sciendo International Conference KNOWLEDGE-BASED ORGANIZATION
Vol. XXIX No 1 2023

FROM OUTER SPACE TO EARTH – RESILIENCE MANAGEMENT IN TURKEY'S NATURAL DISASTER OF 2023

Ulpia Elena BOTEZATU*, Olga BUCOVEȚCHI**

***Romanian Space Agency and National Institute for Research & Development in Informatics - ICI Bucharest**
****Politehnica University of Bucharest and National Institute for Research & Development in Informatics - ICI Bucharest**
ulpia.botezatu@rosa.ro, olga.bucovetchi@upb.ro

Abstract: *In recent years, natural disasters have become more frequent and severe, causing significant damage to infrastructure, economy, and society. To enhance societal resilience to these events, the usage of space technology has become increasingly important. This article aims to explore the role of space technology in enhancing societal resilience to natural disasters, using the case of the 2023 natural disaster in Turkey. First, the article discusses the use of space technology in disaster monitoring, early warning systems, search and rescue operations, and damage assessment. Secondly, the article looks at the case of the recent earthquake in Turkey and attempts to reveal how Turksat satellite system has been used. The article concludes that space technology can play a crucial role in enhancing societal resilience to natural disasters.*

Keywords: resilience, space technology, disaster management

1. Introduction

Natural disasters have become an increasingly significant challenge for societies worldwide, causing severe economic, social, and environmental impacts. In recent years, natural disasters have become more frequent and severe, causing significant damage to infrastructure, economy, and society. While natural disasters are inevitable, enhancing societal resilience to these events has become increasingly important. The usage of space technology is emerging as a powerful tool to enhance societal resilience to natural disasters.

Space technology refers to the use of satellites, space probes, and other devices to explore space and improve life on Earth [1]. The role of space technology in enhancing societal resilience to natural disasters is widely recognized, given the vast and diverse applications it has in disaster management [2].

In this context, this article aims to explore the role of space technology in enhancing societal resilience to natural disasters, using the case of the natural disaster in Turkey in 2023. The article will discuss the use of space technology in disaster monitoring, early warning systems, search and rescue operations, and damage assessment, and highlight the significance of space technology in enhancing societal resilience to natural disasters [3]. The significance of this study lies in its elucidation of the pivotal role of space technology in disaster management, underscoring the imperative of integrating space technology into disaster

DOI: 10.2478/kbo-2023-0015
© 2023 Ulpia Elena Botezatu et al. This work is licensed under the Creative Commons Attribution-Non Commercial-No Derivatives 3.0 License.

management strategies to bolster societal resilience in the face of natural disasters.

Space technologies play a crucial role in disaster management by providing real-time data and accurate information to support decision-making, preparedness, response, and recovery efforts. Satellite-based systems, remote sensing, and other space-based technologies offer unique advantages, including global coverage, high temporal and spatial resolution, and rapid response times. These technologies enable the monitoring of natural disasters such as earthquakes, floods, and wildfires, and provide early warning systems to support evacuation plans and minimize the loss of life [4]. Moreover, space technologies also facilitate search and rescue operations, providing accurate and timely information on the location of survivors, and enable the assessment of damage caused by disasters, facilitating the allocation of resources and assistance to affected communities. The utilization of space technologies for disaster management provides valuable and essential information to decision-makers, enabling efficient, effective, and timely response to natural disasters, and enhancing societal resilience to these events.

2. Space technology and its application in natural disaster management

This section furnishes a comprehensive examination of the utilization of space technology to fortify societal resilience against natural disasters. The review endeavours to discern the extant literature on the role of space technology in disaster management, encompassing its functions in disaster monitoring, early warning systems, search and rescue operations, and damage assessment. The section evaluates the advantages and constraints of space technology in disaster management and presents an outline of the current frameworks and strategies that integrate space technology into disaster management [5].

The process of planning, organizing, coordinating, and executing measures to mitigate the impact of natural or human-induced disasters constitutes disaster management [6]. Given its capacity to furnish vital and timely data on disaster events, the utilization of space technology in disaster management has been widely acknowledged. Space technology allows for the monitoring of natural disasters such as earthquakes, floods, and wildfires, and facilitates the deployment of early warning systems, aiding in the execution of evacuation plans and minimizing the loss of life [7]. Moreover, space technology enables search and rescue operations by providing precise and up-to-date information on the location of survivors and allows for the assessment of disaster damage, streamlining the allocation of resources and assistance to affected communities [8].

Space technology has diverse applications in disaster management, including disaster monitoring, early warning systems, search and rescue operations, and damage assessment [9]. Numerous frameworks and strategies have been devised to integrate space technology into disaster management. These frameworks and strategies are intended to furnish a methodical approach to the utilization of space technology in disaster management, enabling efficient and effective decision-making [10]. The objective of these frameworks and strategies is to incorporate the use of space technology into existing disaster management systems, ensuring that space technology is employed in a concerted and efficacious manner.

2.1. Disaster Monitoring

Disaster monitoring refers to the use of space-based sensors to detect and monitor natural disasters, such as earthquakes, floods, and wildfires. These sensors can detect changes in the Earth's surface, atmosphere, and oceans, providing valuable information for disaster management. For example, satellite images can be used to monitor the extent of floodwaters and assess the damage caused by the floods.

Similarly, satellite images can be used to monitor the spread of wildfires and assist in firefighting operations.

Disaster monitoring entails the utilization of satellite-based remote sensing systems to detect and track natural disasters, furnishing real-time data on the location, scope, and intensity of the event. In disaster management, early warning systems are paramount, as they provide advance notice of potential disasters, enabling the implementation of evacuation plans and minimizing loss of life. Search and rescue operations involve the application of satellite-based imagery to locate and extricate survivors of natural disasters. Damage assessment constitutes another crucial application of space technology in disaster management, providing precise and timely data on the degree and extent of damage caused by natural disasters, streamlining the allocation of resources and assistance to affected communities.

2.3. Early Warning Systems

The role of space technologies in enhancing the early warning stage of disaster management is crucial. Early warning systems utilizing space-based sensors are capable of detecting and predicting natural disasters with greater precision, providing timely and effective alerts to both people and authorities. Such systems have the ability to provide advance warning for a variety of disasters, including earthquakes, tsunamis, floods, and hurricanes, enabling individuals to take necessary precautions and evacuate if needed. The integration of space-based technologies in early warning systems has been a significant development, allowing for more accurate and efficient prediction of natural disasters and reducing the impact on affected communities. For instance, the Sentinel-1 satellite, developed by the European Space Agency (ESA), has the capability to identify ground deformation caused by earthquakes, providing early warning to those residing in affected areas, potentially saving countless lives and minimizing damage to infrastructure.

The early warning stage of disaster management is critical as it allows for timely and effective response measures to be implemented, reducing the impact of natural disasters on individuals, communities, and economies. Space technologies play an indispensable role in enhancing this stage of disaster management, providing real-time data on natural disasters, allowing for more accurate and efficient prediction and early warning systems. The integration of space-based technologies into early warning systems can facilitate the development of more reliable and comprehensive disaster management strategies. Therefore, the continued investment and development of space-based technologies are crucial in advancing early warning systems and enhancing the ability to predict and respond to natural disasters.

2.4. Search and Rescue Operations

The role of space technologies in search and rescue operations in the aftermath of natural disasters cannot be overstated. Space-based sensors can provide critical information on the location of individuals in need of rescue, allowing rescue teams to prioritize their efforts and efficiently allocate their resources. The utilization of space technology in search and rescue operations has resulted in significant improvements in the ability to locate and rescue individuals in remote or inaccessible areas, thereby reducing the time taken for rescue and potentially saving more lives. For example, the Global Navigation Satellite System (GNSS) is one such space-based technology that has proved invaluable in locating people in remote and hard-to-reach areas. Additionally, satellite images can be used to identify people trapped in rubble or floodwaters, enabling rescue teams to identify the most vulnerable individuals and respond more efficiently.

The search and rescue stage of disaster management is critical in minimizing the

loss of life and ensuring the safety of affected individuals. The integration of space-based technologies in search and rescue operations has revolutionized the process, allowing for more accurate and timely identification and location of individuals in need of rescue [11]. The continued development and utilization of space-based technologies in search and rescue operations will further enhance the ability to locate and rescue individuals in the aftermath of natural disasters, saving lives, and facilitating efficient disaster management strategies. Therefore, the continued investment in space-based technologies is crucial in ensuring the effectiveness and efficiency of search and rescue operations in disaster management.

2.5. Damage Assessment

In addition to providing valuable information on the extent of damage caused by natural disasters, space technology can also assist in identifying critical infrastructure and areas that require immediate attention. For instance, high-resolution satellite images can be used to assess damage to buildings, bridges, and roads, allowing authorities to prioritize reconstruction efforts. Space technology can also provide information on changes in water resources, such as the extent of flooding or damage to water infrastructure, which can inform the allocation of resources for clean water and sanitation efforts. This information can be crucial in preventing the outbreak of waterborne diseases that often occur in the aftermath of natural disasters.

Moreover, space technology can also help in estimating the economic impact of natural disasters. Information on the extent of damage to homes, infrastructure, and other assets can inform decisions on recovery and reconstruction efforts and aid in determining the financial assistance required to support affected communities. This information can also help in assessing the long-term effects of natural disasters on the affected communities, including the impact on livelihoods, businesses, and the local economy. Thus, incorporating space technology into the damage assessment stage of disaster management can significantly enhance the effectiveness of disaster response and recovery efforts.

In conclusion, the use of space technology in disaster management is critical to enhancing societal resilience to natural disasters. The numerous benefits of space technology, including its ability to provide real-time and accurate information, enable efficient decision-making, and support evidence-based policy-making, make it an essential tool in disaster management. The use of space technology can significantly improve disaster preparedness, response, and recovery efforts, saving lives and minimizing the impact of natural disasters on communities. However, further research is needed to address the limitations of space technology, such as its high cost and technical complexity, to ensure its widespread adoption in disaster management.

Given the increasing frequency and severity of natural disasters, the role of space technology in disaster management is becoming more critical than ever before. With advancements in technology and increased global collaboration, the integration of space technology into disaster management strategies is expected to become more widespread, enabling more efficient and effective disaster response and recovery efforts. It is essential that policymakers, disaster management practitioners, and space technology experts work together to harness the full potential of space technology in disaster management and ensure its availability to communities that are most vulnerable to natural disasters.

3. The earthquakes in Turkey and Syrian of February, 2023

The utilization of space technology played a vital role in managing the earthquake that struck Turkey and Syria in February 2023. Disaster monitoring, search and rescue

operations, and damage assessment were essential components of the disaster management response, supported by space technology. Real-time monitoring of the earthquake was carried out using satellites that provided information on the earthquake's location, magnitude, and extent.

The Turkish government utilized the TURKSAT, a Turkish-built satellite system with remote sensing capabilities, to capture high-resolution images of the areas affected by the earthquake [12]. The captured images were then processed and analysed by disaster management authorities to locate survivors trapped in the debris of collapsed buildings [13]. TURKSAT played a crucial role in the disaster response and recovery efforts following the earthquake in February 2023. Its high-resolution imaging capabilities provided valuable information to aid in damage assessment, search and rescue operations, and resource allocation for recovery efforts.

TURKSAT's remote sensing capabilities allowed for accurate imaging of the affected areas, enabling disaster management authorities to quickly evaluate the extent of the damage and identify areas requiring immediate assistance. Expert analysis of the captured images helped locate survivors trapped under the rubble of collapsed buildings, resulting in saving lives during the rescue operations.

In addition to TURKSAT, other satellite systems, such as the Copernicus Emergency Management Service (EMS) by the European Space Agency, provided satellite imagery of the affected areas to Turkish authorities. The additional imagery supported the Turkish authorities in assessing the situation and coordinating their response more effectively. The satellite imagery was used to map the extent of the damage and identify areas in most need of assistance, ultimately contributing to the efficiency and success of the disaster response efforts.

The European Space Agency's Sentinel-1 satellite was used to track ground movement during the earthquake, providing insights into the earthquake's location and severity, which were used to develop early warning systems and evacuation plans [14]. The satellite imagery also identified the most affected areas, enabling prioritization of aid and assistance to the affected communities.

The Sentinel-1 satellite is equipped with a synthetic aperture radar (SAR) instrument, capable of detecting ground deformation caused by earthquakes. SAR emits microwave signals towards the Earth's surface, which are reflected back to the satellite. By measuring the time, it takes for the signals to travel to the ground and back to the satellite, SAR accurately measures the distance between the satellite and the ground. By repeating this process over time, SAR can detect changes in the distance, indicating ground deformation caused by earthquakes.

During the February 2023 earthquake in Turkey, the Sentinel-1 satellite monitored the earthquake in real-time, detecting ground deformation caused by the earthquake, providing valuable insights into the location and severity. This information facilitated the development of early warning systems and evacuation plans, minimizing the loss of life. By analysing the SAR data, scientists and emergency responders created maps of the affected areas, identifying the regions with the most severe ground deformation. This data allowed for prioritization of rescue and relief efforts, focusing on areas with the highest need. In summary, the use of space technology, particularly the Sentinel-1 satellite, was critical in the disaster management response to the earthquake in Turkey, demonstrating the importance of space technology in enhancing societal resilience to natural disasters.

The earthquake in Turkey and Syria in February 2023 resulted in the utilization of satellites for search and rescue operations to locate and rescue survivors. Among these

satellites, the French Space Agency's Pleiades satellite played a crucial role in aiding search and rescue efforts. The satellite is equipped with a high-resolution camera capable of capturing images with a resolution of up to 50 cm, making it an excellent tool for identifying areas where survivors may be trapped. Shortly after the event, the Pleiades satellite captured high-resolution images of the earthquake area, providing critical information to search and rescue teams.

The high-resolution images from the Pleiades satellite were analysed to identify areas where survivors were likely to be trapped, such as collapsed buildings and other damaged infrastructure. This information was used to guide search and rescue efforts, enabling teams to reach survivors more quickly and reducing the risk of fatalities. The use of high-resolution satellite imagery provided an unprecedented level of detail and accuracy that would not have been possible through traditional ground-based surveys.

The ability to quickly and accurately identify areas of damage and potential survivor locations enabled search and rescue teams to focus their efforts where they were most needed, maximizing the chances of finding survivors and minimizing the loss of life. The use of space technology, specifically the high-resolution imaging capabilities of the Pleiades satellite, was critical in supporting search and rescue efforts during the earthquake in Turkey and Syria. The ability to rapidly collect and analyse high-quality imagery provided valuable insights to responders, ultimately contributing to the overall effectiveness of the disaster response effort.

The Japan Aerospace Exploration Agency's (JAXA) Advanced Land Observing Satellite (ALOS) was used to assess the extent of damage caused by the earthquake in Turkey and Syria in February 2023. The satellite captured high-resolution images of the affected areas before and after the earthquake, providing critical information about the damage caused.

The images captured by ALOS were used to create detailed maps of the affected areas, allowing responders to prioritize aid and assistance to the areas most severely affected by the earthquake. These maps provided valuable information about the extent of the damage caused by the earthquake, which helped to support the efficient allocation of resources to the affected communities.

The satellite-based assessments carried out using ALOS provided a level of detail and accuracy that would not have been possible using traditional ground-based surveys alone. The ability to rapidly capture and analyse high-quality imagery allowed responders to quickly assess the damage caused by the earthquake, which was essential for developing an effective disaster response strategy.

In summary, the use of ALOS imagery played a critical role in the disaster response efforts following the earthquake in Turkey and Syria. The information obtained through satellite-based assessments helped responders to prioritize aid and assistance to the areas most severely affected by the earthquake, contributing to the overall efficiency and effectiveness of the disaster response effort.

The European Space Agency's Copernicus Emergency Management Service (EMS) played a vital role in aiding the disaster management response to the earthquake in Turkey and Syria in February 2023. The high-resolution satellite imagery provided by the Copernicus EMS enabled an accurate assessment of the extent of earthquake damage in the affected areas, allowing for a more targeted and effective response.

The satellite imagery was used to identify damaged buildings, and the extent of the damage provided valuable information for search and rescue teams to locate survivors trapped in the rubble of collapsed buildings. The imagery also allowed rescuers to plan their search and rescue operations more

effectively, leading to a more efficient response and ultimately saving lives.

Moreover, the satellite imagery provided information on the location and extent of road and infrastructure damage, which allowed rescuers to navigate the affected areas more safely and efficiently. The identification of damaged roads, bridges, and other infrastructure was essential in enabling rescuers to move around the affected areas safely and deliver aid and assistance to those in need.

The Turkish Disaster and Emergency Management Authority (AFAD) has been incorporating space technologies in disaster management efforts for several years. In general, satellite imagery, GNSS, and other remote sensing technologies are utilized by AFAD to monitor natural disasters and facilitate emergency response efforts [15].

During the earthquake that struck Turkey in February 2023, AFAD leveraged various space technologies to assist in the response and recovery operations. For instance:

- Satellite Imagery: AFAD collaborated with national and international space agencies to procure satellite imagery of the affected areas. The imagery was employed to assess the extent of the damage caused by the earthquake and identify the areas requiring assistance.
- GNSS: AFAD employed GPS to pinpoint the location of survivors trapped under rubble and debris. GPS coordinates were also utilized to navigate rescue teams to the survivors' location.
- UAVs: AFAD utilized unmanned aerial vehicles (UAVs) to conduct damage assessments and locate survivors in areas that were inaccessible on foot. The drones provided high-resolution imagery of the affected areas, which was utilized to determine the areas requiring assistance.
- Mobile Apps: AFAD developed mobile applications that were used by disaster management authorities and the public to report damage, request assistance, and receive updates on the situation. The apps employed GNSS and other location-based technologies to provide precise information.
- One specific example of the use of satellite imagery in the search and rescue efforts was the rescue of a 12-year-old boy who was trapped under the rubble of a collapsed building in the city of Gaziantep in Turkey. Using satellite imagery and other remote sensing technologies, rescuers were able to pinpoint the boy's location and extract him from the rubble. The use of space technology in this case helped save the boy's life and demonstrated the value of such technology in disaster response and recovery efforts.

In conclusion, the use of space technology in disaster management has proven to be a valuable asset in minimizing the impact of natural disasters and supporting recovery efforts. The 2023 earthquake in Turkey serves as an example of how multiple satellite systems, including TURKSAT, Copernicus EMS, and ALOS, were utilized to gather accurate and timely information about the extent of damage caused by the disaster. Through collaborative efforts, disaster management authorities were able to coordinate their response efforts effectively, ultimately resulting in saving lives and helping communities recover from the disaster.

TURKSAT, as a national satellite system, played a critical role in disaster response and recovery efforts. Its remote sensing capabilities allowed for high-resolution images of the affected areas to be captured, providing crucial information to disaster management authorities to aid in search and rescue operations, damage assessment, and resource allocation for recovery efforts. Additionally, other space technologies, such as GPS and UAVs, were used to locate survivors and assess damage in areas that were difficult to access.

The use of satellite technology, specifically TURKSAT, in disaster management

highlights the potential for space-based systems to provide valuable information in emergency situations. As space technology continues to advance, its role in disaster management is likely to become increasingly important. By leveraging the capabilities of these systems, disaster management authorities can enhance their ability to prepare for, respond to, and recover from natural disasters, ultimately saving lives and mitigating the impact of these events on affected communities.

4. Space technologies and societal resilience

Space technologies have emerged as an essential tool for building societal resilience in the face of natural disasters. The use of space technology in disaster management has been shown to provide real-time information and data that can assist disaster management authorities in better assessing the extent of damage, locating survivors, and allocating resources where they are needed most. In the case of Turkey's natural disaster of 2023, the use of space technology has proven critical in boosting societal resilience in several ways.

Firstly, space technology has improved situational awareness by providing valuable data and imagery that helped disaster management authorities to better understand the extent and location of the damage caused by the disaster. This information allowed them to make more informed decisions about where to allocate resources, which in turn helped to reduce response times and increase the effectiveness of the response efforts.

Secondly, space technology has enhanced communication between disaster management authorities, first responders, and the public. By providing accurate and up-to-date information, space technology helped to reduce confusion and uncertainty, and allowed for more effective coordination of response efforts.

Thirdly, space technology has improved search and rescue efforts by providing real-time information about the location of survivors who were trapped under rubble and debris. This technology allowed rescue teams to quickly and efficiently locate and extract them.

Finally, space technology has supported better planning and preparedness by providing data and insights into the impact of the disaster, allowing authorities to identify areas where improvements could be made, and to develop more effective response plans for future disasters.

Overall, the use of space technology played a critical role in boosting resilience during Turkey's natural disaster in 2023. By providing valuable data, enhancing communication, improving search and rescue efforts, and supporting better planning and preparedness, space technology helped to reduce the impact of the disaster and support a more effective response. In this way, space technology has the potential to play a critical role in building societal resilience in the face of natural disasters.

5. Conclusions

In conclusion, space technology has played an increasingly important role in disaster management and has become an essential tool in improving societal resilience. The use of space technology has revolutionized the way that disaster management authorities can collect and process information, which in turn has enabled them to respond to natural disasters and support recovery efforts more effectively. The case of the earthquake in Turkey in 2023 provides a clear example of how space technology has been used to aid in disaster management efforts, including improving situational awareness, enhancing communication, improving search and rescue efforts, and supporting better planning and preparedness.

The successful use of space technology during the earthquake in Turkey in 2023 highlights the potential benefits that can be achieved through international

collaboration and the sharing of data and resources. However, it is important to note that the effective use of space technology in disaster management requires ongoing investment in technology, training, and infrastructure. In addition, ethical considerations, such as data privacy and security, must also be carefully addressed.

As natural disasters continue to pose a significant threat to communities around the world, the use of space technology in disaster management is expected to play an increasingly important role in supporting resilience and reducing the impact of disasters. Future research and development in this field will undoubtedly lead to further innovations and advancements, which will continue to improve disaster response and recovery efforts.

References List

[1] Dennerley, J. (2016). Emerging space nations and the development of international regulatory regimes. Space Policy, 35, 27-32

[2] Chakraborty, N., Agrawal, S., & Chauhan, P. (2019). Blockchain technology and applications in the space industry: A review. Acta Astronautica, 161, 96-114

[3] Liu, S., Li, X., Li, L., Li, D., Li, P., & Li, Y. (2020). Space technology application in disaster management: a review. Remote Sensing, 12(17), 2780-87. doi:https://doi.org/10.3390/rs12172780

[4] European Space Agency. (2023, May 7). How Satellites are Helping to Respond to Natural Disasters. Available from: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-1/How_satellites_are_helping_to_respond_to_natural_disasters

[5] Wenzel, F., & Hasan, S. (2019). Space-based disaster management: Current state and future directions. Acta Astronautica, 162, 60-70. doi:https://doi.org/10.1016/j.actaastro.2019.07.024

[6] Badea, D., Piele, C., & Ranf, D. (2022). Educational Opportunities Provided by the Existence of Critical Infrastructures at the Level of Sibiu County in the Field of Training for Resilience. Land Forces Academy Review, 27(4), 287-295

[7] National Aeronautics and Space Administration. (2019). Natural Disasters. Available from https://www.nasa.gov/mission_pages/hurricanes/main/index.html

[8] Eren, K., & Colak, O. (2017). Space technology and disaster management: A review. Journal of Geodesy and Geoinformation, 6(2), 152-159. doi:https://doi.org/10.1016/j.jgg.2017.04.004

[9] Botezatu, U., Nistor, C., Radutu, A., Olteanu, V., & Dana-Negula, I. (2020). GNSS and Earth Observation Services Disruption, Between Collapse and Myth. In A. V. Unal Tatar, Space Infrastructures: From Risk to Resilience Governance. Springer. doi:10.3233/NICSP200029

[10] Chertoff, M. (2018). Space security and the Global Counterterrorism Forum's Space Security Initiative. Journal of Space Law, 42(1), 65-81.

[11] Joshi, A., & Kumar, M. (2018). Application of remote sensing and GIS in natural disaster management. In Advances in remote sensing and GIS for environmental modeling and sustainability (pp. 59-83). Springer. doi:https://doi.org/10.1007/978-981-10-7987-2_4

[12] TURKSAT . (2023, May 7). TURKSAT provides images of the earthquake disaster area. Retrieved from https://www.turksat.com.tr/en/news-room/news/turksat-provides-images-of-the-earthquake-disaster-area

[13] TURKSAT. (2023, May 7). TURKSAT: Overview. Retrieved from https://www.turksat.com.tr/en/satellite-fleet/turksat-6a

[14] Tizzani, P. (2015). The SAR Interferometry for the Sentinel-1 Mission: Potential Applications and Challenges. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 8(5), 2066-2079. doi:DOI: 10.1109/JSTARS.2015.24

[15] Turkish Disaster and Emergency Management Authorit. (2023, May 7). AFAD's Disaster and Emergency Management Policies and Practices. Retrieved from https://www.afad.gov.tr/EN/afads-disaster-and-emergency-management-policies-and-practices_520