Impact of Eyjafjallajökull on tourism and international flights

Anita Anna Jónsdóttir

Líf- og umhverfisvísindadeild

Háskóli Íslands

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Declaration

I hereby declare that this essay is written by me and that it has neither been partially nor completely submitted before to a higher educational degree.

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Anita Anna Jónsdottir

Abstract

Iceland has frequent volcanic eruption however the extent of the disruption on aviation caused by Eyjafjallajökull eruption between March to May was unexpected. Passengers all over Europe was affected either by planes getting, delayed, rescheduled or canceled. Visitation numbers in Iceland declined fast in relation to the disruption caused on airline operation, which can have damaging effect on businesses and economies reliant on the income generated from tourists. The aim was to assess Icelandic airline operations affected by Eyjafjallajökull's eruption in relation to tourist arrivals. The research is based on semi-open questions taken by the primary airlines in Iceland, Icelandair and Iceland Express and numerical data collected from EUROCONTROL and Icelandic Tourist Board.

Arrivals and departures dropped by half during 15th-28th of April. However, the airlines continued operations. The solution was relocation with flights embarking from alternative cities, such as Akureyri in the north and Egilsstaðir in the east. Tourist numbers dropped around 17,5% in April and May. Icelandair estimates losing about 20% of scheduled flights and rescheduled 180 flights, and Iceland Express lost about 100 flights in relation to the eruption. However, the effects on tourist were not significant, with increased numbers shortly after the eruption ceased.

Útdráttur

Oft hafa orðið eldgos á Íslandi þá aldrei hefur röskun flugs verið eins mikil eins og við eldgosið í Eyjafjallajökli á milli Mars og Maí. Farþegar um alla Evrópu urðu fyrir áhrifum vegna tafa, niðurfellingum eða endurbókunar á flugi. Fjöldi ferðamanna fækkaði mjög hratt með truflunum á flugumferð, sem gæti haft skaðleg áhrif á viðskipti og hagkerfi sem reiðir sig á tekjur ferðamanna. Markmiðið var að meta áhrif eldgosins í

Eyjafjallajökli á flugrekstur í tengslum við komur ferðamanna til Íslands. Ransóknin er byggð á hálf opnum spurningum sem tekin voru af aðal flugfélogunum á Íslandi, Icelandair og Iceland Express og tölulegum gögnum tekið saman frá EUROCONTROL og Ferðamálastofu Íslands.

Komur og brottfarir minkuðu um helming á tímabilinu 15-28 apríl. Flugfélögin heldu samt áfram starfsemi frá öðrum borgum eins og Akureyri fyrir norðan og Eigilsstaðir fyrir austan. Fjöldi ferðamanna minkaði um 17,5% í apríl og maí. Icelandair áætlar að hafa misst um 20% af áætlunarflugi sínum og breytt um 180 flugum og Iceland Express missti um 100 flug í tengslum við gosið. Hins vegar virðist áhrif gosins ekki hafa verið svo mikil þar sem farþegafjöldinn jókst strax eftir að gosinu lauk.

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1. Introduction

Tourism has been one of the fastest growing industry in Iceland over the recent years. It has proven a valuable financial part of the Icelandic economy, especially after the financial crisis in the end of 2008 (Jóhannesson, Huijbens & Sharpley, 2010). Air transportation accounts for the largest share of spending in the tourism sector, which makes it a significant part of tourism revenues. In 2008 the total tourism consumption from air transportation in Iceland reached 51 ISK billion. In addition, the significance of tourism in 2009 it directly employed 5.1% of total number of jobs in Iceland and supported businesses in all parts of the country (Icelandic Tourist Board, 2011).

Iceland's geographical location makes it highly dependent on air transportation to maintain tourist flow. Iceland is located in the middle of the Atlantic Ocean on the border of two tectonic plates, which makes it geologically active with frequent earthquakes and volcanic eruptions. The volcanic eruptions are constantly forming and reforming the landscape, creating features of unspoiled nature that are in large extent attributes that attract visitors to the country (Guðmundsson, 2010; Sæþórsdóttir, Ólafsdóttir & Ólafsson, 2009). Hazardous incidents from these events have in the past affected the country and its inhabitants greatly. Disruption of air traffic however has never been an issue (Petersen, 2010). Such instances could consequently cause extreme harm to businesses directly and indirectly relating to tourism, including the whole country economically. Yet the uniqueness of Iceland has been the interaction between fire and ice (Sigurbjarnarson & Gíslason, 2002). This distinctive attribute is also the main reason why tourist numbers fell drastically in 2010 when Eyjafjallajökull eruption occurred. Airlines all over were struck hard as an eruption occurred under a glacier in south part of Iceland on April 2010. It caused large ash discharge to affect air traffic in many parts of Europe that greatly interrupted, threatened and economically affected airline operations and tourism in many parts of the world.

The overall aim of this study is to assess the link between volcanic eruption and airline operations in Iceland, as well as potential effect of volcanic hazard on tourism.

That will be done by: a) looking at the impact that the Eyjafjallajökull eruption in 2010 had on airline operations; and b) evaluating the influence the eruption had on foreign visitors coming to Iceland. The key research question put forward is: *What is the impact of Eyjafjallajökull eruption in 2010 on airline operations as regard to tourist arrivals to Iceland?* The key question is supported by the following sub-questions:

- *How did the Eyjafjallajökull volcanic eruption affect international flights?*
- *How did the Eyjafjallajökull eruption affect visitation numbers during the eruption?*
- *How did the Eyjafjallajökull eruption affect visitation numbers after the eruption?*
- *How did tourists react to the Eyjafjallajökull eruption?*
- *Did the Icelandic airlines emergency response to the eruption mitigate the impact on tourists?*

Understanding the circumstances a volcanic eruption can cause airline operations help recognize the level of affect such an event may have on visitation numbers and in turn tourism businesses and economic earnings from tourism. Such evaluation is likely to give a better comprehension of the effects future eruptions might have on tourism to Iceland.

After the introduction, the background section explains the significance of tourism in Iceland and the role of aviation and flight operations. In addition, the chapter discusses in short the dangers a volcanic eruption can cause aviation, and the recognized threat in Iceland. The second part of the background section introduces the event of Eyjafjallajökull eruption in 2010, the role of ash and its effect on European airspace. Thereafter, the research methods are described and the results presented. The last chapter discusses the research results and concluding remarks.

2. Background

2.1 Aviation and tourism

2.1.1 Foreign visitors in Iceland

The Icelandic tourism has experienced for the last ten years (i.e. 1999-2009) considerable increase in arrival numbers. According to the Icelandic Tourist Board (2010a) the annual average increase of foreign visitors during that period has been 6,8%, while the worldwide increase of international arrivals in 2009 was recoded to have reached 6,7% (UNWTO, (World Tourism Organization), 2011a). Five times during this period the annual number has gone over 12% (Figure 1) (Icelandic Tourist Board, 2010a).

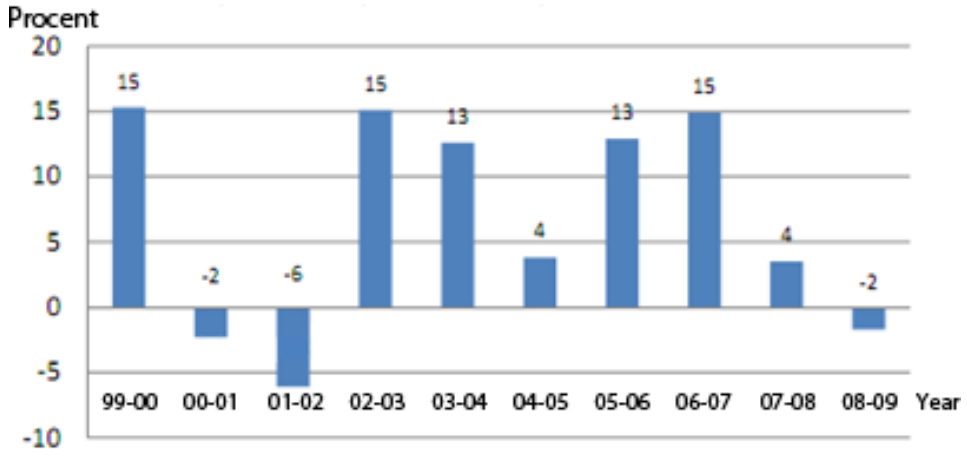

Figure 1. Yearly increase foreign visitors to Iceland (Icelandic Tourist Board, 2010a).

As shown in Figure 1 there has been a drop in tourism numbers during some periods. In 2001 there is a decrease in the number of passengers flying internationally. It can be explained by the threat to aviation after the September 11th terrorist attack in United States, which halted air traffic for three days (UNWTO 2011a). The second downturn was the financial crisis at the end of 2008 and beginning of 2009. Europe was the hardest hit by the global financial crisis and economic recession with -4% (UNWTO

2011b. During the same period Iceland only had a decrease of -2% (Icelandic Tourist Board, 2010a). However, UNWTO (2011a) states that the continent in recovery has had an increase of +3% in 2010, and tourism is on all time high (UNWTO, 2011b). The Icelandic Tourist Board calculated 502,000 visitors to Iceland in 2008 while 2010 had a lower number of 494,769 (Figure 2).

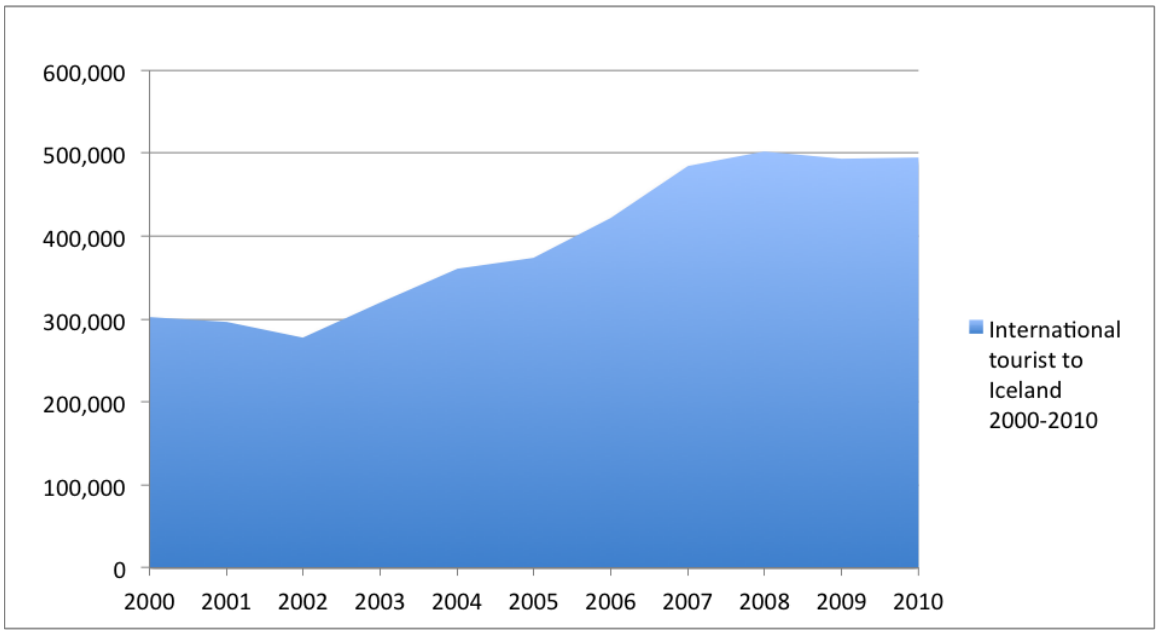

Figure 2. International tourists to Iceland 2000-2010 (Icelandic Tourist Board, 2010b).

According to a survey taken summer 2010, 82% of the tourist named nature as the main factor for their visit, and came for the purpose of leisure. The busiest tourism period is during summer, June-August (Guðmundsson, 2010). The appreciation of geological attraction and activities has been on the rise with a recognized new type of tourism. According to Dowling (2010) the market for geotourism in Iceland has great potential, especially with the unique character of the landscape and the creation of a geopark in the south part of Iceland (Rangárþing eystra, 2010).

2.1.2 Aviation in Iceland

Leifsstöð, the international airport in Keflavik is the primary airport and covers about 95% of total annual number of tourists arriving to Iceland (Icelandic Tourist Board, 2010a). Significant decrease of 1.1% in arrivals is seen going through the airport between the years 2009 and 2010 (Table 1). In 2010 there was however an increase of visitors entering the country at Seyðisfjörður using sea transport by 10.6%. Statistics also show an increase of international tourist by 29.9% entry at other airports. However, there was a total of 0.2% increase of international visitors between 2009 and 2010, by point of entry (Icelandic Tourist Board, 2011a).

Table 1. International visitors by point of entry to Iceland (Icelandic Tourist Board, 2011a.)

Point of entry	2009	2010	(%)
Keflavik airport	464,536	459,252	-1.1
Seyðisfjörður seaport	13,866	15,336	10.6
Other airports	15,539	20,181	29.9
Total	493,941	494,769	0.2

Main airlines in Iceland are Icelandair and Iceland Express, which together virtually holds the entire Icelandic airline market share. Both operate through the hub in Iceland with flights in and out from the country, with the main tourist flow arriving from Britain, Germany, Denmark, Norway, Sweden, France, Netherlands, Spain, Italy, Finland, United States and Canada, which accounts for about 80% of the tourist market (Guðmundsson, 2010). Table 2 show the distribution of market area of visitors through Keflavik airport between 2008-2010.

Table 2. Visitors through Keflavik airport 2008-2010 by market area (Icelandic Tourist Board, 2011a).

Market area	Number of visitors			Increase/ decrease (%)		
	2008	2009	2010	07/08	08/09	09/10
Nordic Countries	119,204	119,742	112,757	-0.2	0.5	-5.8
United Kingdom	69,982	61,619	60,326	-4.7	-12.0	-2.1
Central/S-Europe	117,727	135,021	132,005	12.7	14.7	-2.2
N-America	51,063	54,972	64,613	-12.3	7.7	17.5
Other	114,696	93,182	89,551	10.7	-18.8	-3.9
Total	472,672	464,536	459,252	3.0	-1.7	-1.1

All markets show a decrease in visitors except North America with an increase of 17.5% from 2009 to 2010. The highest decrease of visitors through Keflavik airport was from the Nordic countries.

Iceland Express holds an estimated 30% of the airline market share (Kristín Þorsteinsdóttir, public relations officer for Iceland Express, personal communication, 04.04.2011), while Icelandair holds the majority of about 70% (Guðjón Arngrímsson, public relations officer for Icelandair, personal communication, 08.04.2011). Both airlines have similar routes. Most of them are to Europe, with daily departures to London and Copenhagen. Direct flights are also available to the West, New York and Boston. During summer time both airlines pick up operations with additional flights and destinations.

Iceland Express is relatively young and was founded in 2003 with a business strategy of holding cost down to provide as low prices as possible. It is the only low cost airline in the country and connects Iceland with 18 airports around Europe and locations in United States and Canada. In addition the airline operates seasonal direct flights between Copenhagen and Akureyri in Northern Iceland. The company outsources numerous activities but holds a staff of around 120 people based in Reykjavik, Keflavik, Copenhagen, London and Luxemburg. Flights are operated by Astraeus Airlines (Figure 3) (Iceland Express, 2011).

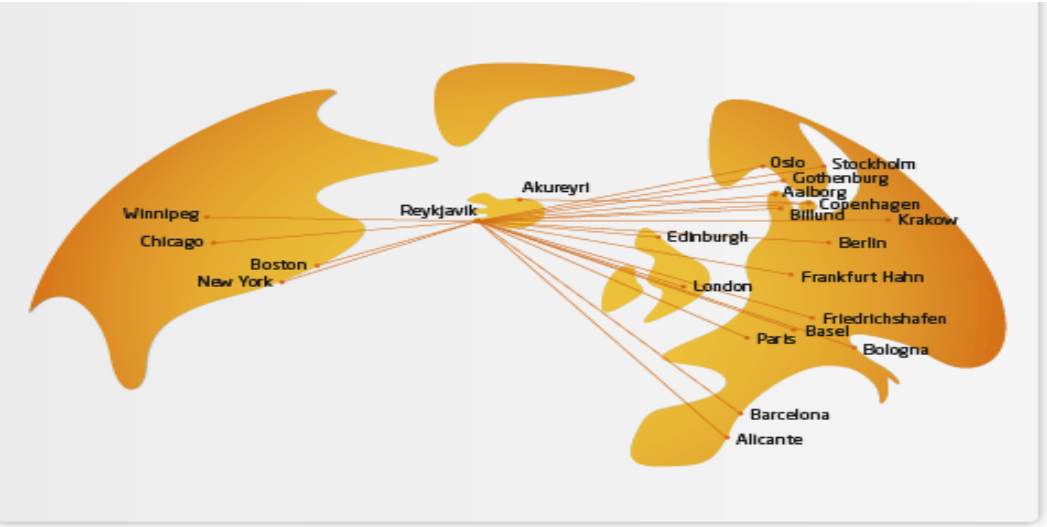

Figure 3. Destinations and routes taken by Iceland Express summer 2011 (Iceland Express, 2011).

Icelandair is the leading airline company in the country and started operation as early as 1937 (Icelandair, 2011). The airline is a part of Icelandair group, a holding company with 12 subsidiaries focused on airline and tourism sectors, with operations around the world (Icelandair Group, 2008). Icelandair offer trips from and to 28 big cities in Europe, United States and Canada and join 15-20 cities in Europe with 5-8 cities in North America, with Iceland as the intermediate point (Figure 4). The company has 1200 employees (Icelandair, 2011) and handles annually around 1.7 million passengers (Arngrímsson, 2010).

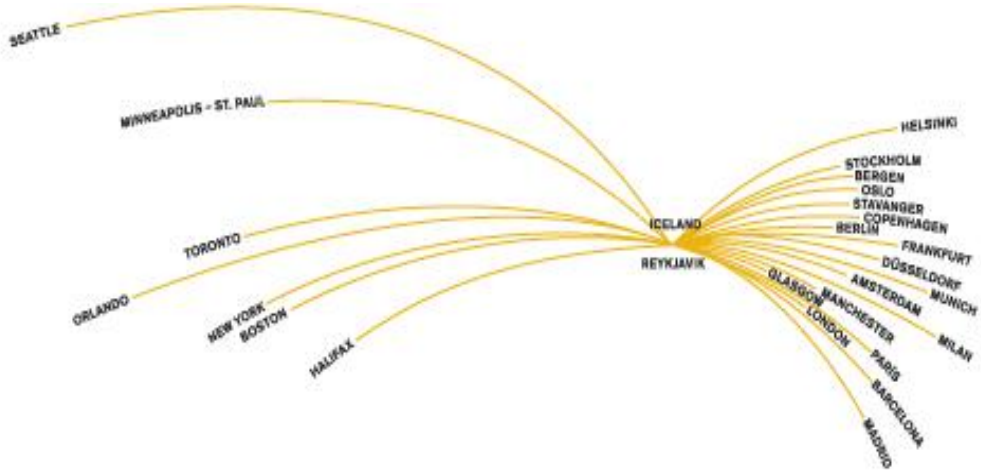

Figure 4. Destinations and routes taken by Icelandair 2011(Icelandair, 2011).

Iceland's location allows airline operational advancement. According to Guðjón Arngrímsson (personal communication, 08.04.2011) Icelandair conducts their operations in three markets: "To Iceland, From Iceland, Via Iceland". Icelanders traveling abroad (domestic market), tourist coming to Iceland and the third market is over the Atlantic Ocean i.e. the market joining the continents of Europe and America/ Canada. The market share traveling between the two continents is only 1%. Compared to other airlines this is considerably small in relation to international standards but considered large for the airline. Access to the big northern Atlantic market allows the airline´s high turnover of passengers. About 10% of passengers traveling between Europe and America decide to stay overnight or longer in Iceland. Icelandair operation is based on a navigation system that was established around 1990. The business idea behind the system is to have flight operations around the clock. Flights departing from Iceland early in the morning to a city in Europe and arrive back later during the day, just to continue west and again arrive early in the morning in Iceland (Guðjón Arngrímsson, personal communication, 08.04.2011). According to Guðjón Arngrímsson (personal communication, 08.04.2011) this operational system has contributed to the increase in tourist numbers to Iceland. Around the time the operational system began tourist numbers increased more rapidly.

2.2 Volcanic hazards on aviation safety

2.2.1 Hazards

The threat on aircrafts from volcanic eruptions is the contact with ash. Records of hazards on aviation in the past have been aircrafts entering ash clouds containing fine ash, causing surging, flameout and thrust loss of engines. This makes planes descend without power several thousand meters before being able to restart engines again (e.g. 1989 Redoubt volcano in Alaska). In some cases passengers have noticed the smell of sulfur gas and cabin filling up with fine dust (e.g. 1982 eruption of Galunggung volcano in

Indonesia). There have also been cases with extensive damage to engines and exterior surfaces. The eruption at Redoubt Volcano in Alaska affected airspace operation when it erupted for couple of months in 1989-1990. Airplanes were forced to cancel or re-route flights during the eruption, affecting the economy in Anchorage significantly (Casadevall, 1993).

The other effect on aviation is the ash fall at airports when wet it becomes slippery, making landing and takeoffs dangerous (Casadevall, 1993). Casadevall (1993) states that ash clouds vary in type and the extent of threat they can cause. Ash cloud typically is a mixture of sharp, angular fragments consisting of a volcanic glass, minerals and rock elements. It ranges in different sizes, from a fine powder to 3 millimeters in diameter. The ash is hard and can easily scrape surfaces made of glass, plastic and metals. Casadevall (1993) describes three types of ash clouds, but one type is the greatest threat to airlines, the drifting ash cloud. It consists of gas and fine ash, created by violent eruption columns. The size of the particles is of lightweight, which enables the fragments to get picked up by the wind and travel great distances. Ash clouds can circle the globe in a matter of weeks. However, usually it deposits most of the ash within a few hours to a few days.

2.2.2 Volcanic eruptions in Iceland

Volcanic eruptions are common phenomenon in Iceland with regular intervals every 3-4 years (Gudmundsson et al., 2008). In the past 40 years there have been eight explosive eruptions with tephra fallout in parts of Iceland, i.e. Hekla in 1971, 1980, 1991 and 2000, Gjálp 1996 and Grímsvötn in Vatnajökull 1998 & 2004. The threat of disruption on air traffic from eruptions in Iceland is great since they are generally recognized for producing ash (Gunnarsdóttir & Karlsdóttir, 2010). Davies, Larsen, Wastegård, Turney, Hall, Coyle & Thordarson, (2010) additionally point out that the eruptions are often characterized by producing large volumes of tephra and has the potential to last for weeks or even years. However, all previous eruptions had minimum impact on air traffic (Petersen, 2010). The latest before Eyjafjallajökull was the small

eruption of Grímsvötn in 2004, which resulted in closure of airspace in some areas across northern Europe. The disruption did not maintain long as the wind direction changed heading to north- northeast (Oddsson, 2005 in Davies et al., 2010). In majority of these cases Gunnarsdóttir & Karlsdóttir (2010) point out that the ash plumes are dispersed to the north and northeast over the arctic region.

Davies et al. (2010) measured Eyjafjallajökull widespread dispersal of Icelandic tephra with past eruptions. Results showed neither the dispersal pattern nor tephra volume produced from the recent eruption were particularly unusual for Icelandic eruptions. In fact the eruption was relatively small in comparison to the past 20 most voluminous eruptions that deposited tephra in mainland Europe. Past geological evidences provide a general indication of past eruptive frequency and magnitude, but it is very complex to predict the likelihood of eruptions similar to Eyjafjallajökull in the future. This is mainly because of the critical role of weather patterns in distributing the ash. Large eruptions in Iceland have occurred in history such as Vedde Ash, Saksunarvatn Ash, Hekla 4 or Hekla 1845, 1947, Askja 1875. All contributed dispersing ash on mainland Europe. However, no matter how big the eruption is, Davies et al., 2010 maintain the weather patterns play a critical role of ash presence in the atmosphere. Threats other than ash can also have an effect on air traffic. High concentration of sulfuric acid could consequently halt air traffic for months over the North Atlantic (Gudmundsson et al., 2008). Gudmundsson et al. (2008) explains that another major eruption such as Laki 1783, which had those characteristics could cause severe economic impact in Northern Europe. Gunnarsdóttir & Karlsdóttir (2010) also notes that future eruptions as expected of the most hazardous volcano in Iceland, Katla has the potential of causing considerable disruption to air traffic.

2.3 Eyjafjallajökull

2.3.1 The volcano

Eyjafjallajökull is 1666m high ice capped stratovolcano, situated in the south central of Iceland. Compared to the most active volcano in Iceland, Grímsvötn volcano with more than 70 documented explosive eruptions Eyjafjallajökull has produced relatively small and less productive eruptions during history (Watson, Prata, Rose, Saunders, Schneider, Thomas, Thordason & Zehner, 2010). Only three have been documented in historical times, i.e. in the years 920, 1612 and 1821-1823 (Brandsdóttir, Tarasewicz, Hensch & Þorbjarnardóttir, 2010).

2.3.2 The eruption of 2010

An explosive eruption occurred 14th of April, and lasted until 23rd of May 2010, after lying dormant for nearly 200 years. The volcano showed signs of seismic instability for about a year until the first eruption started on the eastern flank of Eyjafjallajökull ice cap at Fimmvörðuháls, on 20th of March and lasted to 12th of April 2010 (Petersen, 2010).

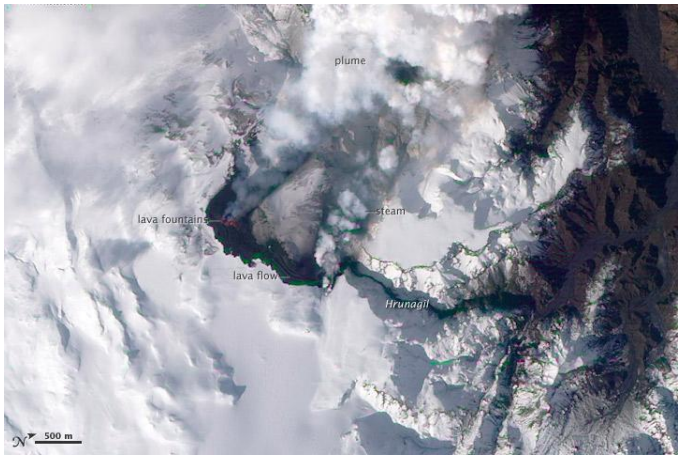

Figure 5. Fimmvörðuháls staging a 500-meter long open fissure on the 24th March 2010. (NASA´s Observatory, 2010 March 24).

Figure 5 displays the event of the small-scale eruption with minor ash production, which created two scoria/spatter cones (Watson et al., 2010) and a small lava flow. Because of the harmless nature of the eruption and relatively easy access to the eruption site, many drove or hiked to get a glimpse of the spectacle (Petersen, 2010). Two days after Fimmvörðuháls eruption halted, an explosive subglacial eruption started beneath the ice cap in the caldera of Eyjafjallajökull (Petersen, 2010). The new event did not attract the same response from the general public because of the increased danger. The magma melted the ice and came in contact with the water causing explosions, sending ash and volcanic aerosols into the atmosphere (Watson et al., 2010). The activity had irregular surges, decreasing and then increasing again. The volcano's explosive activity accelerated, leading to fine and rich ash discharge (Petersen, 2010). The eruption later changed styles, from phreatomagmatic to magmatic, which means that external water no longer had access or interacted with the magma in the vents. The magnitude intensity dropped, reducing production of ash and then new seismic activity occurred that once again intensified the eruption. This led to 5000-9000 meters high columns with increased production of ash. The eruption lasted for a total of 39 days (Watson et al., 2010).

During the eruption of Eyjafjallajökull the IMO (Icelandic Meteorological Office) monitored threats the volcanic activity and ash dispersal had on aviation. IMO gave status reports out every 3 hours or more often if necessary to London VAAC (Volcanic Ash advisory Center). They informed the plumes height and activity, Color of the plume, lightening activity, seismic and hydrological activity, surface and upper air observations (Vogfjörd, Jakobsdóttir, Gudmundsson, Roberts, Ágústsson, Arason, Geirsson, Karlsdóttir, Hjaltadóttir, Ólafsdóttir, Thorbjarnardóttir, Skaftadóttir, Sturkell, Jónasdóttir, Hafsteinsson, Sveinbjörnsson, Stefánsson, & Jónsson, 2005). In early hours a plume got visible. Directly after the news reached VAAC, alerts were issued to the European aviation authorities and other VAAC centers around the world. The London VAAC simulations showed that ash would travel over Europe due to strong northwesterly winds at high elevations (Gudmundsson, Pedersen, Vogfjörd, Thorbjarnadóttir, Jakobsdóttir, & Roberts, 2010).

2.3.3 The threat of weather condition and role of Ash on air traffic

Weather condition is a factor contributing to the distribution of ash. In the case of Eyjafjallajökull the role weather patterns played had significant effect on distribution of ash. Davies et al. (2010) explains not the most voluminous or extensive eruption necessarily cause widespread dispersal of tephra, but rather the weather pattern. In addition, Gunnarsdóttir and Karlsdóttir (2010) explain it was the very small grain size of the ash that particularly was the source of the long-range dispersal and the widespread effects. Only about 3% of Iceland land area experienced excessive ash fall.

In the case of Eyjafjallajökull eruption there was an anticyclone south of Iceland that influenced the wind direction. When the eruption turned explosive it increased size and production of ash and aerosols. The interaction of water and magma had considerable effect on the plume activity between 14th-17th of April (Petersen, 2010). Figure 6 illustrates the thick ash dispersing south towards Europe.

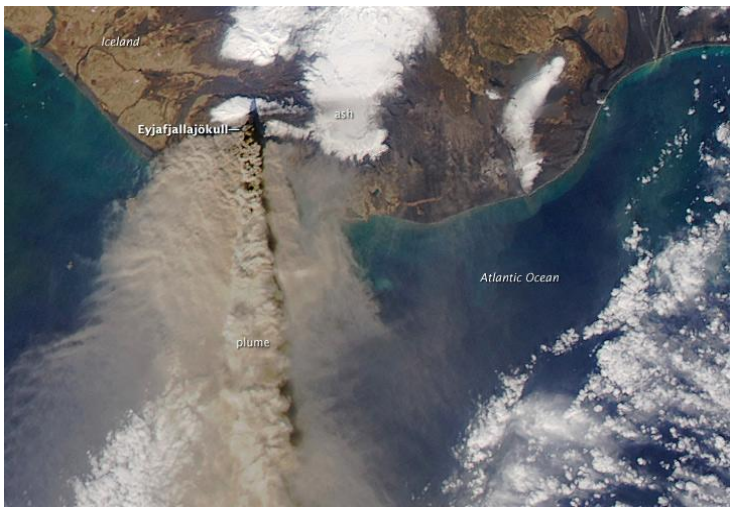

Figure 6. Thick ash pouring south from the volcano on the 17th of April 2010. Taken with Moderate Resolution Imagine Spectroradiometer (MODIS) on NASA´s Aqua Satellite (NASA´s Observatory, 2010 April 17).

During this period the plume rose highest, up to 9000m. However, most of the time the plume was rich in ash and stayed lower than 6000m (Gunnarsdóttir and Karlsdóttir, 2010).

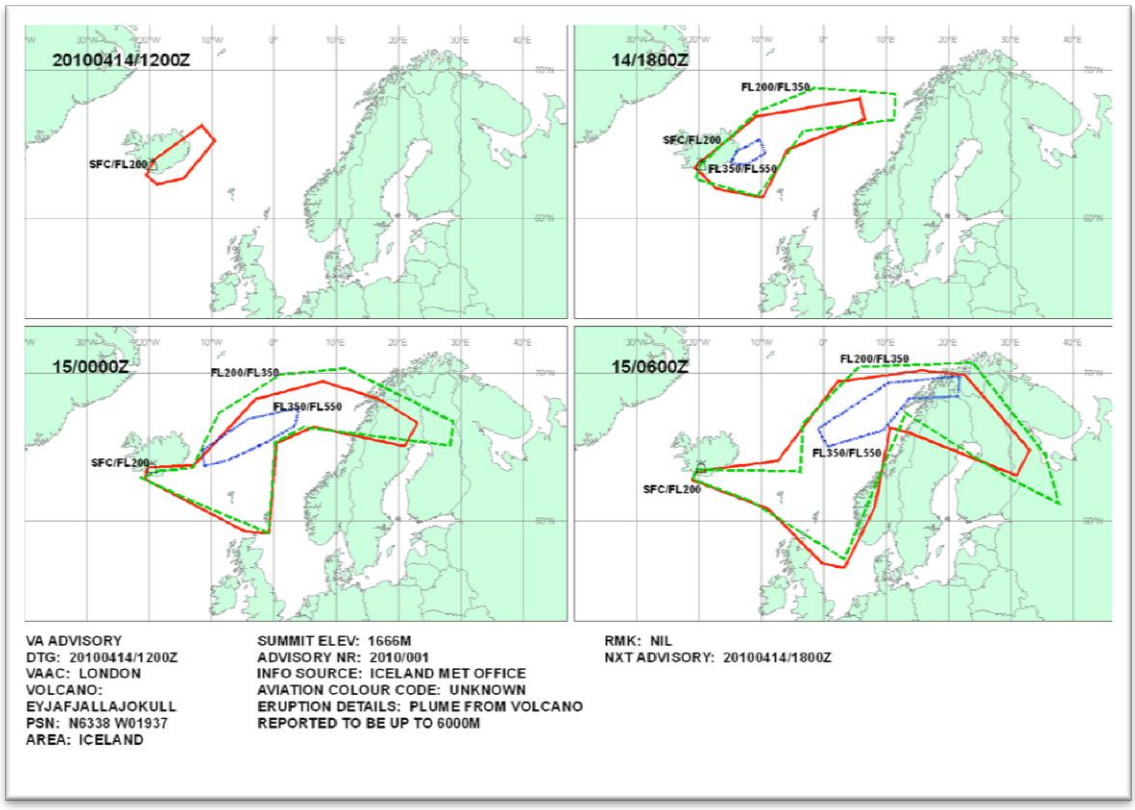

Figure 7. First stages of ash dispersal over Europe on the 14th – 15th of April 2010 (UK Met Office, 2010 April 14th).

The wind spread ash mainly southwards over the North Atlantic and then into the western parts of Europe (Figure 7). First the ash traveled towards northern Norway, closing the airspace. On the 15th of April the ash spread too much larger area, closing also the airspace in Sweden, Great Britain and Northern Ireland (EUROCONTROL, 2010). Ash was carried with the upper-level winds and continued over United Kingdom and continental Europe, disrupting the transatlantic flight routes. On passing days the irregular activity of Eyjafjallajökull made the plume height fluctuate. Between the dates 18th-30th of April the ash dispersal was of low levels (below 6000m), but still had an impact on air traffic (Figure 8) (Petersen, 2010).

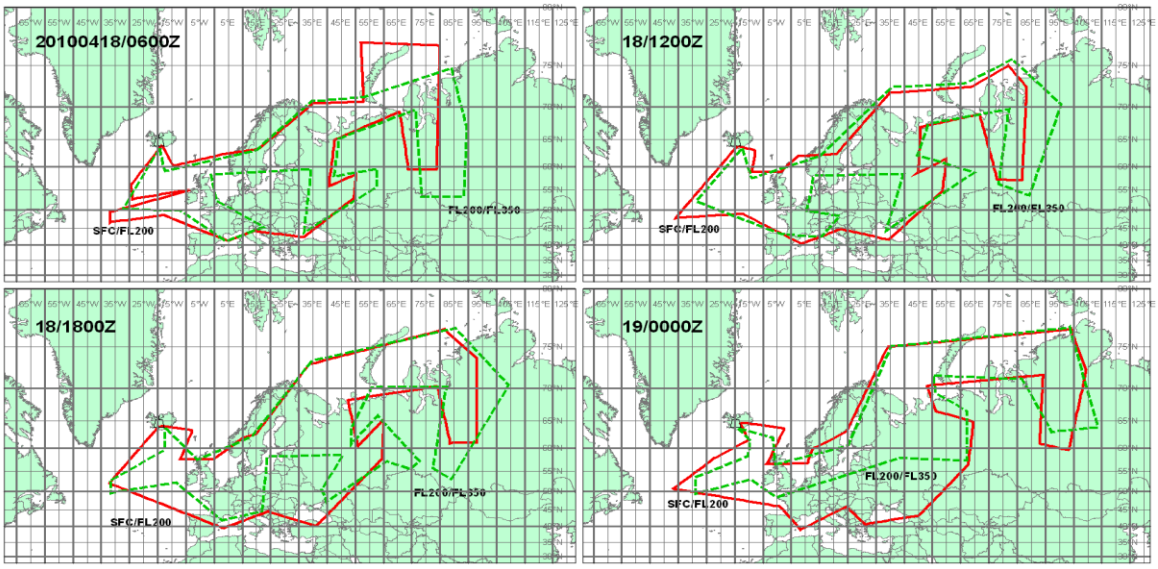

Figure 8. Ash dispersal over Europe on the 18th-19th of April 2010 (UK Met Office, 2010 April 18th).

In Iceland, 24th of April there were low easterly winds with parts of Reykjavik and Keflavik International airport covered in ash. Measurements of airborne particles were low but caused the airport to close temporarily (Petersen, 2010). From 18th of April to 4th of May the eruption had high tremors and allowed lava to flow down the Gígjökull outlet glacier. During this period the plume was weak and ash poor. Ash drifted westward towards Reykjavik and shortly thereafter the activity decreased slowly. Figure 9 illustrates the extent ash had drifted on 9th of May, more south and west. In the end the plume consisted of only steam, until it was announced at rest 22nd of May (Petersen, 2010).

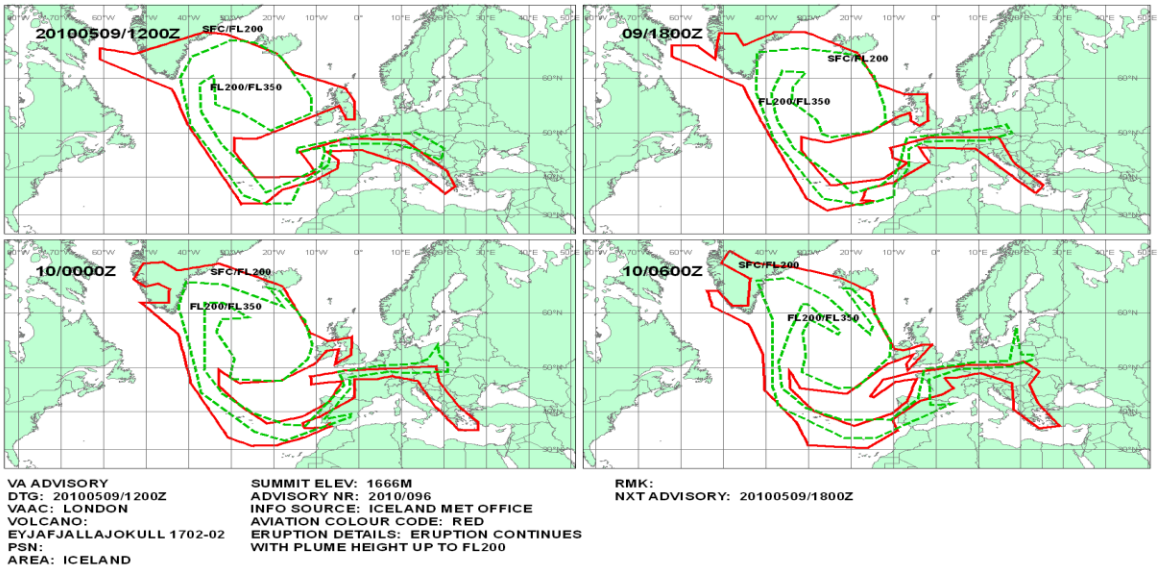

Figure 9. Estimated dispersal of ash over Europe on May 9th 2010 (UK Met Office, 2010 May 9).

2.3.4 Eruptions effect on European airspace

The impact Eyjafjallajökull caused on air traffic was both national and international. The largest effect was however experienced in Europe. This section presents the impact of the eruption on European airspace, which influenced flights and tourists numbers to Iceland. Eyjafjallajökull is the first eruption considered to have caused the largest disruption on air traffic in the world. The plume threatened transatlantic flights, closing parts of North Atlantic and European air space (Petersen, 2010). To ensure safety International Civil Aviation Organization (ICAO) standard rule was to prevent aircraft flying through potentially dangerous ash, which involved no tolerance of ash in the atmosphere (Prata, 2010). In early stages of the eruption controlled airspace of many countries were closed. This affected millions of passengers to be stranded in airports around Europe, and across the world since air traffic to and from Europe were cancelled (Petersen, 2010). EUROCONTROL (2010), the European organization for the safety of air navigation estimated 104,000 flights were cancelled during the main period of the crisis, between 15th-22nd of April. The peak point was 18th of April with 10 million or 80% of passengers unable to board their flights. 5,000 flights

were put on by scheduled and charter carriers to adjust to the eruption. The reason for the additional flights was to reposition aircraft and crews and to accelerate the repatriation of stranded passengers. The countries hardest hit over five days was Finland, Ireland and the UK, with 90% reduction in air traffic. Appendix A show summary of estimated cancellations per country and day between 15th -22nd of April (EUROCONTROL, 2010). The shutdown was over much of northern Europe from 15th of April to 21st of April (Figure 10). The Keilir aviation academy conference held in September 2010 in Keflavik, revealed 16.000 flights were cancelled on 16th of April and a similar amount on the 17th of April (Pálsson, 2010).

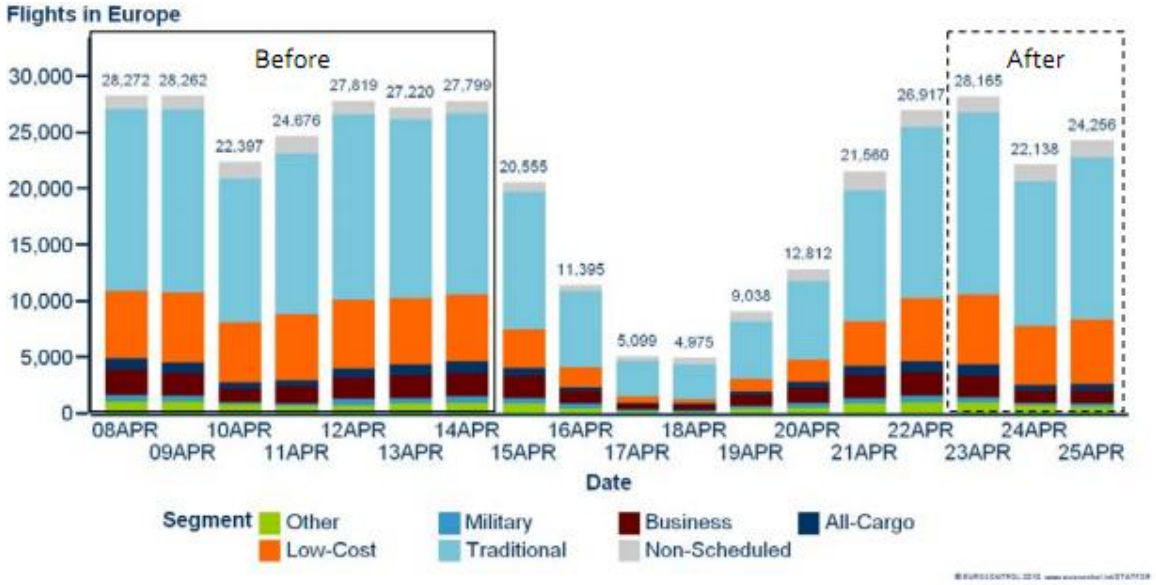

Figure 10. Impact on air traffic in Europe before and during the eruption 8th-25th of April. The figure also illustrates disruption of flights in different segments (EUROCONTROL, 2010).

After 21st of April the ash cloud extended to areas in Europe, causing airspaces only to close from time to time in different parts. In May the most affected region was the airspace of Ireland, Northern Ireland and Scotland (i.e. on 4th to 5th of May) and Spain, Portugal, Northern Italy, Austria and southern Germany on 9th of May (EUROCONTROL, 2010).

The restrictions were lifted when the introduction of new guidelines on volcanic ash density were applied. Before 21st of April the tolerance was zero and the rule was to

avoid flying. After 21st of April the tolerance became 0.1 mgm^{-3} and beyond $2mgm^{-3}$ concentration it became no go zone (Prata, 2010). The new policy was necessary, as the old policy did not work well in European airspace. Re-routing aircrafts would be difficult in a continent with many states, such as in Europe (Pálsson, 2010).

Most of the time the ash cloud remained in parts of Europe's Atlantic coast. That explains Ireland, UK and two parts of Portuguese airspace were greatly affected, this is especially due to reduction of over flights. Ireland and the UK had about 90% reduction in flights in the main period but recovered quickly. In other states in Europe there was at least a 15% decline in traffic over the period (15th-22nd of April). South East Europe was least affected. Flights operated between continents were re-routed. According to EUROCONTROL (2010), air traffic was re-routed north of the ash into Icelandic airspace. For several days much larger portion of the daily North Atlantic flow was routed through Icelandic airspace. On average about 260 air carriers flew through in a day. 758 aircrafts came through the area on 8th of May, but peaked on 11th of May when the number rose up to 1012 aircrafts passing through, six times the usual daily traffic (Petersen, 2010).

Closure of airports left 5 million people stranded, however other transport sections such as car rental demand increased greatly (EUROCONTROL, 2010). Economically, the air transportation industry is very important since it accounts for 0,7% of the world GDP and 35% of world trade by value. Organization for Economic Co-operation and Development (OECD) and the UNWTO estimated that the economic impact from loss of aviation was €1.7 billion. Furthermore, the tourist service sector is believed to have lost a similar amount (Pálsson, 2010). There was also a noticeable difference between airline segments. Low cost airlines were more affected by the eruption then other airlines. During the 8-day crisis the low cost air traffic lost 61% of flights, compared to 48% for all traffic. As early as 15th of April the carriers experienced a reduction of 40% while the average was 28% (EUROCONTROL, 2010). EUROCONTROL (2010) states the likely cause was that low cost carriers were higher exposed since many flights are in Ireland and the UK. In addition, low cost operations usually have a less flexible business model. Less equipped to adapt and change to make the best of the available open airspace. Business aviation on the other hand was least affected, with traffic only down by 34%.

The reason is believed their business model was better equipped to handle the situation.

2.4 Summary

Tourism in Iceland has increased dramatically and has become a valuable economic resource. Compared with Europe the country has an above average increase of arrival numbers. Even with the economic recession of 2008 Iceland had a less decrease in tourist numbers then Europe of -2%. During the year of the eruption of Eyjafjallajökull, Iceland experienced an increase of tourist numbers of 0.2% by point of entry, both sea and air transport. However, the international airport in Keflavik saw between 2009-2010 a decrease of 1.1% of tourist arrival numbers. The international airport handles 95% of tourism coming to Iceland with Iceland Express and Icelandair responsible for majority of the market (Icelandic Tourist Board, 2011a). Both airlines have greater numbers of flights to Europe then routes to North America and Canada. Table 2 show that between 2009-2010 the tourism market area from the west increased mostly, North America by 17.5%. An increase of arrival numbers close to 30% between 2007-2010. The numbers from the Nordic countries decreased however by 5.8% and on average other European countries with around -2% (Icelandic Tourist Board, 2011a). The operational advancement according to Guðjón Arngrímsson (personal communication, 08.04.2011) for Icelandic airlines has been Iceland's position in the Atlantic Ocean between the continents and the access to an additional market.

The risk of volcanic hazards on aviation is great, in Iceland. The threat for a volcanic eruption to affect tourism and a country's economy has been seen in other places, i.e. In the case of Redoubt volcano in Alaska (Casadevall, 1993). The threat to airlines is from ash clouds, which damage parts of an aircraft, limiting the ability to fully operate safely. Volcanic eruptions produce different kinds of ash clouds, however the most recognized hazardous ash cloud is the drifting ash cloud, consisting of lightweight fine ash from violent eruption columns (Casadevall, 1993), such as the case of Eyjafjallajökull 2010 eruption. Volcanic eruptions are common in Iceland and are recognized for producing large volumes of tephra. However, in the past volcanic eruption or tephra

fallout has had a minimum impact on air traffic, mostly because wind direction led the fallout north towards the arctic regions (Gunnarsdóttir & Karlsdóttir, 2010). Even with the customary dispersal pattern and production volume of tephra from the Eyjafjallajökull, it is the weather patterns that play a critical role when it comes to ash or gas presence in the atmosphere (Petersen, 2010). Eyjafjallajökull have in the past had few recoded eruptions (Brandsdóttir, Tarasewicz, Hensch & Þorbjarnardóttir, 2010). The 2010 eruptions commenced 20th of March at Fimmvörðuháls and became dormant after 22nd of May at Eyjafjallajökull (Petersen, 2010). According to Petersen (2010) the first eruption was considered a "tourist eruption" because it was easily accessed and harmless while the second explosive subglacial eruption was more dangerous in nature. It was greater in size and had higher concentration of ash and aerosols production. EUROCONTROL (2010) claim the airlines and airports hardest hit was in parts of Europe's Atlantic cost. The effects were worst from 15th to 22nd of April when many parts of the European airspace and airports were closed down because of the ash distribution, hindering flight operations. On average 80% of travelers got affected, making several million travelers not making their destination (EUROCONTROL, 2010), including travelers to Iceland. Flight operation as explained during an eruption is highly dependent on weather patterns. This explains that during the Eyjafjallajökull eruption Icelandic airlines still was able to increase arrival numbers from the west while the impact was greater on visitation numbers from travelers from the European countries.

3. Methodology

3.1 Methods

To adequately cover the event's impact on the Icelandic airline industry and the effect on tourist arrival numbers it was decided to use mixed research methods. This can help cross check results against one another, which might increase the reliability of the research. The research is mainly based on qualitative data, and supported by secondary quantitative data attainable on the topic. The choice for the methods was based on the way to attain information, i.e. to answer the various questions, access and availability of the information and the time period of the research.

In plain terms the definition of qualitative data is information in the form of words. It is intended to approach the world "out there" and to understand, describe and sometimes explain social phenomena "from inside" (Bauer & Gaskell, 2000). Qualitative data is based on material gathered through semi-open interviews taken of representatives from the two airlines selected for this study, i.e. Icelandair and Iceland Express. Interviews as the main method are a good source to get better understanding and involvement of the airlines role during the eruption. Questions can generate rich and candid data and allow a more intricate explanation for the effect the eruption had on the airline. Since there was no open documentation on direct effects, the researcher believed this method was the primary way to get the insight needed. The airlines were contacted by phone and email and asked if they were willing to be a part of the research. At the initial contact the researcher was both times directly directed to the airline public relations officers in regards to the research. Using public relations officers is beneficial to identify key issues and experience of airline operation during the eruption, especially the overview of airline operational effects. They are qualified on speaking on behalf of the company and a in tuned with happenings within the airline.

The participants were Kristín Þorsteinsdóttir from Iceland Express and Guðjón Arngrímsson from Icelandair. Since the participants are public relations officers for the airline the researcher does not consider anonymity an issue to be preserved. Besides

consent was received to use their real identity in this paper. The meeting point for the interviews was the business office of each airline. The length of each interview was various depending on participants input on the topic. One was slightly over half an hour and the second extended a little more over an hour. The interviews were taken 4 of April 2011 with Iceland Express and Icelandair 8 of April 2011.

The interviews were recorded and consisted of prepared questions. Each individual was asked a series of semi-structured questions from a prepared list (Appendix B), which means the researcher had a questioning plan in hand to cover the subjects and for support if topic would stray. This approach welcomed any additional information given. The goal was to get respondents to construct answers using their own words and express their opinion on the subject (Arksey & Knight, 1999) to gather as much information as possible on the topic during the allocated time. To avoid mistranslation the series of questions was both in Icelandic and English since the interviews were taken in Icelandic but presented in English. The questions were also divided into themes to easily work through the information gathered.

The second part of the research is based on quantitative research. The method consists of collected data that can be analyzed in numerical form to help answer questions like who, when, where and how many. Quantitative data in this research is in the form of surveys, statistics and numerical information (Bauer & Gaskell, 2000). This is a good method to measure relations between variables such as the relation between the eruption of Eyjafjallajökull and visitation numbers during and after the eruption, and examining tourist reaction to the eruption. However, statics cannot entirely examine the volcanic eruption effect on international flights nor the insights of airline emergency response to the eruption, thus the alternative approach of interviews are for support. Secondary data from questioners was chosen, as it is an effective way of quantifying data from a sample group taken right after the eruption, testing emotions or preferences. It gives a scale of opinion or emotion and is random and good way to measure intensity.

3.2 Data and analysis

The interviews were recorded and later transcribed to gather most from the interview. The interviews were taken and transcribed in Icelandic and then translated to English. Informative data from the interviews was collected and grouped accordingly after arranged themes from research questions (i.e. effects on flights, airline procedure, effects on visitation numbers, impact on Iceland image and tourist flow and the eruptions overall outcome). Then compared and analyzed to find similarities and differences between answers. Highlighting parts of the transcribed interviews relating to the research.

The objective using quantitative data in this research is that numerical and statistical measurements and analysis explain and help justify the qualitative interpretation. The prototype used in this paper is secondary research from opinion poll taken by Capacent Gallup in May 2010, a survey taken by Guðmundsson (2010) and another by Benediktsson, Lund & Mustonen (2010), both in the summer of 2010. Getting a numerical scale of the arrival numbers was with the help from the Icelandic Tourist Board and EUROCONTROL, and believed the best source to provide this data. Under examination was the correlation of visitation numbers, before, during and after the Eyjafjallajökull eruption, and numerical data and information on flight disruption. The numerical information gave a degree of insight on tourist reaction towards such an event and helped explain better the operational impact on airlines. The data from surveys gave a good insight on the effects on tourists as they were conducted shortly after the eruption. The representation of most tables and statistics was conducted using Microsoft Excel and Microsoft Word.

3.3 Limitations

The main criticism for qualitative research has been that the approach is mainly subjective and easily influenced by the researcher (Bauer & Gaskell, 2000). In this case the main issue of the research is believed to be the few participants involved, which limits

the variety of opinions and views. According to Patton (1988 In Bazeley, 2004:4), a study with just a few interviews “cheapens” the method and thus the result. The purpose of a sampling group is to help draw conclusion about populations. However, in Iceland there are only two airlines responsible for nearly the entire market share from tourists.

The participants were also not considered the best choice to answer all research questions; such as how did tourist react to the Eyjafjallajökull eruption. Thus, quantitative method was used to support the interviews with secondary surveys and statistics. In addition, the participants are in public relations, which the researcher believes makes their main priority the airlines interest influencing their response.

The interviews were taken and transcribed in Icelandic, which means translation was required. Working with the information and translating might influence the interpretation if not translated correctly. Problems can also occur when data is misunderstood and introduced incorrectly. For this reason the Icelandic version is presented in Appendix C. Ensuring validity of the research content the participants were sent a copy of the theses to review.

4. Results

4.1 Effects on flights and airline operations

4.1.1 Effects on flight routes

The effect of the Eyjafjallajökull eruption was more persistent in Iceland than elsewhere. According to EUROCONTROL (2010) in April 2010, Iceland's air traffic was affected for 13 days rather than the 8 days experienced in other European states. The daily operational flight route of both Icelandic airlines got greatly affected by ash dispersal. There were a lot of delays and flight changes, which were determined by wind patterns. Flight disruption in Europe and Iceland were not affected the same way (Guðjón Arngrímsson, personal communication, 08.04.2011). Kristín Þorsteinsdóttir (personal communication, 04.04.2011) points out the problem lied not with the routes per se but the intermittently closure of airports hindering landing and takeoffs. Keflavik International airport might have been open in Iceland, but airports elsewhere would be closed, or the situation reversed. Guðjón Arngrímsson (personal communication, 08.04.2011) explains that when the ash cloud went over Europe, Keflavik airport was open for business but several airports in Europe were closed. At this time flights could continue with their scheduled flights to United States and Canada, with just a few trips conducted to some parts of Europe. Such as north of Norway, Trondheim and Sundsvall in Sweden, as well as with one or two flights to Glasgow in Scotland. For both airlines as long as the airport was operational in Iceland and more or less closed in parts of Europe flights were conducted west, to United States and Canada. After a while the problem shifted closing down Keflavik airport instead, hindering both inbound and outbound flights (Guðjón Arngrímsson, personal communication, 08.04.2011).

The increased flyover in Icelandic airspace did not have any effect on airline operations. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) explains all airlines have their own "slot". Departing and arriving on a specific hour following a

planned schedule. Extra flyover is just on another time or arranged not to affect standard flight schedules.

4.1.2 Flight delays, reschedules and cancelations

The numbers of arrivals and departures in April fell about 45-49% in two separate periods: 15th-20th and 23rd-28th (EUROCONTROL, 2010). An overview from EUROCONTROL (2010) of Icelandic air traffic for the whole month of April illustrates there were 5,519 actual flights and 1,160 estimated cancelled flights. That is about 17% fewer flights over the whole month. Figure 11 illustrates loss of number of International flights in April and the increase over flights in Icelandic airspace (EUROCONTROL, 2010).

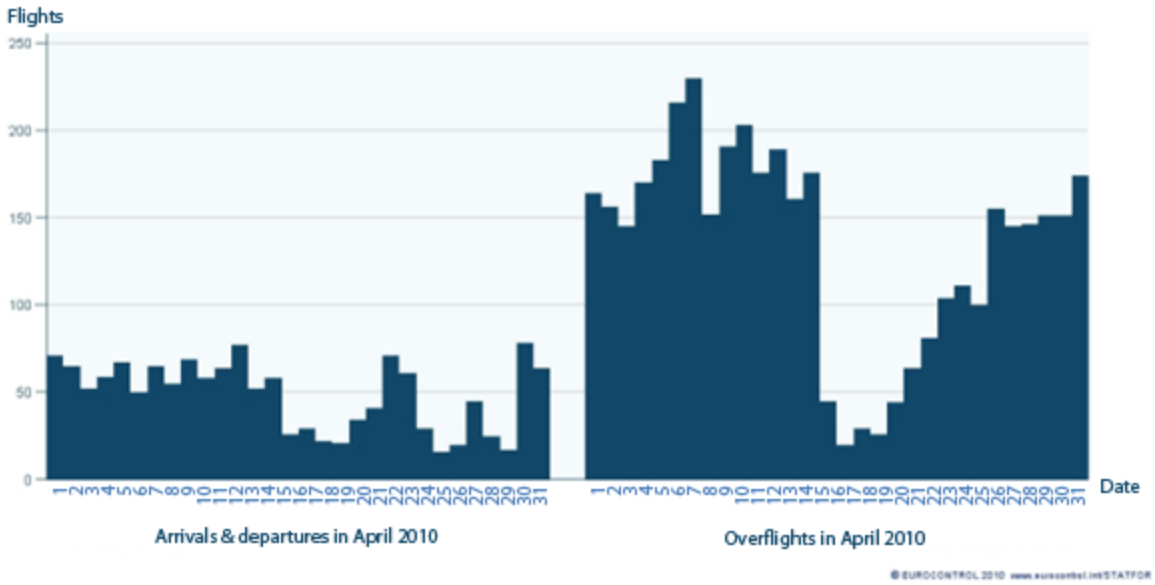

Figure 11. The number of international Icelandic flights during April 2010 (EUROCONTROL, 2010).

In May EUROCONTROL (2010) estimates the entire period from 4th of May to the end of the eruption 22nd of May, Iceland lost approximately 13% (or 250 flights) international arrivals and departures, but "gained" some 3,500 flights due to re-routing. An increase of roughly 60% over the period (Figure 12).

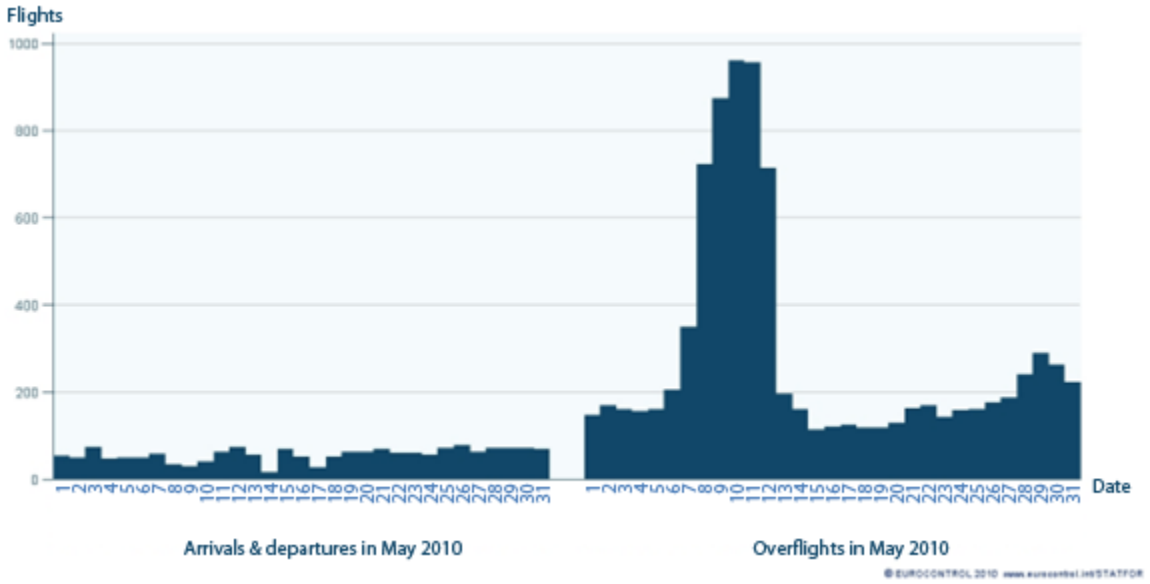

Figure 12. Icelandic flights during May 2010. Illustrates the number of international flights taken per day in May (EUROCONTROL, 2010).

During the days Eyjafjallajökull erupted Icelandair estimates the airline lost about 20% of scheduled flight operations and made about 180 changes in scheduled flights. The remaining 80% of passengers did arrive to their destinations, but at times with delays (Guðjón Arngrímsson, personal communication, 08.04.2011). Iceland Express estimates the effects caused around 100 flight routes to get cancelled, affecting approximately 15-20 thousands passengers (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). Kristín Þorsteinsdóttir (personal communication, 04.04.2011) response to the poor circumstance,

> We naturally had to suspend most flights and things, and we tried to compensate the passengers as much as we could. We managed things after the eruption, the eruption decided how things went. We had to act accordingly and naturally always put safety above everything else, and so we just tried to fix delays after the wind per say and try and minimize the damage as much as we could, naturally. [1]

The quotes in Icelandic of the interview can be viewed in Appendix C.

According to a survey conducted summer 2010, 10% of the respondents agreed the eruption had some effect on their travel plans (Benediktsson et al., 2010). The reason given was mainly that flights had been delayed and route or plans slightly changed. In addition, compared with an opinion poll taken of Icelandic residence in May 2010, 9% stated the eruption disrupted their travel plans (Capacent Gallup, 2010).

4.2 Effect on tourist and visitation numbers

4.2.1 Visitation numbers

In the beginning of the volcanic activities in the Eyjafjallajökull area, i.e. when the first sign of seismic activity occurred at Fimmvörðuháls, both Kristín Þorsteinsdóttir (personal communication, 04.04.2011) and Guðjón Arngrímsson (personal communication, 08.04.2011) said that the visitation numbers were good and that the event was more positive than negative. The event did not disrupt air traffic nor did it seem hazardous "It was more like a tourist eruption" [2] Kristín Þorsteinsdóttir (personal communication, 04.04.2011) describes. However, there were no significant changes in bookings. Visitation numbers during the small eruption of Fimmvörðuháls did not notably increase. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) explains,

> ... I dare not go into it. But everyone who came here just went directly there, to the eruption. [3]

Guðjón Arngrímsson (personal communication, 08.04.2011) also mentions,

> People were not coming in large groups. There were some who came to watch. But nothing we can measure in numbers. [4]

Icelandic Tourist Board (2011b) published an increase of 11,4% in March month 2010 compared with previous year and 0.08% increase in 2011. Tourist numbers decreased as indicated in Table 3 both months of April and May in 2010.

Table 3. Variation in % of arrival numbers Feb-Jun 2010 and Feb-Mar 2011 (Icelandic Tourist Board, 2011b).

	Feb	Mar	Apr	May	Jun
2010	11%	*11.4%*	*-17%*	*-18%*	-0.2%
2011	12.6%	0.08%	-------	-------	-------

Table 4. Monthly tourist numbers 2007-2011 (Icelandic Tourist Board, 2011b).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Des
2007	18,810	17,647	23,700	27,664	34,256	55,727	80,761	81,271	39,065	34,175	23,109	22,814
2008	20,289	20,312	25,619	26,085	36,024	55,978	81,267	83,967	43,907	32,826	24,376	22,022
2009	19,985	18,276	23,697	27,785	34,637	54,489	82,220	92,021	42,463	30,371	21,077	17,515
2010	18,782	20,293	***26,399***	***23,087***	***28,298***	54,391	83,465	89,558	40,863	34,069	21,240	18,807
2011	22,262	22,849	26,624									

Table 4 presents monthly tourist numbers from 2007-2010, and January to March 2011. The highlighted months of 2010 are during the eruption of Fimmvörðuháls 20th of March – 12th of April and Eyjafjallajökull from 14th of April – 23rd of May. Figure 13 displays year round monthly tourists values compared with previous years between 2007-2011. The red column is 2010, showing the drop in April and May. The three first months of 2011 illustrates increased tourist numbers.

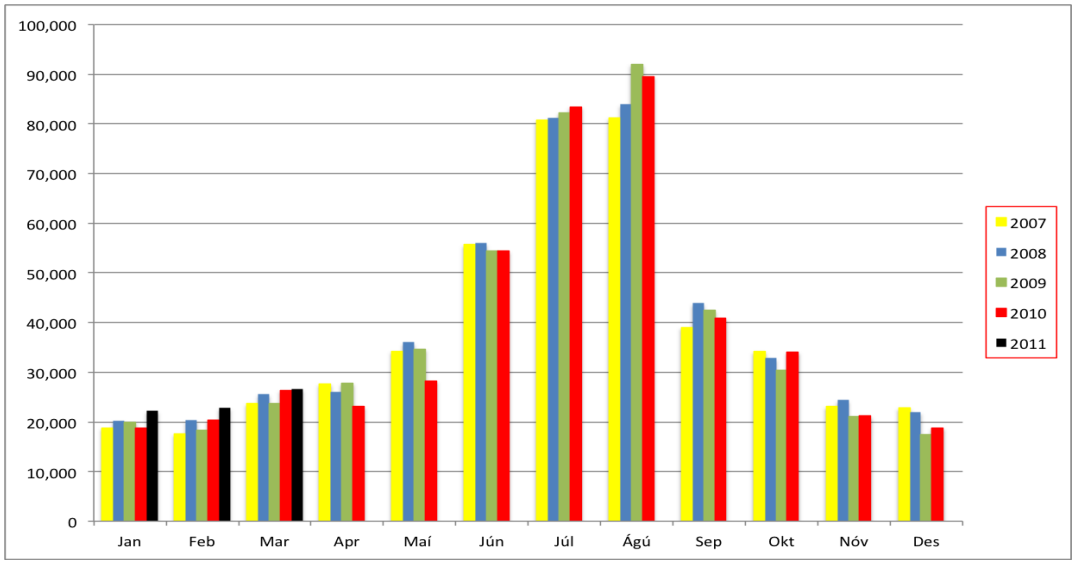

Figure 13. Tourist arrivals from 2007-2011 (Icelandic Tourist Board, 2011b).

4.2.2 Bookings and cancelations

Already on the 15th of April, cancelations of bookings started pouring in, which caused great concern of all in the tourism sector (Kristín Þorsteinsdóttir, personal communication, 04.04.2011; Guðjón Arngrímsson, personal communication, 08.04.2011). The impact was greatly related to the perceived image of Iceland, being dangerous. The decrease in bookings was extreme during and right after the eruption (Guðjón Arngrímsson, personal communication, 08.04.2011). He relates to the situation,

> Yes, it was very understandable. This happened all over the world. People canceled flights, changed plans and such. Perfectly normal and understandable... and that is, especially in regards to Iceland. [5]

The mission for the airline was to neutralize the situation, which was by Icelandair, contacting travel agency's abroad selling tickets, assuring them the situation might soon pass (Guðjón Arngrímsson, personal communication, 08.04.2011).

> When it started naturally all bookings stopped completely. It just stopped. There was nothing coming in, and then it started to flow out. Just minus bookings, just canceled. So the project was really to quickly stop the outflow and much effort was spent to speak with travel agencies and such out in the world. [6]

The obvious reason for cancelations was naturally airports closed, preventing flights. Guðjón Arngrímsson (personal communication, 08.04.2011) expresses also that in some cases maybe fear, fear for security could play some part, but maybe the main purpose for cancellations was fear of vacations getting ruined. Complications from flights like delays and problems relating to flights. He continues,

> I think it is much more that you do not bother going into something that is an unsure situation and do not know what will come out of it. You would rather go sometime later. [7]

Guðjón Arngrímsson (personal communication, 08.04.2011) considers people most likely preferring cancelling or postponing their travel plans, until situations changes. It is not as much people fearful of a volcanic eruption than putting themselves in an uncertain situation. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) has a similar view. She describes, the concern is the uncertainty of flight schedules. Flights might all of the sudden get cancelled, especially since airport operation were constantly getting opened and closed. Also, she considers the main reason people were hesitant to travel was because of the uncertainty of not being able to return back as planned.

According to a survey conducted summer of 2010 by Guðmundsson (2010), 9% of respondents had considered cancelling their trip. Those travelers were mainly from central and south Europe. Tourists from Scandinavia and North America had less concern changing their travel plans. Benediktsson et al. (2010) mostly believe the decrease is likely due to the disruption in air traffic. A second survey also taken during the summer by Benediktsson et al. (2010) showed out of all the respondents there was just one Norwegian couple that had tried to cancel their tickets but was advised by their travel agent to continue with their travel plans.

The flow of tourist changed though when airports started opening again and the threat was put to rest, cancelations halted and bookings started picking up again (Guðjón Arngrímsson, personal communication, 08.04.2011).

4.3 Tourist reaction to the eruption

Initially foreign people misconceptionally thought that Iceland was covered under ash. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) describes the mistaken belief,

> [We] had ash up to our necks in Reykjavik. But here in Reykjavik we never noticed it. [8]

This message was mostly proved wrong when the campaign of "Inspired by Iceland" took a hold of the public. The effort was making people see the country not as affected as how the media had initially presented it (Guðjón Arngrímsson, personal communication, 08.04.2011). When the accurate picture came into play it all turned around. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) informs,

> It went just very well, this was very good ... ended up being a big tourist attraction, ... just as people came here wanting to see the northern lights, they wanted to see the eruption. [9]

People were attracted to the spectacle as they were attracted to any other tourist attraction. The survey taken by Benediktsson et al. (2010) also revealed the eruption was considered to increase respondent's interest of Iceland. Many of the respondents that came in contact or experienced some effects of ash, such as walking on ash thought the eruption had made their trip more exciting. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) considers it to have a positive long-term effect, adding slightly to the country´s appeal. Making Iceland maybe more exciting place to visit and having a positive effect on tourism.

The effects form the eruption got its fair share of publicity, including the difficult pronunciation of EYJAFJALLAJÖKULL. Even with the negative image illustrated by the media it was the biggest publicity Iceland ever received (Guðjón Arngrímsson, personal communication, 08.04.2011). The news all over constantly mentioned Iceland, which Guðjón Arngrímsson (personal communication, 08.04.2011) considers good.

> Iceland was seen everywhere. This is just the biggest publicity Iceland has received. Saying it had some potential in it ... use it somehow. So now, the outlook is pretty good, good. We are seeing quite a great number of tourists to Iceland. [10]

According to both representatives the recent event has not influenced any changes in airline marketing (Guðjón Arngrímsson, personal communication, 08.04.2011; Kristín Þorsteinsdóttir, personal communication, 04.04.2011). Majority of tourist coming to

Iceland is for the reason of nature. The eruption, Guðjón Arngrímsson (personal communication, 08.04.2011) explains,

> ... Is such a big natural occurrence [that] just reinforces the image. Iceland is so natural, so exciting. [11]

Icelandair has this year increased operation by 17% from the previous year. The airline has even more flights and offer additional destinations. During the financial crises of 2008-9 the airline was forced to reduce to 10 aircrafts. However, last year the airline had 12 airplanes, which this year increased to 14. Also, the impact on airline operation might have had a positive effect on the company's atmosphere (Guðjón Arngrímsson, personal communication, 08.04.2011).

> I think it has had a positive effect on work spirit. It was action, this was a huge burden on everyone ... everyone had to impose on themselves and help each other, and it went very well and we came out from this just stronger. So I think it has given a good result. The outcome has been positive. [12]

Tourist flow to Iceland has increased significantly according to Kristín Þorsteinsdóttir (personal communication, 04.04.2011). In the beginning of summer 2010, bookings started pouring in and considering all the summer was exceptional. In addition she explains the tourists going through Keflavik international airport reached a record number last month (March) and the previous before that. She believes the improved financial stability might have influenced the increased numbers. Two and a half years after the crisis people are better situated and more likely to travel.

4.4 Airline response and regulations

The airlines have different operations and means; both however had getting passengers to their destination and doing so safely in common. Iceland Express stated the priority was getting passengers safely from one place to the next, taking one day at a time. The airline kept a 24h watch following alterations caused by the eruption on flights,

which was highly dependent on wind direction. If the Keflavik international airport was closed the airline redirected flights to the north, Akureyri or Egilsstaðir to the east side of the island and transported passengers between cities by buses. At times the airport would just open for a short period to allow departures (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). She explains,

> Then it could just open for twenty minutes or something. Then it was just everyone to the plane and up you see. [13]

These stressful situations made staff work together around the clock to get the most out of the situation (Kristín Þorsteinsdóttir, personal communication, 04.04.2011).

To keep operation going for the ten days the airport was closed in Iceland, Icelandair moved flight operations and staff to Glasgow, making it the temporary hub for the airline. This temporarily disrupted the airlines operation linking Europe in the east with America/ Canada in the west (Guðjón Arngrímsson, personal communication, 08.04.2011).

> This was done temporarily, our people were out there [in Glasgow]. Some just went out on short notice and stayed for 14 days. It was of course chaos. Many had to wait a long time ... [this] was all very uncertain. [14]

Priority for the airline was not to give up operations. Guðjón Arngrímsson (personal communication, 08.04.2011) continues to explain,

> In the short time it was all about not quitting which would perhaps be the easiest way. The solution was to continue even though we had to move to Glasgow with every effort it entails, which is a better option than to close. [15]

The threat on aviation was new and according to international flight regulations the solution was to close airspace down. Both airlines didn't have special regulations in regards to volcanic eruptions. Airline operations follow International flight regulations that cover threats. The general rules and regulations were applied instead to the situation. The priority is always safety and if any doubt flights get cancelled (Guðjón Arngrímsson,

personal communication, 08.04.2011; Kristín Þorsteinsdóttir, personal communication, 04.04.2011). Airlines in general are highly dependent on strict controls about regulations and restrictions. These regulations are combined from several authorities i.e. governmental laws, strict law frame from European Union and ICAO (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). She explains,

> There are very strict safety rules here and they were basically just transferred over to this. [16]

In the middle of the eruption people in the aviation division questioned the decision of the supposed threat and new ash criteria were introduced. The amount of ash concentration just changed allowing airspace to open and flights to be continued. The new ash criteria on a similar eruption would not have the same impact on air traffic as the Eyjafjallajökull eruption (Guðjón Arngrímsson, personal communication, 08.04.2011).

> It would not have as much effect. Both we have already done the research and the view on this is much better now. [17]

For Icelandair the new criteria benefitted airline operations greatly. Guðjón Arngrímsson (personal communication, 08.04.2011) continue to explain,

> It had a considerable effect on us. Because it gave us a much better chance than what we otherwise would have. It's not a question. [18]

The regulations were based on technical and unrealistic criteria. Determined by a line that was calculated and decided based on measurements taken at different sites (Guðjón Arngrímsson, personal communication, 08.04.2011). He recalls a situation,

> I remember from one day it was sunny and pleasant. According to the VAAC map Reykjavik airport was open and Keflavik Airport was closed. The line was right between and the second day the line was just right through Keflavik airport. [19]

Dividing the airfield meant that you were only allowed to land on one side, within the area that had acceptable limits. This criterion allowed aircraft shorter airstrip to operate on (Guðjón Arngrímsson, personal communication, 08.04.2011).

Safety in this business is a priority. When emergency is announced aircrafts obviously don't take any flights (Guðjón Arngrímsson, personal communication, 08.04.2011; Kristín Þorsteinsdóttir, personal communication, 04.04.2011). Icelandair like all airlines have an emergency response system. Guðjón Arngrímsson (personal communication, 08.04.2011) explains the airline's emergency response system is usually for situations concerning accidents. However, the eruption fell into the same category. Part of airline operation is to be prepared if something happens. Icelandair uses Canion international services that specialize in advice and assistance in emergency response planning. This includes exercises and training regularly in regards to crisis response.

> When the volcanic crisis hit, and it closed down. Then we could use this work. Although this is totally different from an accident for instance. However, the concept and methodology one uses [are the same]. We knew how the process ought to be. [20]

During the eruption Icelandair had a committee that met three times a day to evaluate the effects on operations. Time was spent looking at the maps given from VAAC. They discussed about the situation, changes during the last hours and what to do about it. Then each member worked in their specialized field, and after some time they met again to evaluate the situation. The meetings were usually taken every six hours, first starting at six in the morning, then at one in the afternoon and seven at night. Usually meant the airline had six hours to evaluate changes in flight operations (Guðjón Arngrímsson, personal communication, 08.04.2011). He explains,

> There was immediate organization of work and in this sense we have utilized this paradigm, but it's like everyone says each crisis of course has its own texture. There is nothing alike. So it is not possible to create a plan for all of this. [21]

Iceland Express also has an emergency plan to handle crisis situations, but according to Kristín Þorsteinsdóttir (personal communication, 04.04.2011) they were not

actually required for this situation. The airline as well had a team that met to evaluate flight situation and solve complications. The airlines main priorities during the event were customer service and satisfy passengers as much to their ability as possible (Guðjón Arngrímsson, personal communication, 08.04.2011; Kristín Þorsteinsdóttir, personal communication, 04.04.2011). Kristín Þorsteinsdóttir (personal communication, 04.04.2011) mentions,

> If they were stranded then we paid for hotel and food, and just tried to accommodate them as we could. [22]

If another eruption would take affect the airlines would tackle the situation on hand, but in situations such as natural disasters it is difficult to determine its effect (Guðjón Arngrímsson, personal communication, 08.04.2011). The only thing possible according to Kristín Þorsteinsdóttir (personal communication, 04.04.2011) is to try minimizing its effect on airline operations as much as possible. Eyjafjallajökull eruption might have provided some future instructions of how to handle similar situations. Guðjón Arngrímsson (personal communication, 08.04.2011) explains the company is "At least more [prepared] than before. We would know what we are going into" [23]. According to Guðjón Arngrímsson (personal communication, 08.04.2011) there is no saying of the effect Eyjafjallajökull would have on airline operations if the eruption continued. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) plainly stated it would have been bad; still it all depends on the duration.

> One cannot really answer this, you know. How much longer, additional week had probably not changed it much but if it was ten weeks then ... It's hard to answer this. [24]

For Icelandair the eruption did not have considerable damage to airline operation, only 20% loss of flights. Guðjón Arngrímsson (personal communication, 08.04.2011) states, "Yes like this eruption, we trust us completely, but not again and again" [25].

Icelandair noticed one to two days after the eruption started the negative effect it could have on long-term effect on visitors. To counteract the eruptions impact on airline

operations the idea came for the “Inspired by Iceland” campaign. The aim was to neutralize the impact caused (Guðjón Arngrímsson, personal communication, 08.04.2011). He describes,

> People were just afraid of Iceland. We noticed that there were pictures being displayed with people wearing masks and dust and mud was everywhere, and we were thinking we needed to somehow get it clear that Iceland is not dangerous and everything is ok though it is erupting here "Bring out the message that it is safe to travel to Iceland ... . [26]

Arngrímsson (2010) explains that if nothing would be done to counteract the effects Iceland could have lost approximately 100.000 tourists in 2010. To counter this negative image the airline contacted the government and started immediately with a proposal. On the 27th April government officially agreed with the pitch and the work began. The campaign was a mutual effort by handlers in the tourism industry to respond to the damaging possibility of long-term effects on tourist arrivals.

Initially the situation was extremely difficult to handle for airline operations and had large negative effects (Guðjón Arngrímsson, personal communication, 08.04.2011). However, Kristín Þorsteinsdóttir (personal communication, 04.04.2011) considers it proven some positive effects as well, such as the combined efforts of the campaign “Inspired by Iceland”, encouraging people from different parts in marketing and tourism to communicate and work together. Kristín Þorsteinsdóttir (personal communication, 04.04.2011), in the end thinks the situation has just proven a positive outcome and a learning experience,

> I just think the point is that this has only been beneficial and it says somewhere what does not kill you, just makes you stronger. [27]

Guðjón Arngrímsson (personal communication, 08.04.2011) does not consider the eruption to have significant negative nor positive impact. Instead the eruption increased knowledge of the country, such as its position and that it is a volcanic island.

> There are more people who know a little more about Iceland now than before. Not necessarily the opinion is better or worse of Iceland, but awareness of Iceland has increased. [28]

According to Guðjón Arngrímsson (personal communication, 08.04.2011) such coverage is good for the tourism industry for a small island such as Iceland. It has helped increases awareness of the country. He also considers there are opportunities in experiences;

> In all difficulties there are opportunities and definitely in this ... although it had been a disaster, still this has created certain opportunities. [29]

Ash did not cause any damages to aircrafts only disruption on the flights schedules. Guðjón Arngrímsson (personal communication, 08.04.2011) explains that investigations on aircrafts were conducted but there have been no signs of damages on the fleet. However, both airlines were affected financially. Difficult to directly provide an exact number, Iceland Express losses were believed to be around 200 million ISK (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). The economic effect on Icelandair operations however is a little bit different. The estimated official amount presented is for the whole Icelandair group. Icelandair airline share of the group is around 60-70%. The amount is around one billion ISK from income losses and costs, including passenger reimbursement for flight inconveniences. Airline reaction to this situation was though unfamiliar. The rights of passengers were not recognized, some airlines refused to provide compensations and others tried to minimize the inconvenience by taking care of the passenger's needs (Guðjón Arngrímsson, personal communication, 08.04.2011). Icelandair position on the matter;

> Our position was that we would gather together and figure out what it was and what the wishes were and things, then just work on paying it out. It was less than we expected it to be. [30]

The problem was with the amount of compensation. Guðjón Arngrímsson (personal communication, 08.04.2011) explains; "This was based on individuals and their view to the solution..." [31]. Calculating the compensation took a long time. Different persons have

different requirements and views to situations, which can cause several hundred thousand Icelandic kronas in difference between people. He gives an instance were two persons being in the exact same situation e.g. their flights cancelled yet have two different reimbursement bills. One might chose to stay the night at the airport and buys a banana while the other takes a taxi into town, dines at a nice restaurant and books a room at a fine hotel (Guðjón Arngrímsson, personal communication, 08.04.2011).

5. Discussion and conclusion

5.1 The impact of Eyjafjallajökull on airlines operation as regard to tourist arrivals.

Eyjafjallajökull eruption affected the Icelandic airlines operations greatly. However, the influence on visitation numbers was not significant. According to the airlines public relation officers Guðjón Arngrímsson (personal communication, 08.04.2011) and Kristín Þorsteinsdóttir (personal communication, 04.04.2011) the airlines lost less than 20% of regular flights during the period of Eyjafjallajökull's eruption. This assumption is also supported by the Icelandic Tourist Board (2011b) in Table 3, with a decrease in arrival numbers of -17% in April and -18% in May. The effects on other European airlines seemed more affected, especially during the initial eruption period (Appendix A). Flights all over got greatly affected from the production of rich ash plums, which carried ash with the upper level winds mainly to Europe then the accustomed direction to the arctic regions. For the Icelandic airlines this meant flights to the east was restricted depending on wind patterns (Guðjón Arngrímsson, personal communication, 08.04.2011). Both airlines continued with operations through alternative hubs at other locations so operations could continue. In Iceland re-routes of flights was to either Akureyri or Egilsstaðir, which consequently affected tourist flow. Icelandair even operated from other locations in Europe (i.e. Glasgow) (Guðjón Arngrímsson, personal communication, 08.04.2011). Visitors from the European countries going through the international airport at Keflavik was reduced, and numbers were even less from the Nordic countries (Icelandic Tourist Board, 2011a). Flight routes got disrupted causing delays, changes and cancelations of flights, which lasted most of the time during the eruption. EUROCONTROL (2010) stated Iceland was affected for 13 days with arrivals and departures falling by about 45% during 15th to 20th of April and 49%, 23rd to 28th of April. Airlines operated in difficult circumstances with the hub of Keflavik airport closed down.

According to Gunnarsdóttir and Karlsdóttir (2010) it was the eruptions very small grain size of ash that was the source of the long-range dispersal and the widespread effects on air traffic. The eruption had characteristics of the type of eruption mentioned by Casadevall (1993), being the greatest threat to airlines. However flights to the west and a few to Europe was still running (Kristín Þorsteinsdóttir, personal communication, 04.04.2011; Guðjón Arngrímsson, personal communication, 08.04.2011). North America was the only market area with an increase of tourist numbers through Keflavik in 2010 with 17,5% (Icelandic Tourist Board, 2011a). It is presumed the number is higher since Icelandic airlines were able to continue with operations to North America and after the financial crisis of 2008 tourists are better situated to spend money on holiday.

The airline lost only about one fifth of its scheduled flights and rescheduled 180 flights (Guðjón Arngrímsson, personal communication, 08.04.2011). Iceland Express also estimates the eruption caused 100 flights to get canceled (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). This explains that Iceland Express with 30% (Kristín Þorsteinsdóttir, personal communication, 04.04.2011) of the market share was more affected by the eruption then Icelandair holding 70% (Guðjón Arngrímsson, personal communication, 08.04.2011). According to EUROCONTROL (2010) the explanation is that low cost airlines have a less flexible business model.

The effects on visitation numbers during the eruption of Eyjafjallajökull caused cancelations to pour in and bookings to halt. Tourists didn't seem to want to travel during the disruption. Guðjón Arngrímsson (personal communication, 08.04.2011) and Kristín Þorsteinsdóttir (personal communication, 04.04.2011) sensible assumption is, tourist want to avoid unpredictable situations that can affect other engagements such as work, or otherwise negatively affect the experience of their vacation. Not being able to trust the outcome of planned events, such as being forced to stay additional nights at a location because of cancelled flights. Nevertheless, as soon as the eruption subsided bookings started picking up again. During summer 2010 the numbers increased and showed promise. In June the number was -0.2% but during July there were 1,245 additional tourists then the previous year. Even a year after the eruption tourist numbers has never been as high. The improved financial stability, increased exposure from the eruption or

the campaign “Inspired by Iceland” might have some influence in the increased numbers. However, it is difficult to speculate the particular reason for.

5.2 Potential effect of volcanic hazard on tourism

Tourist reacted significantly to the eruption according to Kristín Þorsteinsdóttir (personal communication, 04.04.2011) and Guðjón Arngrímsson (personal communication, 08.04.2011). However, the initial eruption at Fimmvörðuháls 20th of March to 12th of April did not negatively affect the numbers nor significantly increase it. The eruption had characteristics of being “tourist friendly”, yet the event did not significantly increase bookings (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). Tourist numbers, months before the eruption had increased above average. According to the Icelandic Tourist Board (2011b) during February there had been an increase of 11% and during the first eruption in March the increase was 11.4%. Not a significant change compared with the same months of the previous year of 2009. Supporting the fact even with a “tourist friendly” eruption lasting over 20 days did not attract big numbers of tourists.

During the eruption of Eyjafjallajökull the initial perceived “danger” image of Iceland had some part of people reconsidering their travel plans. The effect on annual arrival numbers was not as severe as expected in 2010. The average annual increase of arrival numbers to Iceland by point of entry increased by 0.2% during the whole year, even though the international airport calculated a decrease of -1.1% (Icelandic Tourist Board, 2011a). Benediktsson et al. (2010) reasonably believe the decrease in tourist numbers is likely due to the disruption in air traffic and not necessarily due to cancelations. During a survey conducted by Benediktsson et al. (2010) there was just one Norwegian couple that desired to cancel their trip, while according to Guðmundsson’s (2010) research 9% had considered cancelling their trip.

The main reason for tourists to come to Iceland is for the reason of nature, and as Guðjón Arngrímsson (personal communication, 08.04.2011) explains the eruption is a big nature event that reinforces an image of nature and excitement. It is safe to speculate that the eruption itself might be considered an attraction especially with the new tourism segment of geotourism. According to the summer respondents from Benediktsson et al. (2010) research, overall considered the eruption to increase their interest of Iceland. Adding to their experience of Iceland. Kristín Þorsteinsdóttir (personal communication, 04.04.2011) considers the eruption like any other tourist attraction. In the long term also maybe adding to Iceland's appeal, making it a more exciting destination to visit.

Airline response to the eruption and its effect on tourists did not seem serious enough. Especially when Guðjón Arngrímsson (personal communication, 08.04.2011) considers the airline being able to handle another such an event, but not repeatingly. To continue with operations Icelandair established temporary hubs at possible locations in order to get passengers closer to their destinations (Guðjón Arngrímsson, personal communication, 08.04.2011). However, trips that usually took a few hours, took additionally many hours. At times also special flights were organized to meet the demand. If flights got canceled the airlines offered compensation for the inconvenience of the passengers in the form of meals and lodging (Kristín Þorsteinsdóttir, personal communication, 04.04.2011; Guðjón Arngrímsson, personal communication, 08.04.2011). Customer service and satisfaction was a priority and both airlines compensated passengers that got affected. Iceland Express presumed 15-20 thousand of their passengers were affected by the flight disruption (Kristín Þorsteinsdóttir, personal communication, 04.04.2011). The unexpected low effect on tourist arrivals is presumed to be because of the fast response from airline officials and the airlines persistence to continue airline operation.

The other productive response to the long-term effect the eruption might have on arrival numbers was initiated by Icelandair (Guðjón Arngrímsson, personal communication, 08.04.2011). The airline took the initiative for the campaign "Inspired by Iceland" to helped counteract the negative image reported by the media. The campaign has been well distributed and the outcome proven successful, with arrival numbers

climbing. Hence, Icelandic airlines are believed to have recovered from Eyjafjallajökull eruption.

5.3 Concluding remarks

Disruption on airline operation from volcanic eruptions naturally influences the number of visitors to the country. However, all eruptions are different from each other and as such difficult to predict its effects. A better understanding of how airlines was able to respond to the event, tourist reaction to an eruption and how flights were affected can give awareness of how future similar disruptions might affect tourist numbers. This information is useful as loss in arrival numbers is negative for the Icelandic tourism industry and for an economy reliant on the income.

The result suggests the level of effect on airline operations during an eruption depends highly on strength of the eruption; amount of ash produced and wind direction, certainly as well as the duration of the eruption. The task to examine the relationship between disruption of airline operation and tourist's reaction towards an eruption has been difficult to assess. It is important to note the researcher went into this assignment without having any practical experience in neither airline operations nor volcanology, which probably influenced the depth of the research. The researcher believes the focus would probably be more narrowed if relevant knowledge were present. The assignment was initially believed would give more information then what came out from the research. Greater thought on the questions might have given more information. The research questions were more guided by curiosity and at times difficult to answer without giving obvious answers.

Last remark, Iceland in the past has had eruptions that distributed ash great distances, certainly across places in Europe as well. Presumably safe to say there will be other such disruptions like Eyjafjallajökull on Icelandic airlines, the question is only when.

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Appendix A. Estimated cancellations per state between 15th-22nd of April 2010

This list presents the summary of estimated cancelations per state in Europe between 15th-22nd of April 2010. The highest values over 90% are highlighted red. Iceland had in contrast an average of 45% between 15th-20th of April and 49% between 23rd-28th of April (EUROCONTROL, 2010).

Estimated Fraction Cancelled	15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	20-Apr	21-Apr	22-Apr	All
Albania	17%	43%	68%	77%	31%	14%	0%	0%	34%
Austria	15%	61%	98%	99%	76%	53%	21%	0%	52%
Belarus	0%	63%	86%	83%	61%	23%	14%	0%	42%
Belgium/Luxembourg	39%	96%	98%	98%	97%	72%	25%	0%	65%
Bosnia-Herzegovina	18%	33%	91%	97%	67%	31%	0%	0%	43%
Bulgaria	21%	61%	88%	96%	68%	38%	0%	0%	47%
Canary Islands	25%	34%	55%	45%	23%	1%	0%	0%	25%
Croatia	20%	40%	92%	95%	68%	39%	0%	0%	45%
Cyprus	9%	29%	46%	44%	28%	11%	0%	0%	21%
Czech Republic	12%	87%	98%	98%	89%	66%	28%	6%	60%
Denmark	60%	87%	99%	99%	97%	91%	40%	16%	72%
Estonia	24%	95%	97%	99%	96%	83%	46%	19%	68%
FYROM	16%	49%	86%	91%	69%	30%	6%	0%	45%
Finland	39%	90%	98%	100%	93%	96%	82%	64%	81%
France	20%	67%	87%	92%	77%	54%	16%	0%	51%
Germany	20%	84%	98%	99%	96%	81%	40%	2%	64%
Greece	11%	32%	47%	42%	12%	0%	0%	0%	19%
Hungary	15%	66%	98%	98%	79%	54%	16%	3%	53%
Ireland	54%	94%	98%	100%	100%	90%	48%	8%	74%
Italy	9%	30%	74%	77%	59%	26%	6%	0%	35%
Latvia	23%	95%	97%	98%	93%	75%	36%	7%	65%
Lisbon FIR	25%	40%	56%	46%	32%	0%	0%	0%	26%

Lithuania	8%	87%	90%	91%	81%	61%	25%	0%	55%
Malta	11%	32%	39%	28%	13%	0%	0%	0%	16%
Moldova	17%	50%	95%	92%	80%	43%	17%	14%	51%
Netherlands	53%	96%	98%	99%	98%	75%	33%	1%	68%
Norway	92%	73%	92%	77%	44%	50%	15%	34%	57%
Poland	10%	88%	97%	95%	89%	76%	31%	2%	60%
Romania	12%	52%	94%	97%	81%	42%	12%	1%	48%
Santa Maria FIR	0%	0%	0%	0%	0%	0%	0%	0%	0%
Serbia &Montenegro	18%	48%	92%	97%	68%	39%	0%	0%	47%
Slovakia	17%	77%	98%	97%	78%	48%	13%	0%	53%
Slovenia	20%	55%	97%	99%	70%	51%	9%	0%	50%
Spain	18%	39%	59%	66%	37%	16%	0%	0%	30%
Sweden	54%	84%	99%	99%	83%	80%	57%	32%	71%
Switzerland	13%	64%	98%	98%	94%	61%	23%	2%	56%
Turkey	13%	39%	51%	50%	31%	23%	0%	0%	26%
Ukraine	7%	38%	80%	81%	48%	25%	13%	4%	38%
UK	74%	95%	99%	99%	99%	93%	38%	6%	74%

Appendix B. Interview questions

Below is the list of questions used in the interview with Iceland Express and Icelandair. The questions are divided into five themes and introduced both in English and Icelandic.

Background/ *Bakgrunnur*

- What is the airlines market share in Iceland?
  Hvað er markaðshlutfall flugfélagsins á Íslandi?
- Which flight routs are most taken?
  Hvaða flugleiðir eru mest teknar?

Effect on airline operations / *Áhrif á flugrekstur*

- Have eruptions disrupted the airlines air traffic before? In Iceland or elsewhere? If that is the case what effects did it have on operations?
  Hafa eldgos áður haft áhrif á flugfélagið? Á Íslandi eða annarstaðar? Ef svo hvaða áhrif hafði það á reksturinn?
- Did the eruption cause Delays, Reschedules and Cancellations and to what extent?
  Var eldgosið að valda töfum, endurbókunum eða niðurfellingum og að hvaða marki?
- How did you compensate airline operations to make up for the effects the eruption caused?
  Hvað gerðu þið í flugrekstrinum til að vinna á móti áhrifum eldgosins?
- Can you describe the economic effect the eruption had on the airline? Did the airline give out compensations to passengers?
  Getur þú lýst hvaða efnahagsáhrif eldgosið hafði á flugfélagið? Gaf flugfélagið bætur til farþega?

- Where there any damages caused by the eruption? For instance if there were any affects of ash on aircrafts?
  Urðu einhverjar skemmdir útaf eldgosinu? Til dæmis vegan ösku á flugvélum?
  How were routes affected?
  Hvernig voru flugleiðir fyrir áhrifum?

Effect on tourist and visitational numbers */ Áhrif á ferðamenn og aðsóknartölur*

- How did tourist respond to the eruption?
  Hvernig brugðust ferðamenn við eldgosinu?
- Where there changes in bookings before, during and after the eruption?
  Voru breytingar á bókunum fyrir, á meðan og eftir eldgosið?
- What effect (on visitational numbers) did Fimmvörðuháls eruption have on the airline?
  Hvaða áhrif hafði eldgosið í Fimmvörðuhálsi á aðsóknartölur flugfélagsins?
- What effect (on visitational numbers) did Eyjafjallajökull have on the airline?
  Hvaða áhrif hafði eldgosið í Eyjafjallajökull á aðsóknartölur flugfélagsins?
- How were cancelations during the event and the months after the event?
  Hversu mikið var um afbókanir á meðan og mánuðina eftir atburðina?
- What do you think is the reason for the cancelations?
  Hvað heldur þú að ástæða fyrir afbókunum?

Regulations, precautions and guidelines / *Reglugerðir, varúðarráðstafanir og leiðbeiningar*

- How is the airline procedure when an eruption occur?
  Hvernig eru starfsreglur flugfélagsins um eldgos?
- Did the airline have an emergency plan to handle the situation of Eyjafjallajökull?
  Var flugfélagið með neyðaráætlun til að takast á við ástandið í Eyjafjallajökli?
- Did the increase in over flights affect airline operations?

Hafði aukning á yfirflugi áhrif á rekstur flugfélagsins?

- Did new regulations affect airline operations?
  Hafði nýju reglurnar áhrif á flugreksturinn?

Image and marketing / *Ímynd og markaðsetning*

- How do you think the eruption effected the image of Iceland and tourist flow?
  Hvernig telur þú að eldgosið hafi áhrif á ímynd Íslands og ferðamannastraum?
- Has the airline marketing changed because of the eruption?
  Hefur markaðssetning flugfélagsins breyst vegan eldgosins?
- What effect do you think the eruption had on (long term) operations for the airline?
  Hvaða áhrif heldur þú að eldgosið hefur haft á rekstur flugfélagsins til lengri tíma séð?

Appendix C. Icelandic quotes

This list is the original Icelandic version of the quotes taken from the interview from both Iceland Express and Icelandair. The number displayed below represents the English translation presented in the result section of the paper.

[1] "Við þurftum náttúrulega að fresta flugonum og svona, og við reyndum að koma svo á móti farþeganna og bara eins og við gátum. Þetta var bara svona. Við stjórnuðum eftir... gosið, gosið reið ferðinni. Við þurftum að haga okkur samkvæmt því og náttúrulega var öryggið alltaf sett ofan öllu, og þannig við reyndum bara að redda seinkun eftir vindi sem sagt er og reyna lágmarka tjónið eins mikið og við nátturlega gátum".

[2] "Það var meira svona túrista gos".

[3] "…ég þori ekki fara með það. En það voru að allir sem komu hingað foru bara beint þangað, að eldgosinu sko".

[4] "Fólk var ekki að koma í stórum hópum. Það var einhverjir sem komu til að horfa. En það er ekkert við getum mælt í okkar tölum".

[5] "Já, það var mjög skiljanlegt. Þetta gerðist um allan heim. Að fólk hætti við að fljúga, breytti sinum plönum og svona. Fullkomlega eðlilegt og skiljanlegt… og hérna, sérstakt gagnvart Íslandi".

[6] "Hvenær þetta byrjaði þá náttúrulega hætti bókanir alveg. Það bara stöðvaðist. Það kom ekkert in, og svo byrjaði það að streyma út. Bara svona mínus bókanir, bara hætti við. Þannig að verkefnið var í rauninni mjög hratt að stöðva útflæði og þá fór mikið effort að tala með ferðaskrifstofur og slíkt út í heimi".
[7] "Ég held það sé miklu meira að þú nennir ekki fara inn í einhvað ástand sem er ótryggt og veit ekki hvað verður úr. Þú vill frekar fara einhvern tímann seinna".

[8] "[Við] vorum í öskju up að háls í Reykjavik. En við hérna í Rekjavik urðu aldreg vör við þetta".

[9] "Þetta tókst bara mjög vel, þetta var mjög gott…endaði bara rosalega mikið ferðamanna attraction sko,… eins og fólk komi hingað sem vill sjá norðurljósin, þau vildu sjá eldgosið".

[10] "Ísland sást allstaðar. Þetta er bara stærsta publicity sem Ísland hefur fengið. Þannig að segja það er einhvað potential í því… að nota það eitthvað. Þannig að núna er útlitið nokkuð vel gott. Við erum að sjá töluvert mikla fjölgun á ferðamanna til Íslands".

[11] "…er svona stor náttúru viðburður [sem] styrkir bara þá ímynd. Að Ísland er svona náttúru, svona spennandi".

[12] "Ég held að það er búin að hafa góð áhrif á starfsandan. Þetta var svona action, þetta var mikið álag fyrir alla… allir þurfti að leggja á sig og hjálpast að, og það gekk mjög vel og við komum út úr þessu bara sterkari. Þannig að ég held að það hafi skilað. Að uppistaðar hefur það bara verið jákvætt".

[13] "En svo gat sko bara opnast í tuttugu mínútur eða einhvað. Þá var bara út í vel og upp sko".

[14] "Þetta var gert bráðabera, okkar fólk var þarna úti [í Glasgow]. Sumir foru bara út með stuttum fyrirvara og var í 14 daga. Það var auðvitað chaos. Margir þurftu að biða lengi…[þetta] var mjög óljóst allt"
[15] "Til skamms tíma snerist þetta allt um hætta ekki sem hefði kannski verið einfaldasti leiðin. Niðurstaðan var sú að halda áfram þó við þurftum að færa okkur til Glascow með allri fyrirhöfn sem er á því, þá er það skarri kostur heldur en að loka".

[16] "Það er mjög strangar öryggis reglur hérna og þau voru í rauninni bara yfirfærð á þetta".

[17] "Þá mundi það ekki hafa nærri sér mikið áhrif. Bæði er maður búinn að fara í gegnum rannsóknir og svo er svona önnur svona betri syn á þetta".

[18] "það hafði töluvert mikil áhrif á okkur. Vegna þess það gaf okkur miklu meiri möguleika en hvað við höfðum átt annars. Það er ekki spurning".

[19] "Ég man frá einum degi þar sem það var sól og blíða. Þá var samkvæmt kortinu frá VAAC var Reykjavikur flugvöllur opin og Keflavik flugvöllurinn lokaður. Þannig að linan lá rétt á milli og annan dag lá linan alveg akúrat yfir keflavikflugvöll".

[20] "Hvenær eldgosið skall á, og þetta lokaðist. Þá gátum við nýtt okkur frá þessari vinnu. Þótt þetta er allt öðruvísi eins og slys til dæmis. Þá samt sem áður er hugmyndafræðin og aðferðafræðin sem maður nytir [það sama]. Við vissum alveg hvernig processinn átt að vera".

[21] "Það kom strax skipulag á vinnuna og á því leti til höfum við nýtt þessa hugmyndafræði en það er eins og allir segja hver krísa hefur auðvitað sina áferð. Það er ekkert eins. Þannig það er ekki hægt að búa til plan fyrir þetta allt saman".

[22] "Ef þau voru strandaðar þá borguðum við fyrir hótel og mat, og reyndi bara koma á móts eins og við gátum".

[23] "alla vegna meira [viðbúin] en áður. Við mundum vita hvað við mundum fara út í".

[24] “Maður getur ekki alveg svarað svona, þú veist. Hversu lengur, viku í viðbót hafði örugglega ekki breytt það miklu en kanski ef það væri tíu vikur þá … Það er erfitt að svara svona”.

[25] “Já svona gos, treystum við okkur alveg í það, en ekki aftur og aftur”.

[26] “fólk varð bara hrætt við Ísland… sáum að það voru myndir að berast um allt að fólk var með grímur og það var ryk og drulla um allt, og við forum að hugsa við þurfum einhvern vegin að koma því á framfæri að Ísland er ekki hættulegt og allt í lag þó það er að gjósa hérna” “Koma skilaboðin út að það sé í lagi að ferðast til Íslands…”.

[27] “Ég held bara að upp er staðið að þetta hafi bara orðið til goðs og það segist einhver staðar að það sem ekki drepur þig, það gerir þér bara betri”.

[28] “Það eru fleiri sem vita aðeins meira um Ísland nuna heldur en áður. Ekki endilega að það er betra álit eða verra álit um Ísland, heldur vitund um Ísland hefur aukist”.

[29] “í öllum ógögngum er tækifæri og það er klárlega í þessu… að þótt það hafði verið áfall og þá hefur þetta búið til ákveðin tækifæri”.

[30] “Okkar afstaða var sú að við mundum safna þessu aðeins saman átta okkur á hvað þetta væri og hverjir óskir væri og svona. Svo var bara farið í það að vinna og borga það út. Það var minna heldur en sko hefði átt búast við”.

[31] ” Þetta byggðist allt á einstaklingum og þeirra sýn og lausn og…”.