Analysis of NWS/SPC Watch Counts by Partial Winter and Spring Astronomical Seasons
(January 1 to March 19 & March 20 to June 6)

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**Winter Season* Watch Summary Maps, 2006-2014 in Reverse Annual Order**

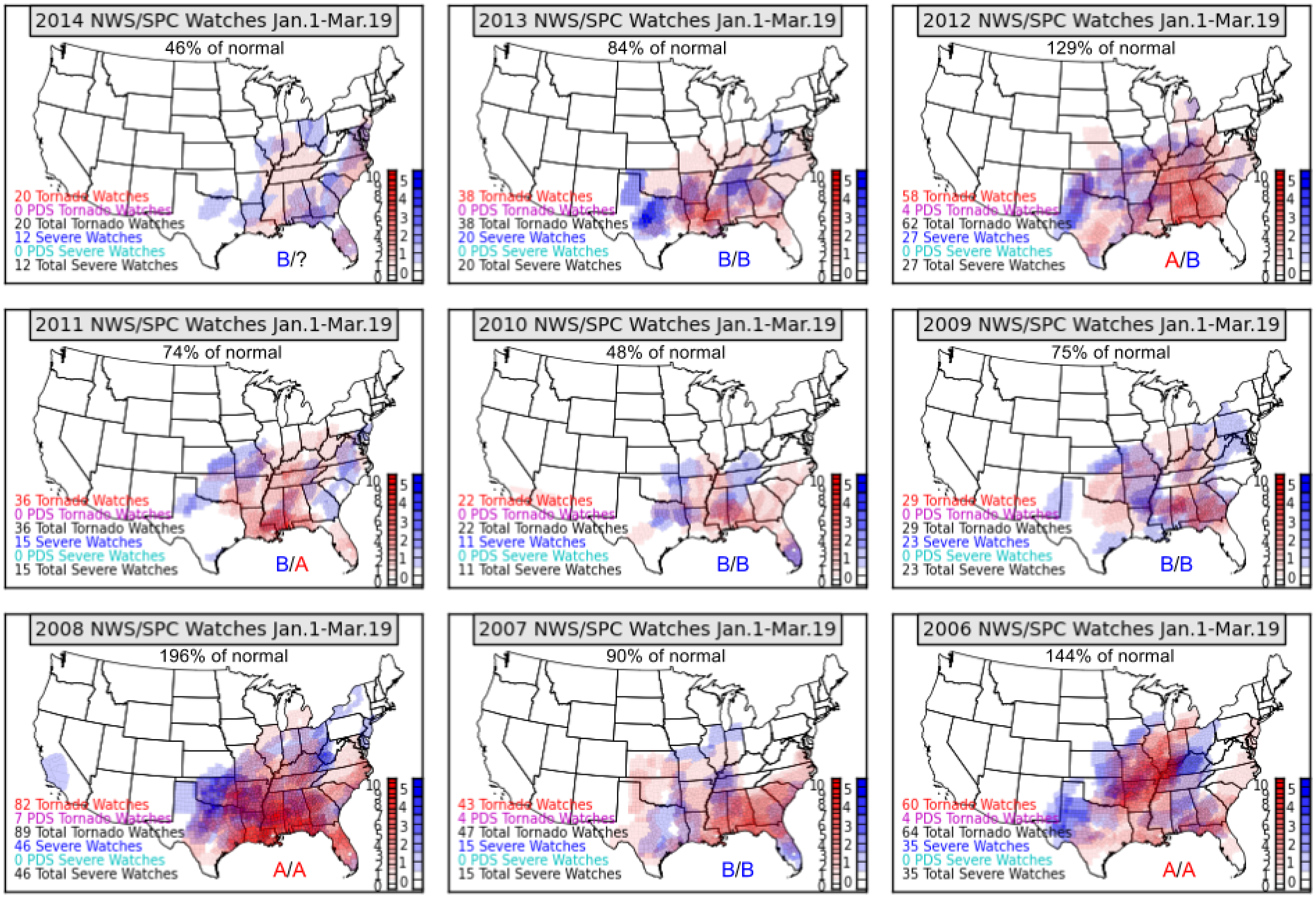


*Fig. 1) Summary watch maps for Jan. 1 through Mar. 19, 2006-2014 (*defined here as the "winter season"), in reverse annual order. Percent of normal watch count values are based on the mean number of total watches issued each winter during the 9-years. Winter watch counts are defined as above or below normal (first A or B in pair) if the total number of watches during the winter season was above or below the 9-year mean of 70 watches. The spring watch count departure is shown by the second letter A or B if the following spring watch count was above or below the mean of 298 watches between 2006 and 2012.*

From January 1 through the end of astronomical winter (the vernal equinox usually occurring around March 20), SPC has issued an average of about 70 watches over the past nine years (Fig. 1). Tornado Watches outnumbered Severe Thunderstorm Watches during this time by about 2:1. The most active start to any year since 2006 occurred in 2008 when a total of 135 watches (89 Tornado and 46 Severe) were issued. One particularly active period occurred on February 5-6, 2008, when more than 80 tornadoes impacted parts of the Mississippi and Tennessee River Valleys during the "Super Tuesday Tornado Outbreak". The 135 watches issued during early 2008 were nearly 200 percent of normal and two standard deviations above the 9-year average of around 70 watches. Based on this 9-year sample, early 2008 was the largest outlier for wintertime watch counts and the corresponding level of severe weather activity.

Winter 2014 has established a new low for tornado watches through March 19. However, the winter watch numbers through March 19, 2014 are nearly identical to those during the period from January 1 through March 19, 2010. Both winters had fewer than half the normal watch counts and were the two most inactive outliers at one standard deviation below the mean. Interestingly, 2011, a year that went on to set new records for tornado numbers, began with slightly above normal numbers for Tornado Watches (36), but a below normal number of Severe Thunderstorm Watches (15), and total watches (51).

**Spring Season* Watch Summary Maps, 2006-2014 in Reverse Annual Order**

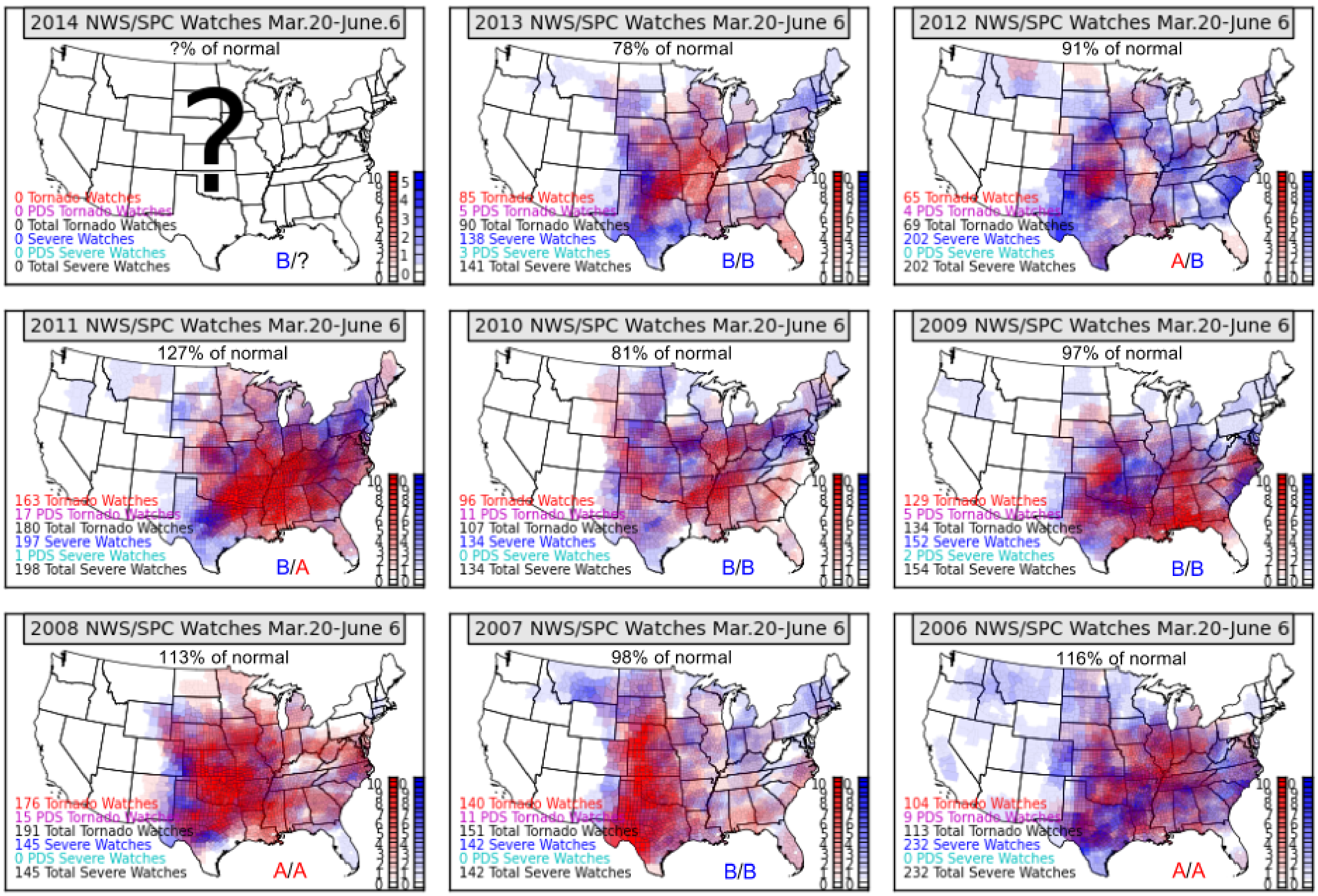


*Fig. 2) Summary watch maps for Mar. 20 through Jun. 6, 2006-2013 (2014 incomplete) (*defined here as the “spring season”), in reverse annual order. Percent of normal total watch count values are based on the mean number of total watches issued each spring during the 8-years (298). Seasonal total watch count departures from winter to spring are shown by the pair of letters in the Gulf of Mexico and are described in the caption for Fig. 1.*

Total watch counts for the partial spring season (March 20 through June 6) are shown in Figure 2. June 6 was used as the ending day of the spring span of days to match the number of days used for the cool season watch maps shown in Figure 1. On average, 35 to 40 percent of the **total annual** watch count is achieved during the 78-day period from March 20 through June 6. Unlike the winter season, Severe Thunderstorm Watch counts were slightly greater than Tornado Watch counts and comprised about 60 percent of all watches issued during this time. On average, about 300 total watches (Severe and Tornado) were issued each spring from 2006 through 2013. The average daily watch count rose to nearly four per day from the first day of spring through the first week in June, compared to an average of less than one watch per day during the winter seasons.

If persistence forecasting were applied during 2011 to predict a continuation of below normal watch numbers into spring, the methodology would have verified poorly. Similarly, if the above normal level of winter watches issued in 2012 were used as a guide for the amount of activity expected into the following spring, that too would have given unsatisfactory results. However, in six of the last eight years, the character of the departure from the normal winter watch count (simply “above” or “below” that season’s mean) has remained the same through the subsequent spring, albeit with varying degrees in the magnitude of the actual departure.

The two above normal winter and spring seasons occurred in 2006 and 2008 and are identified with the “A/A” labels in Figs. 1 and 2. During the winters of 2006 and 2008, the watch count departures were well above normal with percent of normal values of 144 percent and 196 percent, respectively. One could argue these winters were followed by springtime watch counts close to average, but still slightly above normal, with percent of normal values of 116 and 113 percent, respectively.

One-half of the years used for the analysis (2007, 2009, 2010, and 2013), were all categorized as having below normal watch counts in the winter and spring and are identified with the “B/B” labels in Figs. 1 and 2. Again, the magnitude of the seasonal departures from one season to the next do not appear very well correlated. The spring counts in 2007 and 2009, with percent of normal values of 98 and 97, respectively, were preceded by winter counts of 90 and 75 percent of normal. It is probably more accurate to describe 2007 as a “near normal” winter followed by a “near normal” spring in terms of watches issued given watch count departures within 10 and 2 percent of normal for the winter and spring, respectively.

The last two below normal winter and spring seasons occurred in 2010 and 2013. The winter watch count for 2010 was less than half the normal count (48 percent of normal) and was the least active winter for watches until this 2014. Spring 2010 followed with relatively active conditions (compared to the departure for winter 2010 watches), and a watch count of 81 percent of normal. The winter of 2013, with an 84 percent of normal watch count, was nearly double the winter of 2010. However, the spring that followed was relatively less active than 2010, with a watch count of 78 percent of normal.

Figure 3 is a scatterplot showing the relationship between total winter watch counts (y-axis) and total watch counts for each subsequent spring (x-axis). The labels in the quadrants correspond to the labels on the watch summary maps above. The watch counts in this small sample size have a correlation coefficient of 0.41 and relatively low coefficient of determination ($R^2$) of 0.17. This suggests there is a weak relationship between the number of watches issued during the early part of the year and the number of watches issued during the following spring. However, using this relationship to accurately predict and quantify the level of watch activity from one season to the next would likely provide poor results.

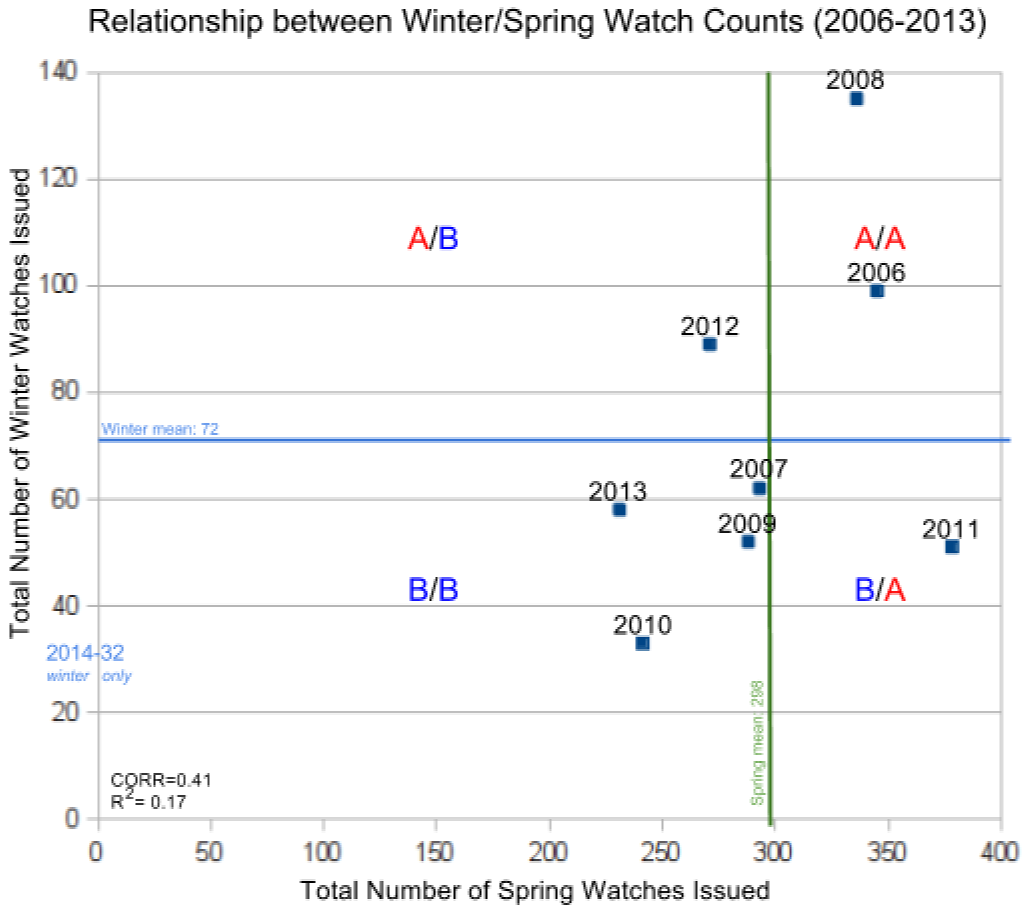


Fig. 3) Chart of the relationship between winter and spring watch counts for the years 2006-2013. WInter 2014 count indicated on the y-axis. Quadrants correspond to the departure from the seasonal mean value with mean the for winter season counts shown by the horizontal blue line and the mean for spring season counts shown by the vertical green line. See text for detailed description.

Seasonal Watch Count FAQ:

***Question) What can we expect in terms of U.S. severe weather activity and tornadoes in the weeks/months ahead?***

**Answer)** Thunderstorm coverage and intensity will increase into April and May, usually reaching a maximum level of activity during one of these months. (In some years April has the greatest monthly tornado total, and in other years, May takes the top spot). Storm events never increase in a linear manner but are the result of strong, transient, large-scale weather systems that act to bring together the ingredients supporting severe thunderstorm and tornado "outbreaks". Depending on how an "outbreak" is defined, there are usually a few to several significant severe weather events somewhere in the United States as spring progresses toward summer. In many years, these larger and more organized severe weather events can continue well into June. However, the potential for widespread tornado outbreaks diminishes significantly by July. The centroid of severe weather potential also migrates from the Southeast and Gulf Coast to the Great Plains from early spring to early summer. (See SPC's severe weather climatology maps and animations to see how severe weather risk increases and migrates over the continental United States through the year: http://www.spc.noaa.gov/new/SVRclimo/climo.php?parm=anySvr).

***Question) Can early-year severe weather activity, or lack of activity, aid in predicting the level of severe weather activity into the spring?***

**Answer)** What's known as "persistence forecasting", or using recent activity levels and forecasting the status quo, will usually provide inaccurate predictions of severe weather activity. Examples of the limitations to this approach are described in the analysis above. While 2011 began with a below normal number of total watches, numerous intense large-scale weather systems contributed to extreme severe weather activity, and a prolific number of tornado outbreaks, during April 2011. The following year, 2012, had an above normal number of watches issued during the winter followed by a below normal number of watches in the spring. Four out of the past eight years, however, have had winters with below normal watch counts followed by below normal counts continuing into spring. While the sample size it probably too small to draw strong conclusions, statistical analysis of SPC partial season watch counts identified a weak relationship between the number of watches issued during the winter, and the number of watches during the following spring seasons between 2006 and 2013.