ASSOCIATION OF GEOSPATIAL INDUSTRIES

Newsletter

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Theme: Disaster Management

In this Issu

From the President's Desk

Geospatial Technologies have emerged as indispensable for Disaster Management, enhancing situational awareness and fostering a proactive approach to disasters. Geospatial technologies enable mapping geographical vulnerabilities, allowing authorities to identify high-risk areas prone to natural disasters such as floods, earthquakes, or wildfires.

The intricate details of terrain, land cover, and population density can be analyzed through advanced mapping techniques, offering valuable insights into potential disaster scenarios. Satellite imagery and GIS data allow for continuous surveillance, tracking the progression of disasters, and facilitating timely decision-making. This real-time information is crucial for deploying resources, evacuating, and coordinating emergency responses effectively.

Geospatial technologies also contribute to developing predictive models, allowing authorities to anticipate the potential impact of disasters, mitigate risks, and enhance overall preparedness. They provide a geographically informed approach to resource management. Emergency responders can identify optimal locations for shelters, supply depots, and medical facilities, streamlining the allocation of resources where they are most needed.

The fundamental concept of GeoResilience emphasizes the capacity of communities and infrastructures to absorb, recover from, and adapt to disasters. By integrating geospatial data into resilience strategies, authorities can develop robust disaster management plans that consider both immediate response and long-term recovery, fostering a resilient environment. By leveraging the power of spatial data and analytics, communities can fortify their defenses, respond swiftly to crises, and ultimately build a more resilient foundation in the face of natural disasters.

AGI's mission has always been to promote and advance not just the Geospatial industry but also Geospatial technologies and applications in India. As a forum for exchanging ideas, techniques, approaches, and experiences by those who design, implement, and use Geospatial technology solutions, AGI dedicates this Edition of its newsletter to the theme of Disaster Management and the role of Geospatial technologies in its development.

I extend my heartfelt gratitude to our dedicated members, partners, and contributors who continue to drive innovation and excellence in the Geospatial domain. Your unwavering support is the cornerstone of our collective success.

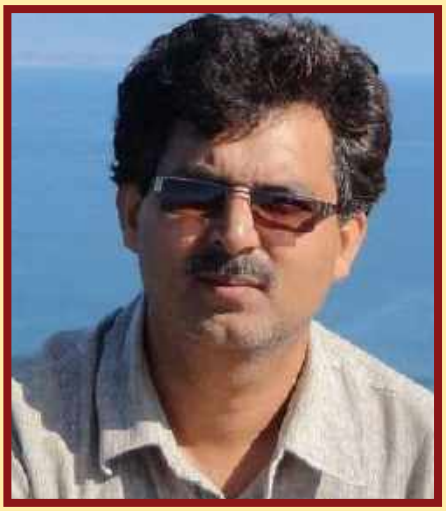
We hope this Edition comes across as insightful and enjoyable. Stay tuned for more insights, stories, and analyses from AGI in the coming months.

Enjoy Reading,

Warm regards,

Pramod Kaushik
President, AGI.

Transient landscape modeling and characterization used to identify the landslide-prone zones in the Himalayas is another emerging domain using Geospatial technology.



"Integrating multiparametric geophysical and geological studies is essential to understanding any natural disaster," *notes Dr. Anand Kumar Pandey, Senior Principal Scientist, National Geophysical Research Institute (NGRI).*

NGRI plays a crucial role in understanding Earth's processes to enhance preparedness and resilience to natural hazards. Could you elaborate on specific research initiatives or methodologies NGRI employs for disaster management?

NGRI has state-of-the-art deployment seismometers in different parts of India. The deployments aim to understand the earth's structure, lateral variation, and seismogenesis. The seismically active Himalayan region is specifically monitored in mission mode along Sikkim, Arunachal Pradesh, Uttarakhand, and Jammu & Kashmir to map seismogenic Main Himalayan Thrust (MHT) and its lateral variation using multiparametric geophysical surveys to understand seismogenesis processes. Transient landscape modeling and characterization used to identify the landslide-prone zones in the Himalayas is another emerging domain using geospatial technology, which NGRI contributes significantly.

As a principal research institute focusing on Earthquake Hazards, can you share insights into NGRI's contributions to predicting and mitigating the impact of earthquakes? How has this research translated into practical applications for disaster response and recovery?

The seismic (and other integrated geophysical) studies are planned as earthquake precursory studies to understand the response of shallow subsurface during an earthquake. It is an ongoing program developing a baseline and time series for identifying and characterizing potential zones of earthquake localizations.

A new initiative on monitoring large landslides and associated mass wasting is being initiated in pilot mode to develop a methodology for an early warning system for flash floods. A pilot study was conducted as the site-specific seismic hazard and risk assessment of Dehradun city, incorporating a quick visual survey of building typology and deriving response spectra for different areas of Dehradun city. The recommendations are accepted by Uttarakhand Govt and incorporated in New Building bylaws (2023).

A similar study was carried out for Lucknow and part of Varanasi city, and the report was submitted to the stakeholders. The vulnerable areas susceptible to different degrees of liquefaction are mapped.

Natural Resources is a key theme at NGRI, including the identification of primary geo-resources. How does NGRI's research in this area contribute to disaster resilience, particularly in scenarios where natural resources might be affected or disrupted due to disasters?

This is very important domain. NGRI is mostly carrying out studies on identifying and characterizing primary geo-resources; however, the implications and disruption during natural disasters is a scenario study where we are yet to make an attempt.

NGRI's multidisciplinary approach involves geophysical, geochemical, and geological techniques. How do these varied disciplines collaborate to provide a comprehensive understanding of potential natural hazards and their implications for disaster management?

Integrating multiparametric geophysical and geological studies is essential to understanding any natural disaster. The efforts during Joshimath have been a recent success story.

NGRI has been contributing towards this goal such as 1991-Uttarkash, 1999 Chamoli, 2001-Bhuj and 2015- Nepal earthquake, 2020-21 Palgarh seismicity swarm and reservoir-induced seismicity in the Koyana-Warna dam-reservoir region,

and many other large dam project are some notable examples in this regards.

Differential SAR interferometry technique is widely used in disaster management studies. What role do such innovative technologies play in disaster mapping and damage assessment?

I would like to list some recent studies NGRI carried out, and they are public domain to elaborate an understanding of this aspect, such as:

- Monitoring active slopes for ground deformation in the Himalayas, such as Joshimath.
- Monitoring ground subsidence of overexploitation and aquifer health >(14 sites across IG plain)
- Pilot project for recurrent volcanogenic earthquake rupture in EAR and co-seismic deformation during the 2021 Assam earthquake.

NGRI emphasizes a vision to minimize the loss of life and property from natural disasters. Can you share specific instances where NGRI's research has directly influenced policy or practical measures for disaster risk reduction at the regional or national level?

I have some updates to share regarding recent initiatives that promote more meaningful interaction. The Seismic Hazard zonation of Dehradun has been adopted in the new building bylaws. The same has been proposed for Lucknow, but it is yet to be considered for the city's building code. The Jabalpur city micro Hazard zonation was a multi-institutional effort. The Central Ganga basin is being monitored for an earthquake response study, which is an ongoing multi-country effort in which NGRI plays a significant role. Lastly, there is a pilot program in development for the Early warning system of GLOF-LLOF and other flash floods in the Himalayas.

The Seismic Hazard zonation of Dehradun has been adopted in the new building bylaws. The same has been proposed for Lucknow, but it is yet to be considered for the city's building code.

Fortifying Communities: The GeoResilience Advantage in Natural Disaster Management

SPECIAL FEATURE

Sakshi Singh, AGI

Geospatial technologies play a pivotal role in transforming traditional disaster management approaches, providing a proactive and dynamic framework for tackling the challenges posed by natural calamities. GeoResilience is a critical concept in this light, encompassing the strategic integration of Geospatial technologies to enhance a community's ability to withstand, respond to, and recover from natural disasters.

The essence of GeoResilience is to use spatial data and technology to protect communities from natural disasters. The concept focuses on utilizing spatial data and technological innovations to fortify communities against the unpredictable forces of nature. Using advanced tools such as GIS, remote sensing, and machine learning, GeoResilience can help analyze, predict, and mitigate natural hazards, save lives, reduce property damage, and ensure sustainable development in vulnerable areas.

Understanding GeoResilience: Genesis and Evolution of the Concept

GeoResilience has evolved as a response to the increasing frequency and intensity of natural disasters. The concept finds its genesis in integrating Geospatial technologies and resilience strategies against the impact of environmental challenges.

The evolution of GeoResilience can be traced back to recognizing the profound influence geography holds in shaping vulnerability and response to disasters. The need for a comprehensive, location-based approach became apparent as disasters became more complex and dynamic. The concept of GeoResilience emerged as a solution, emphasizing the synergy between geospatial data, advanced technologies, and resilience planning. Today, real-time data, satellite imagery, and predictive modeling are integral components of a robust GeoResilience framework.

Proactive Strategies for Building GeoResilience

The concept of GeoResilience has matured beyond reactive measures to encompass proactive strategies. GeoResilience is no longer merely about responding to disasters but entails mapping vulnerabilities, monitoring in real-time, and utilizing predictive modeling to anticipate and mitigate potential risks.

Mapping Vulnerabilities

GeoResilience begins with the meticulous mapping of vulnerabilities within a geographical context. GIS becomes a powerful tool for identifying high-risk areas prone to natural disasters, facilitating a targeted and informed approach to disaster preparedness. Geospatial technologies offer a comprehensive understanding of the landscape's susceptibilities by analyzing terrain characteristics, land cover, and population density.

Real-Time Monitoring with Geospatial Technologies

Geospatial technologies enable continuous surveillance through satellite imagery, providing a bird's-eye view of disaster-prone regions. This real-time monitoring capability allows authorities to track the progression of disasters as they unfold. The availability of instant, location-based data empowers decision-makers to respond swiftly and effectively in the face of evolving situations.

Predictive Modeling for Disaster Impact

Spatial analytics and simulation techniques, facilitated by Geospatial technologies, allow for anticipating various disaster scenarios. This predictive modeling empowers authorities to take proactive measures and implement risk mitigation strategies before disasters.

Resource Allocation and Coordination

Geographically informed resource management ensures critical resources are strategically positioned based on real-time data and predictive modeling. This approach extends to optimizing locations for shelters, depots, and emergency facilities, enhancing the efficiency of resource deployment. GeoResilience, therefore, becomes a guiding force in streamlining resource allocation, fostering a coordinated and effective disaster response that minimizes loss and accelerates recovery.

Strategies for Building GeoResilience in the Face of Disasters

India, with its diverse geographical and climatic conditions, faces a multitude of natural disasters ranging from floods to earthquakes. GeoResilience, the capacity to anticipate, prepare for, respond to, and recover from disasters using Geospatial technologies, can be built using the following strategies:

Comprehensive Mapping and Risk Assessment: Authorities must conduct detailed Geospatial mapping to identify high-risk zones and analyze factors such as terrain, land cover, and population density to assess vulnerability. This mapping serves as a foundation for informed disaster preparedness and response.

Real-Time Monitoring and Early Warning Systems: Implementing real-time monitoring using satellite imagery can help in continuous surveillance. Developing robust early warning systems to leverage Geospatial data can help provide timely alerts to communities in disaster-prone areas, minimizing the impact of disasters.

Community-Centric Resilience Building: It is important to integrate Geospatial data into community-level resilience strategies. Local communities can be empowered by training them in disaster response and recovery with Geospatial insights. The aim should be to foster collaboration between communities, government agencies, and NGOs for a unified approach.

Predictive Modeling and Simulation: Spatial analytics and simulation techniques may be employed for predictive modeling. This can help anticipate potential disaster scenarios and their impacts using Geospatial data, while implementing proactive measures and risk mitigation strategies in vulnerable regions.

Resource Allocation and Coordination: Geographically informed resource management can be used for optimized disaster response. Strategic locations may be identified for shelters, depots, and facilities based on Geospatial insights. Resource allocation and coordination can thus be streamlined to enhance the efficiency of disaster response efforts.

Technological Integration for Data Interoperability: Challenges related to data accuracy and interoperability can be better addressed by integrating advanced technologies. The integration of AI and ML can help enhance the analysis of Geospatial data for more accurate risk assessments.

Public Awareness and Education: Authorities may launch extensive public awareness campaigns leveraging Geospatial visualizations. They can educate the population about the risks they face, evacuation routes, and safety protocols. This can help improve community understanding of GeoResilience and its role in disaster preparedness.

Government Policy Integration: GeoResilience strategies must be integrated into national and regional disaster management policies. Government bodies should lead the way in establishing standards for Geospatial data usage, creating a regulatory framework that supports GeoResilience initiatives.

Continuous Training and Skill Development: Lastly, more investments are required in training programs and skill development for professionals involved in disaster management. They must be equipped with the expertise needed to leverage Geospatial technologies effectively during emergencies, ensuring a competent and resilient workforce.

The above strategies can help India can strengthen its GeoResilience, creating a more prepared and adaptive environment to mitigate the impact of natural disasters and safeguard its communities.

The Way Forward: Targeted GeoResilience Initiatives

Geo-resilience is crucial in disaster response and management. By utilizing Geospatial technology to conduct a thorough evaluation of the affected regions, identify accessible evacuation routes, and collaborate with emergency response teams, governments worldwide can significantly reduce the response time to a disaster, ultimately saving more lives in the process.

In addition to the above applications, maintaining updated databases of populations, businesses, structures, and utilities, while keeping track of the current support levels and available resources in real-time, can further enhance the effectiveness of disaster response and management efforts.

ARTICLE

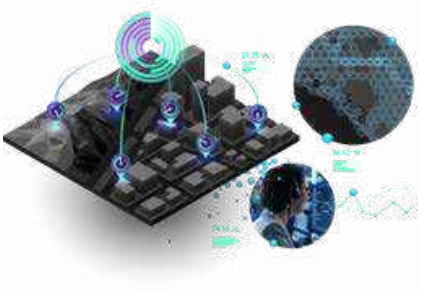
Leveraging ESRI Solutions for Effective Disaster Management

Yogesh Karyakarte, EDS Technologies

Disasters can strike at any time, causing immense devastation to lives, property, and the environment. From natural disasters like hurricanes, earthquakes, and floods to man-made emergencies such as industrial accidents or pandemics, being prepared and having the right tools to manage and respond to these crises is crucial. ESRI, a global leader in geographic information systems (GIS) technology, offers various solutions that can be harnessed to enhance disaster management efforts. This article explores how ESRI solutions can be used for disaster management.

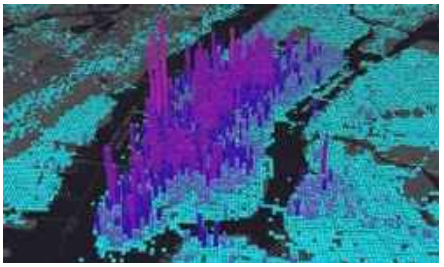
Real-Time Data Visualization

One of the fundamental aspects of effective disaster management is having access to up-to-date information. ESRI's GIS technology enables organizations to collect, manage, and visualize data in real-time. This real-time data can include information on weather patterns, traffic conditions, social media updates, and more. By utilizing this data, emergency responders and disaster management teams can make informed decisions and quickly adapt to changing situations during a disaster.



Spatial Analysis and Modeling

ESRI's spatial analysis tools are invaluable for understanding the geography and impact of disasters. Through GIS, users can create detailed models to predict the potential path and impact of hurricanes, the spread of wildfires, or the flooding patterns in a region. These models help authorities make informed evacuation plans, allocate resources, and establish safe zones for affected communities.



Decision Support Systems

During a disaster, the ability to make rapid and informed decisions is paramount. ESRI solutions offer decision support systems that integrate data from various sources, providing a holistic view of the situation. Decision-makers can analyze different scenarios, assess potential outcomes, and select the most effective response strategies. This helps in optimizing resource allocation and streamlining the response efforts.

Public Engagement and Communication

Effective communication is a key component of disaster management. ESRI provides tools to create public-facing maps and applications that disseminate critical information to the public and stakeholders. These maps can show evacuation routes, shelter locations, and real-time updates on the disaster's progress, ensuring that citizens are well-informed and able to take appropriate action.

Field Data Collection and Mobile Solutions

Disaster management often requires teams to work in the field. ESRI's mobile solutions enable responders to collect data, capture photos, and report back in real-time from the disaster site. This data is then integrated into the central GIS system, allowing for better coordination and decision-making.

Resource Allocation and Logistics

ESRI solutions are instrumental in managing resources and logistics during a disaster. GIS technology helps organizations track the availability and location of critical resources, such as medical supplies, food, and water. This information ensures that resources are distributed efficiently to areas in need.

Recovery and Reconstruction

Disaster management does not end with an immediate response. ESRI solutions continue to be valuable during the recovery and reconstruction phases. GIS technology can assist in assessing damage, prioritizing reconstruction efforts, and monitoring progress. It helps allocate funds and resources where they are most needed for long-term recovery.

International Collaboration

Disasters often transcend borders, and international cooperation is vital in managing global crises. ESRI's GIS technology facilitates collaboration between different agencies, governments, and organizations by providing a common platform for sharing data, maps, and information. This interoperability is essential for efficient disaster response efforts.

Conclusion

Effective disaster management requires careful planning, swift decision-making, and adapting to rapidly changing conditions. ESRI's comprehensive GIS solutions offer valuable tools and resources for all stages of disaster management, from preparedness and response to recovery and reconstruction. By harnessing the power of spatial data and analysis, ESRI empowers organizations and governments to save lives, protect property, and mitigate the impact of disasters. In a world where disaster preparedness is of utmost importance, ESRI's solutions play a critical role in enhancing our ability to manage and respond to emergencies.

We at EDS Technologies have partnered with ESRI India to provide GIS software and services. This partnership further strengthens our commitment to supporting disaster management with cutting-edge technology and expertise. Together with ESRI, we aim to positively impact disaster management across the country, ensuring a safer and more resilient future for all.

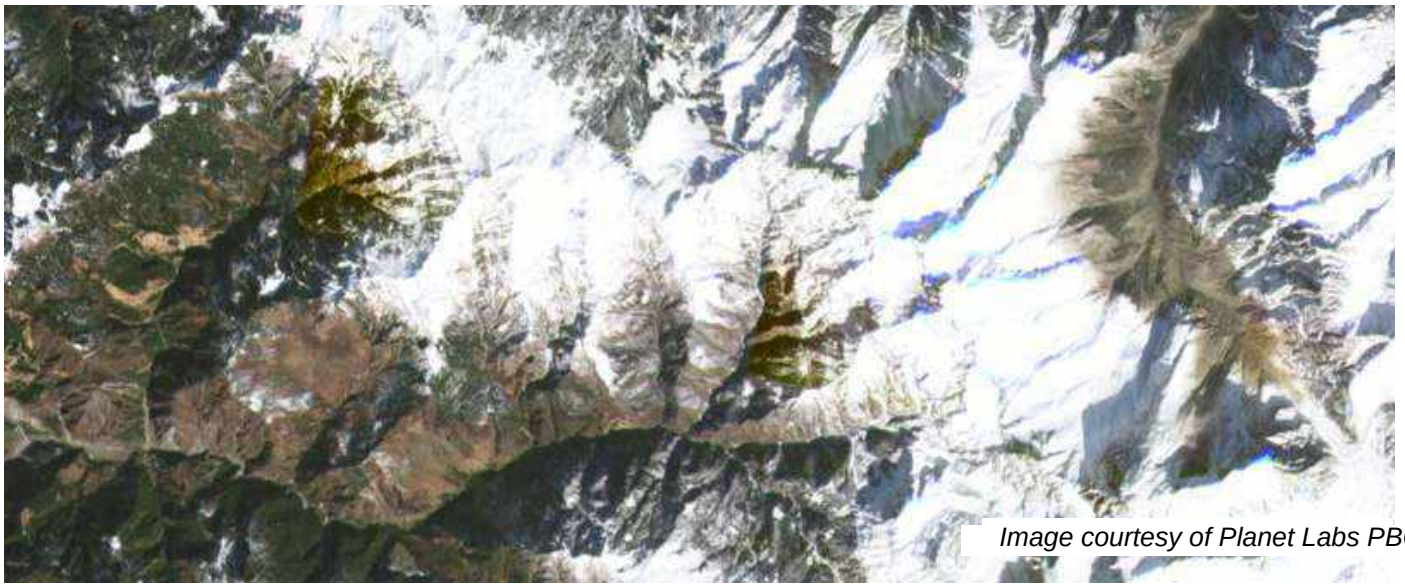


Image courtesy of Planet Labs PBC

Planet's Data Helped Unravel the Geological and Meteorological Interplay in the Chamoli Disaster

Planet

In early February 2021, the Chamoli district experienced heavy rain, leading to flash flooding in the mountainous region. This flooding, combined with a series of interconnected events on February 7, 2021, generated an unprecedented landslide, the generation of a temporary dam in the valley system, and a subsequent breach that impacted local lives and economies.

Getting to the Bottom of the Chamoli Disaster

To better understand the interplay between the factors leading to this landslide, researchers from Aligarh Muslim University and the Indian Institute of Technology Roorkee used Planet satellite imagery. By reviewing PlanetScope data from before and after the event, alongside scientific case studies and published reports, the researchers were able to analyze how the weather events interacted with the unique geological formations of the mountainside to cause such an event.

Their work suggests that a positive feedback system existed between an earlier winter freeze, the rapid flood, wedge rockfall in the region, and erosion in the valley system, leading to the structural instability of the mountain peak and subsequent natural disasters. Planet Dove satellites captured images of the landslide only shortly after the event, revealing a dust and debris path that the scientists could trace to help determine the cause of the landslide.

To better understand the interplay between the factors leading to this landslide, researchers from Aligarh Muslim University and the Indian Institute of Technology Roorkee used Planet satellite imagery.

"There is a need to monitor such extreme hydro-geomorphic events in the vulnerable cryospheric region of Uttarakhand for prospects. The scope of real-time monitoring, analyzing, and alert decimation systems needs to be increased to individual level via mobile phones and public warning systems. An alarming system relying on sensors should be employed for public awareness," said the authors.

How Do We Harness Satellite Data for Disaster Response?

The Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI), a regional flagship initiative of the World Bank, aimed to provide PICs with disaster and climate risk information and associated tools for enhanced risk management to inform development planning and financing decisions. The primary activities included developing an application for Rapid Disaster Impact Estimations immediately following disasters and strengthening the existing Pacific Risk Information System (PACRIS),

a database containing detailed, country-specific information on assets, population, hazards, and risks.

Planet's customer, the Fiji-based Secretariat of the Pacific Community (SPC), used PlanetScope 4- and 8-band products and SkySat tasking to help identify and delineate building and other infrastructure footprints to inform national inventories of infrastructure assets, as well as their exposure to natural disasters. Yet building inventories is just a part of the process; you also need capably trained government agency staff who can use and maintain the data as well as the ability to expand reach and access across the wider Pacific community – particularly when the need arises to communicate risk information to policy and decision-makers effectively.

SPC was able to set up the PACRIS database as a GeoNode location across all of the Pacific nations involved in the project, training over 120 government staff on the platform at its outset in the mid-2010s.

SPC was able to set up the PACRIS database as a GeoNode location across all of the Pacific nations involved in the project, training over 120 government staff on the platform at its outset in the mid-2010s. The six governments also received Post-Disaster Budget Extension Guidelines, which provide a suite of tools for managing financial demands in the wake of any natural disaster.

SPC has expanded to additional nations like Fiji and Kiribati, and with an eye towards specific-country disaster and climate-risk projects such as providing the analytical inputs to Tuvalu's policy reforms around reducing risk to public sector infrastructure assets, a flood management plan for the Solomon Islands; and contributed to the technical underpinning to prepare guidelines for the implementation of Fiji's National Building Code (NBC) for new single-story residential houses and single-story schools located in rural areas.

EXPLORE how Planet data plays a key role in transforming disaster management capabilities amidst the changing climate.

CASE STUDY

Cloudburst at Lhonak Lake, North Sikkim

A cloud burst over Lhonak Lake in North Sikkim resulted in a flash flood in the Teesta River in Lachen Valley on 4 October 2023. At least 18 people died and 102 went missing after the cloudburst in the tiny hilly state. The flood in Sikkim that started around 1.30 am was made worse by the release of water from Chungthang dam.

Studies show that the glacier receded about 2 kilometres in 46 years from 1962 to 2008. It further retreated by about 400 metres from 2008 to 2019. The Teesta basin in Sikkim Himalaya hosts numerous glacial lakes in the high altitude glacierised region, including one of the largest and the fastest-growing South Lhonak Lake.

Respond to disasters faster with on-demand satellite imagery. Rapid response matters in disaster management. Satellite imagery and analytics provided by Blacksky evolved to meet those challenges in three ways:

- Providing imagery quickly
- Capturing imagery of hard-to-reach places
- Monitoring recovery changes

The Teesta basin in Sikkim Himalaya hosts numerous glacial lakes in the high altitude glacierised region, including one of the largest and the fastest-growing South Lhonak Lake.

In the face of traditional challenges in disaster response with satellite imagery, a beacon of hope emerges in the form of BlackSky. This pioneering solution is reshaping the way we address disasters. BlackSky is at the forefront of providing on-demand satellite imagery, offering a transformative response to the limitations that have hampered traditional disaster management. This innovative platform is poised to redefine how governments, organizations, and first responders react to crises.

Features

Real-Time Monitoring: One of the paramount advantages of BlackSky is its ability to provide real-time or near-real-time access to satellite imagery. When disaster strikes, timely information is non-negotiable. BlackSky's platform enables users to request and receive high-resolution images within hours of a disaster, ensuring that critical data is readily available for decision-making.

Global Coverage: BlackSky's constellation of small satellites provides comprehensive global coverage, addressing the issue of limited access in remote or underserved areas. Whether a disaster occurs in a bustling urban center or a remote village, BlackSky's satellites can capture the necessary

imagery, leveling the playing field and extending the benefits of on-demand satellite data to regions that need it most.

High-Resolution Imagery: The platform's high-resolution imagery allows responders to zoom in on specific details, which is crucial for assessing damage, identifying survivors, and evaluating the condition of vital infrastructure. BlackSky's commitment to data accuracy and precision ensures that responders have the tools for effective disaster management.

Cost-Effective Solutions: BlackSky offers cost-effective access to satellite imagery. By democratizing the availability of on-demand data, the platform makes it accessible to a wide range of users, from governmental bodies to smaller NGOs. This cost-efficiency minimizes financial constraints and empowers organizations to direct their resources where they matter most – towards saving lives and alleviating suffering.

Multi-Sensor Integration: BlackSky has multiple sensors, including optical and synthetic aperture radar (SAR). This multi-sensor approach allows for more comprehensive disaster assessments. While optical imagery provides detailed visual data,

Since most of the satellites have been launched in the mid-inclination orbit (MIO) to provide high revisit rate cadence, responsive last-minute tasking, and timely collect-to-data-delivery latency time frames in the mid-latitudes between 53.5° N and 53.5° S.

SAR can penetrate through adverse weather conditions, smoke, and darkness, ensuring that responders can access vital information during the most challenging disaster scenarios.

User-Friendly Interface: BlackSky's user-friendly platform ensures that even those without specialized training can access and interpret satellite imagery. This simplicity in data retrieval and analysis enhances the adaptability of the technology, making it accessible to a wider range of users, including local communities and grassroots responders.

Frequent revisits: Since most of the satellites have been launched in the mid-inclination orbit (MIO) to provide high revisit rate cadence, responsive last-minute tasking, and timely collect-to-data-delivery latency time frames in the mid-latitudes between 53.5° N and 53.5° S.

How Modern Satellites Help Disaster Teams Respond Faster And Monitor Recovery

By providing real-time or near-real-time access to high-resolution satellite imagery, BlackSky empowers responders and decision-makers with the timely information they require. This capability enables the rapid assessment of disaster-affected areas, aiding in search and rescue efforts, resource allocation, and the prevention of secondary hazards. With its global satellite coverage and multisensory integration, including synthetic aperture radar (SAR), BlackSky can capture crucial data even in adverse weather onditions or at night. This technology supports quickly disseminating accurate information to affected populations, reducing panic and confusion while facilitating international aid coordination. Low-latency satellite imagery from BlackSky empowers emergency and first responders by providing them with the information they need to make critical decisions.

ARTICLE

Detecting Fires Early: A Young Team Member of Skyserve Solves a Problem Close to Her Community

Adithya Kothandhapani and Bhavishyaa Vignesh, Skyserve

Skyserve intern Bhavishyaa Vignesh talks about the opportunity to build a fully functional fire detection application with the help of her mentor from SkyServe. She talks about her experience in this article.

In 2020, I took part in ESA's AstroPi challenge, where our team had to identify a problem that could be solved using satellite data. We received satellite images that had our code on them.

We didn't win the challenge. But that left me in awe for a while, how I could see our planet from space, and how I could so many things with the data. It got me excited because we could use the data for so many things that can help a lot of communities like finding algae in lakes, dangerous temperature levels, vegetation, and much much more.

Ever since, I have thought on how cool remote sensing and satellite imagery really is. It sounded unreal. When I got the opportunity to do an internship at SkyServe, I was nervous, amazed, and just excited that I would get to learn about how to use satellite data.

The whole opportunity was awesome. Around the same timeframe that I got a "Yes", fires began burning in Canada. Especially in British Columbia, Alberta, and the Northwest Territories. A lot of families, communities, and even towns had to evacuate because of that. I live much more to the east, but I could smell smoke and the view was slightly disturbed and slowly began to faint. It was all over popular news channels and websites. Some of them showed satellites picking up smoke in their images. That's when my idea clicked. This seemed like an exciting idea, to use satellite imagery to find fires.

I began with the help of my mentor to learn about all of the layers that can be utilized for this application, the first one that I came across was FIRMS (Fire Information for Resource Management System), FIRMS distributes a near real-time active fire data within three hours of satellite observation. I used a color palette of red, orange, and yellow. Yellow is the biggest fire. It had global coverage, was freely accessible, and had real-time updates. So it was perfect for testing. The first time I saw the mini squares pop up on the map, I was so happy, I had goosebumps and that really wanted me to continue.

I added a lot of layers, with bands mostly focusing on B12, B11, and B9.

The different layers would help me understand the different properties, and how to identify a fire. It also helped me understand how to add a layer.

But the three main ones in the program are FIRMS, SWIR composite and a B12-B11 ratio. SWIR standing for short-wave infrared (B12 band of Sentinel-2), can be combined with Near Infrared (B8 band of Sentinel-2) and Red (B4 band of Sentinel-2) to get the`swirLayer` visualization. This layer is what is creating that map-like layer in the background.

The last layer in the code. The calculated ratio is an indicator for potential fire areas. This calculated ratio (`b12b11`) is used as an indicator of potential fire activity. Seeing the distribution of values of this ratio, we selected a trheshold value of 1.5 to detected areas where the SWIR-2 to SWIR-1 ratio is a potential active fire burning when the satellite flew overhead.

But it didn't work perfectly on the first try. I encountered a few major errors:

I saw that there was a fire in a community, on top of a house, so I assumed it was a house fire but it was showing orange and when I zoomed into it, it was showing a rooftop. I searched for fires around the neighborhood in local news, but none were correlated. It showed a gleaming solar panel as fire. That could have multiple reasons for failure. I also had some false detection of fire from the sun glinting from water bodies. So, to confirm if those fires were real, I would check on multiple layers, and my fire detection layer picks up the fires that seem the largest, and will be picked up by almost all of the layers. But FIRMS covers globally and can pick up fires that aren't picked up by others. For the sun glint problem, using a water mask can mask out the water bodies that were in the Area of Interest!

I truly learned a lot in the process, and I am very thankful to SkyServe for giving me the opportunity. I never knew how much can be achieved with satellite data, especially in solving problems like this. With all this new knowledge, I can't wait to continue on this satellite imagery/ remote sensing journey.

> **It was a fun experience working with Bhavishyaa on her project. It is amazing what one can do with satellite data given the tool, imagination and most importantly an infectious passion!**
>
> *-Adithya Kothandhapani*

From the Mentor

Adithya Kothandhapani: It was a fun experience working with Bhavishyaa on her project. It is amazing what one can do with satellite data given the tool, imagination and most importantly an infectious passion!

Over the last few days, we have seen another series of events unfold in Punjab where crop stubble is being burnt due post-harvest. I put together a GIF to show how Bhavishyaa's App helps enable pin-pointing of active fires. The last (mostly green) image is from the high-resolution Google Maps Satellite view - which could in theory be used to even report the address of a farm on fire. If we include a 'Burn Scar' detector alongside this visualization, it shows where recently doused fires have left a visible mark on the land. Notice (a) the wispy smoke columns emanating from the active fires detected in yellow, and (b) that some active fires overlap the burn scars.

The plot above condenses insights from the same area shown in the animation. Intent is to leave you the reader with something to think about. Clue: kharif crops are sown in June & harvested in October (DOY~300); rabi crops are sown in November & harvested in May (DOY~120).

ARTICLE

Esri India's "Indo ArcGIS" for Disaster Management

Esri India

Disasters like floods, cyclones, tsunamis, droughts, earthquakes, fires, storms, and lightning of high severity continually affect the country, leading to huge losses in life, property and livelihood. Such losses can be prevented if the disasters are managed effectively with the use of specially curated GIS solutions and data products.

Indo ArcGIS is a unique product, developed by Esri India to solve some of the most pressing social and business challenges the country is facing today. Indo ArcGIS includes unique Solutions and Data Products for disaster preparedness and management. Esri India is also providing 750+ layers of data through the Indian edition of ArcGIS Living Atlas to support these solutions.

Key Application Areas and Solutions

A. Risk Assessment

- Land Use and Land Cover mapping
- Identifying High Risk Areas
- Identifying Vulnerabilities
- Identifying Human, Livestock, Crops, and Infrastructure at high risk

B. Early Warnings / Hazard Forecasting

- Weather Condition Analysis
- AI/ML/DL based Modelling
- Visualizing the Scope of the Disaster
- Hazard Prediction and Early warnings risk

C. Pre-Disaster Planning

- Infrastructure / Resource Planning
- Locating Relief Centers, Shelter, Control Rooms
- Roads and Network Management
- Identifying Risk of Events and Vulnerabilities
- Identifying Possible Impact of Events
- Evacuation Planning

D. Disaster Response

- Number of People Affected
- Providing Shelters, Health Facilities, etc.
- Identifying Evacuation routes / Alternate / Best route
- Resource Allocation / Relief Distribution
- Crowd Sourcing and Social Media Integration
- Situational Awareness
- Information sharing

E. Post Disaster Monitoring and Evaluation

- Damage Assessment
- Relief Distribution
- Funds Management
- Recovery and Rehabilitation Projects

F. Integrated EoC (Emergency Operations Centre)

Key Solutions and Modules

- GIS for Earthquake Management
- GIS for Flood Management
- GIS for Drought Management
- GIS for Forest Fire Management
- GIS for Storm and Lightning Management
- GIS for Anthropogenic Hazards - Pandemic / Industrial
- GIS for Integrated Command and Control Centre

Overall, Indo ArcGIS Disaster Management Solutions and Data Products enable:

- Seamless access and integration of data and information from varied sources.
- Integration of MIS and GIS-based information from disparate sources.
- Multi-hazard vulnerability analysis.
- Risk analysis and modelling to generate alerts for early warnings and decision support.
- Empowerment of departments and stakeholders for collaborative and timely decision-making.
- Enhancing overall effectiveness of disaster management and emergency response.

GIS to help Forecast Natural Disaster for Villages & Local Urban Areas

ARTICLE

Kesowa

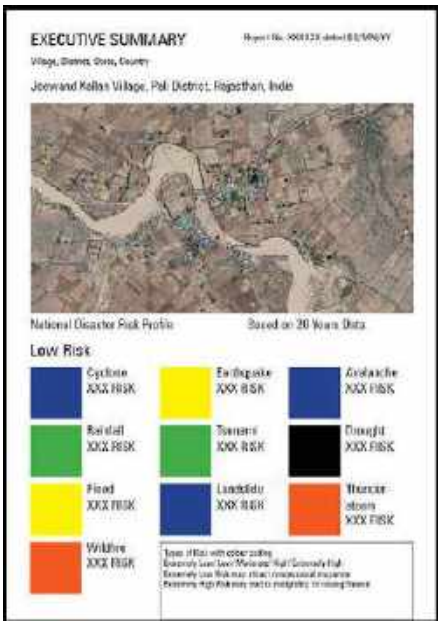
Past Satellite Data in recent years has allowed the identification of various natural disasters at a Macro Level - Rainfall and Flooding, Forest Fires, Tsunamis, Cyclones, Earthquakes, Droughts, Avalanches, and Earthquakes. Drone-based Maps (Drone Data) allow for high-resolution data for further study and have the potential to help plan local initiatives to minimize the risk of natural disasters.

India, with more than 6 Lac Villages, can leverage disruptive technology to help frame and help local panchayat bodies create a disaster risk mitigation plan for the future. With more than 50% of the population residing in Urban Areas, a similar model could be thought of on a City Area/ PIN Code basis.

A GIS Report

A village panchayat representative or Ward Councilor can generate a GIS Report to know what natural disaster risks they are susceptible to, along with suggestions on steps to be taken at the community level to help minimize impact.

Example - 2 Pager Pictorial Report consists of an Executive Summary, a High-Resolution Map (10 ft/3-meter scale) of Natural Disaster Risk and Steps to Mitigate.



Framework for Implementation

This solution brings the opportunity for the development of the GIS Community with multiple options for implementation.

Evolving Opportunities: Potential investible areas that emerge are data platforms, data collection agencies, local skill building, building data sets for real-world AI/ML use cases, and structuring data for standardization

Challenges: Value Proposition Delivery to local stakeholders in vernacular languages in simple formats, delivery of the GIS Report at a reasonable cost – Say Rs 20,000 to Rs 50,000 only, stakeholder policy on data, identifying minimum participative community customers for Piloting Framework, downtime of public data link available.

Village Panchayat Representative/ Ward Councillor

Engages Local GIS Entrepreneur

Access to Past Data (API Based Access to Raster/ Vector Layers from ISRO, SOI, National Disaster Management Authority, etc) for say 10 Years

Update Drone Map with Vector Layers

Analysis - Manual, AI/ML for feature extraction - Ponds, Trees, Building Count, Roads

Data can help benefit numerous stakeholders by helping frame a disaster risk mitigation plan for the future.

Industry - Downtime due to natural disasters is a deterrent to setting up new industries and making existing industrial units efficient. The ability to know how to help minimize natural disasters by planning and implementing community intervention practices can help attract industry and jobs.

Insurance - Crop, Transit, and Property Insurance markets can use reports to profile risk and offer better products. Example – Crop Failure history of a location due to flooding in an area over ten years datasets car help frame crop insurance eligibility and future strategy for livelihood. This can also help identify necessary interventions and cost justification for these investments.

Finance - Improved Finance availability in Low-Risk Zones can help with entrepreneurship, industry, and more. Carbon Credits can be generated on Community Interventions, which can also be sold on the Carbon Credit Exchange, which is envisioned.

Reduce compensation and reworking cost – A study of payment paid and infrastructure repair costs for natural disasters in the past ten years can help create a benchmark to help assess the cost for potential natural disasters on a village basis. This can help incentivize local governments to raise capital for Strategic Interventions.

A study of payment paid and infrastructure repair costs for natural disasters in the past ten years can help create a benchmark to help assess the cost for potential natural disasters on a village basis.

Help vacation of high-risk areas– Areas such as Jharia (Potential Underground Fire Site), Joshimath (Sinking Town), and Archipelago Islands like Chetlat, Kiltan, Amini, and Bitra (submergence due to rising sea levels) are examples of communities which are host to numerous individuals and need of intervention. GIS Maps can help individual land and livelihood owners know the compensation they are due to receive and support local stakeholders in screening and conducting necessary programs like rehabilitation.

Enabling GIS for Conversational AI – Imagine if you can sign up for a Chatbot to send a message to you during the emergency of a specific natural disaster and guide you to the nearest help location based on where your near and dear ones are.

Updates from AGI

Webinars

GIS in Transport and Logistics

AGI conducted a webinar on the transformative power of Geographic Information Systems (GIS) in Transport and Logistics on the occasion of GIS Day 2023. Industry and academic experts discussed various GIS applications like route optimization, fleet management, real-time tracking and predictive analytics, reshaping the way businesses navigate the complexities of the modern supply chain.

Agriculture Analytics with the Synergy of Geospatial Technologies and AI

AGI co-hosted a webinar with its academic partner Anna University. The webinar focused on the integration of geospatial technologies and artificial intelligence in improving agricultural systems and productivity. The attendees were given insights into how these technologies can be used for precise crop management, land-use mapping, yield estimation, and weather forecasting.

Partnerships and Engagements

T-Hub MoU Exchange

AGI and T-Hub, one of Indias most well-known innovation ecosystems, formally exchanged their MoU at T-Hubs Eighth Foundation Day event in Hyderabad, Telangana. he Foundation Day celebrations were marked by a line-up of engaging talks.

OGC MoU Exchange

AGI and The Open Geospatial Consortium (OGC) signed and exchanged a revisited Memorandum of Understanding (MoU) to collaborate on advancing the Indian Geospatial technology landscape at the OGC India Forum on the sidelines of GeoSmart India 2023. The key objectives of this strategic partnership encompass the joint promotion of open standards, innovation, and the overall enhancement of the Geospatial landscape in India.

Events

CEPT ILUS 2023

AGI was a Strategic Partner for the International Land Use Symposium: ILUS 2023 organized by the CEPT Research and Development Foundation in Ahmedabad from 4-6 October 2023. The Centre for Applied Geomatics at CRDF, the multidisciplinary think-do-tank promoted by CEPT University, organized the international symposium to provide a platform for the exchange of knowledge amongst Geomatics students and professionals for the development of research in various aspects of Geo-Information Science.

OGC India Forum 2023

The OGC India Forum was organized by The Open Geospatial Consortium (OGC) alongside GeoSmart India 2023, in partnership with AGI and the Bureau of Indian Standards (BIS). The Forum focused on the transformative power of open standards and the future of FAIR Principles (Findable, Accessible, Interoperable, Reusable) in India. OGC India Forum's new charter, committee compositions, and future roadmap were also unveiled during the event.

Survey of India CORS Network Inauguration

The Survey of India hosted the “Inauguration of Nationwide CORS Network and Stakeholder Conference on Ortho-Rectified Image (ORI) and Digital Elevation Model (DEM) Generation” to discuss the roadmap for better applicability of the newly established CORS network in the country, as envisaged in the National Geospatial Policy 2022. The recently established and operationalized countrywide CORS network was inaugurated by Dr. Jitendra Singh, Hon’ble Minister of Science & Technology, during the event. AGI provided integral support to Survey of India throughout program management and hosting.

India Space Conclave 2023

AGI was a supporting partner at the Indian Space Conclave 2023, organized by the ISpA- Indian Space Association from October 9th to 11th, where leaders converged to explore the boundless possibilities of space technology.

GeoSmart India 2023

Hosted by AGI member Geospatial World, GeoSmart India is an annual conference that brings together industry, government, and academia stakeholders for three power-packed days of sessions, workshops, and user meets. AGI members spoke and exhibited their offerings at the conference. The well-curated and informative plenary and parallel tracks gave each attendee much to take back.

Stay Tuned

AGI-Business World Partnership for BW Supply Chain Summit

AGI has partnered with BusinessWorld for the 2nd edition of The BW Businessworld Supply Chain Competitiveness Summit & Awards 2023, scheduled for 6th December 2023. The conference s themed, “Reinventing traditional supply chains in wake of global uncertainty.” AGI has helped curate the session titled Retrofitting legacy supply chains with location tracking abilities – Reinventing the on-road experience in the conference.

AGI-BIS Partnership for ISO Standards in Action Seminar

Bureau of Standards (BIS), the National Standards Body of India is responsible for the formulation of National Standards in large sectors of economic activities, including Information Technology (IT) sector. India (BIS) is hosting the 57th plenary meeting of ISO TC211 Geographic information/Geomatics along with its working groups during 4th to 8th December 2023 at New Delhi, India. AGI is part of the organizing committee for the meeting, and has helped curate the Global Seminar “TC 211 Geographic Information - Standards in Action” on 6th December 2023 at India Habitat Centre, New Delhi, focused on implementation challenges of geospatial standards in various countries.

AGI Agriculture Report Release

AGI plans to release an industry Report on the Role of Geospatial Technologies in Agriculture Monitoring in December 2023. The Report highlights the scope and applications of Geospatial tools and data in the field, along with challenges and recommendations for policymakers, and successful case studies to learn from.

We value your feedback

AGI seeks to explore various avenues to enhance the quantum of interaction between geospatial industry units, academia, government and various other geospatial players. Therefore, we keenly look forward to your feedback and suggestions on various issues that can help meet our objectives. Write to sakshi.singh@agiindia.com

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