Great Historical Events That Were Significantly Affected by the Weather. Part 11: Meteorological Aspects of the Battle of Waterloo*

Abstract

The Waterloo Campaign extended from 15 to 18 June 1815, with the decisive Battle of Waterloo taking place on the 18th. The campaign involved the "Army of the North" of Napoleon on the one hand, and the Anglo-Dutch and Prussian armies on the other. The latter were commanded, respectively, by the Duke of Wellington and Prince Blücher. A shallow but active low and associated warm and cold fronts crossed the battle area on the 16th and 17th.

The weather had important effects on the battles. On the 16th, in a battle between part of the French army and part of the Prussian army, at the village of Ligny, about 40 km south-southeast of Brussels, thunderstorms connected with the passage of the aforementioned warm front made the use of muskets impracticable.

However, the most important weather effects developed on the 17th and during the night from the 17th to the 18th. Violent thunderstorms occurred early in the afternoon of the 17th close to Ligny, while Napoleon was in the process of attacking the Anglo-Dutch force at Quatre Bras. The rains turned the ground into a quagmire, making it impossible for the French artillery and cavalry, and even for the infantry, to move across the fields in extended order, as required by the emperor. The French advance was so greatly slowed down that Wellington was able to withdraw his lighter force to a better position near Waterloo. Thus, the Anglo-Dutch force was almost completely preserved for the decisive battle of the next day.

The rainshowers of the 17th and the night from the 17th to the 18th softened the ground to an extent that, on the morning of the 18th, Napoleon and his artillery experts judged that the battle—the Battle of Waterloo—could not be started before a late hour of the forenoon [1130 local standard time (LST)]. Until the arrival of the Prussian force, about 1600 LST and later, the battle tended to go in favor of the French, but the Prussians turned the tide of the fighting.

The paper quotes judgments of military historians on the significant effects of the weather. Some historians believe that, had Napoleon been able to begin the attack earlier on the 18th, the battle would have ended in a French victory.

Napoleon’s forces. The emperor was forced to sign his abdication (April 1814) and the victorious allies banished him into exile on the island of Elba, off the west coast of Italy. The French Senate reinstated the Bourbon dynasty in the person of Louis XVI’s brother, styled as Louis XVIII. However, before long, personages loyal to Napoleon sent him messages informing him of dissatisfaction in the country and suggested his return. On 20 March 1815, the former emperor entered Paris, where he was received by enthusiastic crowds. With this began Napoleon’s “one hundred days’ rule.”

Representatives of the powers opposed to Napoleon were holding the “Congress of Vienna” at the time, and decided then and there to form a new coalition against him. Their armies were to invade France from the north, east, and southeast. In conformity with his usual strategy, the emperor wished to deal separately with each army of the coalition. He decided to attack first the enemy closest to Paris: namely, an Anglo-Dutch army, commanded by the Duke of Wellington, and a Prussian army, commanded by Prince Blücher. These two marched into Belgium in June 1815. Napoleon crossed into Belgium on 15 June at the head of his army, the “Army of the North” (Armée du Nord), and on the 16th struck at the Prussians at Ligny, about 40 km south-southeast of Brussels. Events of the remaining days of the “Waterloo Campaign,” which ended with the Battle of Waterloo on the 18th, are described very briefly in the following sections, where emphasis is put on the weather effects on the battles.

1. Antecedent events

Early in 1814, armies of some member states of the anti-Napoleon coalition invaded France and defeated...

2. Weather of the days leading to the Battle of Waterloo, 15–18 June 1815

According to information received from the Belgian Royal Institute of Meteorology in Brussels, there were no regular meteorological stations operating in Belgium in 1815. However, Vanderlinden (1924, 302–304) compiled a brief descriptive account of the weather in the country in 1815, and, in a one-sentence-long statement regarding June, he writes that the beginning of the month was rather rainy and that thunder-
storms occurred on the 12th, 17th, and 20th. Memoirs and letters of participants of the Waterloo Campaign (to be quoted below) record that there was a major thunderstorm in the general area of Waterloo on the 16th in the late afternoon/early evening, and that the thunderstorm that burst on the 17th early in the afternoon was especially violent. The showers and rains of that storm continued, with some intermissions, until about 0800 local standard time (LST) on the 18th, the day of the Battle of Waterloo proper. The showers and rains turned the ground into a quagmire, severely impeding the trafficability of the fields not only for the artillery and cavalry, but the infantry as well. This will be described in the following sections.

In view of the absence of regular meteorological stations in Belgium at the time, we have examined the data of the meteorological stations at the Paris Astronomical Observatory (PAO), at Haarlem and Zwanburg in the Netherlands, and at two stations in the London area (Greenwich and Camden). Table 1 lists some of the data of the PAO and Haarlem. The printed record of observations of the PAO for the month lists the highest and lowest values of the pressure of each day, as well as at midday; air temperatures are stated only for noon. The weather is recorded for three periods of the day: “morning,” “midday,” and “evening.” Haarlem, on the other hand, records, among others, the air temperatures at 0800, 1300, and 2200 LST.

In Table 1 we reproduce the highest and lowest pressure values at the PAO, as well as the remarks on the weather; in the case of the Dutch station, we list its temperatures and the all too brief notes on the weather. The latter do not specify the hours at which the weather stated prevailed.

It is seen in Table 1 that Paris reports a drop in pressure from the 16th to the 17th; the maximum value of the day lowered by over 5 mb. The weather of the day was rainy, with thunder at 1000 LST. The weather of the 18th was very cloudy, but no rain is mentioned. The Haarlem data show a rise of 3°C in temperature from the 16th to the 17th; more significant is (see the next paragraph) the drop of about 4.5°C in the temperatures for 1300 LST from the 17th to the 18th.

Figure 1 is a synoptic map for western and northwestern Europe and the northeastern North Atlantic for the 17th, the day of the most significant weather in the battle area. The map was prepared by John Kington, Climatic Research Unit, University of East Anglia, Norwich, England, based on the data bank built up at the unit; construction of the map was aided by Kington’s study of weather conditions in western Europe in the late eighteenth century (see Kington 1988). The weather of that day had the most serious and fatal consequences on Napoleon’s army.

If we assume that the depression and the cold and warm fronts of Fig. 1 moved essentially eastward (as they usually do), then the data of Table 1 and the pressure and front configurations of Fig. 1 can be connected in a satisfactory manner. It seems probable, and perhaps even certain, that the thunderstorm and showers of the 16th late in the day in the battle area (of the Battle of Ligny, Ligny being a village about 25 km from Waterloo and nearly 40 km to the south-southeast of Brussels, see Fig. 2; the battle was fought between a French force and a Prussian force) were connected with the passage of the warm front of the depression. This suggestion is supported by reports of participants of the battle, which state that on the 17th, by 1300 LST, the air was sultry: apparently, the battle area fell into the warm sector of the low pressure system.

The great thunderstorm and showers/rains of the 17th were in all likelihood associated with the passage of the cold front of the low. This is corroborated by the

<table>
<thead>
<tr>
<th>Date in June 1815</th>
<th>Paris Astronomical Observatory</th>
<th>Haarlem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pressure (mb)</td>
<td>Weather</td>
</tr>
<tr>
<td></td>
<td>Max.</td>
<td>Min.</td>
</tr>
<tr>
<td>15</td>
<td>1009.3</td>
<td>1001.5</td>
</tr>
<tr>
<td>16</td>
<td>1009.8</td>
<td>1003.7</td>
</tr>
<tr>
<td>17</td>
<td>1004.2</td>
<td>1001.8</td>
</tr>
<tr>
<td>18</td>
<td>1005.9</td>
<td>1004.6</td>
</tr>
</tbody>
</table>
data of Haarlem, which show a considerable drop in temperatures from the 17th to the 18th (see Table 1). It seems reasonable that the cold front crossed the Dutch city on the 18th, perhaps at night: Haarlem reports rain and "hard" winds for the day.

3.16 June

Although the meteorological event of the 16th did not have as great an effect on ground conditions—and, hence, the battle—as the meteorological events of the 17th and those of the night from the 17th to the 18th, we shall describe the event in brief, for it was relevant to what happened on the next two days, including the day of the Battle of Waterloo proper.

In conformity with his usual strategy, the emperor endeavored to deal separately with the Anglo-Dutch and Prussian armies, and this meant that he had to prevent the two forces from joining. He found it preferable to deal with the Prussians first and, accordingly, assigned the 16th for this purpose.

About half (two corps) of the Prussian army was located near the village of Ligny (Fig. 2), whereas an Anglo-Dutch force was situated around the village of Quatre Bras, about 32 km south-southeast of Brussels and 12 km to the north-west of Ligny. Napoleon ordered Marshal Ney, commander of the left wing of his army, to attack Quatre Bras and seize it from Wellington’s force, while he himself dealt with the Prussians. The battle began rather late in the day, because the emperor was waiting for one of his corps (Lieutenant-General Gérard’s) to arrive and take up its position. Additionally, he was waiting to hear the din of cannonade from Quatre Bras that would have indicated that Ney went into action (Ney did not). The late start left a maximum of close to six hours of daylight (sunset was about 2020 LST¹), which turned out not to be enough to beat the Prussians decisively. The Prussians put up a determined fight.

About 1930 LST, Napoleon ordered the Imperial Guard, his most loyal and battle-seasoned troops, to launch an attack, hoping that they would be able to secure a definite victory. But about the time he issued

---

¹Although it is almost certain that, had the moon been full and the sky cloudless, the battle could not have been continued at moonlight, it is worth pointing out that during 16–18 June the moon was between its first and second quarter—that is, it would not have provided much light. For data on the phases of the moon in June 1815, see Morrison (1966).
the order, a major thunderstorm burst and the heavy
rains made it impracticable to use the muskets. The
guard had to make a bayonet charge, which was less
effective than volleys of musket fire. The Prussians
were forced to retreat and, although the battle was a
French victory, both sides suffered heavy casualties:
the Prussians lost 16,000 men, and the French 11,000;
the Prussian losses were increased by the subse-
quently desertion of the colors by 8000 troops. It is
almost certain that the number of Prussian casualties
would have been greater had the guard been able to
use its firearms. The possibly greater losses would
have rendered the Prussian force less capable of
recuperating, as it did, from the blow. In any case, as
a consequence of the French victory, the Prussian
army was put out of action for the 17th, when Napoleon
intended to smash Wellington’s force.

4.17 June

a. Thunderstorm and rains

Despite the fact that the pressure drop recorded at
the PAO meteorological station from the 16th to the
17th was notably smaller than from the 13th to the 14th
(not shown in Table 1), the weather of the afternoon of
the 17th and the night from the
17th to the 18th was more thundery and persistently rainy
than on the 14th. This is true not only for Paris but also for the
battle area in Belgium, as indicated by memoirs and letters of
participants of the campaign. It seems reasonable to ascribe the
intense thunderstorm of the 17th
and rains to the passage of the
cold front shown in Fig. 1.

Becke, author of a two-vol-
ume documented study of the
Waterloo Campaign, quotes
(Vol. I, p. 335) a Lieutenant Hope
(Letter of a British Officer, 239–
240; not seen by this author) as
follows: on the 17th “the hazy
morning cleared up about 1000
LST, by noon the sun was pow-
erful, by 1300 LST the air was
sultry and thunder was faintly
heard before 1400 LST.”

Before we turn to descriptions
of the thunderstorm, it is appro-
priate to point out that Hope’s
brief “account” of the weather of
the morning of the 17th sug-
gests that the warm sector of the low of Fig. 1 passed
the battle area in the morning and the earliest part of
the afternoon. The statement that thunder was faintly
heard before 1400 LST corresponds in all probability
to what we call “distant thunder.” Presumably, the
distant thunder originated from the thunderstorms of
the approaching cold front.

Hope describes the thunderstorm as “awful,” “ap-
palling,” and “terrific.” (The letter was written a week
after the event.) Another British officer, Captain C.
Mercer, Royal Horse Artillery, writes as follows (1969,
147, 148):

The sky had become overcast since the morning . . .
large isolated masses of thundercloud, of the deep-
est, almost inky black, their lower edges hard and
strongly defined, lagging down, as if momentarily
about to burst, hung suspended over us, involving our
position and everything on it in deep and gloomy
obscurity . . . . The first gun that was fired seemed to
burst the clouds overhead, for its report was instantly
followed by an awful clap of thunder, and lightning that
almost blinded us, whilst the rain came down as if a
water-spout had broken over us.

A meteorologically particularly significant observa-
tion (less subjective than the previously quoted obser-
vations), indicative of the intensity of the front and

FIG. 2. General map of the area of the Waterloo Campaign. Waterloo is situated about 13
km south-southeast from Brussels. The scale of the map can be estimated from the fact that
the distance between Waterloo and Ligny (scene of the Battle of Ligny on the 16th) is about 25
km.
In a collection of letters, the editor, Major-General Siborne, reprints a letter of Capt. W. B. Inglis, Royal Horse Artillery (Siborne 1891, letter No. 81). In the part of the letter relating to 17 June, the captain writes as follows:

At the last moment the order was given [Wellington’s order to retreat from Quatre Bras] and the whole commenced a rapid retreat in three columns and by different roads. At this instant the heavy black cloud broke with a tremendous clap of thunder and torrent of rain. . . . The road and the ground became so quickly deluged with the heavy rain that was falling, that it became impracticable for the French Cavalry to press our Column in any force. In fact, out of the road in the track of our own Cavalry, the ground was poached into a complete puddle. Seeing this, and having lost the shoe from off a Gun horse, I halted and had it put on in spite of some skirmishers. . . . This will show how impracticable it was for them to press on this cross road. . . . The rain continued very heavily throughout the night.

Brett-James (1964) published excerpts from numerous memoirs and letters relating to the Waterloo Campaign. On pages 93–94 he cites from the memoirs of the French sergeant4 Hippolyte de Mauduit of the Imperial Guard:

The tracks were so deep in mud after the rain that we found it impossible to maintain any sort of order in our column. . . . In looking for easier paths a large number of men went astray, and not until daybreak did they all manage to rejoin the columns. . . . Our greatcoats and trousers were checked with several pounds of mud. A great many of the soldiers lost their shoes and reached the bivouac barefoot.

To sum up the military significance of the thunderstorm and rains of the 17th on the fighting of the same day and the next day, we shall quote the judgments of three military historians.


Rarely has the storm [the thunderstorm of the 17th] been given sufficient credit for the part it played in retarding the Emperor’s fiery, if tardy, pursuit of his foe. Given good weather, then June 17 might have seen very different happenings—even in spite of Ney’s early and disastrous failure. For the sodden roads and fields delayed the French advance tremendously; otherwise Wellington would probably have been attacked towards the evening, so as to ensure that he was immobilised, and then by 0800 LST, on

---

2The above-quoted weather-caused decision of Napoleon to delay the start of the attack is quoted by several writers—e.g., by Captain Siborne (1895, p. 364). Some of the quotes are based on statements made by the emperor at his place of final banishment on the island of St. Helena.

Chandler (1966, p. 1062) quotes Napoleon’s remark, made at St. Helena, regarding the “unfinished” battle of the 17th against Wellington. He is reported to have said that “what would I not have given to have had Joshua’s power to slow down the sun’s movement by two hours.”

4Becke (1914, vol. I, p. 261) gives the rank of de Mauduit as captain.
June 18, at latest, the great battle would have been begun. It might have been as bloody as Eylau5 but it would have been far more decisive, and a French victory.

Professor D. G. Chandler (1966, p. 1062):

It is possible, even probable, that Napoleon would have succeeded in catching up with Wellington and force him to fight there, but for the adverse turn in the weather.

Major-General J. F. C. Fuller (1985, p. 189):

In part at least, this terrific storm of rain saved Wellington, for it so drenched the ground that the French were unable to advance across country and were, in consequence, tied to the Brussels Road. Had they been able, as was Napoleon’s wont, to advance in extended order, it is probable that, in spite of the late start, the Emperor would have caught up with his enemy by five or six o’clock. Had he done so, and had he attacked Wellington and fixed him to his position when not fully deployed, it is also possible that he might have beaten him during the next morning, or what is more likely, have forced him to retire during the night.

b. Marshal Grouchy’s mission

One other important incident of the day that was influenced in no small part by the weather (for the remaining part, the responsibility lay with a high French commander) occurred on the right flank of the French army (the center was commanded by Napoleon himself). Command of the right wing was entrusted by the emperor to Marshal Grouchy, an outstanding cavalry officer and an excellent tactician, but a general officer lacking strategic insight (according to the literature).

As mentioned before, the precise location of the Prussian forces (two corps beaten at Ligny, and two other corps not involved in the previous day’s battle) was not known to Napoleon on the morning of the 17th when he verbally instructed Grouchy to reconnoiter the whereabouts of the Prussians. In a later written order of the same day, the marshal was instructed to proceed to Gembloux (see Fig. 2; Gembloux is about 40 km south-southeast from Brussels and about 10 km northeast of Ligny), pursue the Prussians, and find out if Blücher was moving to the support of Wellington. No doubt (Houssaye 1900a, p. 231) Napoleon’s idea was for Grouchy to interpose his wing between the Prussians and the Anglo–Dutch and thus protect the right flank of the French center.

For the mission, Grouchy was allocated the relatively large force of 33 000 troops, including all three arms, or over 25% of the Army of the North. Such a large body of troops was not meant for an intelligence mission, and this should have been clear to the marshal.

In the afternoon, the various elements of Grouchy’s force began to march toward Gembloux. The march was badly hindered by the sodden ground, due to the persistent rains. For instance, one of Grouchy’s corps (Lieutenant Vandamme’s) took an hour to move 2 km to a meeting point (Becke 1914, vol. I, p. 353). The force led by the marshal himself took about four hours to cover 10 km, reaching Gembloux between 1800 and 1900 LST; one other corps (Lieutenant-General Gérald’s) arrived at Gembloux at 2100 LST. When Grouchy reached Gembloux, he took no action, although some two hours of daylight remained. He should have realized that the French center’s right flank would possibly come under attack by Blücher and, moreover, that Blücher would possibly achieve junction with Wellington. In the latter case, the allies would have presented a much larger force than Napoleon’s. Grouchy’s tardiness meant that the Prussians gained more time to move toward a junction with the Anglo–Dutch.

5. The night of 17–18 June

The rains continued during the night. Some of the memoirs and letters of participants of the campaign describe the rains of the night as “torrential.”

In his collection of excerpts, Brett-James (1964, 98–99) quotes Napoleon’s thoughts during his nocturnal tour (around one o’clock in the morning). He was angry that the Anglo–Dutch force escaped battle the previous afternoon (the 17th) and apprehensive that Wellington and Blücher would possibly link up near Brussels. The emperor reminisced as follows (only the weather-related thoughts are quoted here):

The rain fell in torrents ... the French troops were bivouacked in the mud. The officers thought it impossible for us to give battle during the day. The artillery and cavalry could not manoeuvre on the ground so soaked was it; and they calculated that twelve hours of fine weather would be needed to dry it out.

On page 100, Brett-James cites William Gibney, assistant surgeon to the 15th Hussars (British):

Torrents of rain fell all night, ... a night spent in pouring rain, sitting up to the hips in muddy water.

On pages 102–104, the same compiler quotes from the recollections of British Private Matthew Clay:

By and by, the flint musket then in use was a sad bore on that occasion: from the effects of the wet, the springs of the lock became wood bound and would not

---

5The Battle of Eylau, Prussia, was fought 7–8 February 1807 between Napoleon’s army and a Russian army. The fighting was extremely fierce.
act correctly, and when in action the clumsy flints became useless.

6.18 June—The day of the Battle of Waterloo

On the 18th, the rains stopped between 0700 and 0800 LST (Fuller 1985, p. 193). Soon thereafter, Napoleon set out with General Drouot, commander of the Imperial Guard, for the purpose of examining the state of the ground: Would it be possible to move the guns? Originally, Napoleon intended to begin the attack at 0900 LST at the latest. However, Drouot advised the emperor to postpone the beginning of the battle with the Anglo-Dutch force for a few hours, to let the ground dry in the meantime; otherwise, the attack could not begin with an artillery bombardment. Moreover, the round shot would have buried themselves in the mud instead of ricocheting (Fuller 1985, p. 193, footnote 3; Becke 1914, vol. II, p. 4); that is, many of the rounds would have been wasted.

Thus, on both the 17th and the 18th Napoleon began the attack late in the day and on both occasions in consequence of soaked ground. On the 18th, however, the late beginning was fatal. By midafternoon the battle was close to becoming a French victory. However, about 1600 LST, the first Prussian units joined the combat and were followed by other Prussian units. The combined allied armies greatly exceeded the French army in strength, and this turned the Battle of Waterloo into a decisive allied victory. Wellington himself admitted that, before the Prussians' arrival, his force was close to defeat. In a letter to his brother William, dated 19 June 1815, relating to the Battle of Waterloo, he wrote the following: “It was the most desperate business I ever was in... I never was so near being beat.” (See letter No. 31 in Webster 1948.)

As an outcome of Waterloo, Napoleon lost his throne forever—the political map of Europe was changed by the victorious allies as well. In France, the Bourbon dynasty was reinstated. In the inevitable “soul searching” in France for the causes of the debacle, Grouchy was blamed for the disaster. The marshal defended himself by referring to the abominable state of the ground, which slowed down and exhausted his troops and rendered him unable to prevent the junction of the Prussians with the Anglo-Dutch.

Houssaye’s lines were written late in the nineteenth century (the 1900 edition was the 31st edition). About three-quarters of a century later, the British military historian Chandler (1966, p. 1067) sustains the French scholar’s conclusions. He writes:

This decision [postponement of opening the battle until late in the forenoon because of the sodden ground] proved the most fatal one of the day for the French. For had even an inadequately supported infantry attack been launched against Wellington in the morning, the French must surely have won; for Blücher would have been too late arriving on the field to affect the issue.

7. Conclusions

The above study indicates that the Waterloo Campaign, including the Battle of Waterloo, was notably affected by the rains connected with the passage of a system of warm and cold fronts across the general area of the campaign. The case of the Battle of Waterloo shows that the weather can have far-reaching direct and indirect consequences. Not only did Napoleon lose his throne forever—the political map of Europe was changed by the victorious allies as well. In France, the Bourbon dynasty was reinstated. In the inevitable “soul searching” in France for the causes of the debacle, Grouchy was blamed for the disaster. The marshal defended himself by referring to the abominable state of the ground, which slowed down and exhausted his troops and rendered him unable to prevent the junction of the Prussians with the Anglo-Dutch.

Acknowledgments. The writer is pleased to thank John Kingston, Climatic Research Unit, University of East Anglia, Norwich, England, for preparing the synoptic chart for 17 June 1815 (Fig. 1 in this paper) especially for this study.
ian, National Meteorological Library, Bracknell, Berkshire, England; and Dr. Arijan van Engelen, Royal Netherlands Meteorological Institute, De Bilt, The Netherlands. Dr. H. Einicke, Astronomical Observatory, University of Copenhagen, Copenhagen, Denmark, is thanked for data of the moon in June 1815.

Finally, thanks are due to Dr. A. A. Orgill, senior librarian, Royal Military Academy Sandhurst, Camberley, Surrey, England, for copies of some pages from the literature.

References


With the development of meteorological science and the continual refinement of the technologies used in its practical application, the need to produce a new edition of the International Meteorological Vocabulary (IMV) became evident (the original edition was published in 1966). This volume is made up of a multilingual list of over 3500 terms arranged in English alphabetical order, accompanied by definitions in each of the languages (English, French, Russian, and Spanish) and an index for each language. This new edition has been augmented with numerous concepts relating to new meteorological knowledge, techniques, and concerns. It should help to standardize the terminology used in this field, facilitate communication between specialists speaking different languages, and aid translators in their work.

WMO No. 182, 784 pp., softbound, color-coded index, $95 (including postage and handling). Please send prepaid orders to: WMO Publications Center, American Meteorological Society, 45 Beacon St., Boston, MA 02108-3693. (Orders from U.S. and Canada only.)