

INFLUENCE OF METEOROLOGICAL CONDITIONS ON THE 1941 AND 1944-1945 CAMPAIGNS OF ROMANIAN MILITARY AVIATION

Ana-Maria IAURUM^{*}, Jănel TĂNASE^{**}, Sorin CHEVAL^{***}

^{*}”Babeş-Bolyai” University, Cluj-Napoca, Romania (ana.iaurum@ubbcluj.ro)

^{**}”Henri Coandă” Air Force Academy, Braşov, Romania (tanase_janel@yahoo.com)

^{***}”University of Bucharest”, Bucharest, Romania (sorincheval@yahoo.com)

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Abstract: *The crucial role of meteorology in military activities is evident both theoretically and practically. Meteorological phenomena profoundly influence the planning and execution of ground, air, and maritime operations, and ignoring them can have devastating consequences. This paper explores the importance of meteorological forecasting in the military domain, emphasizing the need to understand atmospheric phenomena for making informed decisions and anticipating potential risks. By analyzing historical data and climate trends, it highlights the possibility of adapting military strategies to climate change and meteorological variability. Moreover, it proposes the use of historical archives, including military ones, to reconstruct past meteorological and climatic conditions, offering a new perspective on how weather and climate have influenced past military operations and may influence future ones.*

Keywords: *meteorology, aviation, military, history, climate*

1. INTRODUCTION

Meteorology has played and continues to play a very important role in the conduct of military activities, whether we are talking about ground, air, or maritime operations. This scientific branch is essential not only from the theoretical perspective of fundamental knowledge but also from a major standpoint. This is due to the immediate, direct, and persistent influences that weather and climate exert on human life and communities. Weather forecasting is indispensable for numerous fields of activity, having a significant impact on operational management and decision-making.

Ignoring the meteorological factor has led to major damage in military activities. In aviation, pilots have no control over weather conditions, but by understanding meteorology they can anticipate potential weather reactions and make informed decisions.

Examining how meteorological phenomena influence the performance of air missions and, to a larger extent, planned operations, represents a significant challenge for military specialists. However, this challenge is all the more pressing for those involved in air operations planning.

Forecasting and anticipating the evolution of atmospheric phenomena is always a crucial challenge to ensure the success of aviation activities, regardless of whether they are of a civil, commercial or military nature. This is true in times of peace, in crisis situations, and in times of war.

Historical documents containing weather data can provide new insight into how past military operations took place. It could also help to better understand how weather and climate influenced the strategies and outcomes of these operations.

By analysing historical data and therefore climate trends, the Romanian Army could develop its strategies and capabilities to adapt to climate change and weather variability in the future. This would involve considering the potential risks and threats associated with extreme or unpredictable weather conditions.

The development of improved capabilities and technologies for forecasting and monitoring weather conditions in areas of military interest would significantly support Romanian Army operations.

Over time, climate change has been understood largely due to climate reconstructions. However, weather events are most relevant to the climate system, and weather reconstructions play an important role in improving our understanding of atmospheric processes, especially during extreme events. [1]

Through detailed analysis of relevant historical documents and available meteorological data, a full picture of how weather and climate conditions have influenced past military operations and could influence future operations could be obtained. Furthermore, it could aim to identify climate trends and changes in the weather regime in Romania's areas of military interest in order to anticipate and adapt to these changes in the future.

Historical written archives include a wide range of materials such as manuscripts, books, diaries, newspapers, navigational records, clerical documents, images/drawings or inscriptions. They provide detailed descriptions of specific weather events or their impact. The identification and collection of such archives are valuable tools for reconstructing weather and climate conditions over the past centuries, based on both direct and indirect observations and human perceptions.[2]

Collecting and analysing these historical data allows researchers to understand long-term climate change and highlight potential changes in weather patterns over time. The information thus obtained contributes to the study of the impact of climate change on weather and the environment by providing useful data for assessing global climate change. For example, Teleti [3] is addressing the process of digitising weather observations from US Navy warship logs from World War II, bringing to light millions of previously unseen weather observations and allowing these observations to be used in historical climate research and for improved reanalysis.

The uniqueness of this work lies in the non-existence of such an approach in Romania. It is known that climate studies, especially climate reconstructions and meteorological analyses using military archives have not been carried out recently in Romania. This research gap can be attributed to several factors, including limited access to historical sources. However, there are examples of previous research in Romania that have examined climate issues using other historical sources. For example, studies such as those by Nicolae Panin, a renowned Romanian climatologist, have focused on using data from church archives and administrative documents to reconstruct climate variability in different historical periods.

This study highlights the capacity of meteorological data extracted from historical archives in the context of the two major campaigns conducted by the Romanian Army during the Second World War, namely the 1941 campaign and the 1944-1945 campaign.

The meteorological information from these two aerial campaigns is relevant to this study and in the context of climate reconstructions because of their distinct periods and seasons, so that the first covered the summer and autumn transition of 1941 and the second covers the autumn and winter of 1944 and the spring of 1945. In this way, we obtain meteorological data from all four seasons, and can then draw pertinent conclusions.

2. DATA AND METHODS

2.1 Analyzed period

In the Romanian Army during World War II, meteorology played a crucial role in the planning and conduct of military operations, having a significant impact on the effectiveness of the actions carried out. Although not always explicitly highlighted, meteorology had a substantial influence on military strategy, tactics and the effectiveness of field operations.

In the context of the two major campaigns conducted by the Romanian Army during the Second World War, namely the 1941 campaign and the 1944-1945 campaign, the role of meteorology was obvious and crucial for the evolution of events and for the results obtained on the ground.

In the 1941 campaign, weather conditions had a direct impact on the conduct of air and ground operations, influencing flight capabilities, visibility and troop mobility. Also, during the 1944-1945 actions, weather conditions influenced the planning and execution of military operations in Hungary and Czechoslovakia, sometimes seriously hampering the conduct of air and ground activities.

Therefore, in these two campaigns, the ability to correctly interpret meteorological information and adapt military strategies accordingly was of particular importance. In addition, during the war, efforts were made to improve meteorological services and the ability to provide accurate and up-to-date information to optimise the planning and execution of military operations.

2.2 Historical data

In the 1941 campaign the air missions were executed under Romanian command, the Air Staff being the planning, organizing and directing body of the large units and units, the cooperation with the German air force of the 4th German Air Flotilla being carried out through the Romanian-German Air Liaison Section.

The Air Battle Group, the large air unit set up for this campaign, comprised bombing aviation - 3 flotillas, 1 fighter aviation flotilla, other aviation structures specialized in reconnaissance, liaison, transport, observation missions, anti-aircraft artillery units, a radio and wire transmission company.[4]

On 22 June 1941, the Romanian air units ready for military action comprised a total of 50 air squadrons, including 6 liaison, 1 transport, 1 medical, 3 reconnaissance, 15 bombing, 17 fighter and 7 observation.[4]

On 22 June 1941, the following air units operated in the Air Battle Group:

- 1st Bombardment Flotilla with Savoia 79 Bombardment Group, 4th Los Bombardment Group and 5th Heinkel 111 Bombardment Group;
- 2nd Bombardment Flotilla with 1st Bombardment Group Potez 63, 18th IAR-37 Squadron and 82nd Bloch 210 Squadron;
- 2nd Guards Aviation Flotilla with 1st Guards Aviation Group and 2nd Guards Aviation Group;
- 1st Fighter Flotilla with 5th Fighter Group Heinkel 112, 7th Fighter Group Messerschmitt 109; 8th IAR-80;
- G.A.L. Command with 1 Reconnaissance Squadron and 116th Liaison Squadron.[5]

From the analysis of the data provided by the archive documents, the following assessment of the activity of the Romanian Air Force in the air campaign of 1941 resulted: [5]

Table 1. The activity of the Romanian Air Force in the Air Campaign of 1941

AVIATION CATEGORIES	WAR MISSIONS EXECUTED	NUMBER OF AIRCRAFT FLOWN ON MISSIONS	NUMBER OF FLIGHT HOURS FLOWN ON MISSIONS
<i>Reconnaissance</i>	254	298	646
<i>Fighter</i>	858	4739	6970
<i>Bombing</i>	463	2002	3873
<i>Observație</i>	3665	3665	6043
TOTAL	5230	10704	17432
<i>Seaplane</i>	566	586	1711
<i>Liaison</i>	830	818	1934
OVERALL TOTAL	6626	12108	21077

Since the first days of action, the Romanian Air Force has been able to demonstrate its professionalism through intense activity, but towards the end of June when weather conditions worsened considerably, air missions were sometimes carried out with great difficulty.

The Romanian air actions on the Western Front after 23 August 1944 were carried out in stages, as follows:

1. Actions of the Air Force under national command, 23 August-9 September 1944:

- a) Stage 23 - 31 August 1944:
 - Air actions in national territory;
 - Ground actions for the defence of airfields and territory;
- b) Phase 1 - 9 September 1944:
 - Rebuilding and reorganization of units, 1 - 6 September 1944;
 - Independent actions 1 - 9 September 1944;
 - Concentration of airborne units on the western area of operations, 6-8 September 1944;
 - Operation to cover the borders and concentration of Romanian-Soviet troops in Transylvania: 23 August - 20 September.

2. Romanian Air Force in the air operation for the liberation of Transylvania, 9 September-25 October 1944:

- Organisation of Romanian-Soviet air cooperation and joint actions in support of the Romanian 1st and 4th Armies and the Soviet 6th Armoured, 27th and 40th Armies, 9-20 September 1944;
- Subordination of the 1st Romanian Air Corps to the 5th Soviet Air Army and air actions from September 20 to October 5, 1944;
- Actions of the 1st Romanian Air Corps to complete the liberation of Transylvania and to prepare for the start of Operation Debrecen.

3. Air Force actions in Hungary, 8 October - 20 December 1944:

- Actions of the Royal Romanian Air Force during the Debrecen Operation, 8 - 30 October 1944;
- Actions of the Royal Romanian Air Force in the Budapest Operation, 30 October - 20 December 1944.

4. Air Force actions in Czechoslovakia, 21 December 1944 - 12 May 1945:

- Air battles in the first part of the Czechoslovak campaign, 21 December 1944 - 25 March 1945;
- Phase II of the participation of the 1st Romanian Air Corps in Czechoslovakia, 25 March - 1 April 1945;
- Phase III of participation of the 1st Romanian Air Corps in Czechoslovakia, 25 March - 11 April 1945;

- The 4th stage of participation of the 1st Romanian Air Corps in Czechoslovakia, 11 - 26 April 1945;
- The last stage of participation of the 1st Romanian Air Corps in Czechoslovakia, 26 April - 12 May 1945;
- Return of the Royal Romanian Air Force to the country.

In the Second Air Campaign, on August 23, 1944, in the first phase, the Romanian Air Force consisted of the following large units and air units:[6]

- 1st Romanian Air Corps;
- 3rd Romanian Air Corps;
- 3rd Fighter Flotilla;
- Interior formations;
- Antiaircraft Artillery Command;
- Passive Defence Command.

There were also Weather Forecasting and Air Navigation Protection Centres, starting in 1938, in Băneasa and Cluj, and from 1941, in Iași [7], whose main objective was to provide the air force with information and data on weather conditions.

2.3 Data from military archives

In this study we used meteorological data extracted from the National Military Archives. Data for the 1941 campaign in which the Air Force actions were conducted in several stages, including the conquest of air supremacy, support of ground troops and the liberation of southern Bessarabia, and engagement in Operation Odessa were taken from the 1st Fighter Flotilla Operations Log, June-October 1941.

And for the air campaign conducted by the Royal Romanian Air Force after Romania's transfer to the United Nations on 23 August 1944 for the liberation of Transylvania, Hungary and Czechoslovakia, data was taken from the Romanian Air Corps Operations Log, August 1944-May 1945.



FIG. 1. Romania during World War II. Romania in WW2 (quickworld.com)

Generally, a day in the Operations Log contains the date, operational activity, results achieved and sometimes details of weather conditions.

During these two campaigns, the methods mentioned in the archives by which meteorological observations were carried out are: aerial reconnaissance, reconnaissance or military transport aircraft could be used to carry out meteorological observations over the areas of interest, and radiosondes, to obtain data on temperature, humidity and pressure in different layers of the atmosphere, weather balloons equipped with measuring devices were used which transmitted the data back to the ground via radio stations.

Of the four months that the 1941 campaign lasted, 118 days to be exact, only 93 days were favourable for flying [8]. In the 25 days in which the activity of the aviation units was hampered by the weather, both the air force and the entire Romanian Army went through difficult moments.

From 4 to 18 July, when the Romanian Air Force was mainly supporting ground troops, weather conditions were one of the main factors that made it difficult to carry out operations according to the approved action plans.

A few examples are illustrative of what has been said:

- on 3 July 1941, between 4.20 and 5.35 a.m., a Heinkel aircrew on a sounding reconnaissance mission reported that "the sky was completely overcast and the ceiling below 100 m"[8], conditions not at all favourable for flying;

- on 17 July 1941, despite the rainy weather, which made air operations very difficult, the bomber air force continuously supported the offensive operations of the ground troops;

- from 18 July 1941 the action of combat aviation was hampered by weather phenomena, rain and low ceiling;

- the combat aviation missions for the last days of the month, established by Air Staff Operations Order No. 62 of 26 July 1941, could not be executed because of unfavourable weather.

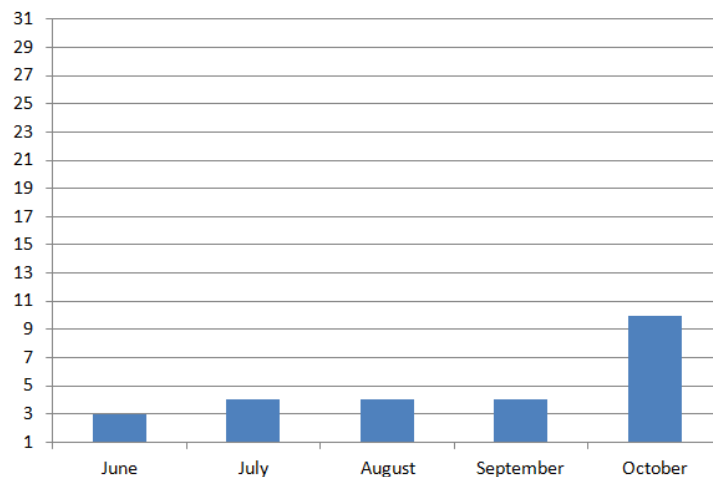


FIG. 2 The number of days on which meteorological data were mentioned in the 1941 air campaign

In figure number 2 we can see how often weather conditions were reported during the 1941 Air Campaign. Only days with unfavourable weather that endangered flight activity have been noted.

During the operation to liberate Transylvania, the Romanian Air Force encountered difficulties due to poor weather conditions which reduced flight activity. Examples are:

- on 27 September 1944, due to bad weather, no air force unit carried out missions [9];

- on 30 September 1944, only the information air force through the 12 Observation Squadron carried out four reconnaissance missions in the area of the 4th Romanian Army [9];

- the units of the 1st Romanian Air Corps could not carry out actions during this period because of the low ceiling and impassable terrain. Although the weather was unfavourable, the offensive on the Transylvanian Front resumed on 30 September 1944, when Arad, Oradea, Targu Mures and Turda were liberated [9];

The actions of the 1st Romanian Air Corps both on the national territory and for the start of the Debrecen Operation were hampered by the weather conditions:

- no aviation missions were carried out between 2 and 6 October due to bad weather;
- between 10 and 14 October 1944, the weather conditions did not permit any air activities;
- between 20 and 26 October, combat air actions could not be executed due to bad weather, except for information actions.

As for the Royal Romanian Air Force actions in Hungary, here too they were confronted with unfavourable weather conditions.

On 3 November 1944, the Soviet Army took the decision that the units belonging to the air force should be deployed beyond the mountains. One of the difficulties encountered in coordinating movements was related to unfavourable weather conditions (fog, low ceiling, rain), and also the lack of a meteorological service providing a local and current weather forecast. Because of the rainy weather, the newly laid out airfields were impractical, and it was not until 16 October 1944 that action on the new airfields was possible.

For the same meteorological reasons, the enemy had a rather low air reaction, only the anti-air reaction to important targets was extremely intense. As soon as the weather became favourable for flying activity, both German and Hungarian air forces did not hesitate to carry out day and night reconnaissance in the area behind the front.

Despite intermittent rains, low ceiling and fog, which until 20 December 1944 made it very difficult for the aircraft to take off and fly, the Romanian 1st Air Corps managed to execute the mission in support of the 27th Soviet Army thanks to the skill of the Romanian pilots. During the period 12-15 December 1944, they made the most of the few periods of time in which flying could take place.

The meteor generally showed in the Tisza area, frequent and persistent rain, often thick fog and haze, poor visibility, weather changing at short intervals and overcast skies at several ceilings. In the Miskolc area and the southern slopes of the Tatra Mountains, rainfall was light, skies slightly overcast, often with haze and fog in the valleys. Temperatures were low and horizontal visibility poor. Therefore, the Romanian 1st Air Corps required a well-developed meteorological service, with networks of stations and radio equipment that could make forecasts [10].

Air operations in Hungary were generally conducted in difficult conditions due to adverse weather conditions (rain, persistent fog, low ceiling). On the other hand, the weather changed rapidly during the course of a mission from one area to another, so that formations had good weather at take-off and at the target, but encountered extremely difficult conditions on their return.

In the Tatra Mountains region, weather changes occurred frequently, with fog and thick haze in the valleys for long periods of time. Thus, due to the non-existence of a meteorological service and out of great necessity, weather reconnaissance flights were often carried out, which were often risky and futile.

The Royal Romanian Air Force in Czechoslovakia, in the first half of February 1945, when bad weather did not allow flights to take place, took care of the preparation of Lucenec airfield. In the other half of February, the 1st Romanian Air Corps, due to the improvement of the weather situation, continued its combat activity in support of the land armies. During this period, the air force activity for the air support of the ground offensive maintained an active and strong character, at an accelerated pace, supported by good weather [10].

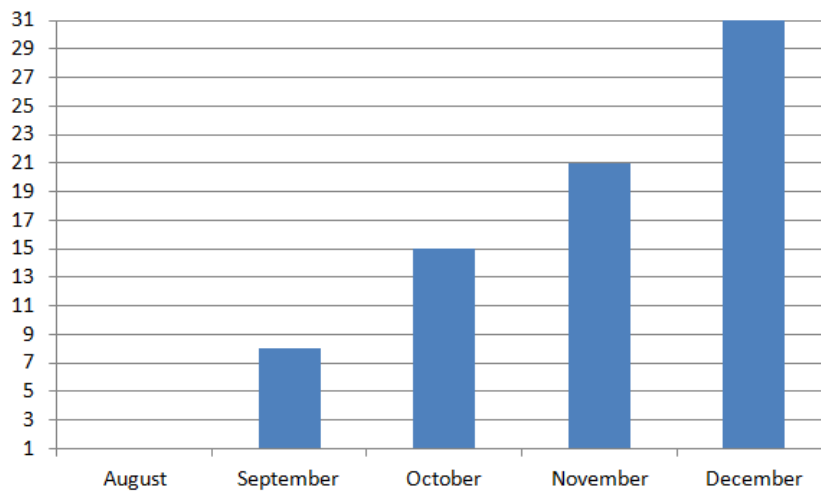


FIG. 3 Number of days on which meteorological data were mentioned in the 1944-1945 campaign between August-December

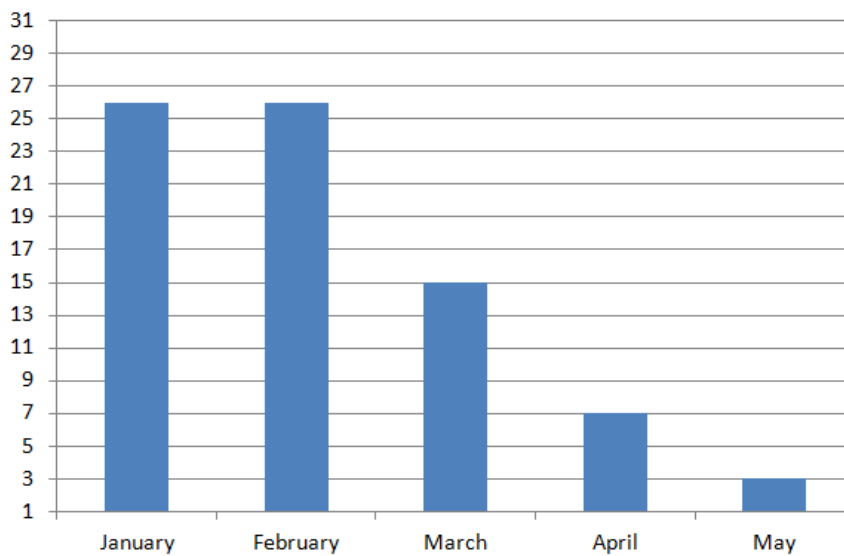


FIG. 4 Number of days on which meteorological data were mentioned in the 1944-1945 campaign between January-May

The number of days represented for each month of 1944 and 1945 in Figures 3 and 4 refers to both days with good flying weather and days when flying was not possible due to weather conditions.

2.4 Methods

The extraction of data from military archives was done manually, so it was necessary to special care in collecting weather data because weather information was not structured into separate headings, but was often sandwiched between other activities of that day.

In order to carry out the present study, separate databases were set up for each Air Campaign investigated. Each Operations Log was subjected to careful and rigorous analysis. The collected data were meticulously organised, including by grouping them according to the following criteria: a) the date on which the weather event occurred, b) the location of the event, c) the event and d) the primary source of the information (Fig. 6).

This process of structuring and categorising the data was essential to allow a detailed and systematic analysis of the information obtained from the operation logs, thus facilitating the understanding of the context and the correct interpretation of the results.

3. LIMITATIONS

Meteorological data was often noted only when it hindered aeronautical activities: "53rd Fighter Squadron. As it rained all night, the morning mission could not be executed, as the ground was completely untenable and the bombers could not take off" [11].

The weather information in the archives is not very detailed, most of the time it mentions the phenomenon that disturbs the activities "haze, fog, rain", rarely it contains details about the height of the base of the ceiling and visibility "weather results are unfavourable: ceiling 350-500 m., and visibility varies from 1500 to 4000 m" [11], and most of the time it only mentions: "unfavourable weather. No activity"[11].

Although the text is clearly worded, there were errors in the spelling of place names and small mistakes in the date. The difficult part was correctly identifying the locations where the weather conditions were unfavourable, as there were multiple events and each air structure had a different mission. Most of the time, the location was not clearly mentioned and had to be deduced from the general context or from the first activities carried out.

4. RESULTS

Careful analysis of documents from the military archives revealed that during the 1941 campaign in southern Bessarabia and operation Odessa, there was a period of 25 days when the Romanian Armed forces could not operate due to unfavourable weather conditions. This discovery sheds new light on the dynamics and difficulties faced by the troops involved in this crucial campaign. The impact of these adverse weather conditions was significant on the overall progress of the campaign.

This data from the military archives not only provides a more detailed perspective on events during the 1941 campaign, but also highlights the importance of external factors, such as weather conditions, on the conduct of military operations and strategies adopted during World War II.

An exhaustive analysis of historical documents reveals that during the intense air campaign for the liberation of transylvania, hungary and czechoslovakia, which took place between 1944 and 1955, weather details were recorded for a total of 152 days. These data provide a detailed insight into the impact of weather conditions on air operations during that tense period of history.

The results are remarkable and indicate a crucial dependence on favourable weather conditions for the progress and effectiveness of air operations. Of the 152 days for which data were recorded, only 11 days reported favourable flying weather.

However, what is more significant is that on the remaining 141 days, weather conditions were characterised as unfavourable for flights. This implies an overwhelming majority of the time air operations were affected by poor conditions, such as dense fog, rain or strong winds, which hampered or even prevented the conduct of flights and the execution of planned military tasks.

5. CONCLUSIONS

From the archival data presented in the first campaign, it appears that, although only 1/5 of the total number of combat days had unfavourable flying conditions, there were dramatic situations in the field actions and only the blood sacrifice of the Romanian troops, who spared no sacrifice, despite the difficult weather conditions, made these situations to be successfully overcome.

The observation made at the end of the campaign was that "in the hard days of the current war the air force wrote with youthful blood: this is not the way through"[12] in that period of time, the rapid maturation that took place in the Romanian Air Force was a real benefit, the Air Force gained a vast experience in the art of air warfare, a reality that would manifest itself with the highest professionalism in the campaigns that followed in the east, over the national territory and in the west.

The Romanian Air Force had a significant performance during the second campaign, despite the fact that out of the nine months the entire operation lasted, approximately four months were characterized by weather conditions unsuitable for flight activities. The assessment made after analyzing this campaign, largely based on information provided by archival sources regarding the meteorological situation, is that when weather permitted aerial actions, the performance of the Royal Romanian Aeronautics demonstrated the viability of its organizational model and doctrine, predominantly offensive and extremely efficient, ensuring the success of ground military actions.

These findings highlight the vulnerability and complexity of aerial operations in the face of meteorological factors and underscore the importance of adapting strategies and planning according to environmental conditions. Additionally, these data provide a clear picture of the challenges faced by pilots and military commanders during the aerial campaigns of that period and emphasize the need to consider external factors in the planning and execution of military operations.

Meteorological data extracted from military archives are essential for climate reconstructions and understanding past climate changes. Moreover, meteorology plays a crucial role in military operations and in protecting personnel and military equipment. Integrating meteorological information into the planning and execution of military operations can enhance their efficiency and safety.

Overall, the analysis of data from the two campaigns provides valuable insight into meteorological conditions and their impact on military operations during those specific periods. These conclusions can serve as a basis for understanding and adapting to meteorological conditions in future military operations.

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