

Climate Change and International Security: Challenges for the Austrian Military Geoservices

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Military geoscientific expertise may contribute to international security with regard to the complex developments caused by climate change. In addition, there are developments and future challenges concerning the military geoservices that relate to the preparation of the Austrian Armed Forces for fast-changing environments.

Introduction

The anthropogenic emissions of greenhouse gases have led to a rise in global average temperature of 1.1°C compared to the measurements of the late 19th century. This ongoing trend is caused by unsustainable energy use, land use, land-use change as well as patterns of consumption and industrial production. Although almost all countries contribute to higher concentrations of greenhouse gases in the air, the individual contributions of states are highly uneven (IPCC, 2023).

Geologically speaking, a higher global temperature leads to very rapid climate change, which, in turn, causes devastating weather phenomena and changes in the appearance of the Earth's surface. As a result, an increase of the global sea level, extreme weather events and extreme temperatures put a strain people all over the world. Serious problems, for example water or food shortages, health problems and an escalation of distributive injustice pertaining to daily necessities, result in accelerated socio-economic changes, which may threaten both national and international security (UN, 2021; German Federal Ministry for Economic Cooperation and Development, 2008).

There is a large number of publications dealing with the geoscientific problems of climate change, and almost every member country/participating State of the EU, OSCE or NATO has implemented the risks of climate change related to security in their national military strategies and policies. This study aims to bridge both poles, the geoscientific and the political

spheres, and elaborates on the military challenges of the effects of climate change on international security from the perspective of Austrian military geography. The findings should serve both members of international military geoservices and interested policy-makers with a military and/or security background.

Austrian military geoscience

Modern military organisations such as the United States Armed Forces, the British Armed Forces or the German *Bundeswehr* have highly specialised organisational structures dealing with the wide range of military geographical needs. However, international military geosciences are often referred to as “military geology”, “geospatial intelligence” or, more generally, “Geoinformation Centre” and involve the application of geoscientific knowledge and techniques to support military operations and national security.

The dynamic interaction of geofactors such as “lithology”, “water”, “soil” and “weather” strongly affects military personnel, operational readiness, military assets, equipment and infrastructure not only during military operations but also during times of peace. Therefore, the following key tasks and contributions of international military geosciences can be defined:

1. Terrain analysis and geospatial intelligence

Military geoservices use geospatial data, satellite imagery, aerial photography, and geographic information systems to gather, analyse and interpret information for military purposes. This may include identifying enemy positions, monitoring changes on the battlefield, and assessing the suitability of terrain for various operations. Therefore, geoscientific analyses of terrain and topographic features are fundamental to understanding their impact on military operations. This includes assessing factors such as slope, elevation, vegetation cover, and geological formations that may affect troop and vehicle movements, visibility, and defence strategies.

2. Environmental impact assessment

For any military activity, it is important to systematically evaluate its environmental impact, including the potential effects of weapons testing, troop movements, and infrastructure constructions on the natural

environment. This information is crucial for minimising environmental damage and complying with international agreements.

3. Resource assessment

Understanding the availability of natural resources, such as water, minerals, and building materials, is important for military logistics and sustainability during military deployments and operations. Resources assessment is an integral part of military self-sufficiency.

4. Infrastructure planning

Military geoservices contribute to the planning and construction of military bases, airstrips, and other infrastructure by assessing the geology and soil conditions of potential base sites.

5. Crisis and disaster response

Geoscientific expertise helps to deal with natural disasters or humanitarian crises by providing geospatial data, which assess the extent of damage, plan relief efforts, and coordinate logistics.

6. Geological hazards

Identifying and mitigating geological hazards such as landslides, earthquakes, and volcanic eruptions in operational areas is crucial for the safety of military personnel and equipment.

7. Navigation and mapping

The timely provision of precise geospatial information is the precondition for accurate navigation, mapping and targeting systems used in military operations.

8. Research

Military geoservices actively contribute to national and international scientific projects in order to close capability gaps in the defence sector and to develop new knowledge.

International military geoservices cover at least one of these tasks but strongly differ in scope and focus. However, military geosciences have played a significant role in modern warfare and defence strategies, although they are hardly mentioned directly in security or defence policy due to their cross-sectional subject matter.

Within the Austrian Armed Forces, the Austrian Institute of Military Geography carries out most of the key tasks of military geosciences, although there is an overlap with other departments and military branches. There is a strong focus on mapping and the visualisation of geoinformation, and the broad spectrum of terrain analysis clearly addresses higher levels of military leadership.

The Austrian Institute of Military Geography is therefore the central contact point for the Austrian Ministry of Defence, its subordinate departments, and state crisis management in all matters relating to analogue and digital geographical data and geoinformation requirements.

Climate change, security and military geosciences

It is common knowledge that the effects of climate change act as an insecurity amplifier, exacerbating existing social, economic, and political tensions especially in vulnerable regions. For example, the ever longer-lasting droughts in the Sahel zone cause serious food and water shortages, which worsen conflicts and accelerate displacement (UNHCR, 2022; UK Parliament Post, 2022). First occurring locally, this scarcity of resources increasingly plays a state-wide and even international role. Especially in regions relying heavily on agriculture, the escalating competition for foodstuffs plays an increasingly destabilising role. Of course, the situation in West Africa and the Middle East regarding the decline in seasonal precipitation is one of the most obvious, but it has also become a serious problem in the South-East Asian and South American regions.

Almost every country in the world experiences an increased number of extreme weather events, which has the potential of disrupting societies and straining emergency response systems even in resilient countries. For example, there is a strong relationship between the increasing number of hurricanes and storm floods, raising national security issues in the USA (GRI, 2022).

However, not only resource scarcity and extreme weather events are responsible for an increasing destabilisation of societies. Due to the melting of the pole ice, the global sea level rises by about 20 cm per year, which creates a new source of conflicts and instability. Nearly 60 percent of the global pop-

ulation live within a radius of 60 km from a coastline, and the danger is acute for some 900 million people (UN, 2023).

While climate change directly or indirectly has primary effects on national and international security, there are also secondary mechanisms. Climate change influences world economics, leading to job losses, increased poverty, and reduced economic stability. This potential instability can, in turn, contribute to security challenges (WBGU, 2007).

Understanding the underlying geoscientific fundamentals of climate change in general allows an earlier detection and possible avoidance of negative effects on security. Military geoservices such as the Austrian Institute of Military Geography deliver geoinformation for ongoing missions, military training and operational planning. Therefore, the relevance of military geosciences will potentially increase.

In order to address security challenges, many countries are incorporating climate change considerations into their national security strategies, thus affecting military policies (e.g. Federal Foreign Office, 2023 or Cabinet Office, 2008). On the one hand, this includes efforts to reduce greenhouse gas emissions to mitigate the impacts of climate change as well as adaptations to military capabilities and workflows. The essential performance of military geoservices could be the identification of the effects of global climate change on local terrain and the consequences for military personnel, equipment and operations.

International political and institutional framework (EU, OSCE, NATO)

Adapting military geoservices to current and future security issues caused by climate change is not (only) a national question. The Austrian Armed Forces act in an international political environment and will therefore most likely be used in multinational frameworks. As a small country, Austria can contribute qualitatively by providing precise and quick geodata during planning and participating in international missions. In the context of the Austrian Security Strategy, three international institutions play a key role for the Austrian Armed Forces and therefore for the Austrian military geoservices (Austrian Security Strategy, 2013): the EU, the OSCE, and NATO.

The European Union (EU)

Climate change poses a significant threat to EU military assets, capabilities, and operations, necessitating adaptations for increased operational effectiveness in the EU defence sector. For Europe, the European Commission highlights the climate-energy-defence connection and proposes actions to enhance climate resilience and energy sustainability in EU defence (European Commission, 2008). Climate change affects all sectors, with severe economic losses recorded in the European economic area between 1980 and 2020. Energy production and distribution are exposed to various climate hazards, while fossil fuels, still part of the energy mix, face climate-related threats (Tavernes Da Costa et al., 2023).

Therefore, the EU recognises the significant security risks associated with climate change and has developed a strategy to address this intersection of climate change and security (European Commission, 2023). In addition, there is an engagement in climate diplomacy to promote international cooperation on climate action on both a political and an economic level. By working with other countries and organisations, the EU aims to prevent and mitigate climate-related security risks.

The EU supports the development of early warning systems that can identify climate-related security risks. This helps anticipate potential conflicts and allows for proactive measures to be taken.

Climate change may lead to resource scarcity, such as water and food shortages, which trigger and intensify regional conflicts. The EU strategies to address these challenges include sustainable resource management and supporting resilience in vulnerable regions. Owing to potential increased migration and displacement as people are forced to leave their homes due to climate-related impacts, the EU provides assistance to those affected (UN General Assembly, 2019).

The EU integrates climate change considerations into its peacebuilding and conflict prevention efforts. It recognises that climate-related factors can contribute to conflict and instability and aims to address these root causes. The focus of the strategy is on cooperation with international partners, including the United Nations, and on coordinating efforts to address climate-related

security risks at a global level. The EU engages with the security sector to ensure that climate change is considered in security planning and operations. The EU's strategy on climate change and security defines climate change as a multi-dimensional challenge that can have far-reaching security implications. By addressing these issues comprehensively, the EU aims to contribute to global stability and resilience in the face of climate-related threats (Lazarou and Tothova, 2022).

The Organization for Security and Co-operation in Europe (OSCE)

The OSCE acknowledges that climate change contributes to conflicts, particularly in regions with limited resources. The approach to climate change and security is rooted in its mandate to promote peace and stability in the Euro-Atlantic and Eurasian regions. Therefore, a strong focus is placed on the importance of early warning systems, international dialogue, and conflict prevention measures to prevent conflicts from arising (OSCE, 2007).

The OSCE promotes sustainable resource management as a means to mitigate potential conflicts that stem from resource scarcity exacerbated by climate change. This includes sharing best practices and supporting capacity building in participating States.

Climate change can lead to more frequent and severe natural disasters. Efforts to reduce disaster risk, including improving preparedness and response mechanisms to reduce the security risks, are just as much part of the strategy as providing assistance and capacity building to OSCE participating States. This may include training, sharing knowledge and best practices in topics related to climate change on a political level.

However, the OSCE also adopts a comprehensive approach to international security that recognises the interconnections between environmental, economic, and social factors. Climate change is considered within this broader context, and efforts are made to address its impacts on overall security. To align efforts in addressing climate change and security at the regional and global levels, there is collaboration with NATO and the European Union focusing on discourse and dialogue events. (Barnhoorn, 2023; OSCE, 2021)

The North Atlantic Treaty Organization (NATO)

NATO conducts risk assessments to identify and analyse the security risks associated with climate change, such as extreme weather events, resource scarcity, and population displacement. Climate change is seen as a “threat multiplier” that exacerbates existing security challenges and increases the intensity of existing conflicts (Farhan et al., 2023).

As the largest global military alliance, NATO has a strong focus on reducing its environmental footprint by incorporating more sustainable practices into its operations and activities. This “greening the military” includes serious efforts to decrease energy consumption and emissions (Barry et al., 2022). In addition, climate change considerations are integrated into military planning processes. This may ensure the minimisation of future climate-related risks and negative impacts on military operations (NATO – OTAN, 2022).

There is also collaboration with the United Nations and the European Union to address the common interests related to climate change and security challenges. For example, NATO promotes the sharing of climate data and information among Member States and partners to improve situational awareness and enhance decision-making.

NATO explores innovative technologies and solutions to enhance its ability to respond to climate-related security threats. The focus is on building resilience within its Member States and partner countries. This includes enhancing the ability to withstand and recover from climate-related disruptions and disasters.

Military relevance for international policies on climate change and security

Environmental damage may justify national or international military intervention, although political or economic sanctions are a more likely response (US Government, 2015; 2021). However, an increasing intensity of extreme climate events could alter public and political attitudes toward military force. Increasing climate instability may require European forces to show an overseas military presence and engage in humanitarian assistance and disaster relief operations. Climate change could therefore lead to a greater emphasis on

armed forces' roles in addressing environmental challenges and security concerns, potentially shifting resources from traditional combat capabilities. European forces may operate in more climate-fragile environments and need to consider the environmental impact of military operations (Berry et al., 2022).

Military challenges and situational awareness

The application of geoscientific methods for military interests purposes the deep understanding of the terrain that surrounds a soldier. Therefore, the methodological framework for analysis is set by the specific mission goal and the level of abstraction, which depends on the recipient of geoinformation. In all cases, the principle “as little as possible but as much as necessary” applies. In this sense, military geosciences are always in the field of tension between scientific accuracy and operational practicability (McNealy et al., 1999).

Due to an increase in complexity, these two poles drift even further apart because of climate change and its negative impact on the environment. This means that one of the most challenging military problems in dealing with environmental topics is the development and application of an appropriate scientific methodology covering the rapid changes of militarily interesting geofactors over time.

To put first things first, however, it is fundamental to become aware of the numerous problems for military personnel, equipment and operations caused by climate change. Embedded in international alliances (e.g. European Union) and organisations (e.g. United Nations), the Austrian military strategic interest focuses on the Balkan region, the Middle East and Western Africa, which are one of the areas most affected by climate change. The most important impacts of climate change on these focus areas are explained below:

Balkans

Like many other parts of the world, the Balkans are experiencing rising temperatures, changes in precipitation patterns, and more frequent extreme weather events. Climate change leads to shifts in rainfall patterns, potentially causing more intense and prolonged droughts or heavy rainfalls, increasing the likelihood of flooding.

The Balkan Peninsula is experiencing higher average temperatures, which lead to more frequent heat waves with negative consequences for agriculture and health. Changes in precipitation affect water resources, such as rivers and lakes, which are vital for local energy production and human nutrition, especially in the southern Balkan regions. On the other hand, heavy rains lead to water quality issues with negative effects on groundwater aquifers.

The most famous disaster was the 2014 flooding in Bosnia and Herzegovina related to Cyclone Tamara. After that, in 2017, the Balkan region was hit by heatwaves and droughts. These crises occurred in a complex post-conflict situation after the collapse of Yugoslavia (IMCCS, 2022).

Middle East

Due to the effects of climate change on the environment, North Africa and the Middle East belong to the most affected regions in the world. These parts of the world are already characterised by their arid and semi-arid climate, water scarcity, and vulnerability to extreme weather events.

Climate change exacerbates this problem by reducing freshwater availability through decreased rainfall and increased evaporation. This leads to more severe droughts, affecting agriculture and access to drinking water. The Middle East experiences higher-than-average temperature increases compared to the global average. Extreme heatwaves are becoming more common, posing health risks and impacting energy demand for cooling.

Coastal areas in the Middle East, including major cities like Cairo and Alexandria, are vulnerable to rising sea levels. This enormously threatens the infrastructure and populations living in low-lying coastal regions. Climate change disrupts traditional agricultural practices in the region. Water scarcity, changing precipitation patterns, and temperature extremes can reduce crop yields and affect food security, exacerbating existing political tensions in the region (CRS, 2023)

During the finalisation of this study, Libya is experiencing one of the most destructive flood disasters in its history. Several dam failures and an overall chaotic situation heavily affect the city of Derna, causing a serious humanitarian crisis. Libya is one of the key countries for cooperation with reference

to migration from the North African region. Therefore, the high risk of the potential negative effects of climate change also has an important security aspect, not only for the European Union or the North African and Middle Eastern countries but also for highly vulnerable population groups located on site. However, there is strong evidence for an increased mobilisation of refugees, asylum seekers, stateless persons and other persons of concern as a result of the negative effects of climate change (The White House, 2021).

Western Africa

The Sahel zone is a semi-arid region in Western and Central Africa that stretches from the Atlantic Ocean to the Red Sea. The beginning of the broad discussion on climate change and international security probably has its origin in the development of terrorism and the worsening environmental conditions in Western Africa.

Climate change contributes particularly to more frequent and severe droughts in the Sahel zone. Reduced rainfall and prolonged dry spells lead to desertification. This threatens rain-fed agriculture and pastoral livelihoods in a region with already harsh conditions (UNHCR, 2022). Crop failures and decreased agricultural productivity cause food shortages and increased insecurity for up to 30 million people, including particularly vulnerable social groups like ethnic minorities, women and children (NEP, UNDP, UN Women, DPPA, 2020).

In addition, water sources in the Sahel zone are heavily under stress due to reduced rainfall and increased evaporation. This affects access to clean drinking water and fuels conflicts over water resources.

Austria

Austria has observed an increase of 2°C in average temperatures since 1880, which is slightly above global average. The number of days with over 30°C and tropical nights has significantly increased. There are more frequent and intense extreme weather events, such as heavy rainfall leading to floods and landslides. The country is known for its beautiful alpine landscapes and glaciers. However, climate change is causing the retreat of glaciers throughout the European Alps.

Austria's security strategy has recognised the growing importance of addressing climate change as a security concern (Austrian Security Strategy, 2013). Rising temperatures, extreme weather events, and resource scarcity can exacerbate conflicts and create instability, both domestically and globally. Climate change exacerbates natural disasters and changes migration patterns. The frequency of disaster relief and humanitarian missions carried out by the Austrian Armed Forces will potentially rise. In addition, climate-change-induced migration, such as people fleeing from areas affected by sea-level rise or extreme weather, can impact border security.

Perspectives of applying military geosciences within the Austrian Armed Forces

Climate change causes and will cause several new military problems. Therefore, every military branch and leader has their own way to adapt to them. From the perspective of the Austrian military geoservices, it is a technological challenge to display fast-changing environments. Of course, this is no isolated military problem but also a geoscientific one. Expressed abstractly, the "terrain" becomes a fast-paced environment, which forces permanent re-analysis. To transport such non-conventional geoinformation, the product range of the military geoservices may be expanded accordingly.

In addition, the occurrence of an increasing number of extreme weather phenomena including their consequences and the potential for extreme forest fires, poses a problem due to the increased need for precise geoinformation. Therefore, rapid map making, and mission geo-support will become increasingly important.

The third future challenge is the potential for more than one critical event caused by climate change that the military will have to react to. There is a risk of losing geoinformation quality due to limited human, logistic and financial resources.

However, climate change has a geographically uneven effect on regions of interest. Probably the biggest challenge will be finding out the mission-specific and relevant geofactors and their influences on the operational readiness of soldiers.

The Austrian Institute of Military Geography strives continually to improve the product portfolio and is aware of the future challenges induced by climate change. The aim is to expand the spectrum and to concentrate military expertise in all geoscientific disciplines with a strong focus on military geology and geoinformatics. In addition, there is active participation in national and international research projects on the subject of effects of climate change on military operations.

Global climate change is one of the most serious problems of humanity. Therefore, minimising its negative effects on the environment and security in parts of the world is of high importance (Green Climate Fund, 2020). This study may give an idea of the future challenges of the Austrian military geoservices in the context of contributing to military operations and contributes to a better understanding of this “exotic” military branch. There are new challenges and tasks, but the Austrian military geoservices are ready to aid in minimising the negative effects of climate change on the Austrian Armed Forces.

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