IDŐJÁRÁS

Quarterly Journal of the Hungarian Meteorological Service
Vol. 119, No. 2, April – June, 2015, pp. 267–275

Meteorological support, weather warnings and advisories in the Hungarian Defence Forces

Richárd Büki[1]* and **Kornélia Radics**[2]

[1]*Geoinformation Service of the Hungarian Defence Forces*
Szilágyi Erzsébet fasor 7–9., H-1024 Budapest, Hungary

[2]*Hungarian Meteorological Service,*
Kitaibel Pál u. 1., H-1024 Budapest, Hungary

**Corresponding author E-mail: buki.richard@mhtehi.gov.hu*

(Manuscript received in final form April 25, 2014)

Abstract—During the history, it has been proved several times that ignoring the quickly changing meteorological circumstances and atmospheric phenomana or their insufficient assessement can result in catastrophic impacts on military operations. Weather plays a very significant role in flight operations, and it can be vital even for planning and executing operations of land forces and for any other open air activities involving armed forces (e.g., disaster relief activities, industrial and natural catastrophes, and in assessement of chemical, biological, radiological, and nuclear events). The possible course of weather and the range of the climatological factors should be taken into consideration for protecting life, property and infrastucture.

In the Hungarian Defence Forces, the focus of the meteorological support is on providing the necessary meteorological information for decision makers supporting the planning and executing certain military activities, and enhancing efficiency. This is a very complex task and that is the reason for having specialized meteorological service and capability within the Hungarian Defence Forces which can meet these requirements.

The military weather warnings and advisories ("military weather warnings") are specialized type of forecasts. They alert the military users on the possible or expectable severe weather, which can significantly impact life and property in order to mitigate the unfavorable effects of the severe weather. For avoiding misinformation in the meteorological support in our daily routine, the military weather warnings should be in harmony with the weather warnings issued by the Hungarian Meteorological Service for civilian users, which is enabled by the strong and efficient cooperation between the two services.

This paper describes some effects of weather on military activities in general and military weather warnings within the Hungarian Defence Forces.

Key-words: weather impact, warning, advisory, severe weather, military

1. Introduction

In order to deeply understand how civilian and military meteorology differ, firstly it is needed to be defined. By definition, the military meteorology is the science concerned with the collection and analysis of the understandings of the physical characteristics of the past, current, and predicted states of the atmosphere, including space, and the ability to exploit this information for the planning and conduct of military activities.

This paper highlights those weather elements that affect the different branches of the Hungarian Defence Forces.

2. Impacts of different meteorological elements on military activities

2.1. Barometric pressure

The weight of the air affects gunnery computations and ballistic preformance in armour operations.

The air pressure affects artillery operations due to projectile trajectory, barofuzing, and fire control calculations. Moreover, the vertical pressure profiles are essential in both baroarming and barofuzing as they are required for calculating densities for ballistic firing data (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

Aviation is one of the main user of barometric pressure data. Densitiy altitude, which is in strong connection with the barometric pressure, determines if an aircraft has enough lift capabilities and performance to get off the ground. Too much densitiy altitude limits fuel, weapons, and passenger loads.

2.2. Clouds and sky cover

Low overcast clouds limit the effectiveness of aerial illumination devices. Overcast clouds tend to limit heating of inactive targets and lower target detection ranges for thermal sights. NVG (night vision googles) are limited by clouds blocking natural light from the moon and stars. Close air support and aerial resupply missions are degraded by low clouds. Low ceilings affect target acquisition systems and terminally guided munitions. Low overcast clouds will limit the effectiveness of aerial illumination devices (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

Clouds are always a major consideration for aviation operations. Low overcast clouds will limit the effectiveness of aerial illumination devices. Overcasts tend to limit heating of inactive targets and lower target detection range for thermal sights. NVG are limited by clouds blocking natural illumination from the moon or the stars. Best use of most NVG requires about a

quarter of the moon, 30 degrees above the horizon, scattered clouds, and the sun more than 5 degrees below the horizon. Close air support and aerial resupply missions are degraded by low clouds.

From a CBRN (chemical biological radiological and nuclear) point of view, persistent overcast low clouds usually indicate a neutral condition for the hazardous materials, while broken low clouds indicate an unstable condition during the day and a moderately stable condition at night.

Overcast skies with low cloud bases reduce the effectiveness of infrared and photographic collection systems, and may restrict the use of UAVs (unmanned aerial vehicle).

2.3. Humidity

Coupled with high temperatures, high humidity decreases crew effectiveness in closed vehicles. The humidity should be taken into consideration in artillery operations due to its use to compute virtual temperatures for ballistic firing data.

High humidity destroys some chemical agents such as lewisite and phosgene because of rapid hydrolysis. High humidity increases the effectiveness of HC and phosphorous smokes, some chemical agents, and both wet and dry forms of biological agents. High humidity improves the effectiveness of wet aerosols by reducing evaporation, while low humidity assists agent aerosols (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

Extreme humidities affect handling, storage, and use of building materials. When coupled with high temperatures, humidity affects personnel and significantly increases the time to perform physical work.

2.4. Precipitation and icing

Rain and snow degrade trafficability and limit visibility. They also degrade target acquisition and NVG. Rain and snow affect visibility and the safety of both crew and airframe.

Rain and snow will effect the persistence of chemical agents and may produce radioactive rainout and hot spots. Snow may cover and neutralize certain liquid agents. Rain may even work as a decontaminate. On the other hand, some agents may be very persistent on snow (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

High rainfall rates influence river currents, water depth, and bridging operations. It complicates other construction or maintenance jobs, affects flooding, rivercrossings, soil bearing strength, and explosives.

Ice on lifting surfaces affects the aerodynamics of the aircraft. Even a little ice is a big problem.

Even moderate amounts of rain and snow will obstruct vision and degrade photographic and infrared data collection systems (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

2.5. Wind and turbulence

Trajectory projections and first round hit capability can be affected by high crosswinds. Winds affect the accuracy of rocket fire and firefinder radar trajectory computations (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

Strong winds aloft impact all ballistic projectile aiming calculations. Accurate and timely meteorological data can compensate for the problem. Wind profiles play a major role in ballistic wind compensations for artillery firing.

Strong winds, especially cross-winds, affect aircraft control near the ground during take-off and landings. Turbulence is a critical condition affecting all aviation assets and missions. It may cause aircraft structural damage or even crashes during take-offs and landings. Severe turbulence may cancel all operations.

Winds play a significant role in CB (chemical and biological) agent dispersion, chemical agent persistence, and aerial delivery methods. Very light and strong winds degrade effectiveness of smoke and CBRN operations. Wind direction is considered for fallout pattern determination.

Ground level winds affect river crossings, port management, and all watercraft. Construction projects in chronic wind areas may need to recalculate structural strength figures. Strong winds may damage or prevent installing antennas.

2.6. State of the ground

Frozen ground improves mobility and significantly increases the time available to prepare fighting positions. Deep snow slows movement of tracked vehicles. Frozen ground and mud affects munitions, sensors, and indirect fire.

Soil conditions impact the effectiveness of chemical agents. Bare, hard ground favors short-term effectiveness and high-vapor concentrations. If the surface is porous, such as sand, the liquid agent quickly soaks in. Vegetative cover reduces exposure to ultraviolet light and favors the survival of wet aerosols (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002). Wet soil degrades the effectiveness of smoke munitions.

Ground conditions impact mining operations, trenching, and any excavation job. Snow cover can impact the emplacement of scatterable mines.

Ground state affects trafficability and movement rates. Frozen ground improves mobility and will increase the time available for preparing fighting positions.

Wet grounds can affect trafficability and movement rates. Frozen ground improves mobility and significantly increases time available for preparing fighting positions. Deep snow slows movement of tracked vehicles. Frozen ground affects systems such as mines, sensors, and indirect fire.

2.7. Temperature, frost line, and thaw depth

High and low temperatures influence the type of lubricants to be used, engine warm-up periods, and sustained rates of fire for weapons.

High temperatures decrease the time personnel can remain in vehicles. High temperatures cause gun tube droop, shimmering, mirages, and vehicle exteriors to be too hot to touch. Extremely high temperatures increase water consumption.

Low temperatures degrade the ballistics of main guns, require frequent starting of engines, and may increase maintenance problems and possible detection by the enemy. Extremely low temperatures reduce personnel effectiveness and decrease the availability of water because of freezing.

Temperature profile affects calculations of ballistic artillery firing. The profile is used to compute virtual temperatures for artillery firing. Extreme cold affects gun accuracy and fuse functioning.

High temperatures reduce lift capability. Cold temperatures increase maintenance requirements and the time needed to accomplish each task. The number of personnel that can be carried on a flight is reduced due to the weight of cold-weather gear.

Some agents are more persistent at low temperatures. Vaporization may be a problem with higher temperatures. Normal atmospheric temperatures have little direct effect on a biological agent aerosol. Sub-freezing temperatures make water-based decontamination methods ineffective.

High temperatures impact trafficability, influence flood control, and dictate the use of certain construction materials. Cold weather influences ice thickness and river crossings, while ice flow problems affect bridges. For example, armored vehicle launched bridges are affected by warming if they were set up on frozen ground. Alternating freezing and thawing (frost heaves) may destroy the effectiveness of emplaced mines.

Frozen soil increases the difficulty of grounding equipment. At extreme cold temperatures, cables snap and wire is unmanageable. Extreme cold also shortens battery life and may put systems requiring a good source of battery power out of service.

Too cold or too hot conditions dictate the type of lubricants to be used, engine warm-up periods, and sustained rate of fire for weapons. Extreme low temperatures reduce personnel effectiveness, and decrease the availability of water because of freezing. Temperatures changing from above to below freezing can freeze stationary tracks into the mud. High temperatures cause gun tube "droop," shimmering, mirages, and vehicle exteriors to be too hot to touch.

The frost line impacts site selection, construction, excavation, and trafficability.

2.8. Visibility

Visibility affects visual target acquisition, fire adjustment, and electro-optical (E-O) target designation. Reduced visibility affects the placement of forward observers and fire support teams (*METOC Effects Smart Book, (http://www.fas.org)* – Homepage of the Federation of American Scientist, 2002).

The lack of good visibility affects landings and take-offs, terminally guided munitions, and the ability to distribute scatterable mines.

Low visibility decreases the effectiveness of visual, photographic, infrared, and E-O collection systems.

Poor visibility increases the survivability of infantry units.

2.9. Thunderstorms and lightning

Electrical storms restrict the use of and handling some munitions and fuse types because of safety.

Extreme weather that includes thunderstorms and lightning is very hazardous to inflight operations, refueling, and rearming operations.

Electrical storms, and the associated rain and wind, affect electronic systems in general and antennas, shelters, and mobility in particular.

3. Weather warnings and advisories

Certain weather conditions endanger life and/or property, pose a safety hazard, or adversely impact operations. Weather units should monitor these phenomena and provide products and services to support the possbily affected services and units when these conditions are observed or forecasted. These items include weather advisories and warnings.

A weather warning (WW) is a special notice provided to supported customers that alerts them to very likely weather conditions of such intensity that could pose a hazard to life or property.

A weather advisory (WA) is a special notice provided to supported customer that alerts them the likely potential of weather conditions that could affect their operations.

Within the Hungarian Defence Forces (HDF), the meteorological support is clearly defined in a Manual on Supporting Military Activities signed by the Chief of General Staff. This manual is the highest level document, and it is a framework for the main principles, duties ans goals in the field of military meteorological support.

Each unit involved in military meteorological support has its Standard Operating Procedure (SOP). This SOP deals with the aspects of military meteorolgical support at a certain unit in detail (including range of product, duties and responsibilities, order of reporting, threshold values for different weather elements if they apply). The SOPs are completed by the respective meteorological unit and approved by the Geoinformation Service of the HDF (GEOS).

GEOS is the supervising unit in the field of military meteorology in Hungary. There is a Weather Forecast and Training Department within the GEOS providing the personnel for the continuous meteorological support and professional supervision over the meteorolgical support acitivities carried out in the HDF.

As the leading professional meteorological unit of the HDF, GEOS is entitled to issue WWs and WAs for the whole activity spectrum of the HDF and MoD including excercises, troop movement, tansport, and any other open air activities.

There are three types of WAs and WWs isued by GEOS:

- Preliminary General WA is a forecast in plain text format for general military users with 24–72 hours lead time.
- General WA is a forecast in plain text format for general military users with 3–24 hours lead time.
- WW is a forecast in plain text for general military users with 1–3 hours lead time (*Fig. 1*).
- In every case when a WA or WW has been issued, its receipton is verified by phone call and sent via electronically as well.

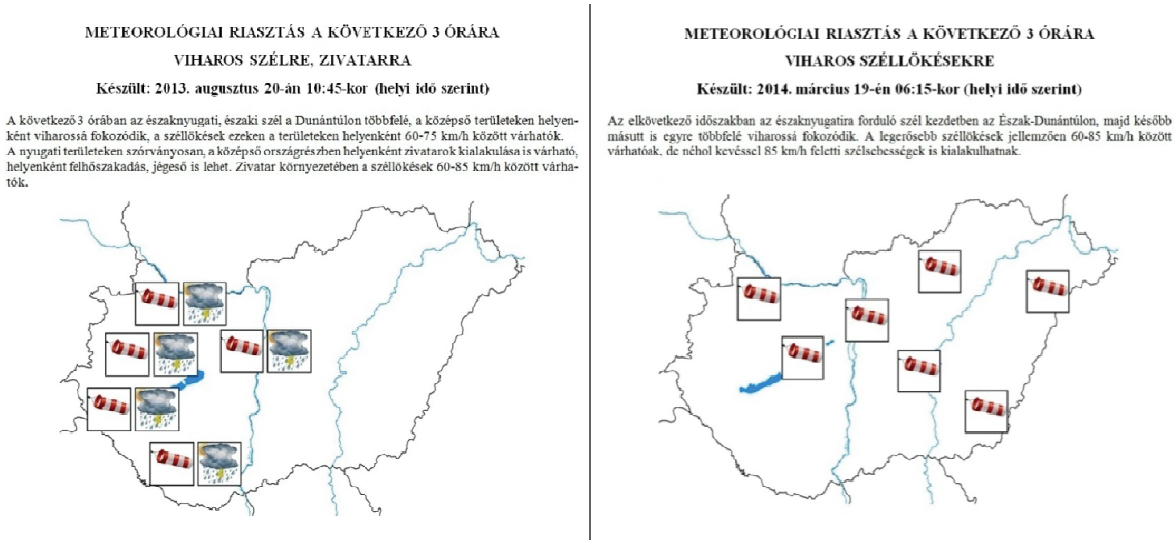

Fig. 1. Two examples for weather warnings issued by GEOS.

The Meteorological Center of the Air Command and Control Center of HDF (ACCC) provides meteorological support for the military aviation in Hungary and entitled to issue aviational WWs in harmony with the WWs and WAs issued by GEOS. The WWs are in a text and map combination format with an abbreviated form of text explanation (*Fig. 2*). The issued WWs are sent to GEOS and the MSUs at the airfields.

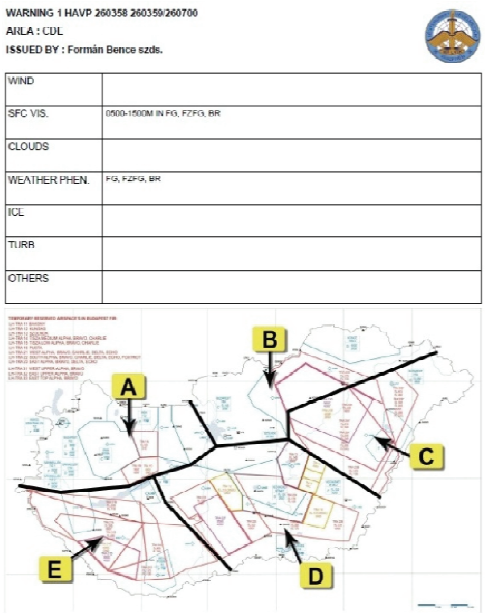

Fig. 2. An example for weather warning issued by ACCC.

Different weather warnings and advisories by Hungarian military MSUs are summarized in *Table 1*.

Table 1. WAs and WWs

No.	Station	Airbase	Lon [° E]	Lat [° N]	Altitude [m]	To
1	Kecskemét	59. Szentgyörgyi Dezső Air Base	19.75	46.91	114.0	designated local users GEOS ACCC
2	Szolnok	86. Szolnok Helicopter Base	20.13	47.17	90.0	designated local users SARS GEOS ACCC
3	Pápa	Pápa Airbase	17.50	47.37	146.6	designated local users Heavy Airlift Wing Search and Rescue Service GEOS ACCC

4. Conclusions

The weather and its effect can pose significant threat to life and property. This is valid to a wide range of military activities; therefore, it is vital to operate a capable, well structured, and regulated system of meteorological support. In order to fulfil its mission, every level of the military meteorological support in Hungary provides in-time weather warnings and weather advisories to mitigate the possible negative effects of weather.

References

METOC Effects Smart Book, (http://www.fas.org) – Homepage of the Federation of American Scientist, 2002