A Revised Climatically Optimal Major League Baseball Season in North America

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ABSTRACT

A study conducted in the late 1980s determined the climatically optimal placement of the Major League Baseball season based on temperature and several other climatic variables. Numerous changes have taken place in Major League Baseball since the late 1980s which could have potentially altered the placement of the climatically optimal season. This paper updates the previous work in order to determine the current climatically optimal season. The results indicate that the climatically optimal season has only changed slightly since the time of the previous study. As found in the previous study, based on climate alone, the season should begin and end at a later date than is currently the case.

Key Words: baseball season, climate, temperature, Major League Baseball

INTRODUCTION

Considerable research has been conducted in recent decades within the realm of sports geography (Rumney 1995, Meyer-Arendt and Lew 2003). Sports climatology is a subfield of sports geography which addresses relationships between climate and sports. The number of published papers dealing with sports climatology has been relatively limited compared to the field of sports geography overall. Lipski and McBoyle (1991) and Brottan and Wall (1993) have examined the impacts of global warming on downhill skiing, McConnell (1994) studied the impacts of climate on the success of college baseball teams, while Kraft and Skeeter (1995) and Chambers et al. (2003) have explored the impacts of climate and atmospheric conditions on fly ball distances in baseball. One area that has received very little attention is the relationship between climate and the actual scheduling dates of outdoor sporting events. This paper serves to update an earlier study of mine which did address the issue of climate and scheduling of the Major League
Baseball season (Skeeter 1988a).

As most people who have ever played or watched the game in person know, baseball is not a cold-weather sport. In Major League Baseball, cold weather may increase the number of injuries, affect player performance, diminish the comfort level of the players and fans, and decrease team revenues by lowering attendance and the associated parking and concession profits. Although the exact effects of cold weather are difficult to quantify, it is clear that from a climatic standpoint alone, it is preferable for the Major League Baseball season to be played during the warmest portion of the year to avoid the problems with cold weather as much as possible. During the late 1980s, I determined the most climatically optimal time of year for the Major League Baseball season to be held based on temperature and several other meteorological variables (Skeeter 1988a, hereafter referred to as ‘the previous study’). Since that time, a number of changes have occurred or will soon occur in Major League Baseball that could potentially influence the climatically optimal placement of the season. These changes include the following:

1) The number of teams has increased from 26 to 30 – with new teams being added in Denver, CO, and Miami, FL, in 1993 and in Phoenix, AZ, and Tampa, FL in 1998.


3) Milwaukee and Toronto have changed from open-air stadiums to retractable domes.

4) San Francisco began play in a new stadium in 2000 that has much less wind and fewer uncomfortably cold conditions than Candlestick Park, the team’s former stadium (Smith 2001).

5) An additional round of playoff games (best of five) was added in 1995 as a result of each league expanding from two to three divisions and adding a “wild card” team to the playoffs, i.e., the team with the best record in the league among those teams not winning their division makes it to postseason play. This has extended the length of the postseason by approximately one week.

6) Beginning with the 2010 season, the Minnesota Twins will be playing in an outdoor stadium instead of the domed stadium that they have played in since 1982. This is particularly noteworthy since Minneapolis has the coldest temperatures of any of the Major League cities during the early and late portions of the baseball season.

Due to all of the above changes, it is useful to update the original work to determine whether there have been changes to the climatically optimal season.

DATA AND METHODS

The locations of all of the Major League cities are shown in Figure 1. Similar to the previous study, cities which experience temperatures that are almost always warm enough to be suitable for baseball during the entire baseball season (defined here as cities with mean temperatures above 60ºF in both April and October) were not included in the study (Anaheim, Los Angeles, and San Diego, CA; Arlington, TX; Atlanta, GA; and Miami, FL). In addition, cities with domed stadiums (whether retractable or permanent) were also excluded (Houston, TX; Milwaukee, WI; Phoenix, AZ; Seattle, WA; Tampa, FL; and Toronto, ON). In addition, I left out San Francisco and Oakland (despite April mean temperatures below 60ºF) due to their marine climate, which results in a lack of temperature conditions particularly unsuitable for baseball. For all other Major League cities I determined the climatically optimal starting and ending dates for the season.

After exclusions, fourteen cities remained in the analysis, with two cities having two teams each. For each of those cities, I collected average mean daily temperatures (NCDC 2008c). Although the daily means do not necessarily reflect game time temperatures,
usually around 7 p.m. local time, they are as suitable for delimiting the warmest portion of the year as game-time temperatures would be. The daily temperature data were used to determine the beginning and ending dates of the warmest season-length periods for the fourteen non-domed Major League cities with the coolest April and October temperatures.

I determined two different season-length periods, one for the regular season only, and one including both the regular season and the postseason. The regular season lasts six months (give or take a few days). Including the postseason extends the length of the season to nearly seven months. There is no obvious answer to the question of which season-length period Major League Baseball officials should use for centering the season. On the one hand, during the regular season there can be up to 30 teams in action on any given day, while during the postseason eight teams play during the opening round (Division Series), four teams play during the second round (League Championship Series), and only two teams play during the final round (World Series). Also, postseason games are usually sellouts regardless of the weather conditions, while the vast majority of regular season games do not sell out. Since cold weather certainly limits game-day ticket sales, early and late season temperatures can affect revenues. Therefore, based only on the number of games being played and ticket sales it would be considered preferable to center the regular season within the warmest six-month period. However, because of the increased interest in and importance of the postseason games, it could be argued that it is most important for the entire season (including the postseason) to be centered within the warmest seven-month period.

The full slate of opening day games usually takes place on the last Monday in March or the first Monday in April. The final day of the regular season is usually the final Sunday in

Figure 1. Location of the twenty-eight cities which have Major League Baseball teams. Chicago and New York have two teams each.
September or the first Sunday in October. For this study, the six-month period was defined as consisting of 183 days, based on the current regular season length, while the seven-month period was defined as being 211 days. I determined the climatically optimal placement of the two season-length periods for each of the fourteen cities by averaging the mean daily temperatures of the first and last day of all possible six-month (183 days) and seven month (211 days) periods extending from spring into autumn. For each city, the highest average of the first and last day temperatures represented that city’s climatically optimal season. Whenever different periods produced the same average, I selected the period which had the most similar beginning and ending temperatures in order to prevent one portion of the season from having more extreme low temperatures than necessary. Finally, I averaged the starting dates for all of the cities to determine the climatically optimal opening day and the ending dates for all of the cities were averaged to determine the climatically optimal final day.

To provide further useful climatic information for the first and last month of the season, I collected and compared average April and October precipitation totals, precipitation frequencies, snowfall totals, and wind speeds for each of the non-domed Major League cities, including the warm weather cities (NCDC 2008a, 2008b). I then tested the differences of these April and October data for statistical significance using a matched-pairs t-test (McGrew and Monroe 2000).

RESULTS

The dates of the climatically optimal six-month and seven-month seasons for the 14 cities are presented in Table 1. For the six-month period, the date for opening day ranges from April 18 (St. Louis and Washington) to April 25 (New York). The date for the final regular season games ranges from October 17 (St. Louis and Washington) to October 24 (New York). The average opening and ending dates for the six-month period are April 21 and October 20. These dates are slightly earlier than those found in the previous study, partly because of the exclusion of Oakland and San Francisco which were included in the previous study, but are still approximately three weeks later than the present Major League regular season opening and closing dates.

For the seven-month period the date for opening day ranges from April 3 (Kansas City and Minneapolis) to April 11 (Cleveland and New York). The date for the final regular season games for this period ranges from October 30 (Kansas City and Minneapolis) to November 7 (Cleveland and New York). The average opening and ending dates for the seven-month period are April 7 and November 3. These dates are approximately one week later than the present dates for the regular season opening day and the typical end of postseason play.

As was the case with the previous study, it is apparent from the above that based solely on temperature, the Major League Baseball season should be shifted to later in the year. The beginning and ending dates should be anywhere from one to three weeks later than is presently the case depending upon which season-length period is chosen. However, temperature is not the only important meteorological factor which should be considered. Precipitation and windy conditions are also detrimental to players and spectators. If more precipitation and stronger winds are found to occur in the cities with non-domed stadiums in April than in October, as was found to be the case in the previous study, this would further argue for moving back the season’s start and end dates.

I collected mean monthly precipitation amounts, precipitation frequencies, snowfall totals and wind speeds for all twenty-two Major League cities without domed stadiums (including the warm weather cities as well as Oakland and San Francisco) for the months of April and October (NCDC 2008a, 2008b) (Table 2). These climatic variables also generally support having a later starting and ending of the season due to the
Table 1: The beginning and ending dates of the climatically optimal six-month (183 days) and seven-month (211 days) seasons for each of the fourteen coldest Major League cities without domed stadiums, and the mean daily temperatures in degrees Fahrenheit on these dates for each of the cities. For computing the average dates and temperatures, Chicago and New York were included twice, since there are two teams in each city.

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<td>Average</td>
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The preponderance of conditions more suitable for baseball in October than in April at the vast majority of the cities. Specifically, April precipitation totals exceed October totals at 16 of the 22 cities. A matched-pairs t-test yielded a p-value of .065, indicating only moderately significant differences in April and October precipitation totals. Interestingly, the previous study, based on an earlier 30-year climatic normal period, found that all 19 of the examined cities had higher April than October precipitation totals. Two new Major League cities (Miami and Washington) have higher October than April totals. The difference is very slight in Washington but it is substantial in Miami. Miami’s higher October precipitation totals mostly result from the influence of tropical disturbances during autumn’s active tropical season. Three cities formerly found to have higher October than April totals (Baltimore, Boston and Kansas City) now have higher totals in April, but the difference is very small. The city of Dallas (used to represent Arlington, TX) now has much higher October than April average precipitation totals but this is almost definitely due to several anomalously large precipitation events that happened to occur in October during the most recent 30-year period (for example, Dallas received over 16 inches of precipitation in October 1981). Overall, in terms of precipitation totals, the indications are not as strong as in the previous study. However, since over 70% of the non-domed Major League cities receive more precipitation in April than in October, it still
supports the idea that the start of the season should be shifted to a later date.

Arguably, the frequency of measurable precipitation occurrence may be more important than precipitation totals since the frequency of precipitation may give a better indication of how often games would be cancelled, delayed, or played under less than ideal conditions. All but one (Miami, again largely due to tropical systems) of the 22 cities have greater April than October precipitation frequencies. A matched-pairs
t-test yielded a p-value of .0001 indicating that April and October precipitation frequencies were clearly significantly different. This certainly further supports the idea of shifting the start of the season to a later date.

While snow is relatively uncommon at most of the Major League cities during April and October, it is worth noting that at all but one (Kansas City) of the 13 cities which average more than a trace of snow in April or October, the April totals are higher. One “fluke” October 1996 snowstorm resulted in Kansas City having higher snowfall totals in October than in April (such was not the case in the previous study). Denver, which is one of the new Major League cities, is by far the snowiest of the cities and receives over two times more snow in April than in October. Minneapolis is the second snowiest of the cities and receives over five times more snow in April than in October. A matched-pairs t-test yielded a p-value of .0011, indicating highly significant differences in the April and October snowfall totals. These snowfall totals, and especially the addition of Denver as a Major League city and the change of Minneapolis to a non-domed city, further support moving back the start and end of the season.

Finally, the wind should not be overlooked. Even though games are rarely, if ever, cancelled due to winds alone, strong winds can certainly make for uncomfortable conditions for players and fans alike, especially when combined with cold weather. In addition, the wind can influence the game by affecting the flight of the ball (Skeeter 1988b; Kraft and Skeeter 1995). Importantly, at every Major League city without a domed stadium, the average April wind speeds exceed the average October wind speeds. This is consistent with the previous study. In addition, all of the cities with retractable domes (which would likely be open if there was no precipitation or cold weather) also have higher average wind speeds during April than during October. A matched-pairs t-test yielded a p-value of .0000, again indicating highly significant differences for the two months. The wind data, like all the other climatic variables, provide support for moving the start of the season to a later date.

A BRIEF CLIMATOLOGY OF THE RESULTS

Clearly, both April and October are transition months, with October having slightly higher temperatures than April for all of the cities. There is a slight tendency for the more continental locations (those farthest away from the moderating effect of large bodies of water) to have somewhat earlier climatically optimal starting and ending dates for the season. This is due to these cities warming slightly faster in the spring and cooling slightly faster during autumn than the more maritime cities, whose rates of spring warming and autumn cooling are slowed by their proximity to the water. These differences would have been much greater if truly maritime locations such as west coast cities had been included in the analysis. Indeed, the previous study did include the cities of Oakland and San Francisco and those two cities had starting and ending dates approximately two weeks later than the average of the other cities, which is much greater than the differences of only a few days found between the cities included in the present study.

The April and October precipitation differences are quite substantial across much of the country. For all of the cities combined there is approximately 10% more total precipitation and approximately 25% more frequent precipitation during April than during October. The combination of a higher April than October sun angle (leading to unstable conditions and convective precipitation) and a more southern location of the polar front jet stream in April than in October (leading to cyclonic precipitation) favors this tendency for more precipitation in April than in October across almost the entire United States. Of the Major League cities examined, Miami is the only major exception due to the previously mentioned influence of tropical systems during autumn.
Even though many of the cities receive little if any snow during either April or October, most of those cities which do receive measurable average snow amounts during one or both of the months receive well over twice as much in April as in October. This is due to the combination of colder temperatures and more cyclonic precipitation during April than October.

Finally, wind speeds across the country are on average approximately 20% greater in April than October. Again, every Major League city examined experiences windier conditions in April than in October. During April there are still large equator-to-pole temperature and pressure gradients (which are greatest in the winter and least in the summer) which result in relatively strong winds. Conversely, by October these gradients have not increased enough to cause the winds to be as strong as during April.

Across most of the United States, the month of April experiences colder temperatures, greater precipitation amounts and frequencies, greater snowfall totals and greater wind speeds than October. Clearly, April is both wetter and more “winter-like” than October.

SUMMARY AND CONCLUSIONS

The changes that have occurred in Major League Baseball since the late 1980s have not significantly altered the timing of the climatically optimal season from that determined in the previous study. From a temperature standpoint, it remains the case that the season should start and end approximately one to three weeks later than is presently the case. Moreover, the precipitation and wind speed data also continue to support starting and ending the season later than at present. However, as described in the previous study, there are many additional factors beyond climate which must be considered in the determination of the optimal temporal placement of the season. These factors include tradition, the possible desire of the fans for an early start to the season following a long winter without their pastime, and a general lack of other major sporting events in early April. Perhaps most importantly, extending the season later into the fall would increase the already significant fan, media, and stadium conflicts with collegiate and professional football. These factors would favor not shifting the opening and closing dates to later in the year. Therefore, although there is a climatically optimal time period within which to center the season, there is no definitive answer to the complex question of what time period is really optimal for the placement of the season once all factors are considered.

A seemingly simple partial solution which would result in fewer cold weather games would be to alter the schedule so that most of the early season games are played in the warm weather cities or domed stadiums. However, Major League Baseball officials have been resistant to this idea because of fears of creating a competitive imbalance, the need for one of the New York teams and one of the Chicago teams to play at home on opening day (so that both would not have to be at home on the same dates later in the season), and complaints by the management of several cold weather teams that they would miss out on the tradition (and revenues) associated with opening day.

While the management of Major League Baseball never took action to shift back the start and end dates of the season following the previous study (perhaps because of those factors which argue against such a change), it remains a climatically appropriate option that they may wish to consider. But again, as important as the weather is, there is more to be considered than the weather in determining how long we should wait to hear the opening day refrains of “play ball.”

ACKNOWLEDGEMENT

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REFERENCES


