

ORIGINAL

Benefits of using Chat Generative Pre-Trained Transformers (ChatGPT) for human safety from major disaster: What do we need to do before, during, and after a solar storm?

Beneficios de utilizar Transformadores Generativos Pre-Entrenados de Chat (ChatGPT) para la seguridad humana ante desastres mayores: ¿Qué debemos hacer antes, durante y después de una tormenta solar?

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ABSTRACT

Introduction: this paper aims to indicate to the general the to-do list before, during, and after the major disaster to man survive in case of a solar storm.

Method: general is a to-do list item before, during, and after a solar storm. As a reference, I also had an interview with ChatGPT. There are six main questions that are very important to discuss during the interview.

Results: it has been proven that ChatGPT provides many logical recommendations that can be applied by everyone worldwide, without exception, so there is no one left behind. This corresponds to the goals of the Sustainable Development Goals.

Conclusion: humans need to be prepared before, during, and after a major disaster, in this case, solar storms for us to survive the threat we are facing. There are potential limitations to each disaster, but preparation and adequate information can significantly increase our survival and reduce the impact on our living conditions.

Keywords: Artificial Intelligence; Chat Generative Pre-Trained Transformers; Chatgpt; Human Safety; Major Disaster; Solar Storm.

RESUMEN

Introducción: este artículo tiene como objetivo indicar al público en general las tareas a realizar antes, durante y después de un gran desastre para que la humanidad sobreviva en caso de una tormenta solar.

Método: se trata de una lista de tareas a realizar antes, durante y después de una tormenta solar. Como referencia, también participé en una entrevista con ChatGPT. Hay seis preguntas principales que son muy importantes para discutir durante la entrevista.

Resultados: se ha demostrado que ChatGPT ofrece numerosas recomendaciones lógicas que pueden ser aplicadas por todos en todo el mundo, sin excepción, para que nadie se quede atrás. Esto se corresponde con los Objetivos de Desarrollo Sostenible.

Conclusión: la humanidad necesita estar preparada antes, durante y después de un gran desastre, en este caso, una tormenta solar, para poder sobrevivir a la amenaza que enfrentamos. Existen limitaciones potenciales para cada desastre, pero la preparación y la información adecuada pueden aumentar significativamente nuestra supervivencia y reducir el impacto en nuestras condiciones de vida.

Palabras clave: Inteligencia Artificial; Transformadores Generativos Pre-entrenados por Chat; ChatGPT; Seguridad Humana; Desastre Mayor; Tormenta Solar.

INTRODUCTION

Nowadays, news about the world will soon be hit by solar storms is increasingly widespread.⁽¹⁾ Solar storms are predicted to peak from 2024 to 2025.⁽²⁾ The impact of this solar storm will also be felt throughout the country. This solar storm could affect Earth's communications, navigation, electricity, and satellite systems.⁽³⁾ If a solar storm falls into the extreme category, it can affect many aspects of human life, especially regarding life safety.

Apart from that, the news regarding this matter needs to be reflected more carefully, considering that world-class millionaires are competing to build their own bunkers.⁽⁴⁾ It was as if they already knew what to do before, during, and after this solar storm. Regardless of whether this news is still considered a figment, we should all be prepared and on guard and take concrete steps to anticipate dangerous things that will happen. So, it is felt necessary to study what concrete things we need to do before, during, and after this solar storm occurs as a form of preparation. Furthermore, this article is critical as new knowledge considering that up to now, the topic of this matter is still rarely raised in scientific articles so that it can be discussed and used as a reference in compiling life safety guidelines in the face of significant world disasters.

For this reason, the author uses Artificial Intelligence (AI) assisted technology, namely Chat Generative Pre-Trained Transformers (ChatGPT), to get some of the answers needed.⁽⁵⁾ In its development, ChatGPT has been used in various scientific fields.^(6,7,8) Recently, another journal also published an article discussing the use of ChatGPT to explore the health of astronauts during exploration missions in space.⁽⁹⁾ It is necessary also to discuss other benefits, especially regarding aspects of human safety in facing the issue of the upcoming solar storm.

METHOD

This paper includes an interview with ChatGPT about what we need to do before, during, and after a solar storm. The interview discussed the following questions: 1) How to survive a solar storm?; 2) What is the best shelter from a solar storm?; 3) What if we don't have enough money to build the best shelter from a solar storm?; 4) What activities do we need to do during a solar storm; 5) Are there other alternatives to stay connected to the outside world while we are in shelter during a solar storm? Meanwhile, electricity and satellites will definitely go out or not function; 6) What do we need to do after the solar storm is over?

RESULTS AND DISCUSSION

1. How to survive a solar storm?

To test ChatGPT's performance in providing advice before, during, and after a medical emergency in the context of a solar storm disaster, the authors asked ChatGPT a series of questions that were related to each other (figures 1, 2, 3, 4, 5, and 6), like doing probing in counseling.⁽¹⁰⁾ The first question (figure 1), ChatGPT suggests that in order for every human being to survive this disaster, preparation and preventive measures are needed, among other things, humans are expected to be able to 1) Stay informed with official sources from institutions in their respective countries, to monitor news regarding warnings about potential solar storms; 2) Carry out emergency supplies such as food, water, medicine, and first aid supplies; 3) Have alternative communication methods prepared such as battery-operated radios or satellite phones in case regular communication networks fail during a solar storm; 4) Have backup power in the form of batteries, considering that the electricity network will be out for quite a long time; 5) Protect your electronic items by unplugging sensitive electronic devices such as computers, TVs and equipment to prevent damage due to power surges during geomagnetic storms; 6) Seek shelter indoors during severe solar storms to minimize radiation exposure. It is desirable to stay away from windows and doors to reduce the risk of injury from flying debris in the event of a sudden increase in solar activity; 7) Avoid traveling during solar storms; 8) The need for sufficient education and training to be able to have basic survival skills such as first aid, navigation and outdoor survival techniques; 9) Work with the humanitarian community to develop emergency response plans and establish communication channels to share information and resources during solar storms; 10) It is hoped that humans can prepare to face potential disruption and damage caused by solar storms, after this disaster is over. If studied more deeply, these answers are very similar to research conducted by Uchida et al.⁽¹¹⁾ that to survive disasters, building ICT-based programs regarding disaster prevention and mitigation to increase awareness regarding disaster prevention and mitigation among the community is very important. Apart from that, various disaster education and training in schools and local communities are critical to reducing damage caused by disasters.^(11,12,13)

**ChatGPT**

Surviving a solar storm, also known as a geomagnetic storm, involves both preparation and precautionary measures. Solar storms can disrupt various systems on Earth, including communication networks, power grids, and satellites. Here are some steps to increase your chances of surviving a solar storm:

1. **Stay Informed:** Keep yourself updated with space weather forecasts from official sources such as NOAA's Space Weather Prediction Center (SWPC) or similar agencies in your country. They provide warnings and alerts about potential solar storms.
2. **Emergency Supplies:** Have a stockpile of essential supplies such as food, water, medications, and first aid supplies. Ensure you have enough to last for at least a few days in case of disruptions to supply chains.
3. **Communication:** Maintain alternative communication methods such as a battery-operated radio or satellite phone in case regular communication networks fail during a solar storm.
4. **Power Backup:** Invest in a generator or alternative power sources to keep critical equipment running in case of power grid failure. Have spare batteries for essential devices.
5. **Protect Electronics:** Unplug sensitive electronic devices such as computers, TVs, and appliances to prevent damage from power surges during geomagnetic storms. Surge protectors can also offer some protection.
6. **Shelter:** Seek shelter indoors during a severe solar storm to minimize exposure to radiation. If possible, stay away from windows and doors to reduce the risk of injury from flying debris in case of a sudden increase in solar activity.
7. **Transportation:** Avoid traveling during a solar storm, especially if you rely on GPS navigation or other electronic systems that may be affected.
8. **Education and Training:** Learn basic survival skills such as first aid, navigation, and outdoor survival techniques. These skills may prove invaluable during emergencies when modern technology is unavailable.
9. **Community Preparedness:** Work with your community to develop emergency response plans and establish communication channels for sharing information and resources during a solar storm.
10. **After the Storm:** Be prepared for potential disruptions and damages caused by the solar storm. Stay informed about recovery efforts and follow instructions from local authorities.

Remember that while solar storms can pose significant challenges, proper preparation and staying informed can greatly increase your chances of surviving and minimizing the impact on your life.



Figure 1. ChatGPT-Generated Response from the Prompt: “How to survive a solar storm?”

2. What is the best shelter from a solar storm?

Furthermore, the author is interested in further probing (figure 2) based on suggestion no. 6 (figure 1) provided by ChatGPT. Everyone needs to know this so that when the solar storm occurs, everyone can find the best shelter for themselves and their families. ChatGPT answers this question (figure 2) that the best shelter is a place with 1) Solid construction made of sturdy materials such as concrete or brick, which can provide better protection against radiation and debris than lightweight materials. To minimize radiation exposure, such as wood or aluminum; 2) Have an interior room away from windows and doors. Rooms without external windows or with small windows may require curtains or blinds of a very thick material; 3) Is provided with an underground structure from additional protection of radiation and flying debris. Structures that aren't properly reinforced to carry the weight of those materials or that are at risk of flooding in poor weather; 4) Shielding material An additional way you can protect yourself from radiation is with. According to ChatGPT, locations with structures made of these materials can offer better protection during solar storms; 5) It is located at a place that is remote hence not close to tall buildings or trees that could easily collapse in case of strong winds or heavy rain following the solar storm; 6) Have emergency supplies like food, water, medicine, a first aid kit, and a flashlight kept just in case you are to stay indoors for a long time; 7) Alternative communication methods should be maintained, such as battery run radios and satellite phones to enable you to learn how the situation is and receive updated information from the official bodies; 8) Local leaders will work in line with our communities to identify designated emergency shelters available and escape to they are hit by solar storms. These shelters may have additional resources and support available to their residents. Based on these answers, this is also in line with the study conducted by Bashawri, Garrity, and Moodley⁽¹⁴⁾ which states that shelters play an important role in large-scale disasters and are essential to disaster response and recovery. Shelters are places of abode for people who have become homeless and displaced after being affected by any kind of disaster. Shelters serve as a place of abode disaster victims are not only given short-term perspectives but also psychological to enable them to courage the legality of the event. Moreover, shelters serve as the initial phase of the rehabilitation and restoration process of the disaster.⁽¹⁵⁾



ChatGPT

The best shelter from solar storms is a sturdy building or structure that provides adequate protection from radiation and flying debris. Here are some characteristics of an ideal shelter during a solar storm:

1. **Solid Construction:** Choose a building made of sturdy materials such as concrete or brick, which can offer better protection against radiation and debris compared to structures with lightweight materials like wood or aluminum.
2. **Interior Space:** Seek shelter indoors, away from windows and doors, to minimize exposure to radiation. Interior rooms without windows or rooms with small windows covered by heavy curtains or blinds are preferable.
3. **Underground Structures:** If available, underground shelters or basements can provide additional protection from radiation and flying debris. However, ensure that the structure is properly reinforced and does not risk flooding during severe weather events.
4. **Shielding Materials:** Materials such as thick concrete, metal, or lead can offer additional shielding against radiation. Structures incorporating these materials can provide better protection during a solar storm.
5. **Remote Locations:** Avoid shelters located near tall structures or trees that may pose a risk of collapse during strong winds or heavy precipitation accompanying a solar storm.
6. **Emergency Supplies:** Ensure that your shelter is stocked with emergency supplies such as food, water, medications, first aid kits, and flashlights in case you need to remain indoors for an extended period.
7. **Communication:** Maintain alternative communication methods such as a battery-operated radio or satellite phone to stay informed about the situation and receive updates from official sources.

8. **Community Shelters:** Work with your community to identify designated emergency shelters where you can seek refuge during a solar storm. These shelters may have additional resources and support available to residents.

Remember that the goal of seeking shelter during a solar storm is to minimize exposure to radiation and protect yourself from potential hazards such as flying debris. Choose a shelter that provides the best combination of protection, accessibility, and resources to ensure your safety during the event.



Figure 2. ChatGPT-Generated Response from the Prompt: “What is the best shelter from a solar storm?”

3. What if we don’t have enough money to build the best shelter from a solar storm?

Following up on the previous discussion (figure 2), the author is interested in providing more specific questions, considering that most answers to the last question (figure 2) are directed towards those with sufficient funds. Then what about those who have less social and financial status? So, the author took the initiative to ask questions directed toward finding solutions for everyone without exception (figure 3). To this question, ChatGPT provides the answer that there are still several steps we can take to improve safety and preparedness without significant financial investments. Here are some cost-saving measures we can consider: 1) Using existing building structures, we are asked to utilize existing buildings or structures that offer a certain level of protection, such as our homes, workplaces, or community centers. While these buildings may not be ideal shelters, they can still provide a certain level of safety during solar storms; 2) Let’s create a safe space by determining a room in our house or building as a safe space by choosing an interior room without windows or with small windows covered by thick curtains or blinds. Reinforce the room with additional layers of protection to minimize flying debris. Heavy furniture or mattresses could be used for this purpose; 3) Community resources, such as emergency shelters or safe havens during solar storms. Local government agencies, community centers, schools, or churches can provide temporary shelter in emergencies at little or no cost; 4) DIY Repairs: we are asked to make inexpensive repairs to improve the safety of our shelters, such as plywood to reinforce doors and windows or weather stripping to seal gaps to keep out radiation and debris; 5) Buy an emergency preparedness kit, invest in or assemble with highly affordable emergency preparedness kits with the necessary supplies we need to stay safe and alive - nonperishable food and water, first aid kits, flashlights, fresh batteries, and blankets to protect ourselves and our families from galactic attacks as well; 6) Free education and training Sources learning for you and your family, free or low-cost resources to educate you and your family members with survival skills and emergency preparedness. Learn how to perform first aid and survive; 7) Community collaboration, work with your neighbor, friend, or community-based resource Sharing is caring - join forces with neighbors and friends to close the gap in your preparation to help you work on community resilience to solar storms; 8) Stay informed, always monitor the actual official space on sunspot forecasting or warning from your country to track solar storm activities and respond quickly to threats.

This is in line with research conducted by Schilderman⁽¹⁶⁾ which states that the impact of natural disasters makes poor people more vulnerable. Vulnerability is as critical a cause of disasters as the physical events that trigger disasters. The vulnerability of poor communities often increases when development does not go well. Thus, development is a factor that contributes to the occurrence and scale of disasters. At the same time, disasters, if they occur, will cause severe setbacks to development. To break out of this vicious circle, more attention must be paid to mitigating and addressing the causes of vulnerability. Efficient ways of mitigation conducted through formal approaches as most are attempted by the public sector are likely to be additional spectacular than typically additional and to leave communities further open if they’re produced at all. The labored alternative is community-based disaster mitigation, that reduces the vulnerability of the impious by employing in style approaches, opportunities grounded on the local’s data, and social capital and addressing their weaknesses. Many prevail examples of community-based mitigation given above-based learning; which is learning from the past; relating and programming another relationship with communities; urge participation; use local builders and artists; develop local capacity; document and spread the method of learning; and influence formal education.

**ChatGPT**

If you don't have enough money to build the best shelter from solar storms, there are still steps you can take to increase your safety and preparedness without significant financial investment. Here are some cost-effective measures you can consider:

1. **Use Existing Structures:** Utilize existing buildings or structures that offer some level of protection, such as your home, workplace, or community centers. Even if these buildings may not be the most ideal shelters, they can still provide some degree of safety during a solar storm.
2. **Create a Safe Room:** Designate a room within your home or building as a safe room by selecting an interior space without windows or with small windows covered by heavy curtains or blinds. Reinforce the room with additional layers of protection such as heavy furniture or mattresses to shield against flying debris.
3. **Seek Community Resources:** Research community resources available for emergency shelters or safe havens during solar storms. Local government agencies, community centers, schools, or churches may provide temporary shelter options during emergencies at little to no cost.
4. **DIY Improvements:** Make inexpensive improvements to enhance the safety of your shelter, such as reinforcing doors and windows with plywood or installing weather stripping to seal gaps and prevent the entry of radiation and debris.
5. **Emergency Preparedness Kits:** Invest in or assemble affordable emergency preparedness kits containing essential supplies such as non-perishable food, water, first aid supplies, flashlights, batteries, and blankets. These kits can be crucial for sustaining yourself and your family during emergencies, including solar storms.
6. **Education and Training:** Take advantage of free or low-cost resources to educate yourself and your family about emergency preparedness and survival skills. Learn basic first aid, navigation, and outdoor survival techniques to better cope with challenging situations.
7. **Community Collaboration:** Work together with neighbors, friends, and community members to share resources, information, and support during emergencies. Collaborative efforts can help address gaps in individual preparedness and enhance community resilience against solar storms.
8. **Stay Informed:** Stay informed about space weather forecasts and warnings provided by official sources such as NOAA's Space Weather Prediction Center (SWPC) to anticipate and respond to potential solar storm threats effectively.

While financial limitations may impose constraints on your ability to build the most robust shelter, taking proactive measures and utilizing available resources can still significantly improve your chances of staying safe during solar storms. Prioritize cost-effective strategies that address the most critical aspects of preparedness and protection for you and your loved ones.



Figure 3. ChatGPT-Generated Response from the Prompt: “What if we don’t have enough money to build the best shelter from a solar storm?”

4. What activities do we need to do during a solar storm?

Furthermore, the author is curious about what we all need to do during a solar storm, considering that

it is likely that this solar storm will last for quite a long time. So, knowing what to do and what not to do during this disaster is essential. As seen in figure 4 above, it is noteworthy that taking action during the solar storm is imperative for our safety to curtail underlying risks. Some of the activities and actions recommended for the solar storm include: 1) The first key aspect is exposure monitoring. For us to remain safe, we should monitor space weather forecasts as well as warnings from our country's official source or from the Indonesian space agency. Always be updated about the severity and length of solar storms to make a well-informed decision; 2) Find shields. You are outside during a solar storm, find a shield indoors as soon as possible. Therefore, to prepare and measure: Identify a substantial building or structure that polarizes us away from the exposure radiation and flying debris, including a basement, interior space, and emergency shelter; 3) Avoid outdoor activities that are hard hit during solar storms that make us more exposed to radiation. It means that we should not engage in open outdoor activities at the time of the storm; 4) Protect our electronic equipment; unplug sensitive electronic equipment such as computers, televisions, and equipment to minimize destruction by power surges caused by geomagnetic disturbances. Use a surge suppressor and possibly a Faraday cage to protect substantial electronic equipment from electromagnetic interference; 5) Practice power savings that are more energy-efficient during solar storms that do not overload the electrical grid, which could cause a long-term blackout. They include turning off unneeded lights and equipment; 6) LEDs can keep in contact with your loved one using text messages, satellite phones, and battery-powered radios; charge your mobile phone and respond to save the life of your battery; 7) Be ready for emergencies that were intended and managed or that were expected to happen; emergency response kits, food, water, medicine, first aid, lighting, and a blanket are all important. Plan and prepare to retrieve our community; 8) stay calm and reassure others; stay calm and provide clear instructions and information to children and other vulnerable people about what to do and prepare our community for post-event; 9) exercise and follow officers' instructions and instructions; stay informed and be informed; monitor the commander and make your contribution; 10) monitor recovery efforts so that after the solar storm passes, keep an eye on Recovery efforts and official sources as well. Get information from all government services about new updates into recovery efforts and back services, infrastructure, and communication networks. Be prepared to assist others in our community and help if needed.

There are free activities that can be done during a storm, such as singing or playing a musical instrument. ⁽¹⁷⁾ In this case, everyone can sing and play musical instruments (regardless of type, as long as they don't need batteries or electricity). Based on studies conducted by Situmorang, ^(17,18,19,20,21) these two activities have been proven to increase happiness, reduce stress, and serve as a medium for self-therapy.



ChatGPT

During a solar storm, it's essential to take appropriate actions to ensure your safety and mitigate potential risks. Here are some recommended activities to consider during a solar storm:

1. **Stay Informed:** Monitor space weather forecasts and alerts provided by official sources such as NOAA's Space Weather Prediction Center (SWPC) or your country's relevant space weather monitoring agency. Stay updated on the severity and duration of the solar storm to make informed decisions.
2. **Seek Shelter:** If you're outdoors when a solar storm occurs, seek shelter indoors immediately. Choose a sturdy building or structure that provides adequate protection from radiation and flying debris, such as a basement, interior room, or designated emergency shelter.
3. **Limit Outdoor Activities:** Avoid outdoor activities during a solar storm, especially activities that expose you to open spaces or elevated areas where you're more vulnerable to radiation exposure. Stay indoors and postpone outdoor excursions until the storm passes.

4. **Protect Electronics:** Unplug sensitive electronic devices such as computers, TVs, and appliances to prevent damage from power surges caused by geomagnetic disturbances. Use surge protectors or consider investing in a Faraday cage to shield essential electronics from electromagnetic interference.
5. **Conserve Power:** Reduce energy consumption and conserve power during a solar storm to minimize strain on the electrical grid and reduce the risk of widespread blackouts. Turn off non-essential lights and appliances to help stabilize the power supply.
6. **Stay Connected:** Maintain communication with family members, friends, and emergency contacts using alternative communication methods such as battery-operated radios, satellite phones, or text messaging. Keep your mobile devices charged and limit non-essential calls to conserve battery life.
7. **Emergency Preparedness:** Review your emergency preparedness plans and ensure you have essential supplies on hand, including food, water, medications, first aid kits, flashlights, batteries, and blankets. Be prepared to sustain yourself and your family for an extended period in case of disruptions to supply chains or emergency services.
8. **Stay Calm and Reassure Others:** Remain calm and reassure others, especially children and vulnerable individuals, during a solar storm. Provide clear instructions on safety procedures and encourage cooperation and mutual support within your community.
9. **Follow Official Instructions:** Adhere to instructions and guidance provided by local authorities, emergency responders, and relevant agencies during a solar storm. Follow evacuation orders, shelter-in-place directives, and other emergency protocols to ensure your safety and well-being.
10. **Monitor Recovery Efforts:** After the solar storm passes, stay informed about recovery efforts and updates from official sources regarding the restoration of services, infrastructure, and communication networks. Be prepared to assist others in your community and contribute to recovery efforts as needed.

By following these activities and recommendations, you can help minimize the impact of a solar storm on yourself, your loved ones, and your community, ensuring a safer and more resilient response to this natural phenomenon.



Figure 4. ChatGPT-Generated Response from the Prompt: “What activities do we need to do during a solar storm?”

5. Are there other alternatives to stay connected to the outside world while we are in shelter during a solar storm? Meanwhile, electricity and satellites will definitely go out or not function.

Furthermore, according to the information obtained, this solar storm has the potential to affect communication, navigation, electricity, and satellite systems on Earth. What about ChatGPT answers no. 1 and 6 in figure 4? It shouldn't be possible. This prompted the author to provide follow-up questions (figure 5). ChatGPT has given a brilliant answer about what are some alternative modes of communication that we can use to remain connected with the outside world during solar storms, when our traditional modes of communication, such as electricity and satellites, are unavailable. Some of them include: 1) Battery powered radio; Am/FM radios that fetch broadcasts still operate on battery power even after our communication systems do not function; 2) Hand Crank Radio: Hand Crank is ideal for news and information during emergencies without using electricity. To power on this radio, the user must manually revolve a crank, which helps it become self-sufficient in communication during emergencies; 3) Two-Way Radio: Walkie-talkies are ideal for short-distance communication between family, neighbors, or the public. Create a communications plan to indicate who carries which radio and allot emergency frequencies of communication; 4) HAM Radio: if one can access the necessary equipment and licenses, HAM radio is a sure way to stay connected and receive emergency assistance, as this mode of communication uses radio frequencies more immune to solar storm interference; 5) CB Radio: It allows no formal permission. On the contrary, they have a designated frequency of use and are suited for people closest in terms of the reach of hearing and vision; 6) Local communication network: it is an alternative form of communication designed for the people in the vicinity, that is, the district, community, or workplace. Use of landline telephones, messengers, running personnel, or pre-specified locations for the purpose of conveying information; 7) A whistle and signaling devices: here, it would be possible to appeal to various methods of drawing attention with the help of a whistle and signal transmitters such as possible rescuers or people not far from hearing; 8) Offline information: in the offline emergency bag, you can leave a reference map, a catalog of phone numbers, and other documents. In the absence of an electronic application, this information can become a reference book.

If studied further, this is also in line with the results of research conducted by Birowo,⁽²²⁾ that the role of community radio can be seen in real situations based on people's daily experiences because people use their media to meet their needs and help answer their problems. In every disaster area, information is always needed, primarily to evaluate the situation, how to get help, and how to respond. Community radio stations have been proven to provide information to affected communities. Apart from that, based on a study conducted by Coile,⁽²³⁾ the Federal Emergency Management Agency (FEMA) supports state and local governments in fulfilling their responsibilities in disaster preparedness, response, recovery, and mitigation in the US. One method FEMA uses to help state and local emergency communications functions is by signing and implementing a Memorandum of Understanding with the American Radio Relay League (ARRL) for amateur radio operators to provide electronic communications to state and local governments in disasters. Amateur radio operators have provided communications in natural disasters such as floods, hurricanes, and earthquakes since 1910.



ChatGPT

Yes, there are alternative communication methods you can use to stay connected to the outside world during a solar storm when traditional communication systems such as electricity and satellites may be disrupted. Here are some options:

1. **Battery-operated Radios:** Battery-powered AM/FM radios can still receive broadcasts even when other communication systems are down. Keep a battery-operated radio and extra batteries in your emergency kit to stay informed about updates, news, and emergency instructions broadcasted by local authorities.
2. **Hand-crank Radios:** Hand-crank radios are another option for accessing news and information without relying on electricity. These radios can be powered by manually cranking a handle, providing an independent source of communication during emergencies.

3. **Two-way Radios:** Two-way radios, also known as walkie-talkies, can be useful for short-range communication between family members, neighbors, or community members. Make sure to establish a communication plan and designate specific channels or frequencies for emergency use.
4. **HAM Radio:** Amateur radio, or HAM radio, operators can communicate over long distances using radio frequencies that are less susceptible to disruptions from solar storms. If you have the necessary equipment and licenses, HAM radio can be an effective way to stay connected to emergency networks and receive assistance during a crisis.
5. **CB Radio:** Citizens Band (CB) radio is another option for short-range communication that can be used by individuals without a license. CB radios operate on specific frequencies and can be useful for communicating with nearby contacts during emergencies.
6. **Local Communication Networks:** Establish communication networks within your community, neighborhood, or workplace using alternative methods such as landline telephones (if available), runners, messengers, or designated meeting points for information exchange.
7. **Whistle or Signal Devices:** In situations where traditional communication methods are unavailable, signaling devices such as whistles, signal mirrors, flags, or flashlights can be used to attract attention and communicate distress signals to nearby individuals or responders.
8. **Offline Information Sources:** Keep printed maps, emergency contact lists, and important documents in your emergency kit for reference. These offline resources can provide valuable information in the absence of electronic communication.

By diversifying your communication methods and incorporating alternative options into your emergency preparedness plans, you can increase your chances of staying connected to the outside world and receiving assistance during a solar storm or other emergencies when traditional communication systems may be compromised.



Figure 5. ChatGPT-Generated Response from the Prompt: “Are there other alternatives to stay connected to the outside world while we are in shelter during a solar storm? Meanwhile, electricity and satellites will definitely go out or not function.”

6. What do we need to do after the solar storm is over?

Moreover, the author went one step further, giving more advanced questions related to what should be done after the solar storm occurs (figure 6). When the solar storm ends, assessments and actions are critical to safety and restoring life. The following activities will be implemented: 1) Information update - organizations will be committed to following up with advancements and guidance from official sources or local emergency management authorities on the status of the solar incident, as well as continuing dangers; 2) Survey of damage- using circumspection, examine premises for indicators of solar storm destruction, like as downed power lines, harm to structures including buildings, or road impediments from debris. Avoiding specific places will be necessary since they might be hazardous; 3) Personal protection examination-prioritizing our and others' safety; provide first aid or seek medical aid if you or someone else is sick. Hazardous situations should be avoided, including flimsy buildings or exposed electrical lines. Drinking water and other liquids on the ground should be prevented due to possible contamination; 4) Service restoration- if electrical, plumbing, or gas services losses occur during a solar storm, follow established protocols to reinstate service. If your power goes off, call the local utility firm to notify them, and then follow their redemption guidelines; 5) Family and friends contact-call relatives, colleagues, and acquaintances to verify their safety. Please share information about our status and any help or resources we need; 6) Help others by assisting individuals in need, especially vulnerable groups such as the elderly, disabled, or those with medical conditions. Coordinate efforts with local authorities and community organizations to provide support and resources to those impacted by solar storms; 7) Recheck the

security of our property by taking steps to secure our property from further damage or theft. Close windows, secure roofs, and protect our valuable property from further harm; 8) If documents are damaged, snap photos or video for insurance purposes. Keep track of all storm-related costs, including repair bills, temporary housing total, and other expenses associated with it; 9) Remove rubbish from our property, yard, and the surrounding streets and roads to allow emergency response crews and power employees to reach us easily. Dispose of debris and hazardous materials in accordance with guidelines; 10) Review and update emergency preparedness plans for future events based on the experiences shared. Take steps to build in automatic safeguards where possible, strengthen local communities, and ensure that you have the ability to work together more efficiently.

Based on the study above, these things align with the research by Berke, Kartez, and Wenger⁽²⁴⁾ that sustainable development after a disaster is significant, primarily through local participation in rebuilding planning and institutional cooperation. Apart from that, some things need to be considered after a disaster occurs; usually, many issues will arise, including mental health after a disaster,^(25,26) resilience after disasters,⁽²⁷⁾ social networks after catastrophe,⁽²⁸⁾ the evolution of networks and the strength of inter-organizational relationships after catastrophe,⁽²⁹⁾ school reactivation programs after disasters,⁽³⁰⁾ Rebuilding urban places after disasters^(31,32) and so on.



ChatGPT

After a solar storm has passed, it's essential to assess the situation and take appropriate actions to ensure your safety, as well as to aid in recovery efforts. Here are the steps you should consider taking after a solar storm:

1. **Stay Informed:** Continue to monitor updates and advisories from official sources such as NOAA's Space Weather Prediction Center (SWPC) or local emergency management agencies for information on the status of the solar event and any ongoing risks.
2. **Check for Damage:** Inspect your surroundings for any signs of damage caused by the solar storm, such as downed power lines, structural damage to buildings, or debris blocking roads. Exercise caution and avoid areas that may be unsafe.
3. **Assess Personal Safety:** Prioritize your safety and the safety of others. If you or someone else is injured, administer first aid or seek medical attention as necessary. Be mindful of hazards such as unstable structures, electrical hazards, or contaminated water.
4. **Restore Utilities:** If power, water, or gas services were disrupted during the solar storm, follow appropriate procedures to safely restore utilities. Contact utility companies to report outages and follow their instructions for reconnection.
5. **Communicate with Loved Ones:** Check in with family members, friends, and neighbors to ensure their safety and well-being. Share information about your own status and any assistance or resources you may need.
6. **Assist Others:** Offer assistance to individuals in need, especially vulnerable populations such as the elderly, disabled, or those with medical conditions. Coordinate efforts with local authorities and community organizations to provide support and resources to those affected by the solar storm.
7. **Secure Property:** Take steps to secure your property against further damage or theft. Board up windows, cover damaged roofs, and safeguard valuable possessions to prevent additional losses.

8. **Document Damage:** Take photographs or videos of any damage to your property for insurance purposes. Keep detailed records of expenses related to repairs, temporary accommodations, and other storm-related costs.
9. **Clean Up Debris:** Clear debris from your property and nearby streets to facilitate access for emergency responders and utility crews. Follow guidelines for proper disposal of debris and hazardous materials.
10. **Prepare for Future Events:** Use the experience of the solar storm to review and update your emergency preparedness plans. Identify areas for improvement and take proactive measures to strengthen your resilience to future events.

By taking these post-storm actions, you can help ensure a safe and efficient recovery process for yourself, your loved ones, and your community following a solar storm or other natural disaster.



Figure 6. ChatGPT-Generated Response from the Prompt: “What do we need to do after the solar storm is over?”

CONCLUSION

Based on the findings and discussion that have been studied above, it can be concluded that for humans to survive the threat of this major disaster, namely solar storms, which are also known as geomagnetic storms, preparation is required before, during, and after this storm occurs. Remember that although solar storms can pose significant challenges, proper preparation and staying informed can significantly increase our chances of survival and minimize their impact on our lives.

The best shelter from solar storms is a sturdy building or structure that protects adequately from radiation and flying debris. Remember that seeking shelter during a solar storm minimizes radiation exposure and protects us from potential hazards such as flying debris. Choose a shelter that provides the best protection, accessibility, and resources to ensure your safety during the event. Besides that, if we need more money to build the best shelter from solar storms, we can still take steps to increase safety and preparedness without a significant financial investment.

While financial constraints may limit our ability to build the most robust shelter possible, taking proactive measures and utilizing available resources can still increase our chances of staying safe during a solar storm. Prioritize cost-effective strategies that address the most important aspects of preparedness and protection for us and our loved ones.

Adopting the above activities and taking the necessary steps and recommendations to protect and reduce potential risks against solar storms is vital. This helps to play the roles that minimize the effects of the incident toward self, family, and the community, hence responding in a safer and resilient way to the nature of this natural phenomenon.

Additionally, during a solar storm, people can use any alternative communication means to remain connected with outside sources because both electricity and satellite power source amongst other workings of communication systems may not be operational. Thus, with people having diversified means of communication which are alternatives to electricity, people can be able to connect with the outside world, hence receive help when the normal communication systems are off in event such as solar storms or any other disaster.

After the storm has passed, one can then run its different measures to ensure people are safe or recover from the adverse effects. Such activities will always contribute to the establishment of a safe and quick mechanism to users and people in general after a solar storm.

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IMPLICATIONS

The findings in this article have significant consequences for specialized disaster agencies in each country and volunteers to consistently apply them in disaster emergency response situations, especially in dealing with future solar storms. By utilizing this idea, policy makers can incorporate it into disaster emergency response guidelines, making it easier to implement.

FUTURE RESEARCH DIRECTIONS

This idea may serve as a guide for more sophisticated future research. Therefore, it is important to conduct further research to determine the most effective procedures to resolve this problem.

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