Using Seasonal Forecast Data

To Predict Precipitation and Ground Conditions For

Equestrian Events In Conyers, GA

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INTRODUCTION:

The Olympics are a time of ceremonies, competition, and enjoyment. To get this far, however, there is a lot of preparation that goes into planning each ceremony, venue or sporting event. Construction around the Olympic area starts as much as eight years before the actual event.

The climate plays a large role in the selection of a city to host the Olympics. If the climate is too warm or gets too much precipitation, this will severely hinder the odds of getting to host the Summer Olympics. On the other hand, the climate might be just right to hold the summer Olympics. Finding the proper place to host each event and deciding when to start construction on each venue, all depends on the climate of that particular area.

BACKGROUND:

We decided to look at the 1996 Summer Olympics, which was held in Atlanta, Georgia. Equestrian is one of many sports in the Olympics, but it is one of the few that depends heavily on the soil type and the climate of the area. This sport was held in Conyers, Georgia in Rockdale County about 25 miles southeast of Atlanta (Georgia Highway Map). Rain causes problems with Equestrian because it can hinder a jump if the ground is extremely wet. The type of soil here is “well drained with a loamy surface layer and a reddish or brownish clayey subsoil” (Soil Survey). Since the soil helps to drain precipitation quickly, only a heavy amount of rain will have a large impact on delaying the competition. This is one reason this sport was held in this area.

There are specific requirements for the Equestrian venue and many other accommodations are provided. Some of the requirements include two large areas with one in sand and the other in grass, at least five jumping areas with at least two in grass,
small and large water obstacles in two of the jumping areas, and a dressage facility. The
dressage facility consists of sand, but not deep sand which can be harmful to the horses.
Other accommodations include a galloping track.

DATA ANALYSIS:

In the analysis of seasonal precipitation forecast for Conyers, GA, actual recorded
amounts of precipitation for the surrounding area was compared to hindcasts for over a
20-year period to see how well seasonal forecasts perform. Due to the purpose of this
project, the months of interest were July, August, and September. These months were
selected because they are the summer months.

The actual precipitation data for Conyers was not available for our desired time
period because of the absence of a weather station, but there are surrounding co-op
weather stations and we used those for our analysis. We took ten surrounding co-op sites
and gathered their monthly precipitation data from 1979 to 1999. The ten co-op sites
were Covington, Winder, Norcross, Bolton, Jonesboro, Experiment, Forsyth, Monticello,
University of Georgia Plant Science Farm, and Atlanta International Airport. Then we
averaged together this data for each month during this 20-year period and labeled this our
actual precipitation for Conyers, Georgia. The single central grid point that we used for
the hindcast model encompasses all of these co-op sites.

For our hindcast model run, we averaged five adjacent grid points. One grid
point was centered over Conyers, Georgia and then we took the adjacent grid points
located to the north, south, east and west of Conyers. We averaged these five points to
come up with a single value for the hindcast for July, August, and September from 1979
to 1999 and labeled this value as the hindcast for Conyers. We did this to come up with a
more accurate value to compare with the actual precipitation that occurred in the area of
Conyers, Georgia. Two hindcast runs were made. One run had no lead-time and the other had a three-month lead-time to see if this lead-time would affect our results.

Once the hind cast and actual precipitation values were calculated, we compared them month-by-month over the 20-year period. We also looked at and compared the total amount of precipitation over the entire three months between the hind cast and actual values. Another analysis we did was to look at the actual precipitation values versus those of the hind cast. Our hope was to see a regression line on these graphs with a close one to one relationship helping to support the effectiveness of the seasonal forecast model.

RESULTS AND INTERPRETATION:

a. Hindcast results with no lead-time

When looking at our line graphs of the actual precipitation and the hindcast model results over the 20-year period we notice that the hindcast produced a bias in that they predicted more precipitation than what actually fell for most of the months (Fig. 1). The only time when the hindcast was on target or was underestimating the amount was when there was either a hurricane or tropical storm present. In August 1992 and July 1994, there was Hurricane Andrew and Tropical Storm Alberto respectively. These storms dumped an excessive amount of precipitation on the southeast and caused our results to be skewed and also verified to us that the hindcast model does not do a very good job when it comes to tropical storms and hurricanes. The hindcast showed in 1993 and 1998 an increase in precipitation from the previous years, but what actually took place was a drought. This tells us that, for the most part the hindcast doesn’t handle precipitation extremes very well. Also looking at the line graphs from each month during the period we noticed that for the first ten years the trends that were evident in the actual
precipitation observations were very comparable to the trends that were occurring in the hindcast results (Fig. 2-4).

From the scatter plots, there does not appear to be a very good correlation between the hindcast results and the actual precipitation recorded (Fig. 5-7). A one-to-one ratio is needed to suggest a strong correlation, but the highest $R^2$ value was 0.029 in July with a positive correlation and the others were all negatively correlated. This shows us that the hindcast did not produce very reliable results in August and September, but the July hindcast did better at forecasting precipitation.

b. Hindcast results with three months lead-time

After looking at our line graph for the three-month lead-time total precipitation and hindcast output, we noticed there to be the same trend in the first half of the period as with the no lead-time hindcast run (Fig. 8). There was also in the second half of the period the same problem with the hindcasts not producing accurate results as with the occurrences of the precipitation extremes.

The line graphs for each month did not trend as well as with the no lead-time during the whole period (Fig. 9-11). Looking at July and September, the hindcast and the actual precipitation matched up sporadically throughout the period, but the majority of the time contradicted each other. August, for the most part, trended well during the first half of the period, but because of the precipitation extremes in the second half, produced inadequate results.

The scatter plots all show a negative correlation, which suggests poor performance by the hindcasts (Fig. 12-14). Except for July, the $R^2$ values were near zero, which had a value of 0.065. Compared with the no lead-time run, the three-month lead-time run performed worse.
FORECAST FOR SUMMER 2003:

The values obtained from the seasonal forecast model run with a three-month lead-time gave us the following:

July 8.91 inches
August 9.34 inches
September 7.20 inches

Knowing how our hindcast performed with the three-month lead-time, these values will most likely be an overestimated value. Most of the time with the hindcast results were overestimated, the only time that they were not was when there was a tropical storm or hurricane. Since we know this is the trend, our forecast for the three-month period from July to September for 2003, for Conyers, Georgia, is lower than these values in a range from 10-15 inches for the three-month period.

CONCLUSIONS:

To summarize, the hindcast must be taken ‘with a grain of salt.’ If it is known that the hurricane season will be active, chances are the hindcast will be an underestimate for that period. With normal conditions or a prolonged dry spell, the hindcast will tend to overestimate the actual precipitation that occurs. It must also be noted that this analysis was confined to a region of the southeast United States centered around Conyers, Georgia and the results for other areas may differ.
REFERENCES:

Georgia Highway Map website, 1999:
International Federation for Equestrian Sport website, 2003:
Soil Survey, 2000:
Southeast Regional Climate Center, 2001:
U.S. Geological Survey, 1998:
Figure 1
Total Precipitation for July, Aug, Sept

Years

Precipitation in inches

Total Avg Precip for July, Aug, Sept
Total Hindcast Precip for July, Aug, Sept
Figure 2
July Precipitation

Year

Precipitation in inches
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00

July Total Avg Precip  July Hindcast Precip

Legend
Figure 3
August Precipitation

Precipitation in inches

Year

August Total Avg Precip
August Hindcast Precip
Figure 4
September Precipitation

Figure 5
July Precipitation

y = 0.2663x + 2.5379
R² = 0.029
Figure 6
August Precipitation

\[ y = -0.243x + 5.6868 \]
\[ R^2 = 0.0566 \]

Figure 7
September Precipitation

\[ y = -0.3161x + 6.0454 \]
\[ R^2 = 0.0684 \]
Figure 8
Hindcast and Actual March Runs

Figure 9
July precipitation
Figure 12
July Scatterplot

\[ y = -0.5149x + 8.2054 \]
\[ R^2 = 0.065 \]

Figure 13
August Scatterplot

\[ y = -0.0161x + 3.9609 \]
\[ R^2 = 0.0002 \]
Figure 14
September Scatterplot

\[ y = -0.036x + 4.1799 \]

\[ R^2 = 0.0008 \]