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2010 Eyjafjallajökull Eruptions: A Case Study

Introduction

In March 2010, the Icelandic volcano Eyjafjallajökull erupted and by April 2010, it entered the explosive phase, canceling over 100,000 airline flights in Europe, $200 million economic damages, and leaving the local population with respiratory problems.[1] While there were no fatalities reported, this disastrous event threatened the agricultural livelihood of the Icelandic residents and left millions of passengers helpless due to the canceled flights. Ash from volcanoes is a significant hazard to active aircrafts, as it can impair flight navigation and cause engine damages.[2] This event led to improved airspace communication, coordination, and reevaluation of volcanic preparedness and research.[3]

Facts of the Case

Eyjafjallajökull is one of Iceland's ice caps at about 100 km^2, in which a stratovolcano exists; this volcano is considered among the highest glaciers in Iceland at about 1,650 meters. Three phases occurred during the 2010 Eyjafjallajökull eruptions. The first phase was the effusive eruption, where olivine basaltic andesite lava was released in the atmosphere.[3] While the eruption itself was not critical, it led to local evacuations.[3] The second phase was the explosive eruption, where fine glass ash erupted 8 km into the air and led to agricultural impacts.[4] The Meteorological Institute of Iceland was continuously monitoring the volcanic activity and reported consecutive vapor explosions occurring due to hot magma colliding with snow.[5] This phenomenon disrupted aircraft travel due to multiple factors, but primarily because the ejected volcanic ash and plume dispersed in the southeast direction of the jet stream. In addition to this, after the eruptive phase, the melted glacial ice flowed into the volcano which increased the explosive power, as well as created an ash cloud directly under the jet stream.[5]

Epidemiological aspects of the event

Surveillance was conducted by the London Volcanic Ash Advisory Center (VAAC). Dispersion models were created to predict the spread of the volcanic ash across the northeastern Atlantic.[6] As volcanic research becomes more relevant one study focused on the long-term physical and mental health effects of the Eyjafjallajökull volcanic eruption. A prospective cohort study was conducted in 2010 and 2013 in which over 1,000 participants were categorized by exposure level to observe physical symptoms, psychological distress (GHQ-12), perceived stress (PSS-4), and post traumatic stress disorder symptoms (PC-PTSD).[7] It was observed that there was an increased physical symptoms in the exposed, such as morning phlegm during winter (OR = 2.14), skin rash/eczema (OR = 2.86), and increased usage of asthma medications (OR = 2.80).[7] It was also reported that there was a higher prevalence of wheezing and phlegm (OR = 2.35; OR = 2.81).[7] A limitation of this study is that self-reported data can be misleading and lead to bias. While the Eyjafjallajökull eruptions were not the strongest historically, this study emphasized the impact of long-term volcanic exposure on local residents.

Management of the event

The local response to the eruptions included aid for civilians; 500 local farming families were evacuated swiftly but international and domestic flights were canceled.[8] The Civil Protection Department implemented an evacuation plan and closed roads that lead to the risk zone areas. Iceland declared a state of emergency, which halted airspace travel for safety. Due to canceled flights, the economic damage was vast and caused chaos among abandoned passengers. Communication tactics included telecommunication, installed webcams and thermal imaging cameras to view the volcanic activity.[1] The aftermath involved appointing an advisory group to respond efficiently to future environmental emergencies and airlines adjusting their policies dealing with volcanic ash.[1]

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Summary
The Eyjafjallajökull eruptions was a pivotal historical moment in both volcanology and air space travel, emphasizing the reality and importance of disaster and emergency preparedness. Countless individuals were affected by these events. While these events happen over a range of many years, current climate change and the recent Tonga eruption reinforce the importance of planning and updating monitoring measures and protocols of areas with volcanic activity- it should not be left behind when considering preparedness.

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