Supplementary material: What defines the success of maps and additional information on a multi-hazard platform

Working Paper

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Supplement of

What defines the success of maps and additional information on a multi-hazard platform?

Irina Dallo et al.

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Supplementary tables and figures

Table S1: **Overview of several applications communicating information about different hazards in a multi-hazard context**. The applications are differentiated and compared with respect to the criteria: hazard type (natural/ anthropogenic/ socionatural), time scale (long-term, short-term and real-time), geographical scale (global, national, local) and the presence of certain functionalities and information contents (yes/ no) *(Johnson et al., 2018; Meissen et al., 2013; Meissen & Voisard, 2008)*.
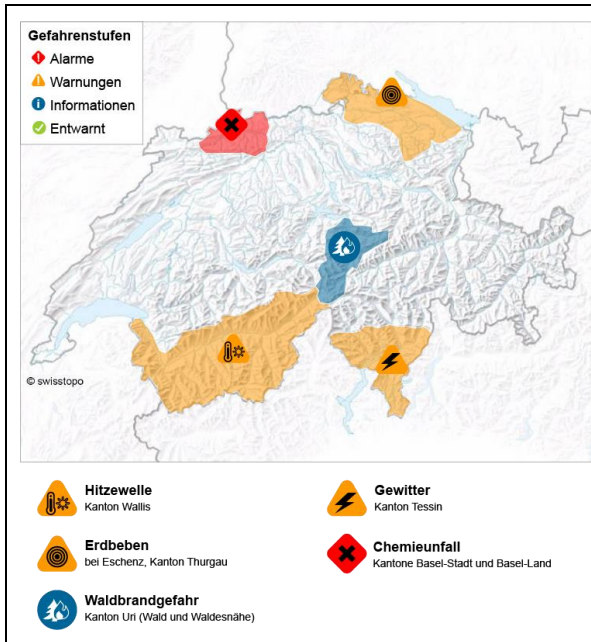
	Name	Country	Language	Hazard type	Time scale	Geographical scale	Push notifications	Individual settings for push notifications	Scientific description	Disaster toolkit	Individual emergency plan	General behavioural recommendations	Hazard-specific behavioural recommendations	Separate maps for each hazard	One single map	Harmonized hazard categories	Actual news, blog etc.	Link to social media	Links to other platforms
				General characteristics								**Specific characteristics**							
Only Mobile App	Hazard Redcross	Canada, Mexico & Indonesia	en	natural, anthropogenic & socionatural	long-term, short-term & real-time	national & local	yes	yes	yes	yes	no	no	yes	no	yes	yes	no	no	yes
	DisasterAlert	international	en	natural & anthropogenic	short-term & real-time	global	no	no	no	no	no	no	no	no	yes	yes	no	no	yes
	First aid app	several countries	de, en, fr, it, rm	primary health, but also natural, anthropogenic & socionatural	long-term, short-term & real-time	-	no	no	yes	yes	no	yes	yes	no	no	-	no	no	yes
	NINA (Notfall-Informations- und Nachrichten-App)	Germany	de	natural, anthropogenic & socionatural	short-term & real-time	national & local	yes	yes	no	yes	no	yes	yes	yes	no	no	no	no	yes
	FEMA (federal emergency management agency)	international	en, es	weather	long-term, short-term & real-time	local	yes	yes	no	yes	yes	yes	no	yes	yes	yes	no	yes	yes
	AlertSwiss	Switzerland	de, en, fr, it	natural & socionatural	long-term, short-term & real-time	national & local	yes	yes	yes	no	yes	yes	yes	no	yes	yes	yes	yes	yes

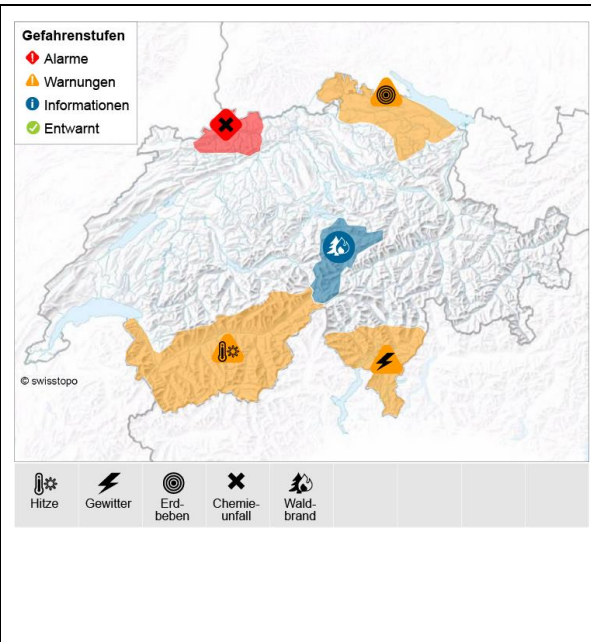| Category	Name	Country	Language	Hazard type	Temporal	Spatial scale													
Website and corresponding Mobile App	MeteoSwiss	Switzerland	de, en, fr, it	primary weather, but on the app also other natural hazards	short-term & real-time	national & local	yes	yes	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
	Umweltinfo Bayern	Germany	de	primary weather, but on the website also other natural hazards	short-term & real-time	local	yes	yes	yes	no	no	no	yes	yes	no	yes	yes	yes	yes
	GDAC (global disaster alert and coordination)	international	en	natural	short-term & real-time	global, national & local	yes	yes	yes	yes	no	no	no	no	yes	yes	yes	yes	yes
	WIND	Germany	de	weather	short-term & real-time	national & local	yes	yes	no	no	no	no	yes	yes	yes	yes	yes	yes	yes
	AlertMap	international	en	natural, anthropogenic & socionatural	short-term & real-time	global & national	yes	yes	no	no	no	no	no	no	yes	no	no	no	no
	KATWARN	Germany	de	anthropogenic & socionatural	short-term & real-time	national & local	yes	yes	no	no	no	no	yes	yes	no	yes	yes	yes	yes
	Met UK weather warnings	UK	en	weather	short-term & real-time	national & local	yes	yes	yes	no	no	yes	yes	no	yes	yes	yes	yes	yes
Only Website	Natural Hazards Portal	Switzerland	de, en, fr, it, rm	natural	long-term, short-term & real-time	national & local	no	-	yes	no	yes	no	yes	yes	yes	yes	yes	no	yes
	PLANAT (national platform for natural hazards)	Switzerland	de, en, fr, it, em	natural	long-term	national & local	no	-	yes	yes	no	yes	-	-	-	yes	no	yes	
	ARPA (agenzia regionale per la protezione ambientale)	Piemonte IT	it	natural	long-term & short-term	local	no	-	yes	no	no	no	no	yes	yes	yes	yes	no	yes
	Protezione civile (Presidenza del Consiglio die Ministri Dipartimento della Protezione Civile)	Italy	it, en	natural, anthropogenic & socionatural	long-term	national	no	-	yes	no	no	no	yes	no	no	no	yes	no	yes
	Istat (Istituto Nazionale di Statistica)	Italy	it	natural	long-term	national & local	no	-	no	no	no	no	no	yes	yes	no	no	no	no
	ThinkHazard	international	en, fr, es	natural	long-term	national & local	no	-	yes	no	no	yes	yes	yes	no	yes	no	no	yes
	GIN (Common Information Platform for Natural Hazards)	Switzerland	de, en, fr, it, rm	natural	short-term & real-time	national & local	yes	yes	no	yes	no	no	no	yes	yes	yes	yes	no	yes
	Vigilance météorologique	France	fr	weather	short-term & real-time	national & local	no	-	yes	no	no	no	yes	yes	yes	yes	no	yes	yes
	HungerMap	international	en	natural, sociological & anthropogenic	short-term & real-time	global	no	-	no	no	no	no	no	no	yes	yes	no	no	no

Table S2: **The twelve start page designs developed for the conjoint choice experiment**, representing the international approaches to combine multiple hazards on a single platform. The twelve designs differ regarding the map format, the hazard classification and the availability of textual information below the map.

ID	Map format	Hazard Classification	Additional information around the map
111	single map	three categories	textual information
121	single map	four categories	textual information
131	single map	five categories	textual information
112	single map	three categories	pictograms
122	single map	four categories	pictograms
132	single map	five categories	pictograms
211	separate maps	three categories	textual information
221	separate maps	four categories	textual information
231	separate maps	five categories	textual information
212	separate maps	three categories	pictograms
222	separate maps	four categories	pictograms
232	separate maps	five categories	pictograms

111

112

Gefahrenstufen
- 🔴 Alarme
- 🔶 Warnungen
- ℹ️ Informationen
- ✅ Entwarnt

Hitzewelle
Kanton Wallis

Gewitter
Kanton Tessin

Erdbeben
bei Eschenz, Kanton Thurgau

Chemieunfall
Kantone Basel-Stadt und Basel-Land

Waldbrandgefahr
Kanton Uri (Wald und Waldesnähe)

121

Gefahrenstufen
- 🔴 Alarme
- 🔶 Warnungen
- ℹ️ Informationen
- ✅ Entwarnt

Hitze | Gewitter | Erd-beben | Chemie-unfall | Wald-brand

122

Gefahrenstufen
- 🟢 Geringe Gefahr
- 🟡 Mässige Gefahr
- 🟠 Erhebliche Gefahr
- 🔴 Grosse Gefahr
- 🔴 Sehr grosse Gefahr

Hitzewelle
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131

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Hitze | Gewitter | Erd-beben | Chemie-unfall | Wald-brand
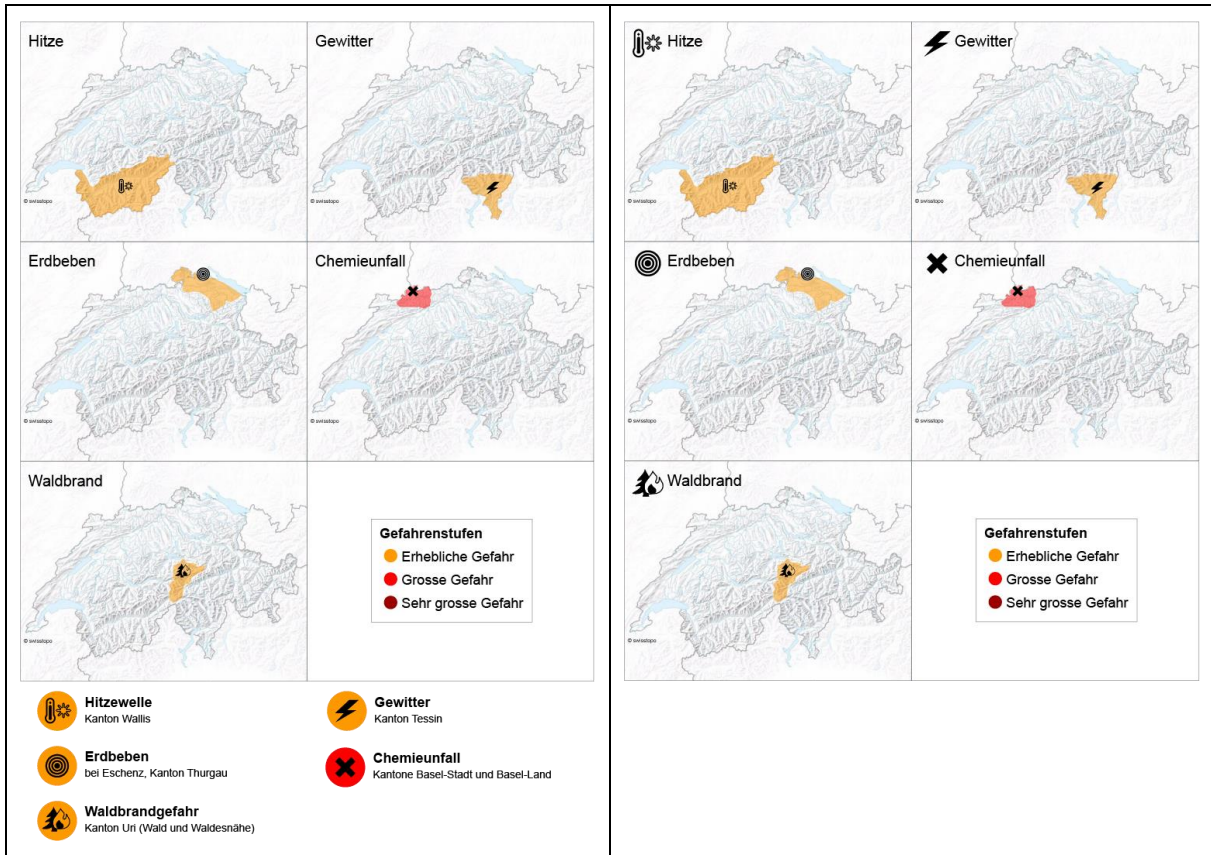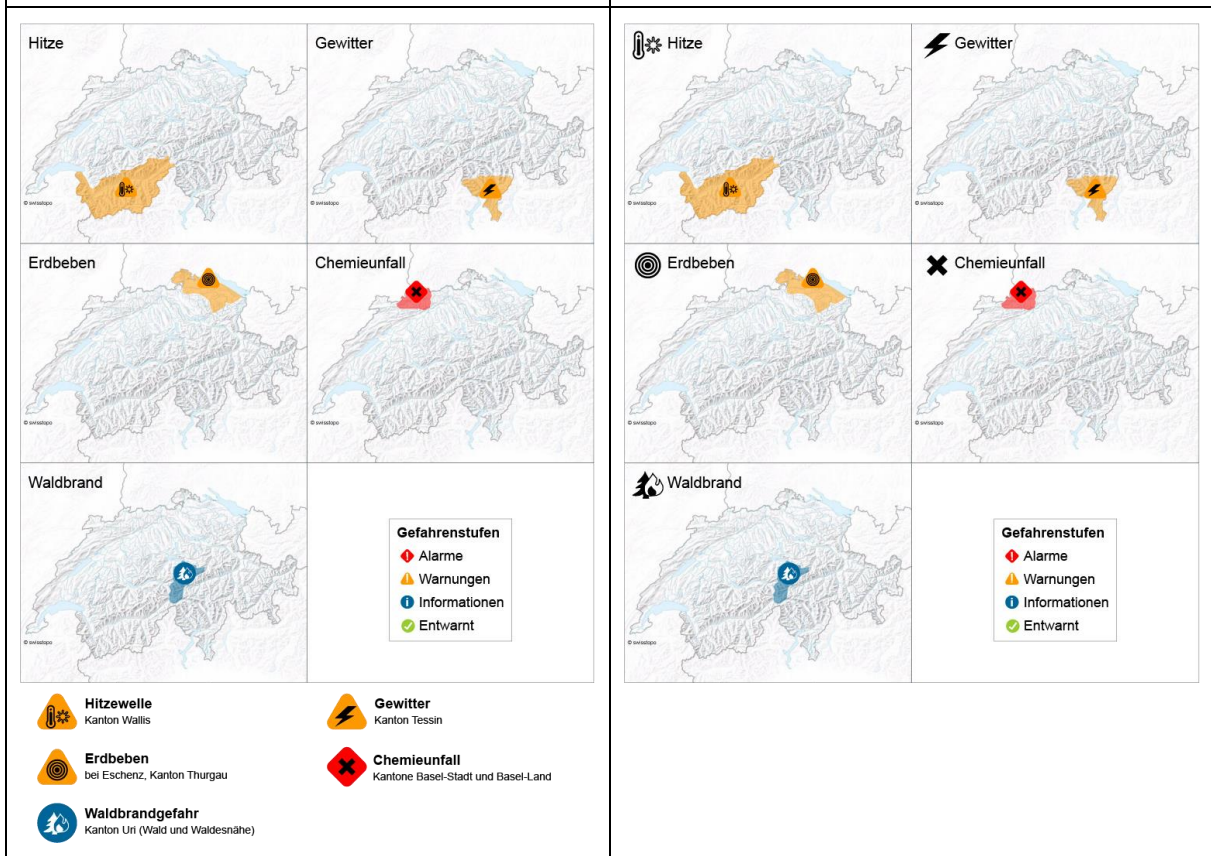
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211

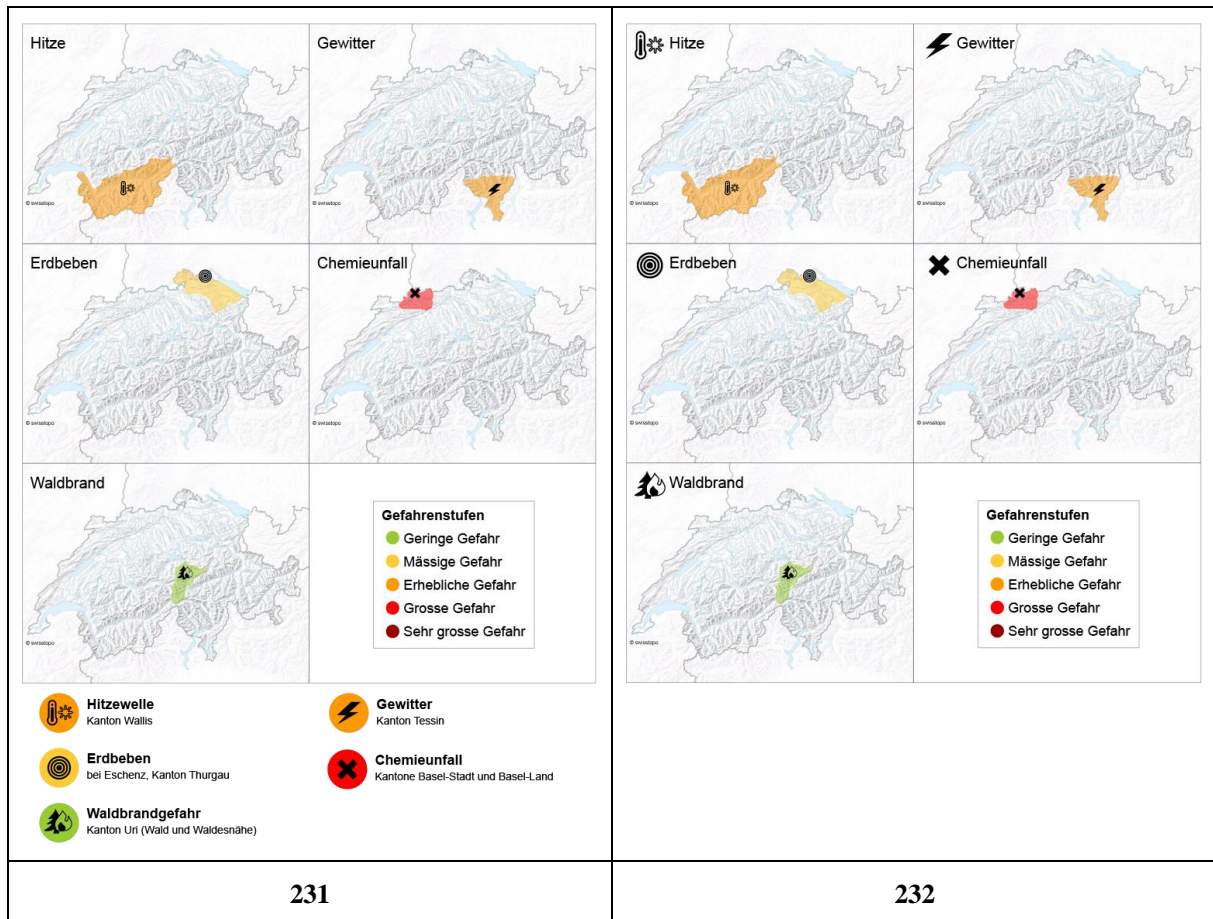**212**

221

222

| 231 | 232 |

Table S3: **The eight hazard announcements developed for the conjoint choice experiment.** The eight alternatives differ regarding the format of the behavioural recommendations and the possibility to inform friends and family.

ID	Hazard type	Behavioural recommendations	Sharing function
AAA	thunderstorm	textual	available
AAB	thunderstorm	textual	not available
ABA	thunderstorm	pictured	available
ABB	thunderstorm	pictured	not available
BAA	earthquake	textual	available
BAB	earthquake	textual	not available
BBA	earthquake	pictured	available
BBB	earthquake	pictured	not available

AAA

⚡ Gewitter

Zürich, Di., 06. Aug. 14:00 – Mi., 07. Aug. 18:00

- **Art der Gewitter**: Ziehende Gewitter
- **Begleiterscheinungen**: Hagel, Sturmböen, Starkregen

Verhaltensempfehlungen

- Die lokale Wetterentwicklung beobachten, Informationen einholen und das Verhalten den Verhältnissen anpassen
- Blitzgefährdete Kreten, exponierte Bäume, Baumgruppen, Masten oder Türme meiden
- Schutz suchen: in einem Gebäude / Auto (Fahradayscher Käfig)
- Verzicht auf Bergtouren oder andere Outdoor-Aktivitäten
- Nähe von metallischen Gegenständen oder Wasserflächen meiden
- Wenn man beim Baden überrascht wird, sofort aus dem Wasser steigen
- Überflutete Strassenabschnitte umfahren oder wenn nötig langsamer befahren
- Bachbette und stark geneigte Hangzonen meiden
- Anweisungen der Behörden sind in jedem Fall zu befolgen

Kontakt

Zuständige Bundesbehörde: Bundesamt für Meteorologie und Klimatologie MeteoSchweiz

Informieren Sie Ihre Familie und Freunde:

AAB

⚡ Gewitter

Zürich, Di., 06. Aug. 14:00 – Mi., 07. Aug. 18:00

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Verhaltensempfehlungen

Kontakt

Zuständige Bundesbehörde: Bundesamt für Meteorologie und Klimatologie MeteoSchweiz

Erdbeben

Eschenz, Region Bodensee

16:15 Erdbeben mit einer Stärke von etwa 4.5 bei Eschenz (TG). Verbreitet spürbar. Kleinere Schäden möglich.

Verhaltensempfehlungen

Im Gebäude
- In Deckung gehen (z. B. unter einem stabilen Tisch)
- In Acht nehmen vor herunterfallenden oder umstürzenden Gegenständen (z. B. Regale, schwere Möbel, Fernseher, Musikanlagen und Beleuchtung) sowie die Nähe zu Fenstern und Glaswänden meiden, die zerbrechen könnten
- Das Gebäude nur verlassen, wenn die Umgebung sicher ist (wenn z. B. keine weiteren Gegenstände wie etwa Ziegel herunterfallen)

Im Freien
- Im Freien bleiben, nicht in ein Gebäude fliehen
- Nähe zu Gebäuden, Brücken, Strommasten, grossen Bäumen und weiteren Dingen meiden, die einstürzen oder herunterfallen könnten
- An Gewässern Uferbereich verlassen

In einem Fahrzeug
- Fahrzeug anhalten und während des Bebens nicht verlassen
- Brücken, Unterführungen, Tunnels und Nähe zu Gebäuden am Strassenrand meiden (Einsturzgefahr)

Kontakt

Zuständige Bundesbehörde: Schweizerischer Erdbebendienst an der ETH Zürich

Informieren Sie Ihre Familie und Freunde:

BAA

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BAB

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Eschenz, Region Bodensee

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Verhaltensempfehlungen

Im Gebäude

Im Freien

In einem Fahrzeug

Kontakt

Zuständige Bundesbehörde: Schweizerischer Erdbebendienst an der ETH Zürich

Informieren Sie Ihre Familie und Freunde:

BBA

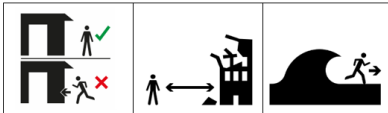## Erdbeben
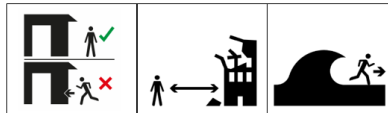
Eschenz, Region Bodensee

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Verhaltensempfehlungen

Im Gebäude

Im Freien

In einem Fahrzeug

Kontakt

Zuständige Bundesbehörde: Schweizerischer Erdbebendienst an der ETH Zürich

BBB

Table S4: **Preferences for communication channels.** As part of the first question block, the participants were asked the following question: Which of the following communication channels would you use to stay informed about the current hazard situation?

Answer possibilities	yes [%]	rather yes [%]	rather no [%]	no [%]
Separate websites	12.0	32.7	35.7	19.7
Separate apps	11.8	29.4	38	20.7
Single website	50.1	35.2	9.5	5.2
Single app	54.2	29.2	9.0	7.7
Social media	12.0	21.4	31.4	35.3
Radio	50.0	29.2	12.8	8.1
Television	45.6	29.2	12.8	8.1
Online newspaper	21.9	34.8	24.2	19.1
Google	22.1	35.9	24.6	17.3

Notes: In the survey, the order of the channels was randomized.

Table S5: Separate rating of the start page designs. Three-way ANOVA conducted to analyze the effects of the three attributes on respondents' preferences for start page designs.

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	91	90.96	62.721***
Hazard classification	2	52	25.82	17.803***
Additional information	1	44	44.37	30.599***
Map format : Hazard classification	2	1	0.28	0.193
Map format : Additional information	1	8	7.6	5.283*
Hazard classification : Additional information	2	1	0.62	0.426

*p < 0.05; **p < 0.01; ***p < 0.001

Table S6: **Separate rating of the start page designs including the covariates and control variables**. Three-way ANOVA conducted to analyze the effects of the three attributes, the covariates and the control variables on respondents' preferences for start page designs.

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	91	90.96	66.283***
Hazard classification	2	52	25.82	18.814***
Additional information	1	44	44.37	32.337***
Numeracy skills	1	5	4.56	3.234
Hazard experience	1	1	0.88	0.640
Trust	1	234	234.44	170.847***
Risk perception	1	28	28.02	20.416***
Gender	1	6	5.84	4.252*
Education	9	18	2.03	1.482
Age	1	3	3.06	2.232
Residential canton	24	103	4.29	3.129***
Employment	6	22	3.70	2.697*

*p < 0.05; **p < 0.01; ***p < 0.001

Table S7: **Forced choice task of the start page designs**. Three-way ANOVA conducted to analyze the effects of the three attributes on respondents' choice of the start page designs.

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	28.3	28.284	119.466***
Hazard classification	2	19.6	9.785	41.330***
Additional information	1	9.1	9.075	38.330***
Map format : Hazard classification	2	0.3	0.172	0.725
Map format : Additional information	1	5.3	5.263	22.229***
Hazard classification : Additional information	2	1.2	0.622	2.628

*p < 0.05; **p < 0.01; ***p < 0.001

Table S8: **Forced choice task of the start page designs including the covariates and control variables**. Three-way ANOVA conducted to analyze the effects of the three attributes, the covariates and the control variables on respondents' choice of the start page designs.

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	28.3	28.284	117.760***
Hazard classification	2	19.6	9.785	40.740***
Additional information	1	9.1	9.075	37.782***
Numeracy skills	1	0.0	0.018	0.074
Hazard experience	1	0.0	0.000	0.001
Trust	1	0.0	0.002	0.009
Risk perception	1	0.0	0.005	0.021
Gender	1	0.0	0.008	0.032
Education	9	0.0	0.005	0.022
Age	1	0.0	0.000	0.001
Residential canton	24	0.2	0.009	0.039
Employment	6	0.0	0.002	0.010

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

Table S9: Percentage of interpretation questions correctly answered. In the survey, the order of the three questions was randomized.

Question related to	correct answer [%]	wrong answer [%]	do not know [%]
Heat wave	87.11	7.81	5.08
Earthquake	25.26	66.80	7.94
Thunderstorm	78.39	15.49	6.12

Table S10: Hazard experiences of the participants. As part of the fourth question block, participants had to answer the following question: "I was already exposed to one of the following hazards and was negatively affected by their impacts (e.g. property damage, health problems)."

Hazard types	yes [%]	no [%]
Earthquake	18	82
Forest fire	9	91
Thunderstorm	54	46
Heatwave	41	59
Pandemic	5	95
Power outage	49	51
Chemical plant accident	9	91
Nuclear power plant accident	5	95
Epizootic	7	93

Notes: In the survey, the order of the channels was randomized

Table S11: Interpretation. Three-way ANOVA conducted for the sum variable of the three interpretation items, including the covariates and control variables. Post-hoc tests for each sub-question additionally showed that participants' hazard experiences influence their ability to answer the questions correctly.

Start page design – Sum variable of the interpretation items

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	0.01	0.0074	0.018
Hazard classification	2	1.70	0.8522	2.019
Additional information	1	0.39	0.3891	0.922
Numeracy skills	1	3.03	3.0324	7.184**
Hazard experience	1	0.82	0.8235	1.951
Trust	1	0.79	0.7934	1.880
Risk Perception	1	0.00	0.0030	0.007
Gender	1	0.98	0.9824	2.328
Education	9	7.23	0.8035	1.904*
Age	1	0.52	0.5237	1.241
Residential canton	24	14.72	0.6131	1.453
Employment	6	1.18	0.1965	0.466

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

Table S12: Participants' perceived usefulness. Three-way ANOVAs conducted for each sub-item "understanding of the information presented", "motivation to seek further information" and "motivation to take (precautionary) actions". In addition, the sum of these items was calculated and a three-way ANOVA was run including the covariates and control variables.

Usefulness item 1 – Understanding the information presented

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	3.8	3.757	2.786
Hazard classification	2	1.8	0.917	0.676
Additional information	1	0.0	0.030	0.022
Map format : Hazard classification	2	0.3	0.174	0.128
Map format : Additional information	1	3.5	3.460	2.550
Hazard classification : Additional information	2	0.6	0.297	0.219

Usefulness item 2 – Motivation to seek further information

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	11.4	11.391	9.314**
Hazard classification	2	1.3	0.672	0.539
Additional information	1	1.0	0.990	0.794

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Attributes	Df	Sum Sq	Mean Sq	F-value
Map format : Hazard classification	2	3.1	1.549	1.242
Map format : Additional information	1	1.8	1.794	1.438
Hazard classification : Additional information	2	1.2	0.603	0.484

Usefulness item 3 – Motivation to take (precautionary) actions

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	14.5	14.528	10.696**
Hazard classification	2	0.6	0.295	0.217
Additional information	1	0.2	0.223	0.164
Map format : Hazard classification	2	0.4	0.177	0.130
Map format : Additional information	1	1.3	1.340	0.986
Hazard classification : Additional information	2	2.8	1.396	1.028

Usefulness sum variable – including the covariates and control variables

Attributes	Df	Sum Sq	Mean Sq	F-value
Map format	1	9.3	9.251	10.523**
Hazard classification	2	1.0	0.504	0.573
Additional information	1	0.3	0.299	0.340
Numeracy skills	1	17.7	17.720	20.156
Hazard experience	1	3.3	3.274	3.724
Trust	1	28.9	28.910	32.885***
Risk Perception	1	1.3	1.299	1.477***
Gender	1	1.6	1.604	1.824
Education	9	3.4	0.374	0.425
Age	1	0.5	0.475	0.540
Residential canton	24	16.4	0.683	0.777
Employment	6	10.3	1.719	1.955

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table S13: Earthquakes – separate rating of the announcements. Two-way ANOVA conducted to analyze the effects of the two attributes on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	0.3	0.303	0.214
Sharing function	1	7.2	7.199	5.067*
Interaction effect	1	1.9	1.916	1.348

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table S14: Earthquakes – separate rating of the announcements including the covariates and control variables. Two-way ANOVA conducted to analyze the effects of the two attributes, the covariates and the control variables on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	0.3	0.30	0.224
Sharing function	1	7.2	7.20	5.312*
Numeracy skills	1	0.0	0.00	0.001
Hazard experience	1	0.1	0.14	0.105
Trust	1	97.0	97.02	71.589***
Risk perception	1	9.5	9.46	6.979**
Gender	1	0.0	0.2	0.013
Education	9	11.4	1.27	0.936
Age	1	0.4	0.36	0.269
Residential canton	24	38.1	4.59	1.170
Employment	6	4.8	0.80	0.590

*p < 0.05; **p < 0.01; ***p < 0.001*

Table S15: Earthquakes – forced choice task of the announcements. Two-way ANOVA conducted to analyze the effects of the two attributes on respondents' preferences.

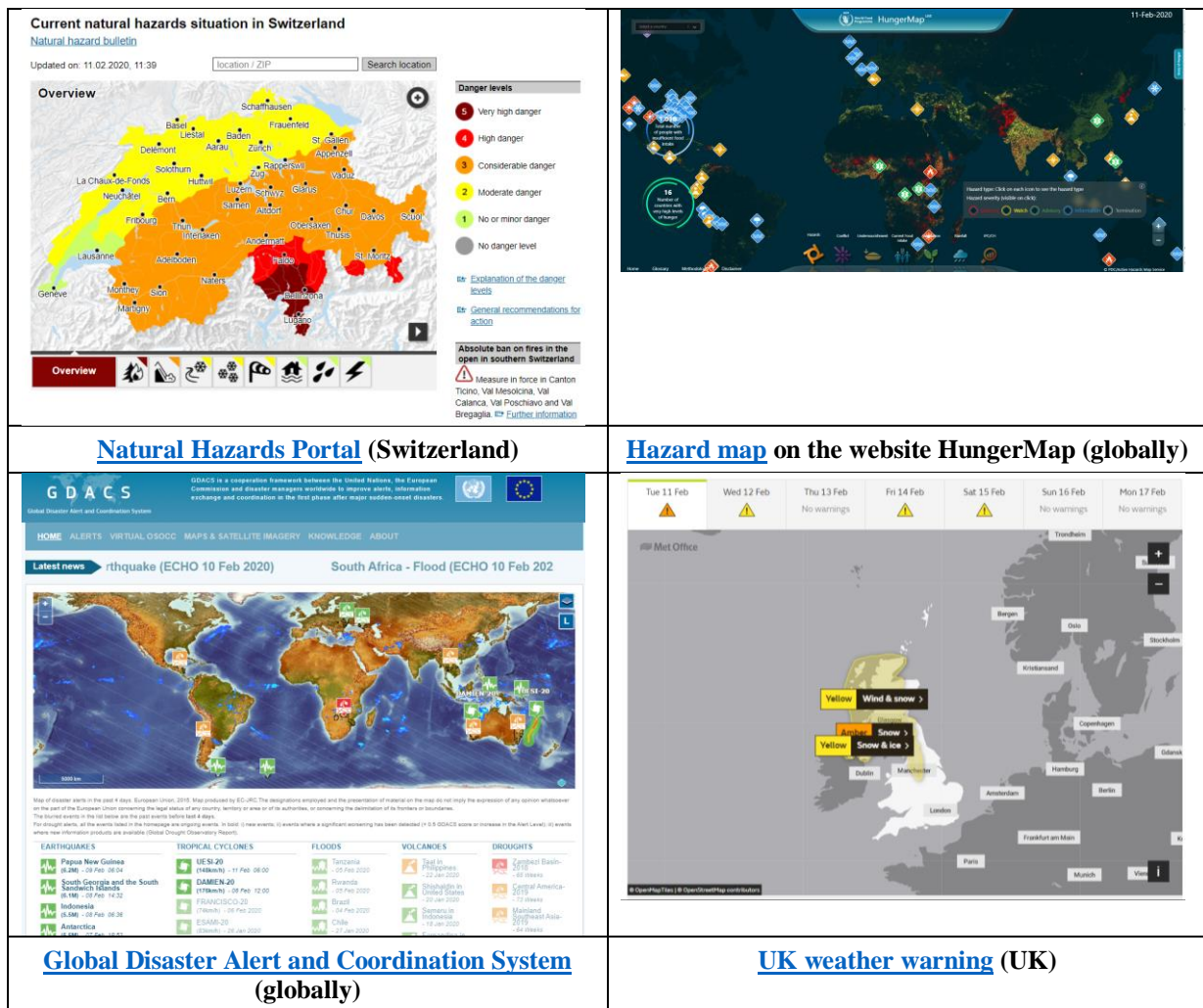| Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	0.4	0.407	1.651
Sharing function	1	4.0	3.974	16.120***
Interaction effect	1	2.0	1.951	7.914**

*p < 0.05; **p < 0.01; ***p < 0.001*

Table S16: Earthquakes – forced choice task of the announcements including the covariates and control variables. Two-way ANOVA conducted to analyze the effects of the two attributes, the covariates and the control variables on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	0.4	0.407	1.603
Sharing function	1	4.0	3.974	15.653***
Numeracy skills	1	0.0	0.000	0.001
Hazard experience	1	0.0	0.006	0.022
Trust	1	0.0	0.002	0.007
Risk perception	1	0.0	0.001	0.003
Gender	1	0.0	0.001	0.002
Education	9	0.0	0.001	0.005
Age	1	0.0	0.000	0.000
Residential canton	24	0.1	0.002	0.009
Employment	6	0.0	0.005	0.019

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

Table S17: Thunderstorms – separate rating of the announcements. Two-way ANOVA conducted to analyze the effects of the two attributes on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	4.0	3.997	2.865
Sharing function	1	0.5	0.487	0.349
Interaction effect	1	5.2	5.172	3.708

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

Table S18: Thunderstorms – separate rating of the announcements including the covariates and control variables. Two-way ANOVA conducted to analyze the effects of the two attributes, the covariates and the control variables on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	4.0	4.00	3.038
Sharing function	1	0.5	0.49	0.370
Numeracy skills	1	0.0	0.05	0.038
Hazard experience	1	0.7	0.75	0.570
Trust	1	106.0	105.96	80.537***
Risk perception	1	13.2	13.19	10.028**
Gender	1	0.9	0.85	0.647
Education	9	11.2	1.25	0.949
Age	1	0.8	0.77	0.587
Residential canton	24	39.4	1.64	1.248
Employment	6	12.3	2.06	1.564

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

Table S19: Thunderstorms – forced choice task of the announcements. Two-way ANOVA conducted to analyze the effects of the two attributes on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	2.0	2.042	8.295**
Sharing function	1	4.0	4.025	16.346***
Interaction effect	1	0.8	0.751	3.052

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$*

Table S20: Thunderstorms – forced choice task of the announcements including the covariates and control variables. Two-way ANOVA conducted to analyze the effects of the two attributes and the covariates on respondents' preferences.

Attributes	Df	Sum Sq	Mean Sq	F-value
Behavioural recommendations	1	2.0	2.042	8.044**
Sharing function	1	4.0	4.025	15.852***
Numeracy skills	1	0.0	0.006	0.023
Hazard experience	1	0.0	0.000	0.001
Trust	1	0.0	0.004	0.015
Risk perception	1	0.0	0.000	0.000
Gender	1	0.0	0.000	0.000
Education	9	0.0	0.002	0.008
Age	1	0.0	0.010	0.038
Residential canton	24	0.1	0.004	0.015
Employment	6	0.0	0.004	0.016

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Figure S1: **Exemplary start pages of multi-hazard platforms** (Deutscher Wetterdienst, 2015; European Union, 2020; Federal Administration, 2019; Federal Office for Civil Protection, 2020; Federal Office of Meteorology and Climatology MeteoSwiss, 2016; Frauenhofer-Gesellschaft, 2020; MET Office, 2020; PDC, 2020; PDC/ Active Hazards Map Service, 2020; Red Cross, 2020). The pictures of the different multi-hazard platforms underline the variety of the design approaches. They mainly differ regarding the map format, the hazard classification and the textual information added around the map.

MeteoSwiss (Switzerland)	**AlertSwiss (Switzerland)**	**WarnWetter (Germany)**
DisasterAlert (globally)	**KATWARN (Germany)**	**Hazards – Red Cross (Chile)**

Natural Hazards Portal (Switzerland)

Hazard map on the website HungerMap (globally)

Global Disaster Alert and Coordination System (globally)

UK weather warning (UK)

References for Figure S1:

Deutscher Wetterdienst. (2015). *WarnWetter App*.

European Union. (2020). *Global Disaster Alert and Coordination System*. https://www.gdacs.org/

Federal Administration. (2019, July 4). *Current natural hazards situation in Switzerland* [Artikel]. Natural Hazards Portal. https://www.naturgefahren.ch/home/aktuelle-naturgefahren.html

Federal Office for Civil Protection. (2020). *AlertSwiss App*.

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MET Office. (2020). *UK weather warning*. https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings#?date=2020-03-24

PDC. (2020). *DisasterAlert App*.

PDC/ Active Hazards Map Service. (2020). *Hazard Map*. https://hungermap.wfp.org/

Red Cross. (2020). *Chile Hazards—Red Cross App*.

Figure S2: Conducted survey (translated from German into English). In total, 810 respondents recruited from the German-speaking part of Switzerland completed the online survey from November 18 to November 28 2019. They were recruited by Respondi, an online access panel provider. Due to unrealistic short answering times, 42 respondents were excluded from the analysis leading to 768 respondents. We used quota sampling with quotas based on age and gender, representing the average population of Switzerland.

Online Survey

Original language of the survey: German

Field phase: 18.11.2019 – 25.11.2019

Quota: Age and Gender (Eurostat 2018)

Quality Check done

Consent form

Welcome

Thank you for participating in the survey that is conducted by the Swiss Seismological Service at ETH Zurich as part of a European research project.

How do we collect and process your data?
The survey takes about 15 minutes to complete. All your answers will be anonymized and treated in accordance with the provisions of data protection. Your details can thus not be linked to your person and will not be passed on to third parties.

☐ I agree that my personal data will be processed in accordance with the information given above.

Introduction

Nowadays, information and warnings about different hazards are available on different websites or apps for smartphones. The survey aims to assess the needs of the Swiss population with regard to the use of such websites and apps. With your participation, you make a significant contribution to ensuring that warnings about impending hazards in Switzerland meet the needs of the population. By hazards, we mean both natural hazards (e.g. floods, earthquakes) as well as anthropogenic and socionatural hazards (e.g. traffic accidents, epidemics, accidents at chemical plants).

Use of communication channels

In everyday life and your free time you are exposed to various hazards. Imagine you would like to go hiking in the mountains with your friends this weekend. In advance, you would like to inform yourself about the weather conditions and the current avalanche hazard. On the day itself, you

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would also like to be timely informed if, for example, a landslide or an accident blocks a road or railway connection and you have to take a different route. Nowadays, there are various channels through which you can obtain such information.

1) Through which of the following channels can you imagine obtaining information on current hazards in Switzerland?

   no (1) / rather no / rather yes / yes (4)

   - Separate websites for each hazard
   - Single website for all hazards
   - Separate apps for each hazard
   - Single app for all hazards
   - Social media (e.g Facebook, Instagram, Twitter)
   - Radio
   - Television
   - Online newspaper (e.g. 20 Minuten, Blick)
   - Google

2) Which hazards would you combine on a single multi-hazard website or app?

   Textfeld

A relatively new development are apps for smartphones that disseminate information and warnings about multiple hazards.

3) Do you know multi-hazard apps that contain information on current hazards (e.g. heat waves, storms, fire in an industrial plant)? If so, which ones?

   Yes (+ text field)   *(1)*

   No   *(2)*

4) Do you use multi-hazard apps to stay informed about the current hazard situation in Switzerland? If so, which ones?

   Yes, often (+ text field)   *(4)*

   Yes, but only rarely (+ text field)   *(3)*

   No, but I could imagine using one in the future. *(2)*

   No, and I can't imagine using one in the future. *(1)*

Start page designs I

On a website or in an app, information about multiple hazards can be displayed differently. We thus would like to know which presentation you prefer. For that, two different options are always displayed to you side by side.

Conjoint Choice Experiment
Please first take a close look at the two presentations and then answer the questions.

Randomized, each participant received three consecutive pairs of start page designs.

Exemplary pair	
Presentation 1	Presentation 2
Would you use representation 1 to inform yourself about the current hazard situation? *strongly disagree (1) / strongly agree (5)*	Would you use representation 2 to inform yourself about the current hazard situation? *strongly disagree (1) / strongly agree (5)*

If you have to choose one of the two presentations, which one would you prefer?
- Presentation 1   *(1)*
- Presentation 2   *(2)*

Start page designs II

In a next step, you see one of the possible presentations of the current hazard situation. For that, click "Next".

Randomized, participants receive one of the twelve start page designs.
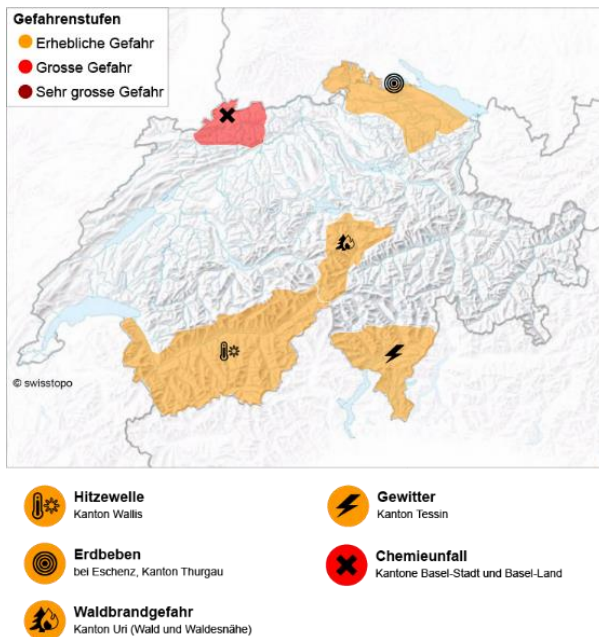
1) Take a look at the presentation of the hazards and judge whether the following statements are true or false.

true (1) / false (2) / don't know (3) → randomized

- The warning in the canton Valais means that I have to be prepared for a heat wave in this area.
- If I am in the canton Basel, I do not have to be prepared for an earthquake in the near future.
- If I am in the canton Basel, I do not have to be prepared for a strong thunderstorm in the near future.

2) How do you assess the following statements in relation to the hazard information you have seen before?

Strongly disagree (1) / strongly agree (5) → randomized

- The map makes clear to me what hazards I am currently exposed to in an area/ at my place of residence.
- The hazard information presented motivates me to inform myself about behaviours recommended.
- The hazard information presented motivates me to take (precautionary) actions.

Hazard announcements I

In addition to the graphical presentation, you can look up more detailed information on the current hazards in announcements attached to the icons displayed on the maps. Now, we would like to deal in detail with the content of such announcements. As before, two options of warnings are displayed next to each other.

Randomized, each participants received one pair of earthquake announcements and one pair of thunderstorm warnings.

Please first take a close look at the two announcements presented side by side and then answer the questions.

Exemplary pair	
Announcement 1	Announcement 2

Announcement 1

Erdbeben

Eschenz, Region Bodensee

16:15 Erdbeben mit einer Stärke von etwa 4.5 bei Eschenz (TG). Verbreitet spürbar. Kleinere Schäden möglich.

Verhaltensempfehlungen

Im Gebäude

Im Freien

In einem Fahrzeug

Kontakt

Zuständige Bundesbehörde: Schweizerischer Erdbebendienst an der ETH Zürich

Informieren Sie Ihre Familie und Freunde:

Announcement 2

Erdbeben

Eschenz, Region Bodensee

16:15 Erdbeben mit einer Stärke von etwa 4.5 bei Eschenz (TG). Verbreitet spürbar. Kleinere Schäden möglich.

Verhaltensempfehlungen

Im Gebäude
- In Deckung gehen (z. B. unter einem stabilen Tisch)
- In Acht nehmen vor herunterfallenden oder umstürzenden Gegenständen (z. B. Regale, schwere Möbel, Fernseher, Musikanlagen und Beleuchtung) sowie die Nähe zu Fenstern und Glaswänden meiden, die zerbrechen könnten
- Das Gebäude nur verlassen, wenn die Umgebung sicher ist (wenn z. B. keine weiteren Gegenstände wie etwa Ziegel herunterfallen)

Im Freien
- Im Freien bleiben, nicht in ein Gebäude fliehen
- Nähe zu Gebäuden, Brücken, Strommasten, grossen Bäumen und weiteren Dingen meiden, die einstürzen oder herunterfallen könnten
- An Gewässern Uferbereich verlassen

In einem Fahrzeug
- Fahrzeug anhalten und während des Bebens nicht verlassen
- Brücken, Unterführungen, Tunnels und Nähe zu Gebäuden am Strassenrand meiden (Einsturzgefahr)

Kontakt

Zuständige Bundesbehörde: Schweizerischer Erdbebendienst an der ETH Zürich

Would you use announcement 1 to find out more about a current hazard?	Would you use announcement 2 to find out more about a current hazard?
strongly disagree (1) / strongly agree (5)	*strongly disagree (1) / strongly agree (5)*

If you have to choose one of the two announcements, which one would you prefer?

- Announcement 1   *(1)*
- Announcement 2   *(2)*

Hazard announcements II

Users can also receive such announcements about (impending) hazards as a push notification (= message that appears on the screen of your smartphone, even if you are not currently using the app). Which settings regarding the receipt of such push notifications would you like to be able to define by yourself?

1) I would like to be able to activate or deactivate push notifications based on…

Select one or more answers. → randomized
(0 = not quoted / 1 = quoted)

- … the hazard category.
  (I can choose the category from which I receive a notification: e.g. moderate hazard, considerable hazard, very great hazard.)
- … the type of the message.
  (I can choose for which type I receive a notification: e.g. alarm, warning or information.)
- … the hazard type.
  (I can choose for which hazards I receive a notification: e.g. heat wave, flood, earthquake, epidemics.)
- … my current location (GPS).
- … a specific area (e.g. canton)

Finally, a few general questions

1) I was already exposed to one of the following hazards and was negatively affected by their impacts (e.g. property damage, health problems).

yes (1) / no (2) → randomized

- Earthquake
- Forest fire
- Thunderstorms
- Heat wave
- Pandemic
- Epizootic
- Power outage
- Chemical plant accident
- Nuclear power plant accident

2) Natural, socionatural and anthropogenic hazards (such as, for example, the ones in the previous question) ...

Strongly disagree (1) / strongly agree (5) → *randomized*

- … endanger my personal safety.
- … endanger the safety of my family.
- … limit my quality of life.
- … are difficult for me to control.
- … cause financial losses for me.
- … trigger a general fear in me.

3) Please estimate your mathematical skills with the help of the following questions.

Is very easy for me (1) / is very difficult for me (5) → *randomized*

- How good are you at fractions?
- How well can you calculate with percentages?
- How easy is it for you to calculate a tip of 15 percent?
- How easy is it for you to calculate how much a T-shirt costs after deducting a 25% discount?

4) How much trust do you have in the following institutions in Switzerland?

no trust at all (1) / very high trust (5) → *randomized*

- Scientific experts who collect and evaluate data of the different hazards.
- State institutions that are responsible for hazard information (e.g. MeteoSwiss, Swiss Seismological Service, Federal Office for the Environment).
- State authorities (e.g. Federal Office for Civil Protection, police), which issue warnings on current impending hazards.
- Media which reports on hazards and disseminate warnings.
- Private providers who use their own apps to provide information about hazards and disseminate warnings (e.g. insurance companies, private weather services).

Sociodemographic data

1) Gender
   - Female *(1)*
   - Male *(2)*
   - Other *(3)*

2) How old are you?
   _____ years

3) What is your highest school leaving certificate?
   - University *(1)*
   - Advanced technical college *(2)*
   - Technical college *(3)*

- Federal diploma *(4)*
- Masters Degree *(5)*
- Matura *(6)*
- Secondary technical school *(7)*
- Vocational school *(8)*
- Apprenticeship *(9)*
- Compulsory school *(10)*

4) Are you currently employed?
- In education without remuneration (e.g. school, university studies) *(1)*
- In training with remuneration (e.g. school, university studies) *(2)*
- Full-time employed (80-100%) *(3)*
- Part-time employed (less than 80%) *(4)*
- Full-time housewife or househusband *(5)*
- Currently without work *(6)*
- Retired *(7)*

5) In which canton do you live?
- Aargau *(1)*
- Appenzell Innerrhoden *(2)*
- Appenzell Ausserrhoden *(3)*
- Bern *(4)*
- Basel-Landschaft *(5)*
- Basel-Stadt *(6)*
- Freiburg *(7)*
- Genf *(8)*
- Glarus *(9)*
- Graubünden *(10)*
- Jura *(11)*
- Luzern *(12)*
- Neuenburg *(13)*
- Nidwalden *(14)*
- Obwalden *(15)*
- St. Gallen *(16)*
- Schaffhausen *(17)*
- Solothurn *(18)*
- Schwyz *(19)*
- Thurgau *(20)*
- Tessin *(21)*
- Uri *(22)*
- Waadt *(23)*
- Wallis *(24)*
- Zug *(25)*
- Zürich *(26)*

6) Finally, do you have any further comments?

Text field

Thanks

You have reached the end of the survey and your answers have been automatically saved. Thank you for taking the time.

Further information on the research project can be found here:
https://tdlab.usys.ethz.ch/de/forschung/multigefahren.html.

Yours sincerely,
Irina Dallo
Swiss Seismological Service der ETH Zürich