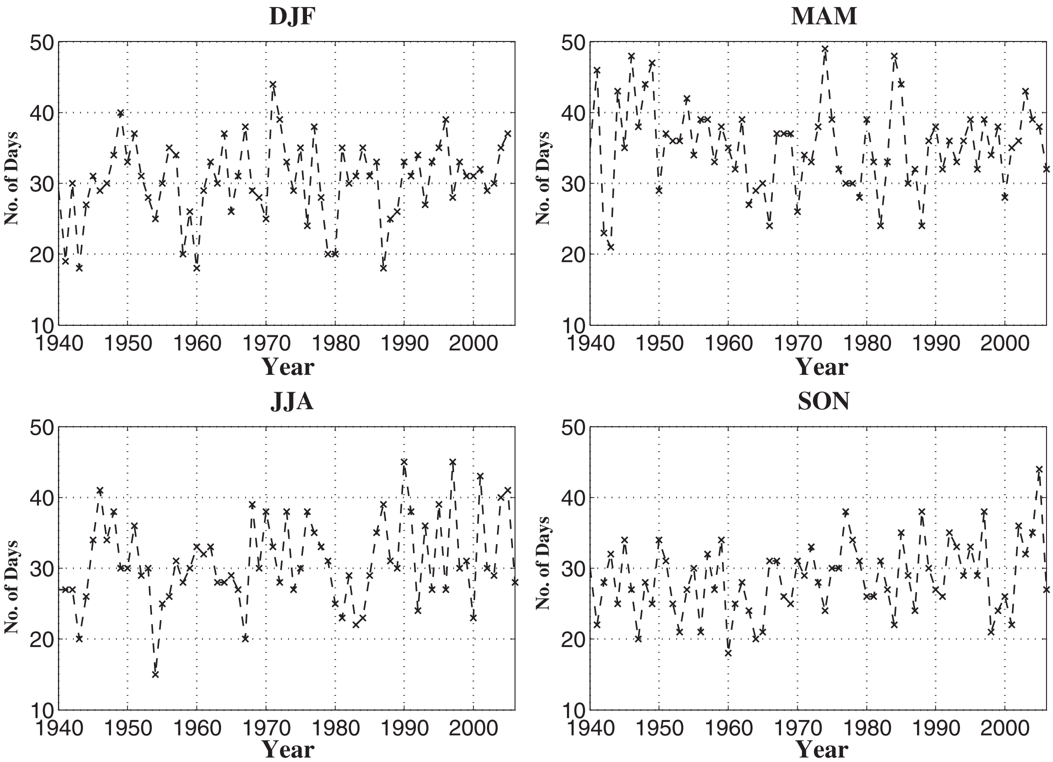

FIG. 5. Number of days per season with measurable rainfall (1940–2006).

increase in the number of freeze-free days is consistent with observations from North America and many other areas (Alexander et al. 2006; Easterling 2002). The lack of change in the length, onset, or termination of the freeze-free season itself, however, appears to be fairly unusual. Species may be very sensitive to changes in freeze events, and warming related to increased freeze-free days prior to the freeze-free season could potentially trigger plant metabolic activities before the relative safety of the freeze-free season (Parmesan et al. 2000; Scheifinger et al. 2003).

d. Extreme events

Changes in extreme events have been observed for many locations around the world (Alexander et al. 2006), and many of these trends are expected to continue through the next century (Easterling et al. 2000). Even more so than changes in the mean state, extreme temperature (e.g., heat waves and cold snaps) and precipitation events (e.g., floods and droughts) can have a disproportionately high impact on the functioning of ecosystems and societies (Parmesan et al. 2000).

A simple way to investigate changes in the frequency of extreme events is to examine changes in the number of days per year exceeding some statistical threshold. In this case, we examine changes in days with extreme heat, cold, or precipitation, based on percentile thresholds calculated over the entire record: 90%, 95%, and 99%. There are strong trends toward increased (decreased) occurrence of days with extreme heat (cold) (Fig. 7 and Table 3), especially in the last 30–40 years. In particular, extreme-heat events are becoming more frequent and, in some cases, reaching unprecedented levels of occurrence, at least in the context of the last century. For example, prior to 1980, 99% threshold events (daily maximum temperatures greater than 31.7°C) rarely occurred more than 10 days yr^{-1}. Since then, these events began to occur at least 10 days yr^{-1}, often occurring more than 20 days yr^{-1}. Even less-extreme warm events happen more often; 90% warm events now regularly occur more than 60 days yr^{-1} whereas, prior to 1980, they only breached this level twice. Positive trends in the extreme-heat events are mirrored by significant negative trends in the extreme-cold events, although recent occurrences appear to be within the range of the last century.

Calculating from 1940 onward (at the beginning of consistent daily precipitation monitoring), there is a significant trend toward increased occurrence of extreme-precipitation events, especially the low and moderate extremes (i.e., 90% and 95%). These trends, however, appear to be largely anchored by several years with very

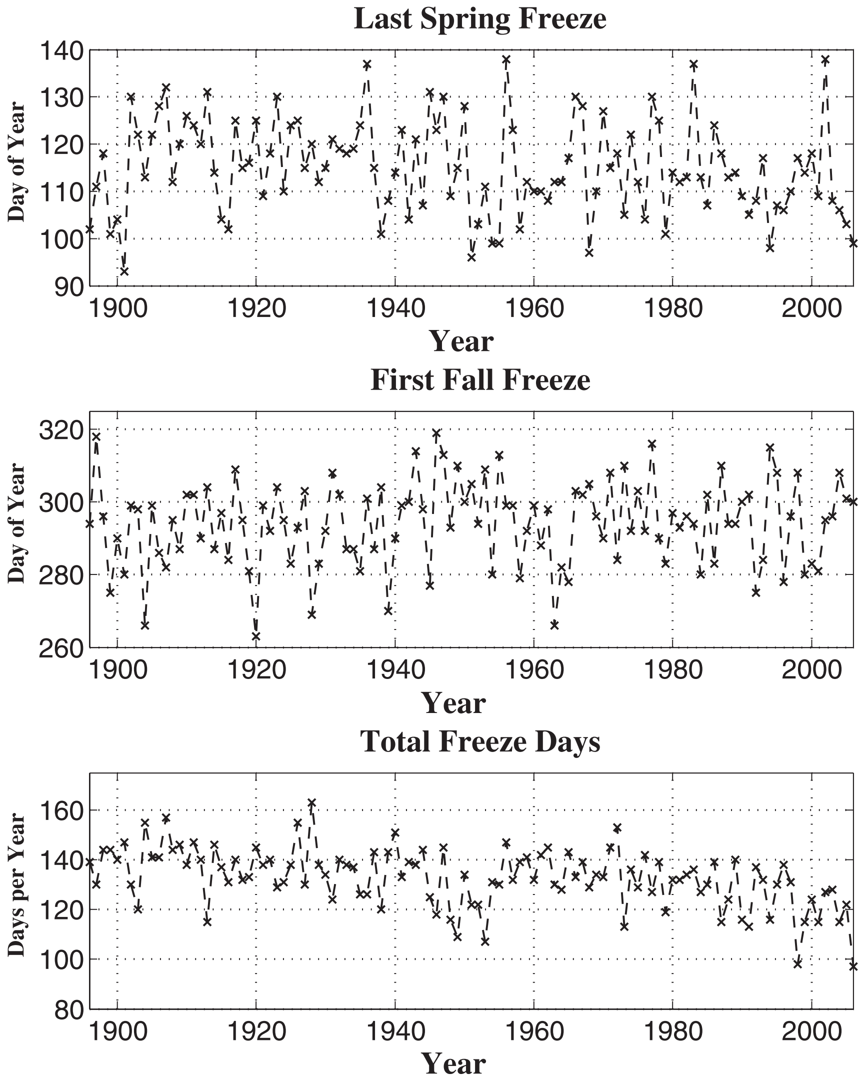

FIG. 6. Date of first fall freeze and last spring freeze and total number of freeze-days per year.

low or nil occurrence of extreme-precipitation events in the 1950s and 1960s that are at least partially related to the 1960s Northeast drought. Indeed, when the Mann–Kendall trend test is repeated for the latter part of the record (1970–2006), the trends become insignificant except for a marginal tendency toward increased occurrence of moderately extreme precipitation events (i.e., the 95% threshold).

4. Discussion and conclusions

Regional analyses of climate change are often based on data from a network of stations, ostensibly to limit localized biases from one or only a few stations. Even with this approach, however, there still may be major biases and errors that may not be uniform across stations or through time. With this in mind, we feel it may be worthwhile to revisit select stations within these networks for which we do have high confidence in the record.

In many respects, the Mohonk Lake climate record shows similar patters of change with other, more regionally focused analyses. The full twentieth-century warming trend at Mohonk Lake is consistent with overall warming trends in the southern Hudson River Valley of about 1°–2°C (Trombulak and Wolfson 2004). This is especially true for winter, when mean temperature trends are very similar to regional average trends (+0.012°C yr^{-1} for the Northeast region; +0.013°C yr^{-1} for Mohonk Lake; Hayhoe et al. 2007). Frequency of extreme-temperature events is changing rapidly, especially since 1970, with increased (and in some cases, historically unprecedented) occurrence of days with extreme heat mirrored by a more modest trend toward decreased

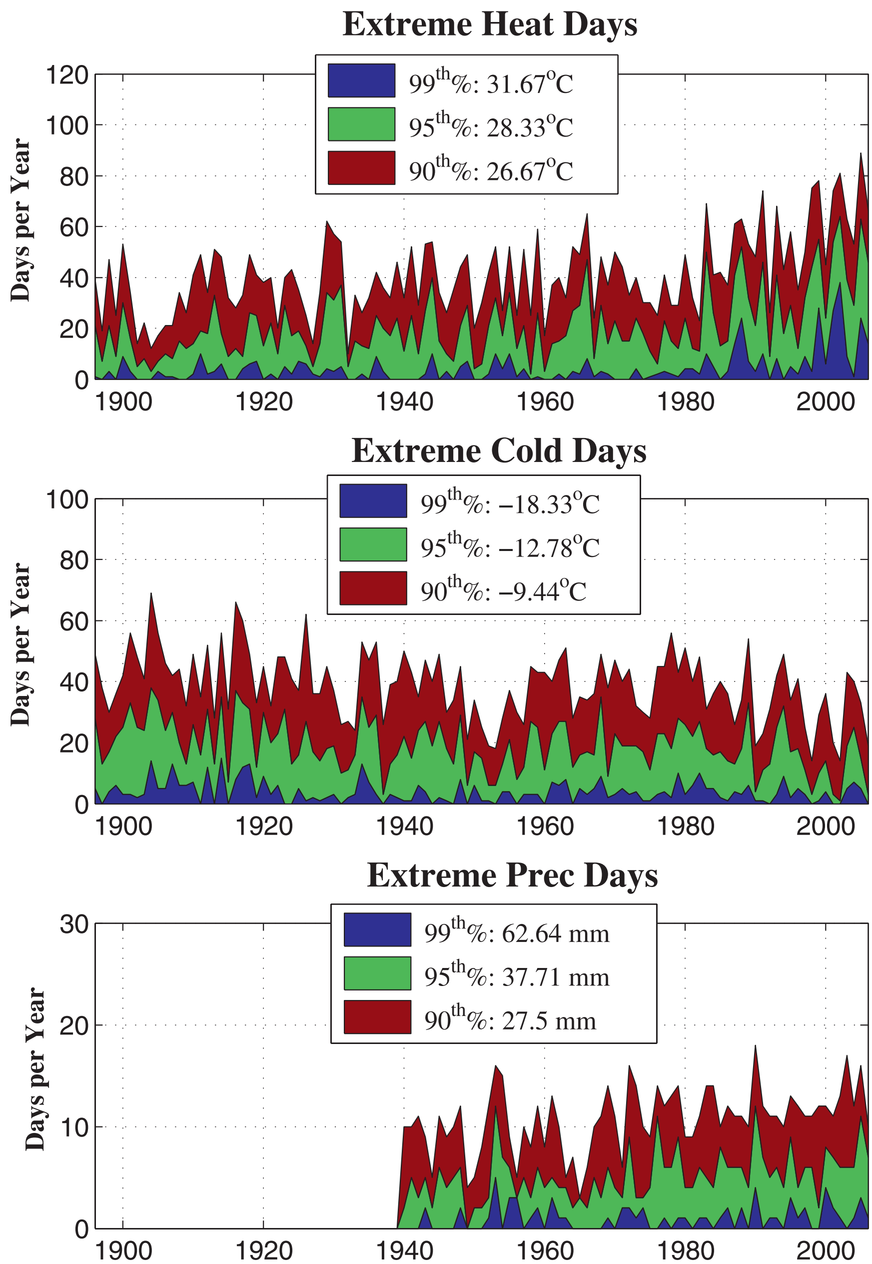

FIG. 7. Number of days with extreme heat, cold, or precipitation per year.

occurrence of days with extreme cold, consistent with trends in extreme-temperature events for the region and across the United States (DeGaetano and Allen 2002). For precipitation, there is a significantly positive trend in precipitation over the course of the twentieth century. This trend is confined to SON but has a similar total increase (99 mm) when compared with overall regional trends (95–100 mm; Huntington et al. 2009). Beyond the similarities, however, are several features at Mohonk Lake that deviate substantially from regional-scale patterns. These include the following:

- There is a warming trend driven largely by trends in JJA temperatures ($+0.017°C\ yr^{-1}$, as compared with the Northeast region trend of $+0.007°C\ yr^{-1}$; Hayhoe et al. 2007). The strongest temperature trends at Mohonk Lake are for maximum temperatures, in contrast to trends driven by minimum temperatures for much of the region.
- There is a trend over the last 30 years, toward increasing diurnal temperature range during summer, driven by much larger increases in maximum temperatures than in minimum temperatures (Huntington et al. 2009).

TABLE 3. Trends (Mann–Kendall tau), including significance, in extreme-event days (extreme heat, cold, or precipitation).

Threshold	1896–2006* tau	(*p* value)	1970–2006 tau	(*p* value)
Extreme heat				
90%	0.305	0.000	0.441	0.000
95%	0.287	0.000	0.411	0.000
99%	0.228	0.001	0.443	0.000
Extreme cold				
90%	−0.221	0.001	−0.301	0.009
95%	−0.217	0.001	−0.322	0.006
99%	−0.077	0.251	−0.126	0.296
Extreme precipitation				
90%	0.287	0.000	0.098	0.418
95%	0.329	0.000	0.228	0.062
99%	0.170	0.069	0.098	0.440

* For extreme precipitation, the period covered by the first tau is 1940–2006.

- A reduction in the number of freeze-days per year with little change in the length of the freeze-free season (Hayhoe et al. 2007).

Our analysis is not meant as an indictment of other stations or networks as a whole. Rather it showcases the value of the select few records that have preserved consistent methods and the ability to analyze daily data in depth with confidence and limited post hoc quality control. Maybe more important, it provides a reliable point of comparison with overlapping records that may have major discontinuities and inhomogeneities in their measurements (due to station moves, instrument changes, etc.), and may provide new opportunities for attempts to correct these issues. This study suggests there is value in revisiting select stations similar to Mohonk with good documentation, consistency, and quality control in the USHCN and other networks.

Acknowledgments. We gratefully acknowledge the support and assistance of the Daniel Smiley Research Center of the Mohonk Preserve. Three anonymous reviewers provided valuable comments that greatly improved this manuscript.

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