Appendix 1

Appendix 1, includes the expert judgment that was sent to the experts.

Expert judgement - Reykjanes peninsula

This *expert judgement* is sent to 15 experts on Icelandic volcanism. The aim is to combine the results and use them to calculate the spatial probability of a new volcanic eruption occurring within the Reykjanes peninsula. The end result will be a hazard map of the area.

You, as an expert, will be asked to assign weight (relative importance) to each dataset. This judgement AHP uses a decision making matrix of 7 x 7 factors to judge the relative importance of one factor over the other in the paired or binary combinations. The relative e importance of each data set is measured using the SAATY scale. The results from all the expert judgements will be used to obtain the final weights of each dataset. The importance shall be assigned of your personal opinion regarding which of the different structural parameters is more or most suitable to indicate the position of a new eruption in the area.

Please use your expert opinion only and entirely without the use of references or any other outside sources. Your answers will remain anonymous.

Any questions or suggestions are welcome.

THANK YOU FOR YOUR PARTICIPATION

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Instructions

When making a volcanic hazard map, the first step is to define the potential hazard footprint. The relative importance of different volcano-structural datasets will be used to generate a susceptibility map of the Reykjanes peninsula. In order to get the best results, the combined *expert judgement* of 15 scientists will be used to weight the different datasets.

Datasets

The datasets used in this study are compiled from multiple sources. The original datasets of different locations of vents and fissures were compared to aerial photos from Samsýn and the geological map of Reykjanes peninsula from ÍSOR. The ages indicated in *figure 1* are obtained from the surrounding lava flows from the ÍSOR datasets.

Datasets 1 to 4 are volcanic fissures/vents of different ages. Close-up images of the volcanic features are shown in the Appendix. Datasets 5 and 6 are both tectonic features, and have been extracted from a much larger dataset containing all the fractures in the area (not included here). Dataset 5 shows only the fractures which are located within the regions with the highest density of fractures, while dataset 6 contains those fractures that are located within the youngest lava flows in the area.

Dataset 7 are points with geothermal activity. The geothermal activity encompasses fumaroles, warm springs and mud pools.

Figure 0-1/2: Copy of the expert judgement that was sent to the experts, pages 1–2.

DATA – ALL REYKJANES

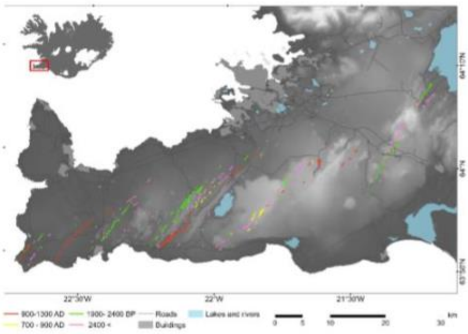

Figure 1: Reykjanes volcanic features

DATASET 1: Volcanic features, vents and fissures from 900–1300 AD

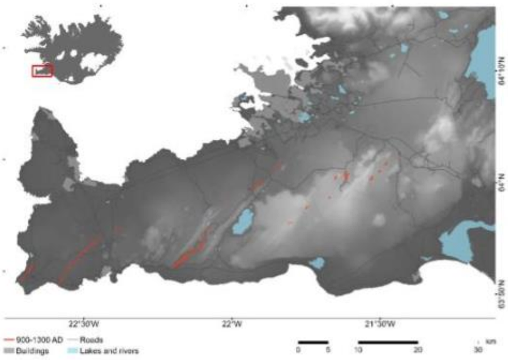

Figure 2: Volcanic features from around 900–1300 AD.

DATASET 2: Volcanic features, vents and fissures from 700–900 AD

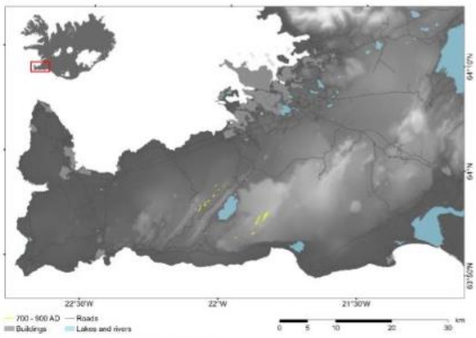

Figure 3: Volcanic features from around 700–900 AD.

DATASET 3: Volcanic features, vents and fissures dated 1900–2400 years BF

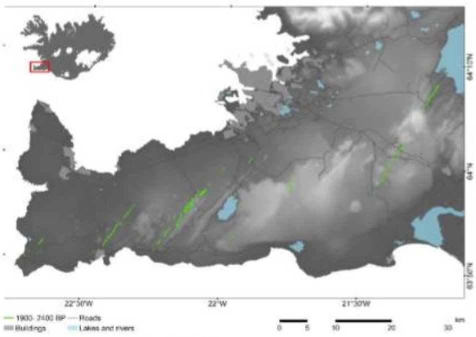

Figure 4: Volcanic features from 1900–2400 years BP.

DATASET 4: Volcanic features, vents and fissures dated over 2400 years BP

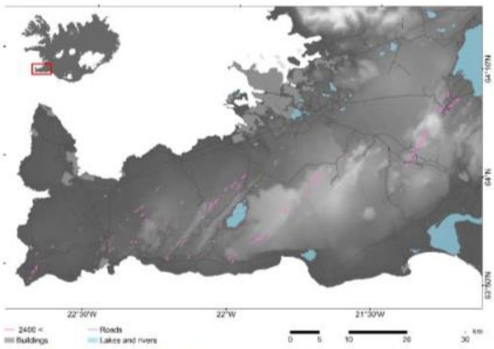

Figure 5: Volcanic features over 2400 years BP.

DATASET 5: Tectonic features, selected fractures after density calculations

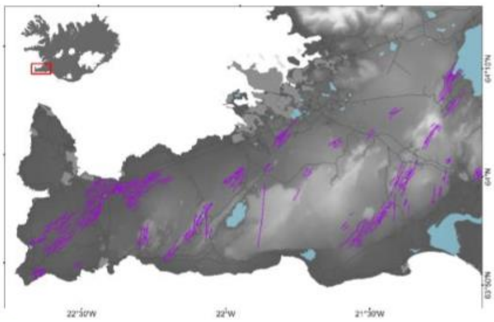

Figure ***Error! No text of specified style in document.****-3/6: Copy of the expert judgment, pages 3–6.*

DATASET 6: Tectonic features, in the youngest lava flows

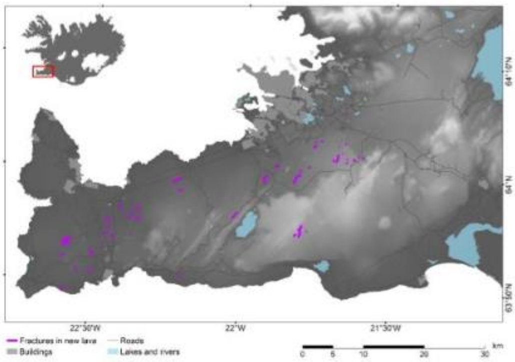

Figure 7: Fractures in historic lava flows

DATASET 7: Geothermal activity

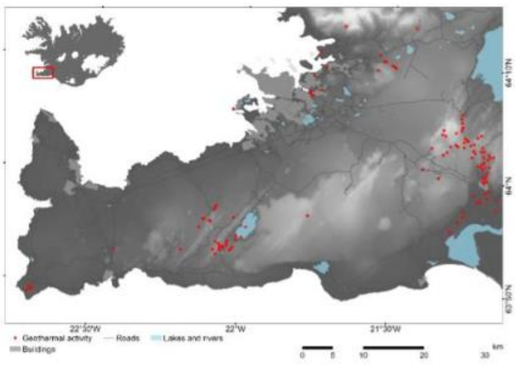

Figure 8: Geothermal activity

Methodology

The Analytic Hierarchy Process (AHP, is a matrix for decision making, which allows a pairwise comparisons between two elements. Here we use the SAATY (Saaty, 1980) scale (see *figure 7*) to determent how much more important one element over another. Individual experts may not be consistent in how they make judgements regarding the relative importance of the different factors, but this tool has a way to calculate the consistency and thereby improve the decision that will be made from the outcome of the expert judgements. An example of consistency in AHP, is to consider three items A, B and C. If item A is more important than B, and item B is more important than C., then the judgement is consistent if item A is also more important than item C.

The SAATY scale (Saaty, 1980) will be used as a reference during the process of "opinion poll" among the experts, in order to ensure consistency between experts when assigning the relative importance between the pairs of dataset or variables. To choose one of the 17 relative importance hierarchies (Table 1), we must consider the variable that is in the row of the paired comparison matrix, with respect to the variable in the column of the same matrix. When the matrix is filled in please use the numbers in the boxes. In *table 1* is an example of a filled in matrix, where numbers are chosen from the boxes of the SAATY scale, see *figure 7.*

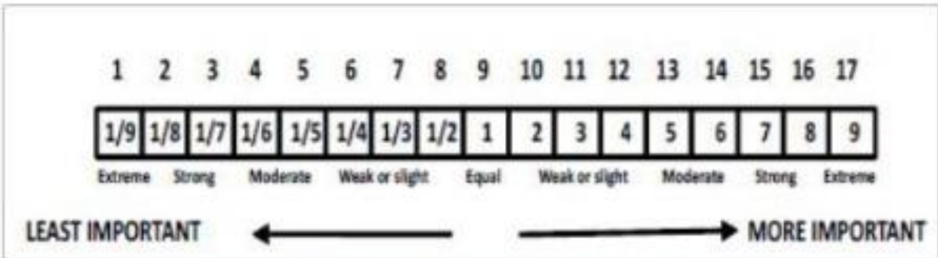

Figure 9: The hierarchical scale of 17 factors of relative importance for the construction of the comparison matrix between pairs of dataset or variables (Geological -structures for the case that concerns us).

Table 1: Example of the matrix. Relative importance between the same variables (example A to A) is equal to 1. The importance of the variables in read are compared to the variables in blue.

	A	B	C	D
A	1	9	5	2
B	1/9	1	1/3	1/9
C	1/5	2	1	1/3
D	1/2	9	3	1

Figure ***Error! No text of specified style in document.****-7: Copy of the expert judgment page 7.*

Expert judgement

Remember to evaluate the variable listen in the rows (in red) with respect to the variables listed in the columns (in blue), according to the numbers in the boxes in *figure 7*. Please fill in all of the blank fields.

	1. Volcanic features AD 900-1300	2. Volcanic features AD 700-900	3. Volcanic features 1900-2400 years BP	4. Volcanic features over 2400 years BP	5. Tectonic fractures	6. Tectonic fractures in new lava	7. Geothermal area
1. Volcanic features AD 900-1300	1						
2. Volcanic features AD 700-900		1					
3. Volcanic features 1900-2400 years BP			1				
4. Volcanic features over 2400 years BP				1			
5. Tectonic fractures					1		
6. Tectonic fractures in new lava						1	
7. Geothermal area							1

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Appendix 2

Information of the lava flow simulations

Table0-1: Lava flow inputs and raster value output

Line	*Line001*	*lina003*	*lina005*	*lina007*	*lina009*	*lina011*	*lina013*	*lina015*	*lina017*
Output resolution (m)	5	5	5	5	5	5	5	5	5
vent type	line	line	line	line	line	line	line	line	line
vent distance (m)	300	300	300	300	300	300	300	300	300
x1	429656	416286	432807	414991	421236	430072	430836	432270	430072
x2	430674	418091	435809	417582	428361	431929	431622	430096	431929
y1	7084232	7076876	7085943	7077940	7077755	7081899	7091310	7088216	7081899
y2	7085110	7079050	7089505	7080993	7086267	7084411	7092142	7086174	7084411
number of iterations	1500	1500	1500	1500	1500	1500	1500	1500	1500
maximum length (m)	20000	20000	20000	20000	20000	20000	20000	20000	20000
High value	0,118	0,0484667	0,0704167	0,037619	0,0281404	0,0909091	0,261667	0,100933	0,0883333
Low value	0,00013333	6,66667e-005	4,16667e-005	4,7619e-005	1,75439e-005	6,06061e-005	0,000166667	6,66667e-005	0,000111111