Observation of Climate Change and Volcano Activity

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Abstract

Research relating to climate change has been increasing ever since the 1820’s when a French mathematician and physicist, Joseph Fourier, theorized that the earth’s atmosphere acted like a greenhouse in the way that energy enters through the glass walls, and then gets trapped inside the walls (History.com Editors, 2017). One of the known effects of climate change is the rise of sea levels, but not much research has been dedicated to studying the relationships between climate change and volcanic eruptions. A Spaced-Based Earth Observation mission to launch satellites with equipment to measure both volcanic eruptions and rising sea levels will be vital to understanding the possible relationship between climate change and volcanic eruption. A team of scientists from United States Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) will collaborate to analyze the data provided from the satellites and study the relation between volcanic eruption and changes in sea levels over a period of five years.

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There has been a lot of research related to climate change in the past few decades, but not as much research has been published about volcanic eruptions and the potential link to climate change. Climate change can be accurately determined in various methods from both earth and space, while volcanic eruptions have been mostly researched from earth. For many centuries, the only measure of volcanic activity is from written accounts of civilizations hundreds of years ago. Along with past accounts and technological advancements, volcanologists have been able to get enough data to review and publish research that shows a considerate rise in volcanic eruption in the past five to six centuries (Public Health Intelligence, 2017). Some of these studies pointed to volcano eruptions both cooling the planet as well as heating it up due to the different gasses that are released during the eruption (USGS, 2019). Research done on the frequency of volcano eruptions in the past twenty-four years displays a rise in the number of eruptions (Venzke E, 2017). Similarly, research shows that climate changes have worsened during this period of time, reflected in the rising sea levels from the melting of the polar ice caps (Venzke E, 2017; Meyer, 2017).

There has not been a lot of research into the relationship between rising sea levels and volcanic eruptions. To study the correlation, it is necessary to collect data over a prolonged period of time. Under the mission to be named Vulcan-C the launching of five satellites, named Vulcan-C-1 through Vulcan-C-5 will allow for a Space-Based Earth Observation to collect data on volcano eruptions and the rising sea levels. The satellites will be equipped with measuring equipment designed for measuring the rising sea levels as well as equipment to identify volcanic eruptions. To measure the sea level, the satellite will have an altimeter that sends radar waves down to the sea and record the time it takes for the radar wave to bounce back to the satellite; and to measure volcanic activity, this satellite will also have refined thermal sensors that will be able to pick up hot spots around the globe (Owen, 2016). It is important to launch each satellite with all the equipment needed to measure both volcanic eruptions and rising sea level in order to have more specific and accurate reading that will pinpoint on the local results of volcanoes and sea levels. The Vulcan-C satellites will collect the data based on each volcanic eruption and the sea level before and after each eruption.

A team of scientists from United States Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) will develop the Mission of Vulcan-C: to gather data on volcanic eruptions and sea levels and to collaborate on the analysis and interpretation of the data. The team of scientists that will be assembled from individuals from both USGS and NOAA will develop a plan, schedule, budget, and process to collect and analyze the data, interpret it and report to the agencies and the public on the results of this mission. Using the data collected from the Vulcan-Cs, the scientists will focus mostly on each large eruption on the Volcanic Explosivity Index (VEI) scale of three or greater, as those are more likely to impact the stratosphere (Venzke E, 2017; Cole and Marlaire, 2014). The Vulcan-C team of scientists on earth will record the data of each eruption, ranging from location, size of plume of smoke, date, time, duration of explosion, as well as the sea levels in the vicinity of each eruption for a period of a few days prior to the eruption and a few days after. If a longer period of time is required to better analyze possible patterns, then the team will be able to communicate the request and get results immediately through a software system to be developed for this mission and to be used by both the USGS and NOAA scientists simultaneously.

The Vulcan-C mission will launch five satellites to collect data over a period of five years for a Space-Based Earth Observation to measure various parameters of volcanic eruptions as well as sea levels. Through the analysis of the data collected, the scientist could potentially identify if there is a cause and effect relationship between climate change and volcanic eruptions. In five years, the Vulcan-C mission will conclude in a report identifying the relationship between volcanic eruptions and provide recommendations for additional research to be planned and executed by both NOAA and USGS, and publish their findings in an effort to educate the public on climate change and the relation to volcanic eruptions. The collaboration of two agencies on this mission could provide lessons learned for future collaborations between agencies on missions that could be groundbreaking.

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