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# Workshop on: “Uncertainty estimation and expert judgment for the definition of ash- affected air-space sectors”

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▶ S. Barsotti

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# This workshop

- **COST ACTION IS1304**
  - Expert Judgment Network: Bridging the Gap Between Scientific Uncertainty and Evidence-Based Decision Making
- **It has been planned at the end of the CA meeting in Rome in October 2014 „Science, uncertainty and decision making in the mitigation of natural risks “**
- **The organizing committee includes A. Neri, E. Scourse, W. Aspinall and S. Barsotti**
- **Several colleagues at IMO has helped and supported during these months**
- **Icelandair is supporting the workshop**

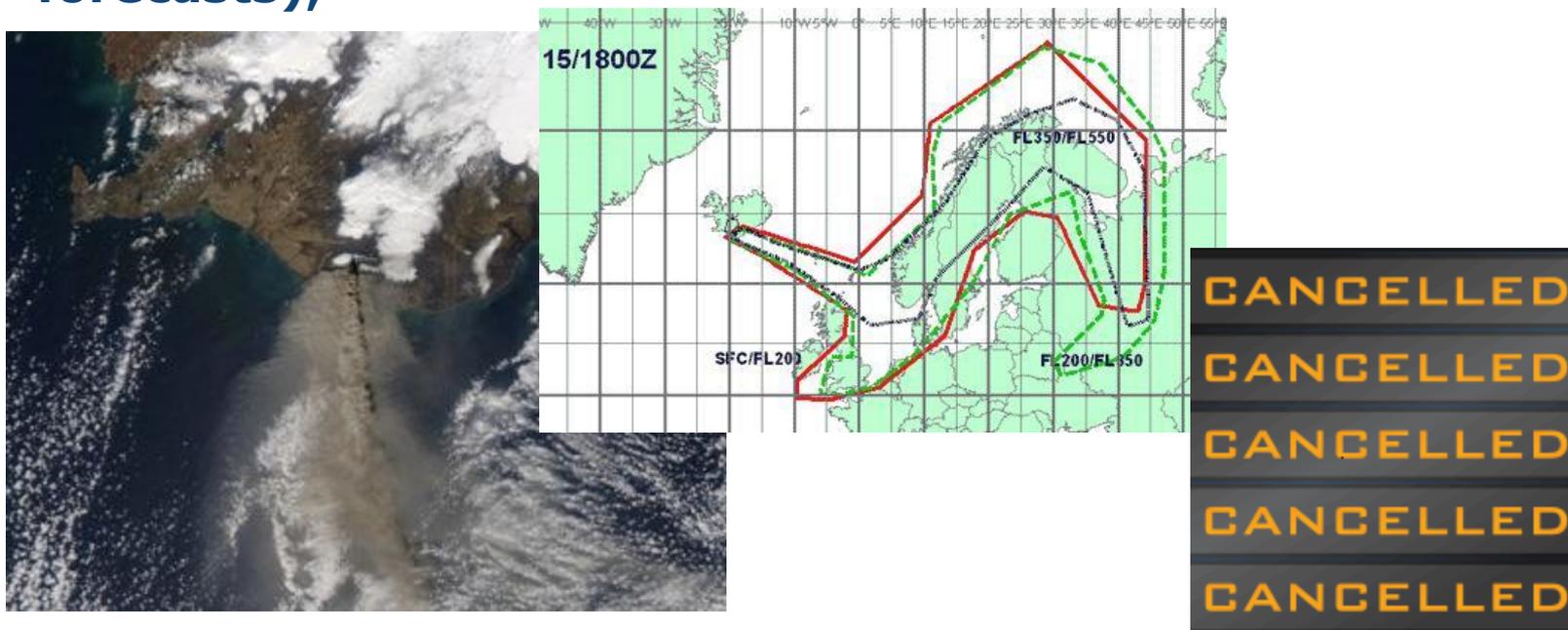
# Why??

- **First of all, to create and allow an exchange of knowledge, views, opinions, know-how, ... between different communities (in particular research vs. operative institutions)**



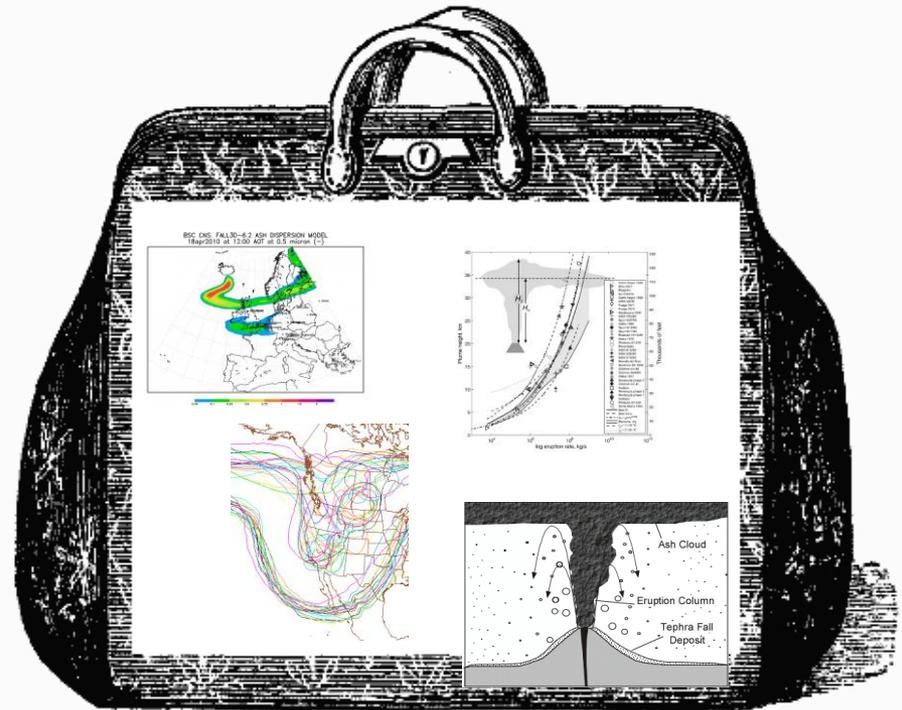
# Why??

- To identify which “uncertain” parameters/quantities/data/models outcomes could or should be evaluated through expert judgment (e.g. eruptive source parameters, numerical model errors, weather forecasts);



# Why??

- To suggest a way for communicating uncertainty in the final product that will be delivered to the aviation in order to make it more informative,...but keeping it simple



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# Let's summarize the workshop in three main questions:

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- 1. How to make the SIGMET more informative?**
- 2. What uncertainty can be or must be contained within the area reported in the SIGMET?**
- 3. Is the expert judgement a feasible approach to manage this uncertainty? If so, in which way it could be useful and applied?**

**Can we answer or make some suggestions??**

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# The agenda: Day 1

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**09:00-09:30** Welcome to the participants and introduction to the meeting (Sigrun Karlsdóttir and Sara Barsotti, IMO)

**Chairman: Simon French**

**09:30-09:50** Procedures currently in use for communicating to aviation in case of an explosive eruption: the SIGMET and its significance (Elín Björk Jónasdóttir, IMO)

**09:50-10:10** The VAACs: how they evaluate uncertainty in their models; example from London (Matthew Hort, UK METOffice)

**10:10-10:30** The VAACs: how they evaluate uncertainty in their models; example from Toulouse (Mathieu Deslandes, Toulouse VAAC)

**10:30-11:00 Coffee break**

**11:00-11:20** The stakeholders (air service providers): how they use information received, and what are their specific needs (Steinunn A. *Arnardóttir*, ISAVIA)

**11:20-11:40** The stakeholders (airlines): how do they use the information received and how they draw a Safety Risk Assessment (SRA) (Icelandair)

**11:40-12:10** Uncertainties in eruptive scenario definition and eruption source parameters estimation (Magnus Tumi Guðmundsson, Univ. Iceland)

**12:10-12:20** Recommendations from VASAG: visible and discernible ash concept and its use for aviation safety (Larry Mastin, USGS)

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# The exercise: Day 1

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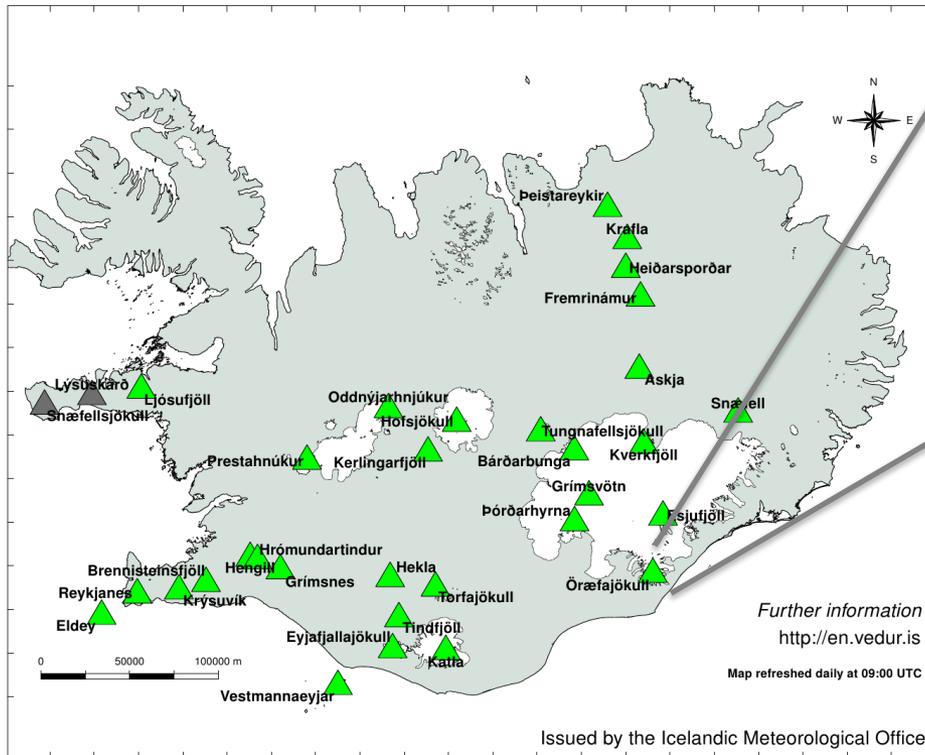
## The VOLCICE exercise:

- **Each month involving IMO, ISAVIA and L-VAAC**
- **To refresh on a regular basis our contingency plans**
- **Two categories: CAT1 and CAT2**
- **Forecaster and seismologist on duty are playing regularly, hydrologists/radar Team/etc...on demand**
- **IMO provides the eruptive scenario and starts the exercise**

# The exercise: Öræfajökull

## Aviation Colour Codes for Icelandic Volcanic Systems

Map refreshed: 09:00 UTC, 21 September 2015. Previous code change: 08:54 UTC, 14 July 2015



Aviation colour codes used by the Icelandic Meteorological Office



- Ice-capped central volcano
- The highest mountain in Iceland
- It erupted twice in historical time
- It produced the largest rhyolite eruption occurred in Iceland in historical time

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# The agenda: Day 2

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**Chairman: Augusto Neri**

**09:00-09:30** Recap of the summary and outcomes from the exercise (Melissa A. Pfeffer, IMO)

**09:30-09:50** Uncertainty during volcanic crises (Sarah Ogburn, USGS)

**09:50-10:10** Efficient Forecasting of Volcanic Ash Clouds (Roger Denlinger, USGS)

**10:10-10:30** Expert judgment: for which sources of uncertainty can we use it (model results, input parameters)??  
Who are the experts?? (Ellie Scourse, Univ. Bristol – Skype connection, hopefully!!)

**10:30-11:00 Coffee break**

**11:00-11:20** How to visualize and represent spatially the uncertainty in the volcanic ash dispersal (Simon French, Univ. Warwick)

**11:20-12:00** Discussion

**12:00-13:00 Lunch**

**13:00-14:00** Discussion

**14:00-14:30 Coffee break**

**14:30-16:30** Finalize the answers to the questions. Conclusion and recommendations.

**17:00** Closure of the meeting

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# The participants

1. **Sarah** Ogburn (USGS, USA)
2. **Roger** Denlinger (USGS, USA)
3. **Larry** Mastin (USGS, USA)
4. **Matthew** Hort (Uk Metoffice, UK)
5. **Ian** Lisk (Uk MetOffice, UK)
6. **Mathieu** Deslandes (Toulouse VAAC, FR)
7. **Simon** French (Dept. of Statistics - University of Warwick, UK)
8. **Sara** Barsotti (IMO, IS)
9. **Augusto** Neri (INGV, IT)
10. **Jean-Christophe** Komorowski (IPGP, FR)
11. **Magnús Tumi** Guðmundsson (Dep. of Earth Sciences, University of Iceland, IS)
12. **Matthías** Sveinbjörnsson (Icelandair, IS)
13. **Steinunn Arna** Arnardóttir (ISAVIA, IS)
14. **Samantha** Engwell (BGS, UK)
15. **Elín Björk** Jónasdóttir (IMO, IS)
16. **Björn Sævar** Einarsson (IMO, IS)
17. **Melissa Anne** Pfeffer (IMO, IS)
18. **Sigrun** Karlsdóttir (IMO, IS)
19. **Theodór** Freyr Hervarsson (IMO, IS)

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# Few practical things

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- **We are now in B9 (old building)**
  - **The canteen is in B7, where we will have the lunches**
  - **This evening the dinner will be at Matur og drykkur (7-7.30 pm)**
  - **Please remind to sign the list of participants, it is very important for the workshop budget and your reimbursement**



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# VOLCICE exercise – CAT1

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- **Discuss about the “expected scenario”**
  - **Discuss about the uncertainty in the process itself and in our capability to describe it**
  - **Follow the products exchange between the major players (timing, product format, how the products are created)**
  - **Analyze the products and consider if, how and when to introduce uncertainties**
  - **Try to define a “new” final products representing some of these uncertainties**

<i>Time (UTC)</i>	<i>Data/products available</i>	<i>Group actions required</i>	<i>Triggered actions (in the exercise only)</i>	<i>Critical issues</i>	<i>Note</i>
<b>13:00</b>	A draft of Event Tree for Öräfajökull	To define the eruption „size“		<i>CRITICAL ISSUES to address: how to define a scenario when we have few historical data?</i>	
				<i>Uncertainty in the size of the „imminent“ eruption</i>	<b>The text will be read to L-VAAC and ISAVIA</b>
<b>14:00</b> <b>VOLCICE exercise will start</b>			Call #1 to London VAAC and Isavia		
			Forecaster at IMO will issue the Sigmet #1		
<b>14:10</b>	Radar data	To interpret the data and estimate the column height		<i>CRITICAL ISSUES to address: how to evaluate plume height estimation uncertainty?</i>	
	Sigmet #1			<i>Uncertainty in the observable (uncertainty in the measure, uncertainty in which parameter to communicate to the VAAC..)</i>	
<b>14:30</b>			Call #2 to London VAAC and Isavia		<b>The text will be read to L-VAAC and ISAVIA</b>
			Forecaster at IMO will issue the Sigmet #2 based on numerical modelling available		
<b>14.30</b>	Sigmet #2 Numerical modelling	To discuss how to estimate/introduce/visualize uncertainty in the forecast products to aviation		<i>CRITICAL ISSUES to address: how to interpret the model results? How they should be fit into the sigmets?</i>	
				<i>Uncertainty in the forecasts</i>	
<b>15.00</b>	L-VAAC graphical charts				
<b>15.15</b>			Forecaster at IMO will issue the Sigmet #3 based on numerical modelling available and L-VAAC products		

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# VOLCICE exercise – CAT1

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## MSG#1

EXERCISE VOLCICE

**Volcano:** Öräfajökull – ICAO number 374010

**Status:** Increasing seismic activity in south Vatnajökull has been recorded in the last week. In the last hours seismicity has become shallower with increased magnitude and signs of seismic tremor have been detected. Eruption at Öräfajökull is imminent or already in progress. Ash plume could reach up to XX km.

EXERCISE EXERCISE EXERCISE

## MSG#2

EXERCISE VOLCICE

An ash plume, rising up to XX km, is seen over Öräfajökull from the ground-based radar in the eastern part the country. Seismic tremor continues to increase in central Vatnajökull, and Öräfajökull continues to erupt.

EXERCISE EXERCISE EXERCISE

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## ÖRÆFAJÖKULL

### Eruption history and pattern

#### 4.1 Central volcano

Öræfajökull is a typical stratovolcano, erupting repeatedly through the same vent. Presently it has cumulated some 370 km<sup>3</sup> of magma above ground. There are no major solfatara areas on surface, which is common for stratovolcanos of this type

#### 4.2 Fissure swarm

Does not exist.

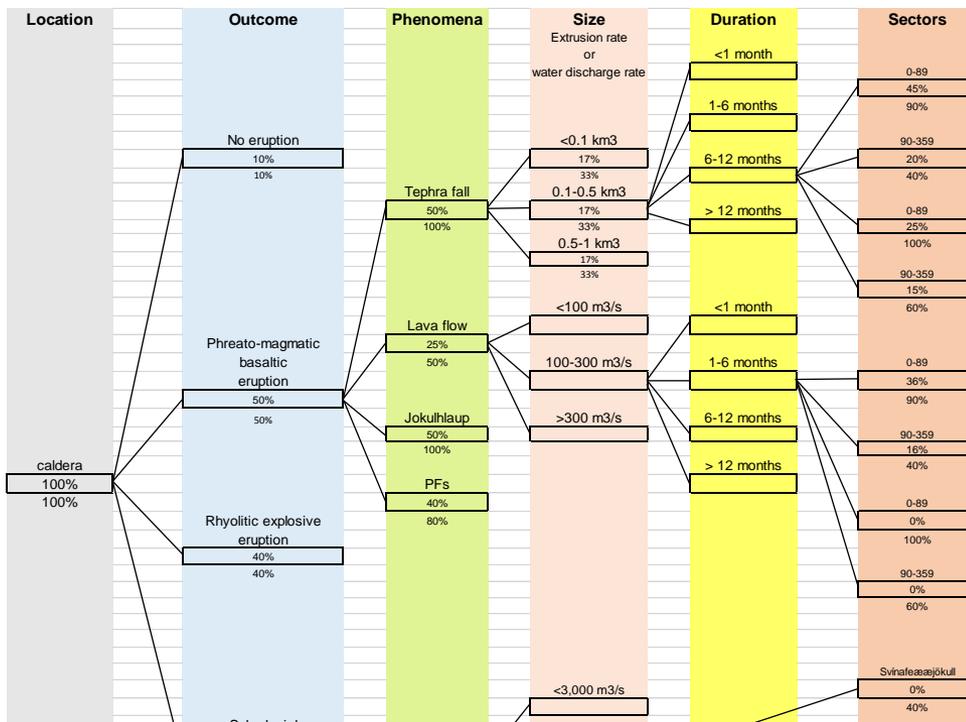
#### 4.3 Frequency and duration of eruptions

Eruptions at Öræfajökull are not frequent, with only two eruptions during historical time in Iceland (~1100 years) in 1727 and 1362. Tephrastratigraphy studies in the area reveal 13 explosive eruptions that can be connected to Öræfajökull, and further 4 basaltic effusive eruptions have occurred during the Holocene. All eruptions are small in comparison to the eruption in 1362 A.D. From these data, the interval between eruptions can be estimated as some 500-600 years.

# VOLCICE exercise – CAT1

Now let's suppose that we are really seeing an increase in seismicity in Vatnajökull and we are really worried that an eruption at Öraefajökull is on its way...

What should we expect??



Give a look to a preliminary version of an Event Tree