



Outcomes from the Volcanic Ash Forecasting workshop - 22nd February 2016

by Kelsey Mulder and Natalie Harvey, University of Reading and Vera Hazelwood, PURE Network

Volcanic ash workshop: forecasting challenges

22nd February 2016, 9.30am-5pm

Royal Academy of Engineering, Prince Philip House, 3 Carlton House Terrace, London SW1Y 5DG

The workshop was be one of the series of events aimed at disseminating the outcomes of the **NERC's** Probability, Uncertainty and Risk in the Environment (PURE) Research Programme, www.pure-network.org.

NERC and the PURE network are grateful for the support of the Maths Foresees Network who has generously sponsored this workshop: <http://www1.maths.leeds.ac.uk/mathsforesees/index.html>

The workshop brought together PURE academics researching issues related to volcanic ash forecasting, especially forecast uncertainty, and users of the forecast from MoD, Met Office, VAC, CAA, the aviation industry and other organisations.

On 22 February 2016, over 30 delegates involved in the aerospace, forecasting, and research communities met in London to discuss the challenges to aviation posed by volcanic ash as well as advances in forecasting and observing the location of volcanic ash following an eruption.

Volcanic ash is a significant hazard to aircraft by reducing visibility and causing both temporary engine failure and permanent engine damage. The presence of ash can disrupt air traffic and as a result can incur large financial losses for the aviation industry. During the eruption of Icelandic volcano Eyjafjallajökull in April 2010, European airspace was disrupted for 13 days and over 95,000 flights were grounded. It is estimated that this disruption cost the airline industry up to **€3.3 billion**. Following this event the UK Civil Aviation Authority brought in new guidelines that not only require predictions of ash location but also ash concentration. This adds another layer of complexity to an issue that is already multifaceted due to the extremely busy airspace and the rarity of the an eruption that might cause disruption in the European region

A unique aspect of this workshop was a survey on different visualisations of volcanic ash information, which workshop participants filled in at the start of the day. The aim of this survey was to see how respondents made flight decisions given conflicting forecast information and see if their decisions changed if the information was presented in different formats (for example, see

Figure 1). Preliminary results from this survey were presented at the end of the day and formed the basis of the concluding open discussion session.

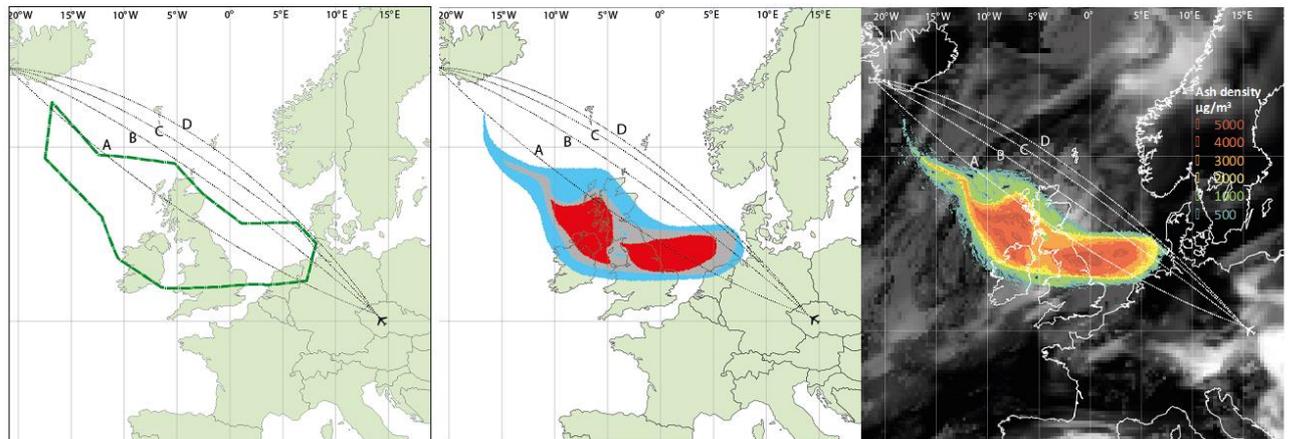


Figure 1: Example of forecasts shown in different ways with the same flight paths overlaid, labelled as A, B, C, and D. Respondents were asked if they would approve the flight paths.

The rest of the morning was devoted to presentations about developments in academic research about volcanic ash. Highlights included producing ensemble volcanic ash forecasts, which could result in probabilistic ash forecasts and advances in retrieving ash location and concentration from instruments onboard satellites. In the early afternoon, industry stakeholders gave short presentations on their involvement and requirements from volcanic ash forecast products. The **day's events concluded with an open discussion session.**

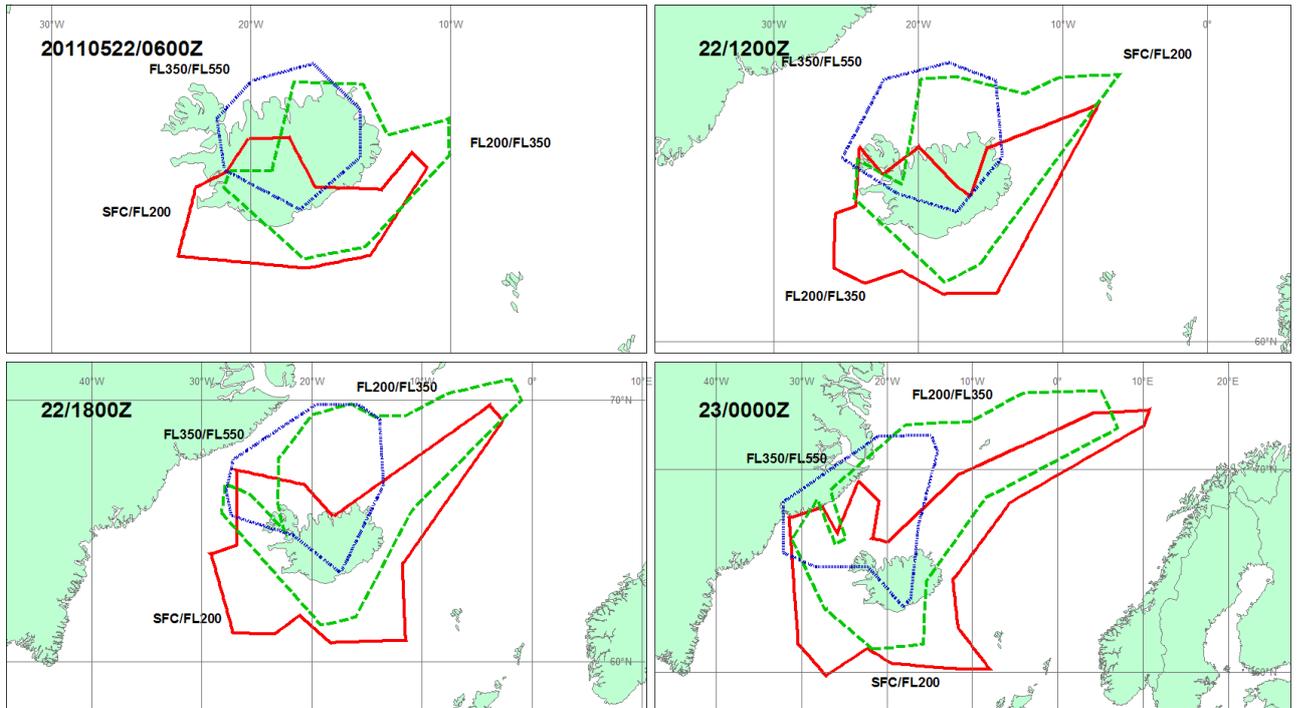
Throughout the day, there were three recurring themes. Firstly the problem of trying to prepare for high-impact, low-probability events was highlighted. The airline industry needs a pre-determined action plan in place long before an eruption occurs. Therefore, new products developed need to be presented to the airlines in advance to change procedures. Because these events are rare in Europe, there are not many case studies on which to base the development of the action plan. The UK Met Office is addressing this issue by using eruptions in South East Asia, which are much more frequent.

Secondly, there seemed to be a mismatch in the definition of "uncertainty" between the research and operational communities. Researchers were keen to share probabilities and limitations associated with the models, but practitioners were reluctant, preferring the "best guess" forecast. However, when asked if, in practice, the operational staff used multiple sources of information, some replied they did verify official forecasts with other, perhaps commercial, volcanic ash forecasts. This comparison of forecasts is a method of verification and determination of uncertainty. Going forward, it was unclear whether uncertainty information may be of use to operations in the future, but there was a call for ash to be treated in the same manner as other weather hazards, such as thunderstorms.

Finally, there is still uncertainty in how much volcanic ash is safe to fly through. It is thought that the dose of ash (i.e. concentration multiplied by time) rather than concentration is more

important. However, predictions of ash concentration are still very uncertain and it is not always possible for pilots to know that they have flown through ash.

The Volcanic Ash Workshop helped continue the collaboration between forecasters, researchers, and operations dealing with volcanic ash and its impacts on the aviation industry. Our goal is to keep the conversation going between these sectors to adapt and improve as we learn from further research and experience.



VA ADVISORY
 DTG: 20110522/0600Z
 VAAC: LONDON
 VOLCANO: GRIMSVOTN 1703-01
 PSN: N6425 W01720
 AREA: ICELAND

SUMMIT ELEV: 1725M
 ADVISORY NR: 2011/004
 INFO SOURCE: ICELANDIC MET OFFICE
 AVIATION COLOUR CODE: UNKNOWN
 ERUPTION DETAILS: GRIMSVOTN ERUPTED AROUND 20110521/1900Z. AT 20110522/0200Z, PLUME HEIGHT ESTIMATED BY RADAR 15-17KM.

RMK: PLUME CLEARLY VISIBLE ON IR AND ASH IMAGERY. WEB CAM SHOWED ASH VISIBLE EARLIER AND HEAVY ASHFALL REPORTED NEAR VOLCANO. AT 21/2300Z, PILOT REPORTED EASTERN EDGE OF ASH NEAR 12W. EXTREME LIGHTNING ACTIVITY DETECTED BY ATDNET SYSTEM OF UK METOFFICE, 7000 BETWEEN 1900Z AND 0100Z.
 NXT ADVISORY: 20110522/1200Z

Official volcanic ash forecasts are issued by volcanic ash advisory centres (VAACs) and consist of polygons on a map indicating the extent of volcanic ash for different levels in the atmosphere. Additional products may also be issued to give further information on ash concentrations. Satellite derived products indicating ash location and ash column loading are also available.