Developing And Implementing The Most Effective Volcano Monitoring Method

Volcanoes are the places where the lava and volcanic ashes reach the earth as a result of the ruptures occurring on the earth. According to Loughlin et al. (2015), every year volcanic activities result in loss of life and property, damage infrastructure and dislocate population (as cited in Blong, 1984). Therefore, volcanoes that are so related to human life should be examined in detail. From this point forth, the aims of this study are to determine the most up-to-date and most effective volcano monitoring method. In this context, primarily literature research was done meticulously and for this purpose, 3 different articles have been reviewed and compiled. The studies of Moran et al. (2008), Sparks et al. (2012) and Loughlin (2015) were evaluated and it was aimed to find the most appropriate result. Accordingly, seismic studies, gas investigations, groundwater and surface water should be investigated.

Although Moran et al. (2008) and Sparks et al. (2012) suggest that taking images with the radar technique called InSAR should be done in volcanic areas, this method alone may not be sufficient. Loughlin et al. (2015) emphasize that the GLOVOMERID database program, in which many volcanologists work together, should also be used. In addition to these, according to Sparks et al. (2012), Muon Tomography and Unmanned Aerial Vehicles should be used in volcanic areas. Although Moran et al. (2008) draw attention to the costs and difficulty of drilling, as Sparks et al. (2012) point out this method should be conducted in suitable areas and also by using the strainmeter should be measured in the boreholes. As mentioned above, when considered the destructive effect, drilling costs should be neglected. (274 words)

Method

This study includes a comparison of 3 different articles for the most effective study of active volcanoes. The ultimate aim of the research is to find the answer to the question asked below.

What should be an effective and advanced system monitoring system for the estimation of volcanic hazards?

In this context, "Instrumentation Recommendations for Volcano Monitoring at U.S. Volcanoes Under the National Volcano Early Warning System" scientific report is penned by Moran et al. (2008) is examined. This article forms a basis for studies. Then, the article named Global Volcanic Hazard and Risk was examined and the systems of volcano monitoring were compared. As a last, the article named Volcano Monitoring a published by AAAS was examined and as a result, the best volcano monitoring methods were gathered under a single roof.

The CRAAP Test was performed in the selection of sources. Accordingly, publications are related to volcano monitoring and the topic is current. Resources can be accessed via the Internet. The scientific research report, written by Moran et al. (2008) was published by USGS, which is accepted as the authority in geology, and received 24 citations. Global Volcanic Hazards and Risk book is penned by Loughlin et al. (2015) and was published by Cambridge publishing house. The number of citation is 52. Monitoring Volcanoes article is published by the

American Association for the Advancement of Science and received 110 citations. All authors have an academic background. Publishings do not contain personal biases and have published by scientific publishing houses.

Although the limitation of the article tried to a wide range of perspective about volcano-monitoring. If applications of Carapezza et al. (2004) are included, about the Stromboli volcanoes, and volcanoes located in the US, which is mentioned in Moran et al. (2008) articles, this study would be more comprehensive. (301 words)

Results

Rocks and metals in a magma circle melt and become pure. The aim of the visual is to evaluate the three different views in a pot and combine them as shown in the mouth of the volcano to reveal the purest and the most effective method. Therefore, a magma visualization shown in Figure-1 was chosen. As can be seen clearly in figure, Moran et al. (2008), Sparks et al. (2012), Loughlin et al. (2015), agree to conduct seismic studies in the volcanic regions, to carry out gas investigations, to perform gas investigations, to examine ground and surface waters and to use the InSAR program. In addition to these, there are different views advocated by the authors. Moran et al. (2008) and Sparks et al. (2012) draw attention to the importance of ground-based systems, while Loughlin et al. (2015) stated that it has some disadvantages such as theft, fire and weather. Loughlin et al. (2015) point out that the examination with InSAR is not sufficient and a database program called GLOVOREMID should be used. There have also been significant developments over time. For example, Moran et al. (2008) assert that drilling should be performed in volcanic areas and Sparks et al. (2012) contend that strainmeter measurements should be made in drilling holes. Finally, Sparks et al. (2012) underline technological methods in gas measurements. They also state that the contents of the lava can be imaged by Muon tomography and also unmanned aerial vehicles offer new monitoring capability. (262 words)

Figure 1. Developing And Implementing The Most Effective Volcano Monitoring Method In A Volcanic Area

Discussion

There are some similar views, differences views, methodological differences and technological developments about volcano monitoring between authors. In this report, firstly, similar points, methodological differences and technological improvements will be given and then different opinions will discuss.

All three authors point out that seismic movements are an important sign that volcano can be activated, and therefore, mention that broadband seismic sensors are used in active volcanic zones. Therefore, volcano monitoring in active volcanic areas should include seismic investigations definitely.

Another consensus of the authors is the gas measurements. The most common gas, after water, is carbon dioxide in the magma. Rising water and carbon dioxide react with SO_2 and HCl in the magma chamber. The heated water evaporates and as a result SO_2, CO_2, H_2S ratios change. That is, these gases may indicate the beginning of volcanic unrest. Therefore, gas

rates in the magma chamber, one of the most important indicators in volcanic monitoring and should be used.

The 3 authors emphasis that in areas where volcanic activity occurs, volcanoes are in contact with water resources. Also, according to Moran et al. (2008), sudden changes in water resources should be examined in detail as it may indicate volcanic unrest. Stromboli volcano eruption in 2002 and 2003 can be given as an example before this explosion, CO2, H2, and He values in water were increased in shallow wells (as cited in Carapezza et al., 2004).

Authors agree that satellite-based methods (InSAR) should be used. Satellite imagery maps the tectonic tension on the continents and provides insights into the exploration of volcanoes. Volcanoes that are thought to be dormant but may be active are determined by satellite systems. However, the disadvantage of this system is that technical issues such as updating the life of the satellite systems depend on space agencies. Therefore, radar systems to be added to unmanned aerial vehicles are more advantageous.

Moran et al. (2008) and Sparks et al. (2012) also remark that ground based and infrared systems are widely used to investigate volcanic areas. These systems are used to document eruptions and ash clouds. It is important to specify the type of eruptions.

There are developments and methodological differences in drilling. Moran et al. (2008) recommend drilling in volcanic areas should be done, however, they draw attention to their costs. Sparks et al. (2012) advocate that drilling in these areas should be done and additionally strainmeter should be used in boreholes.

As for original opinions, according to Sparks et al. (2012), the Muon tomography system provides 3-dimensional monitoring in the area where volcanic activity takes place (Sparks et al., 2012). 3D monitoring also provides the opportunity for studying the movements of the volcano. Also, undoubtedly, the use of unmanned aerial vehicles to study volcanic motions provides advantages in terms of flexibility and planning.

The another original opinion belongs to Loughlin et al. (2015). According to authors, volcanic observatories, hazard assessments and timely evacuation play a critical role in the region where the volcanic activity takes place. For this reason, the programme named GLOVOMERID has been developed. This program enables data sharing among scientists and thus enables active observation. That is, as technological methods InSAR, GLOVOMERID programmes and unmanned aerial vehicles should be used in volcanic areas.

As for different opinions, as mentioned earlier, Moran et al. (2008) and Spark et al. (2012) draw attention to the importance of ground based studies in the study of volcanic activity. However, Loughlin et al. (2015) draw attention to the advantage of on-site experiments and mentions that it contains some disadvantages, such as damage to the observation site, fire or theft. Again, as mentioned previously, the system is important for determining volcanic eruption types. Therefore, this method should be used. The most reasonable solution would be to increase safety measures in work areas. (632 words)

Conclusion

When the three texts were examined, the outlines of the volcanic monitoring method that can be established in a volcanic area have emerged. According to Moran et al. (2008), Loughlin et al. (2015) and Spark et al. (2012) seismic studies in a volcano, gas monitoring, ground and surface waters around the volcanic area should be investigated. In these areas, technological programs such as InSAR and GLOVOREMID should be utilized. The use of this programme should be extended. In the volcanic areas, only satellite-based observations restrict studies. Therefore, volcanic areas should be checked with MUON tomography and analyzed by taking images from the region using unmanned aerial vehicles (Sparks et al. (2012). Although drilling costs are high in steep volcanic areas, it should be implemented. In addition to the satellite, on-site experiments should be conducted and factors such as theft of instruments and fire should be considered. (147 words)