INTERNATIONAL VOLCANIC ASH TASK FORCE (IVATF)

FIRST MEETING

Montréal, 27 to 30 July 2010

Agenda Item 3: Results of the EUR/NAT VATF Meeting (Plenary)
3.1: Evaluation of the Eyjafjallajökull eruption and lesson learned

SUMMARY OF ICELAND´S OBSERVATIONAL NETWORK USED TO MONITOR THE EYJAFJALLAJÖKULL VOLCANIC ASH PLUME AT THE SOURCE

(Presented by Iceland)

SUMMARY

This paper summarises the observational technologies used by IMO (Icelandic Met Office) as a State Volcano Observatory to monitor the volcanic ash plume from Eyjafjallajökull at the source in April and May 2010. It also describes the reporting mechanisms to the London VAAC.

1. INTRODUCTION

1.1. During the explosive eruption of the Eyjafjallajökull volcano in Iceland in April and May 2010, IMO made every effort to monitor the ash production rate and the plume height at the source and produce reports to the London VAAC every 3 hours as an input to their ash dispersion models.

1.2. All possible observing capabilities were used to monitor the eruption and estimate the production rate of the volcano. This can be hard to do as bad weather can hamper visual observation and clouds can make it difficult to see the ash plume with current observational methods.

1.3. This paper summarises the observing capability that was utilised in Iceland and shows what kind of reporting was done to the London VAAC.

2. DISCUSSION

2.1 The following paragraphs provide a short summary of the diverse range of observational technologies used during the volcanic eruption to monitor the plume height at the source and estimate the production rate of the volcano.

2.2 **Weather radar**

2.2.1 The main observation method to monitor the plume height was a C-band weather-radar stationed at Keflavik airport approximately 160 km away from the eruption site. This made it difficult to monitor the plume height below 3 km because of the curvature of the earth and the surrounding landscape. Also, at this distance the resolution of the radar was around 1 km. The radar did not work well in cloudy condition as the ash plume is less reflective than water vapour and disappears in the clouds. Dry ash was also difficult to monitor due to low reflectivity and the long distance from the site. Due to this, some gaps where in the observations that could sometimes be filled with other observations.

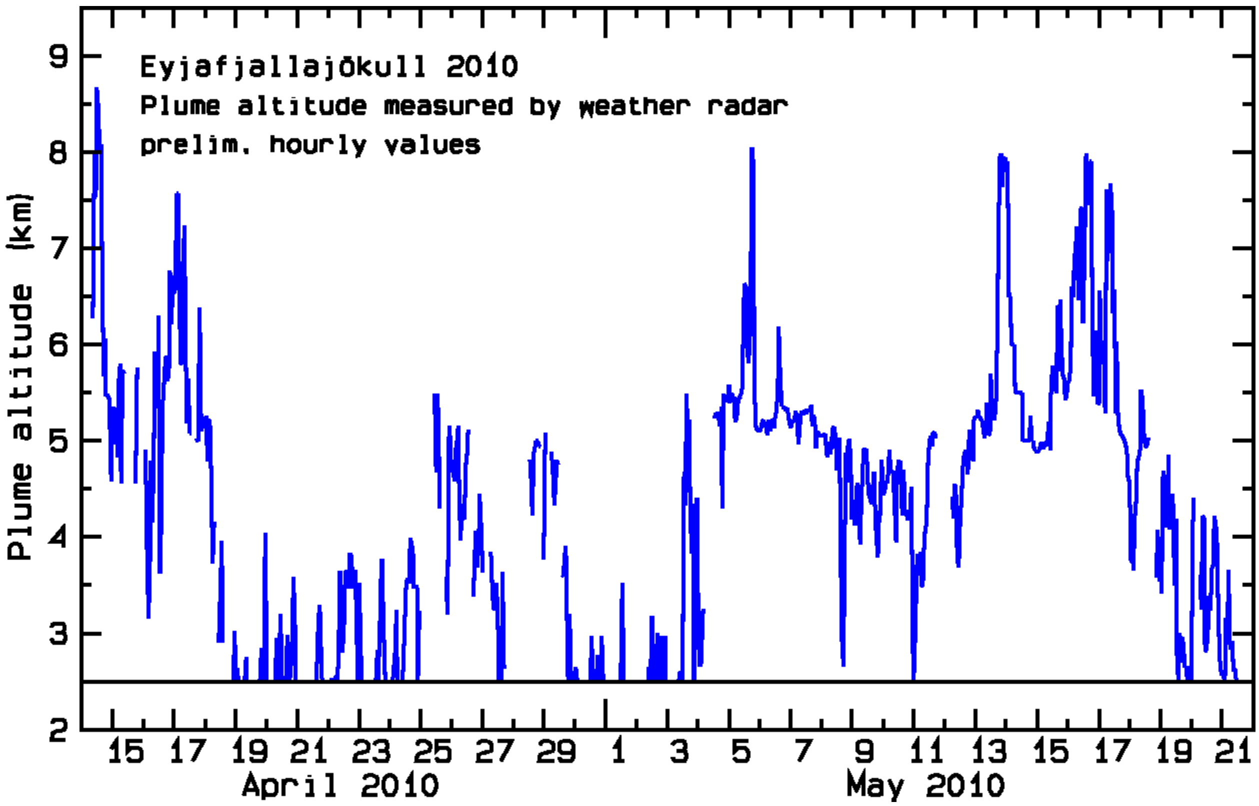

Figure . Plume height measurements with radar. Note the gaps in the series due to heavy cloud cover.

Two methods where mainly used to do the monitoring, MAX(Z) and EHT(Z), i.e. maximum reflectivity and echo top height.

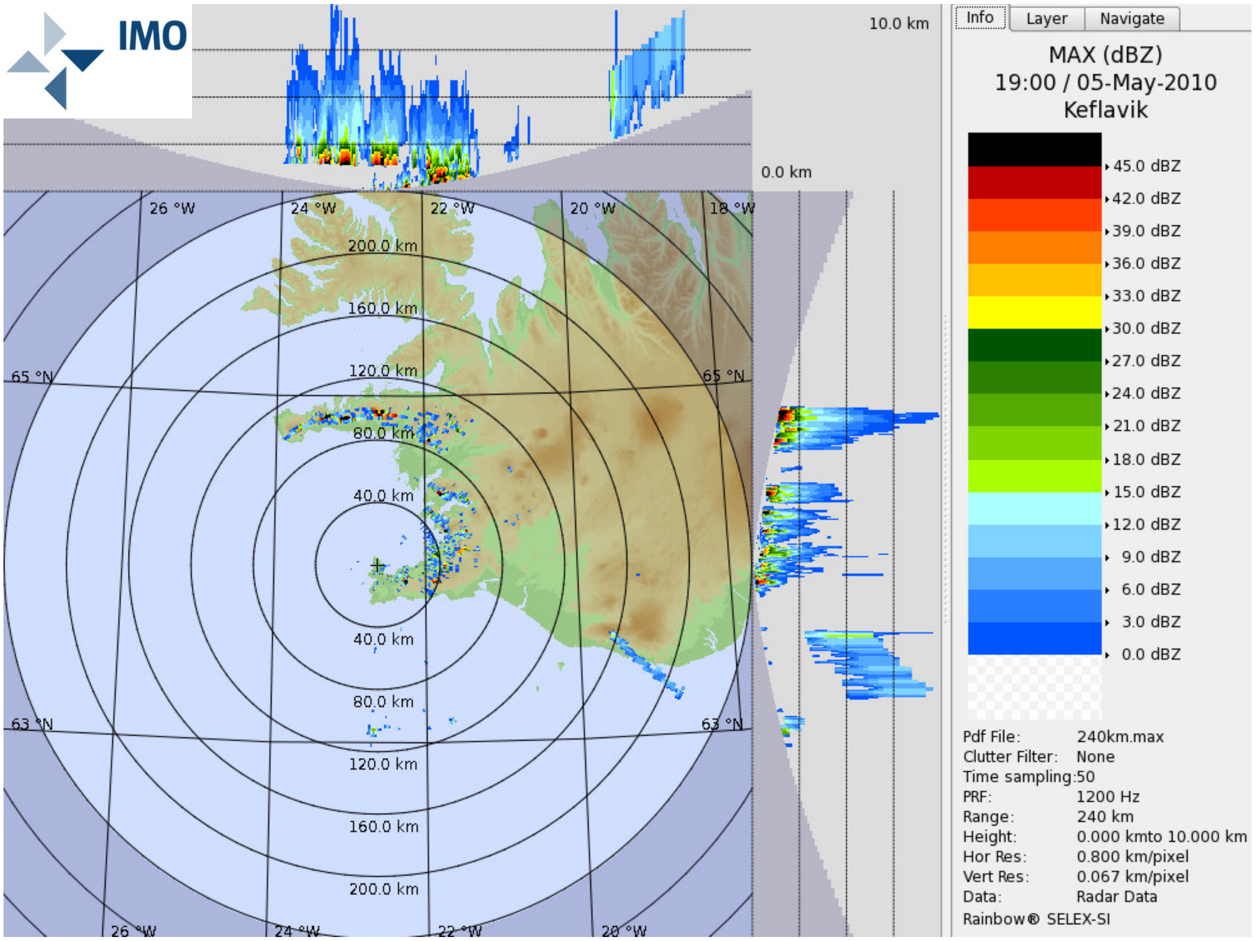

Figure 1. Volcanic ash plume at Eyjafjallajökull, May 5th at 19:00 UTC. Height of the plume is approximately 8-10 km height.

The radar worked well during the eruption to monitor the height, but proved to be of little value to monitor other production change parameters such as ash vs water content of the plume.

2.3 PIREP reports

2.3.1 Regular flights were to the eruption site by the Icelandic Coast Guard with scientists to analyse the status of the eruption and the ash plume. Also whenever possible, airplanes flying past the plume where asked to estimate the plume height and colour.

2.4 Web cameras

2.4.1 IMO got the assistance of the local telecom companies to put up web cams to look monitor the eruption. These cameras prove to be very helpful in monitoring changes in the ash content of the plume and also gave a good visual feeling of the intensity of the eruption at any given time.

2.4.2 At the end of the eruption, an infrared camera was put up with the other cameras and that proved to be helpful as well.

2.5 **Lightning detection**

2.5.1 Lightning detection around the volcano proved to be a good estimate of high production rates of ash in the plume. Electrostatic activity increases with increased ash production. This was used as one parameter to estimate the production rate.

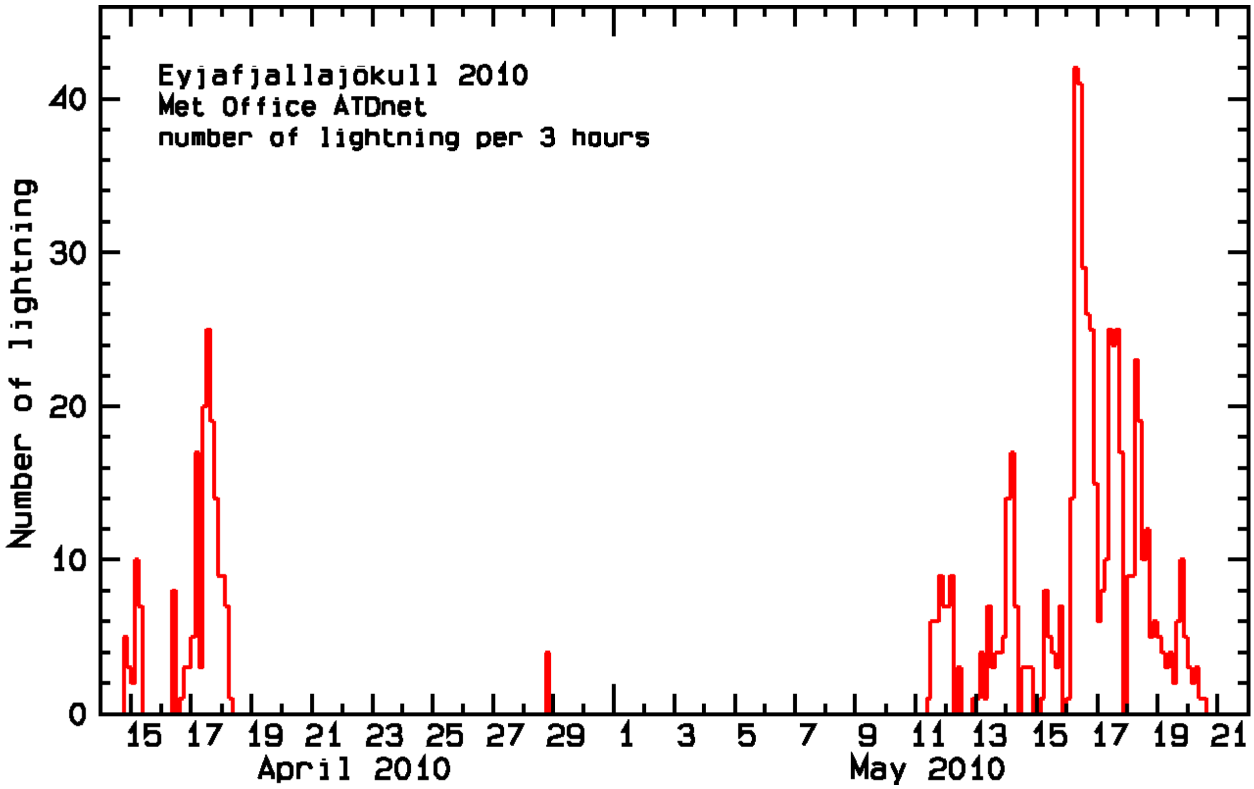

Figure 3. Lightning detection at the eruption site.

2.6 **Geodetic measurements**

2.6.1 Regularly, surveyors close the eruption site were asked to do direct measurements of the ash plume height by using theodolites. This gave accurate measurements of the plume height. This data was then used to calibrate the estimates from the radar measurements to see if the radar was seeing the top. At times, it was clear that the top was missed by 0,5-1 km, probably due to dry ash in the cloud at the top.

2.6.2 **Estimates by scientists**

2.6.3 Finally, it were the scientists on duty that collected all available information, analyzed the trends and gave the final estimates of the eruption status and what trends where being seen in the eruption.

3. REPORTING TO LONDON VAAC

Reporting was done to the London VAAC every 3 hours during an eruption, and more frequently if needed. The reporting process is governed by the quality control system at IMO. The report is done through a standard form, see figure

Veðurstofa Íslands

EBE-010-1

Volcanic ash status report

Date and time of report:

Reported by:

Please contact the Icelandic Met Office to discuss any of the content on +354 522 6313 (direct number) / +354 522 6300

Current height and the height of the eruption for the last 3 hours (extremes and estimated averages)
PIREPs: *(Insert any pilot report information here including approximate time report was made)* **Plume height according to radar:** *(For example: ~ 6-7 km, occasionally pulsating to 9 km OR 6-7 km changing to 7-8 km at 0800 GMT)* **Webcam:** (*Insert height estimate, plume characteristics. For example: Plume dark grey, height 6-7 km)* **Atmospheric details:** (*For example: Winds around the volcano slightly increasing, resulting in lower plume height. Plume drifting E. Increasing W-ly winds aloft in the afternoon. Lightning strikes constantly detected in plume)* **IMO scientists estimate height of plume to be:** *(Insert best estimate, ideally a single height. For example: 6.5 km. Use a range to reflect uncertainty. Please state if you believe the height has changed during the three hours since the previous report and add an approximate time for the change if known. For example: „Current estimated height is now 8 km. The change occurred at approximately 1730 GMT")*

Nature of reports; e.g. by radar, by aircraft or by eye
No PIREP **Radar** **Satellite imagery** **Lightning detection system (ATDnet, UK Metoffice)** **Webcams**

Any obstructions to the observations (clouds, etc.)
BKN/OVC clouds at the volcano

Figure 4.

The report was often followed up with a telephone call to the London VAAC to assist in making the best input into the dispersion model.

3.1 Summary

3.1.1 IMO, with London VAAC is still going over the event and lessons learned.. It is clear from this event that ash is dispersed in layers and the dispersion is dependent on the local weather conditions. This requires better monitoring of the ash plume closer to the eruption with better resolution.

Figure 5. Ash dispersion layers.

A source plume model is probably needed to model the local weather conditions and how the source ash plume interacts with it, thus making a better input into the global dispersion model.

4. ACTION BY THE IVATF

4.1 The IVATF is invited to note the contents of this paper.

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