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# Checking the Accuracy of Folk Sayings "Cold Winter – Cold Spring," "Cold Winter – Hot Summer," and "Hot Summer – Cold Winter" – Ethnometeorology

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*Abstract*

Based on folk sayings "Cold winter—cold spring," "Cold winter—hot summer," and "Hot summer—cold winter" people were for centuries trying to express a long-term weather prediction. In this paper the scientific verification of folk sayings was performed primarily by analysis of the seasonal air temperatures. To include the largest possible number of cases and to perform a detailed processing of data, a classification of seasons was made according to several standards—meteorological-statistical, extreme and mean seasonal temperatures.

Conceivably, the sayings are true in many cases, but that it does not mean that every hot summer will be followed by a cold winter, or that a cold winter will be followed by a cold spring and/or cold summer.

**Key words:** folk sayings, cold winter, cold spring, hot summer, ethnometeorology, temperature

## Introduction

In the period of Enlightenment in the 18th century begins paying attention to the study of ethnology from two viewpoints: educational ideas that through rationalism folk customs and superstitions should be uprooted, until the later standpoint in romanticism that exactly folk customs, beliefs, and other folk wisdom are what makes the crucial characteristics of the Serbian people (Kovačević, 2001a). Ethnometeorology, in this context, refers to folks sayings, customs, and beliefs that are about weather, in other words, about meteorology. They were with us the foundation of explanation, forecast, and interaction with atmospheric elements. The history of science with Serbian people is indicating that the 18th century was the period when scientific achievements in various sciences reach also the educated stratum of the Serbian people (Kovačević, 2001b).

Folk sayings have traditionally reflected the complex relationship between the rural life as an organized system and nature as chaos that needs to be tamed and predicted (Konieva, 2009). The uncertainty of prediction was a consequence of the limits of the local knowledge and human ability (Anderson, 2005). In the times when folk sayings were established—in the period of meteorological observations before invention and widespread use of meteorological instruments, mainly in 18th and 19th century—concepts of "cold," "hot," "average," and "nice" weather were not precisely defined but based on subjective observation. As examples we can present the following descriptions.

1559/60 Pannonian plains: It was a very cold winter and river Tisa froze (Ducić, 1995).

1834/35 Potisje (area around the river Tisa): The winter that year was average, the river Tisa was frozen two times: from December 9 (December 21/new calendar) until January 8 (January 20/new calendar) and from January 12 (January 24/new calendar) until January 17 (January 29/new calendar) (Ducić, 1995).

Sometimes it is mentioned that the winter was nice. The expression "nice winter" does not precisely represent the aspect one has in mind—was the temperature moderate, was there no snow cov-

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er, or no sufficient snow cover formed necessary for the plants to protect them against frostbite. Maybe it was not at all about the weather conditions, but just a statement that in that winter there was enough food, there were no epidemics, there was peace, and so on.

Folk's understanding of a hot and cold season is not the same as the one prescribed by the science of meteorology. It is in the human nature to forget the usual, average events. That's why when a folk saying speaks about hot summer, the only sure thing is that it was not cold; similarly, cold winter or cold spring stays in the folks memory as seasons that were not warm.

Ideas about the weather have a history. In local knowledge the weather seemed to be a puzzle that would be solved (Anderson, 2005). Terms *prophecies* or *predictions* are connected to folk sayings, the term *forecast* is strictly applicable to such an opinion as is the result of a scientific combination and calculation (Anderson, 2005).

Accuracy of proverbs "Cold winter—cold spring," "Cold winter—hot summer," "Hot summer—cold winter" was checked based on the analysis of mean seasonal temperatures for the winter, the spring, and the summer, observed at the meteorological station Belgrade in the period 1887-1986. In meteorology, winter is defined as months of December, January, and February, spring is March, April, and May, whereas the fall is September, October, and November. Mean seasonal temperature is understood as the mean temperature for the respective three-month period.

## Meteorological-Statistical Classification of Winter, Spring, and Summer Temperatures

Meteorology is a science of observation and of arguments about observation (Anderson, 2005). Ethnometeorological folk knowledge from a certain locality competes with the scientific meteorological forecast (Blench, 1999). That is why one of the ethnology topics is finding the relationship between traditional culture and new findings (Radojčić, 2008).

As the first step in the analysis of folk sayings we need to establish meteorological criteria about which temperatures are considered average and which are characteristics of cold and warm seasons. For the quantitative determination of particular meteorological elements we adopted the E.H. Chapman's classification (Chapman, 1919).

On the location of the meteorological station Belgrade in the hundred-years period of measurements taken, the average winter temperature is 1.2°C, the average spring temperature is 11.8°C, and the average summer temperature is 21.1°C. Based on climatological-statistical indicators, we calculated the probable deviation for the winter to be $\sigma = 2.5$, for the spring to be $\sigma = 1.2$, and for the summer $\sigma = 1.1$. In Table 1 is presented the classification of winters, springs, and summers. Limits of the average values describe the span of average seasonal temperatures, i.e. temperatures that can be considered within limits of normal. Temperatures below them refer to a cold season, and those above to warm seasons. Seasonal temperatures lower than the average classify winters, springs, and summers as cold, and those higher than the average as warm.

***Table 1.*** *Classification of average seasonal temperatures for winters, springs, and summers, Belgrade 1887–1986.*

| Cold | Average value | Warm |
|---|---|---|
| Lower than –1.1°C | Winter [$t_{av}$ = 1.2°C] from –1.1°C to 3.5°C | Greater than 3.5°C |
| Lower than 10.6°C | Spring [$t_{av}$ = 11.8°C] from 10.6°C to 13.0°C | Greater than 13.0°C |
| Lower than 20.0°C | Summer [$t_{av}$ = 21.1°C] from 20.0°C to 22.2°C | Greater than 22.2°C |

Based on the classification of seasons derived in Table 1, the analysis of occurrences of cold springs and warm summers that followed cold winters, and occurrences of cold winters after warm summers was performed. Concepts of cold, average, and warm were in all cases defined according to the E. H. Chapman (Chapman, 1919) classification.

***Table 2.*** *Distribution and classification of average seasonal temperatures of winters, springs, and summers, Belgrade 1887 – 1986.*

| | [1] Cold winter | | [2] Warm summer |
|---|---|---|---|
| | Spring [%] | Summer [%] | Winter [%] |
| Warm | 11 | 10 | 15 |
| Normal | 68 | 74 | 46 |
| Cold | 21 | 16 | 38 |

*[1] Distribution of average seasonal temperatures of springs and summers that followed cold winters*
*[2] Distribution of average seasonal temperatures of winters that followed after warm summers*

According to the meteorological-statistical classification of seasonal temperatures, out of all winters in period 1887 – 1986 there were 19% cold winters. These cold winters were in 21% of cases followed by cold springs, in 11% followed by warm springs and in 68% by average springs. After cold winters in 10% of cases the summer was hot, in 16% of the cases the summer was cold, and in majority of cases, 74%, the summer was average. In the same 100-year series there were 13% hot summers. After those hot summers came cold winters

in 38% of cases, 5% of winters were warm, whereas 46% of winters were average.

Using the meteorological-statistical classification it could be shown that the most frequent cases were when after a cold winter came an average spring and summer. Also the saying "Cold winter—cold spring" was true in 21% of cases, "Cold winter—hot summer" in 10%, and "Hot summer—cold winter" in 38% of cases.

## Extreme Seasonal Temperatures

The stark contrast between cold winters and hot summers contributed that in the folk tradition such predictions are perceived as quite accurate. These beliefs are ultimately based upon careful observation by generations of agriculturists (Krappe, 1964).

As extreme seasonal temperatures in Belgrade 1887–1986 incorporated are temperatures with maximal and minimal seasonal values.

Extreme average winter temperatures are presented in Table 3, then temperatures of the springs that followed, and summer temperatures of the summers that were after such winters (Spasova, Janc, 1987).

Difference Δ is given by $\Delta = t_{sav} - t_{av}$ where $t_{sav}$ is the average temperature for observed seasons, whose number is variable, and $t_{av}$ 100-year average seasonal temperature for summer, winter, or spring.

Average temperatures for winters preceding the warmest and coldest springs are shown in Table 4 (Spasova, Janc, 1987).

Extreme seasonal summer temperatures and temperatures of the preceding and following winter are presents in Table 5 (Spasova, Janc, 1987).

Based on Tables 3–5 we can see that the saying "Cold winter—cold spring" was applicable in two cases. One was when after the extremely cold winter 1890/91 came a cold spring and also when the long and cold winter 1928/29 was followed by the 1929 spring that was the coldest in the 100-year series. "Cold winter—hot summer" was applicable when after the coldest winter of 1890/91 came a hot summer and when the colder than average winter of 1945/46 was followed by an extremely hot summer of year 1946. The saying "Hot summer—cold winter" was applicable when the severe and very long winter of 1890/91, with longest recorded series of days with snow cover, was preceded by a summer warmer than average; also, the hottest summer of 1946 was followed by a severe, long winter of 1946/47 with a lot of snow.

## Cold Winter

Occurrence of cold winters after hot summers was analyzed in two ways. One was to isolate all hot summers and to see when they were followed

***Table 3.*** *Average seasonal temperatures before and after extreme winter temperatures, Belgrade, 1887–1986*

| Year | Summer [°C] | Δ [°C] | Year | Winter [°C] | Δ [°C] | Year | Spring [°C] | Δ [°C] | Year | Summer [°C] | Δ [°C] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Maximal winter seasonal averages* | | | | | | | | | | | |
| 1950 | 24.0 | 2.9 | 1950/51 | 4.9 | 3.7 | 1951 | 12.9 | 1.1 | 1951 | 21.9 | 0.8 |
| 1976 | 19.5 | -1.6 | 1976/77 | 4.9 | 3.7 | 1977 | 13.2 | 1.4 | 1977 | 21.1 | 0.0 |
| *Minimal winter seasonal averages* | | | | | | | | | | | |
| 1890 | 21.5 | 0.3 | 1890/91 | -4.5 | -5.7 | 1891 | 11.7 | -0.1 | 1891 | 21.8 | 0.7 |

***Table 4.*** *Average seasonal winter temperature preceding extreme average spring temperatures, Belgrade, 1887–1986*

| Year | Winter [°C] | Δ [°C] | Year | Spring [°C] | Δ [°C] |
|---|---|---|---|---|---|
| *Maximal seasonal spring average* | | | | | |
| 1933/34 | -1.3 | -2.5 | 1934 | 15.4 | 3.6 |
| *Minimal seasonal spring average* | | | | | |
| 1928/29 | -4.1 | -5.3 | 1929 | 9.5 | -2.3 |

***Table 5.*** *Average seasonal winter temperatures before and after extreme average seasonal summer temperatures, Belgrade, 1887–1986*

| Year | Winter [°C] | Δ [°C] | Year | Summer [°C] | Δ [°C] | Year | Winter [°C] | Δ [°C] |
|---|---|---|---|---|---|---|---|---|
| *Maximal seasonal summer average* | | | | | | | | |
| 1945/46 | 1.1 | -0.1 | 1946 | 24.5 | 3.4 | 1946/47 | -2.0 | -3.2 |
| *Minimal seasonal summer average* | | | | | | | | |
| 1912/13 | 1.1 | -0.1 | 1913 | 18.6 | -2.5 | 1913/14 | -1.5 | -2.7 |

by a cold winter; this method would miss a number of cold winters. The other approach was to isolate all cold winters and analyze summers preceding them.

To gather the majority of cases when the winter could be considered cold, we analyzed winters with the following characteristics

1. Extremely low seasonal temperatures.
2. Average one-season temperatures lower or equal to the overall long-term average value, i.e. 1.2°C.
3. Average one-season temperatures lower or equal to 0°C.
4. Cold winters by the meteorological-statistical classification, i.e., winters with average seasonal temperatures lower than –1.1°C.
5. Coldest winters.
6. Winters that were long, very long, or extremely long.

Duration of a winter is the number of days between the first and the last occurrence of a wintery day. In meteorology a wintery day is a day with the average daily temperature lower or equal to 0°C (Ducić, 2003). Based on the series of data processed we may conclude that wintery days may happen any time from October to April and that the duration of winter in Belgrade is on average 40 days (Unkašević, 1994).

As we can see from Table 6, after the coldest winters in 85% of cases a cold spring followed (with temperatures lower than the average); according to the meteorological classification that happened in 31% cases. After the coldest winters came a hot summer (i.e., a summer with average seasonal temperatures higher than or equal to the average) in 54% of cases and a hot summer by the meteorological classification in 23% of cases. The coldest winters were in 75% of cases preceded by hot summers (i.e., summers with average seasonal temperatures higher than or equal to the average) and by hot summers according to the meteorological classification in 25% of cases.

For winters of specific temperature characteristics we calculated the average long-term value as well as its deviation from the seasonal 100-year average temperature. For the temperatures of corresponding summers and springs we also calculated averages and deviations from the average 100-year temperature, as shown in Table 7.

The difference between average temperatures of cold winters, summers, and springs corresponding to the occurrences of cold winters and their 100-year averages indicate whether the seasons were warmer or colder compared to the average. A positive difference indicates that the mean value is above the average, whereas a negative difference indicates the mean value below the average.

Based on occurrence of cold winters according to different criteria we processed statistical data of average seasonal temperatures of springs that followed those winters, as well as of the summers that preceded and followed such winters. Table 8 shows, in percents, the numbers of cases when the summers and springs were warmer or colder than the average. Here a cold season is considered one with average value lower than the long-term average and a warm season is one with average value higher or equal than the long-term average.

In Table 8 is shown a classification of winters according to their temperature characteristics and duration. Winters that are long, very long, or extremely long are in 75% of cases also coldest. If a hot summer is one where the average tempera-

***Table 6.*** *Coldest winters in Belgrade, 1887–1986*

| Year | (1) (°C) | Year | (2) | (3) (°C) | Year | (4) (°C) | (5) (°C) |
|---|---|---|---|---|---|---|---|
| 1887 | - | 1887/88 | very long | -3.0 | 1888 | 11.3 | 20.5 |
| 1888 | 20.5 | 1888/89 | very long | -1.1 | 1889 | 11.3 | 21.0 |
| 1890 | 21.5 | 1890/91 | extremely long | -4.5 | 1891 | 11.7 | 21.8 |
| 1892 | 21.4 | 1892/93 | very long | -3.0 | 1893 | 10.3 | 19.8 |
| 1908 | 21.3 | 1908/09 | very long | -2.2 | 1909 | 11.5 | 20.9 |
| 1913 | 18.6 | 1913/14 | long | -1.5 | 1914 | 12.0 | 19.7 |
| 1928 | 23.3 | 1928/29 | very long | -4.1 | 1929 | 9.5 | 21.4 |
| 1931 | 23.2 | 1931/32 | extremely long | -2.1 | 1931 | 9.8 | 21.9 |
| 1939 | 21.9 | 1939/40 | very long | -2.8 | 1940 | 10.3 | 19.7 |
| 1941 | 20.3 | 1941/42 | very long | -2.8 | 1942 | 10.7 | 22.7 |
| 1946 | 24.5 | 1946/47 | long | -2.0 | 1947 | 14.6 | 22.3 |
| 1953 | 21.7 | 1953/54 | very long | -3.2 | 1954 | 10.8 | 21.7 |
| 1962 | 21.1 | 1962/63 | very long | -2.6 | 1963 | 11.7 | 23.4 |

*Legend: (1) average summer temperature, (2) duration of the winter, (3) average winter temperature, (4) average spring temperature, (5) average summer temperature, "-" means that no data was available*

***Table 7.*** *Seasonal temperature averages of summers that precede or follow cold winters and of springs that follow cold winters, Belgrade, 1887–1986*

| Summer [°C] | Δ [°C] | Winter [°C] | Δ [°C] | Spring [°C] | Δ [°C] | Summer [°C] | Δ [°C] |
|---|---|---|---|---|---|---|---|
| *Average winter temperatures lower or equal to the average value 1.2°C* | | | | | | | |
| 21.2 | 0.1 | -0.8 | -2.4 | 11.6 | -0.2 | 21.2 | 0.1 |
| *Average winter temperatures lower or equal to 0°C* | | | | | | | |
| 21.4 | 0.3 | -2.0 | -3.2 | 11.5 | -0.3 | 21.4 | 0.3 |
| *Average winter temperatures lower than –1.1°C* | | | | | | | |
| 21.4 | 0.3 | -2.3 | -3.5 | 11.6 | -0.2 | 21.3 | 0.2 |
| *Average winter temperatures of coldest winters* | | | | | | | |
| 21.6 | 0.5 | -2.7 | -3.9 | 11.1 | -0.7 | 21.3 | 0.2 |
| *Average temperatures of long, very long, and extremely long winters* | | | | | | | |
| 21.3 | 0.2 | -1.4 | -2.6 | 11.4 | -0.4 | 21.2 | 0.1 |
| *Average temperatures of very long and extremely long winters* | | | | | | | |
| 21.7 | 0.6 | -2.3 | -3.5 | 10.9 | -0.9 | 22.9 | 1.8 |

***Table 8.*** *Percent of warm and cold summers and springs, depending on the characteristics of a cold winter, Belgrade, 1887–1986*

| Summer (that precedes) | | Cold Winter Characteristics | Spring (that follows) | | Summer (that follows) | |
|---|---|---|---|---|---|---|
| Warm [%] | Cold [%] | | Warm [%] | Cold [%] | Warm [%] | Cold [%] |
| 56 | 44 | $t_{sav}$ lower or equal to 1.2°C | 36 | 64 | 55 | 45 |
| 64 | 36 | $t_{sav}$ lower or equal to 0°C | 30 | 69 | 60 | 39 |
| 67 | 33 | $t_{sav}$ lower than –1.1°C | 37 | 63 | 63 | 37 |
| 75 | 25 | Coldest winters | 46 | 54 | 54 | 46 |
| 58 | 41 | Long, very long, and extremely long winters | 25 | 75 | 57 | 43 |
| 78 | 21 | Very long, and extremely long winters | 7 | 93 | 60 | 40 |

ture is above the long-term mean, then the sayings "Hot summer—cold winter" and "Cold winter—hot summer" were true in majority of cases. We can see that hot summers more often preceded a cold winter than followed a cold winter; in both cases, percent-wise, the sayings were proven true. Also, after cold winters in most cases came a cold spring, so that the saying "Cold winter—cold spring" also upheld the test.

## Hot Summer—Cold Winter

A quest for a long-term weather prediction was always intriguing for people. Forecasting the next few months is called the seasonal climate forecast (Blench, 1999). Sayings and proverbs based on opposite cold-hot seasons belong to that category. Based on winter air temperatures, people wanted to predict the spring and the summer, whereas based on summer temperatures they wanted to determine in advance the type of the upcoming winter.

Many such cases were already considered earlier, so that in this section we observe only temperatures of winters that follow hot summers, i.e., when we count all summers whose average seasonal temperatures are higher or equal to the 100-year average of 21.1°C, as well as to 22.3°C according to the meteorological classification.

We started from the definition that a hot summer is a summer whose average seasonal temperature is higher or equal to the average mean of 21.1°C. We can not claim that after such summers a cold winter will follow, namely, that the saying "Hot summer—cold winter" is true. Cold winters with average seasonal temperatures lower than the long-term average (1.2°C) followed hot summers in 43% of cases.

After hot summers followed 55% of all winters with average temperatures lower or equal to 1.2°C,

***Table 9.*** *Average temperatures of winters that followed hot summers, Belgrade, 1887–1986*

| Hot Summer | | Winter that followed | |
|---|---|---|---|
| $t_{sav}$[°C] | Δ [°C] | $t_{sav}$ [°C] | Δ [°C] |
| Average summer temperatures greater or equal to 21.1°C | | | |
| 21.9 | 0.8 | 0.9 | -0.3 |
| Average summer temperatures greater or equal to 22.3°C | | | |
| 23.0 | 0.7 | 0.8 | -0.4 |

***Table 10.*** *Percent of cold winters that followed hot summers with average seasonal temperatures higher or equal 21.1°C; Belgrade, 1887–1986*

| | % (1) | % (2) |
|---|---|---|
| Average winter temperatures lower or equal to 1.2°C | 43 | 55 |
| Average winter temperatures lower or equal to 0°C | 27 | 60 |
| Average winter temperatures lower than –1.1°C | 23 | 63 |
| Coldest winters | 15 | 67 |
| Long, very long, and extremely long winters | 30 | 55 |

*(1) Percent of cold winters with certain characteristics that occurred after hot summers*
*(2) Percent of cold winters with certain characteristics that occurred after hot summers compared to the their grand total (100%) in the 100-year period of observations*

60% of all winters with average temperatures lower or equal to 0°C, and 63% of all winters cold according to the meteorological criteria. After hot summers followed 67% of the severe winters and 55% of the total of long, very long, and extremely long winters.

## Conclusion

Meteorology and statistics reject the strength of popular tradition of weather knowledge (Anderson, 2005). Are they right?

Analysis of the accuracy of folk sayings "Cold winter—cold spring," "Cold winter—hot summer," and "Hot summer—cold winter" was performed based on average temperatures of winters, springs, and summers, both according to the meteorological-statistical classification and by comparison with the long-term averages.

With the meteorological-statistical classification, folk sayings are less applicable because of stricter limits for definition of warm and cold, so that it comprises fewer cases. With extreme seasonal temperatures there were cases when each of these sayings was true.

Observation of average seasonal temperatures indicates that when the winters had characteristics of "cold winters," in average, temperature of the spring that followed was lower than the average, especially if they followed very long or extremely long winters.

Conceivably, the sayings are true in many cases, but that it does not mean that every hot summer will be followed by a cold winter, or that a cold winter will be followed by a cold spring and/or cold summer.

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