



The dynamics and influential factors of behaviour and intention of flood adaptive measures over time

EGU25-3645



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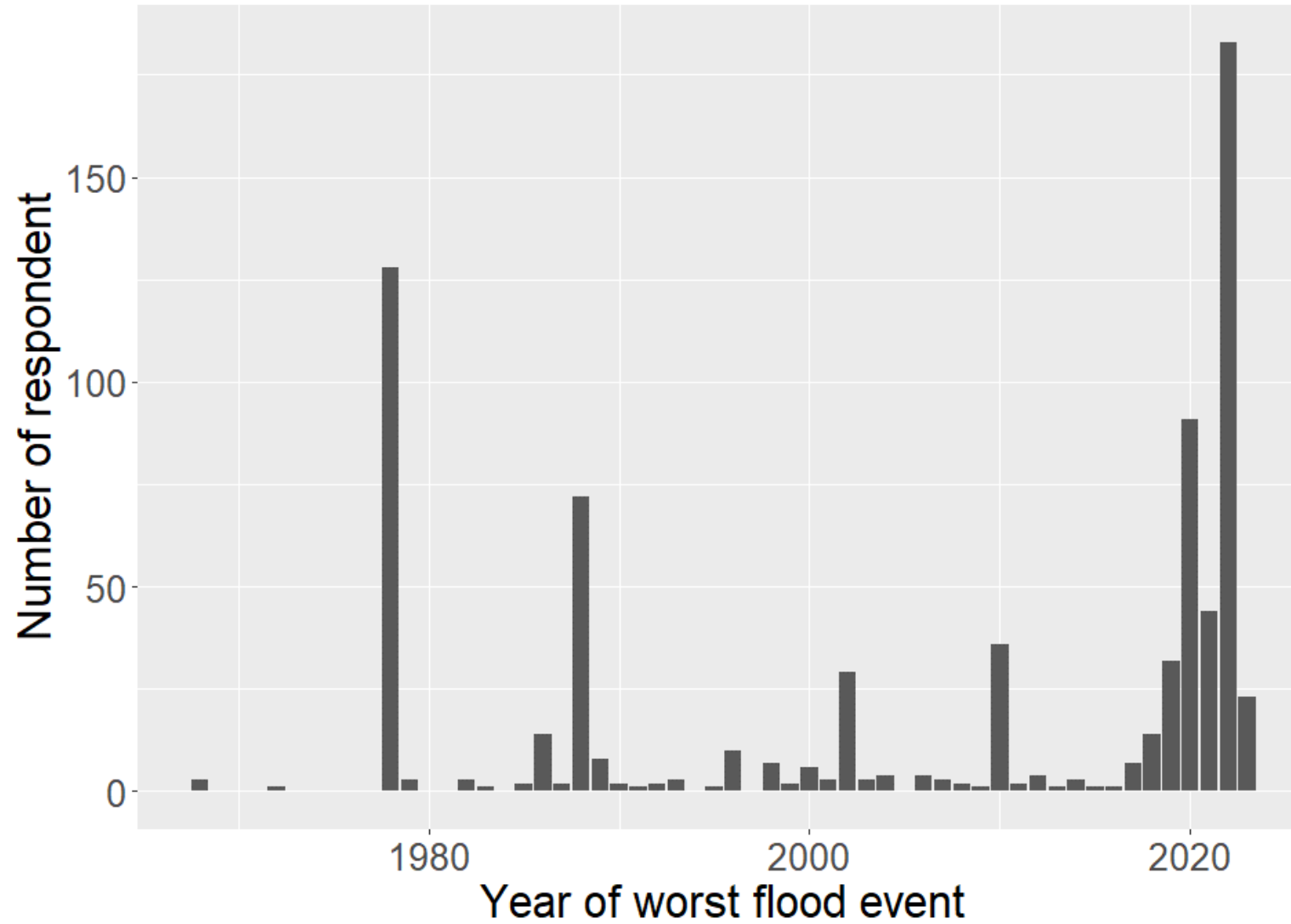


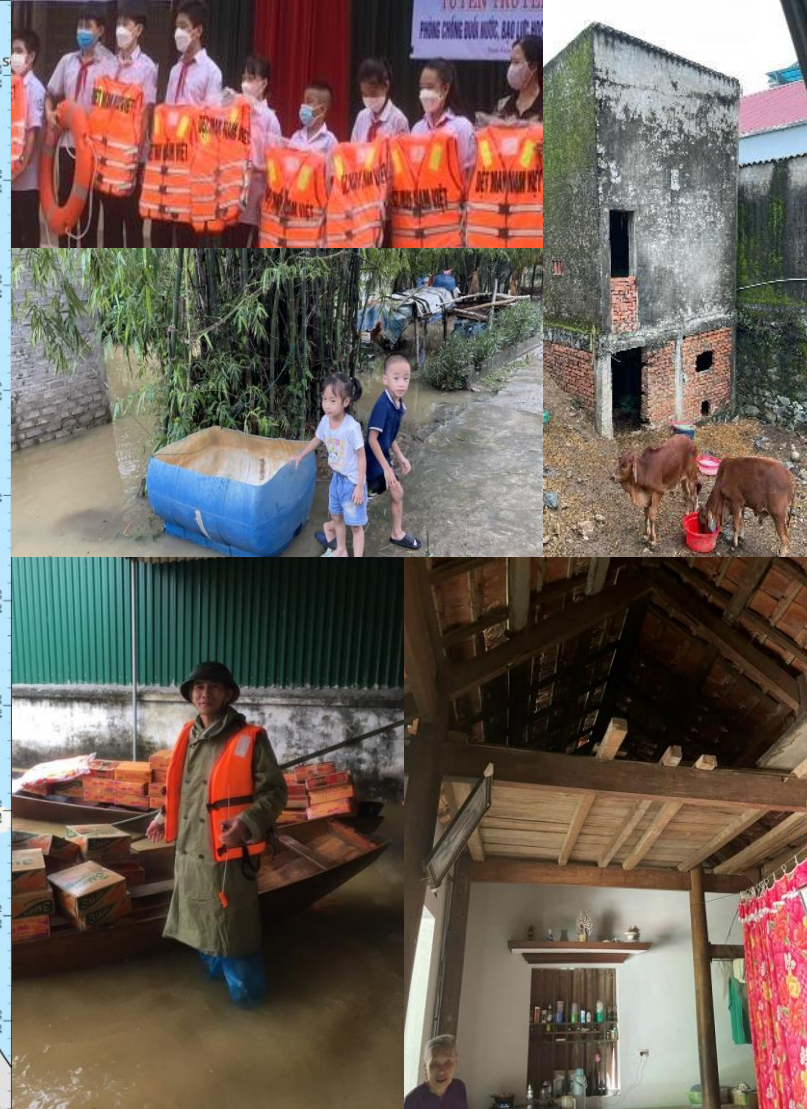
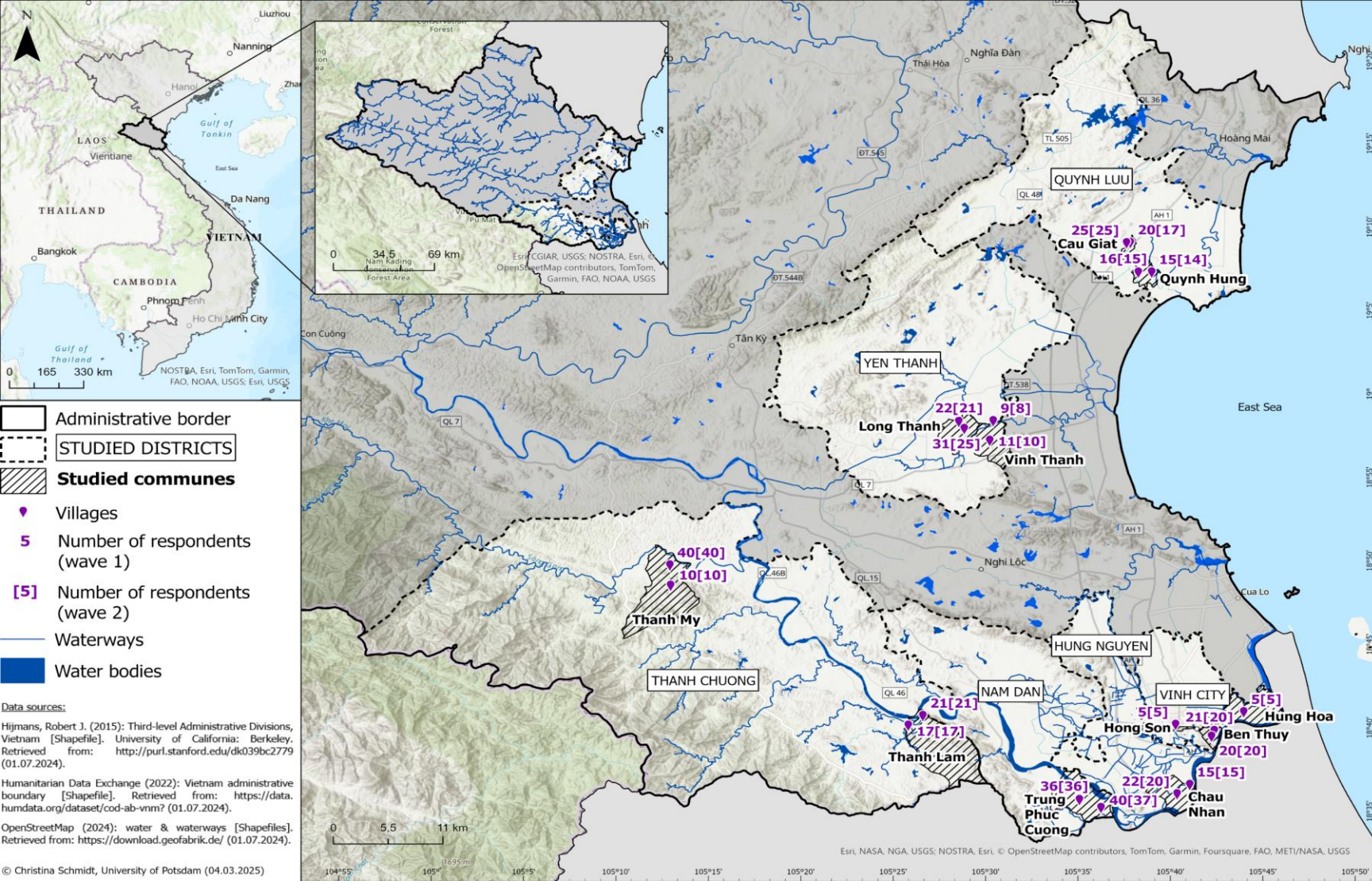
PICO4.8

The manuscript is under preparation

European Geosciences Union

Vienna, May 2025





October 2023

April 2024

401 respondents

381 respondents (95% retention rate)

1. Two minute talk

Intention

What people say they want to do



Behavior

What people actually do



Intention

What people say they want to do



Behavior

What people actually do

Unrealized intention

Literature: 21 and 75%

Our research: 92 and 96%





Intention



What people say they want to do

Behavior



What people actually do

Strongest intention seems to correlate with more implementation of retrofitting houses

Unrealized intention



Literature: 21 and 75%

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Age

Injunctive norms

Risk perceptions

Intention



What people say they want to do

Gender

Descriptive norms

Flood experience

Behavior



What people actually do

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Thank you for
your **IN**tention

Behavior

What people actually do

Intention

What people say they want to do



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11. Take home messages

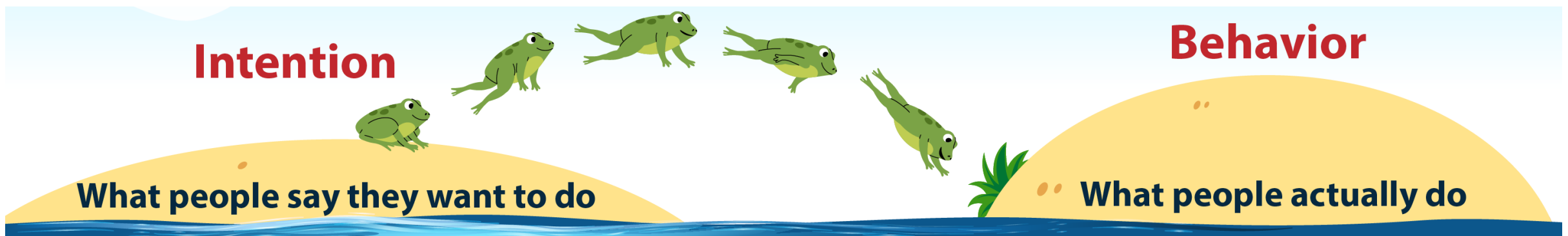


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SUMMARY: Adaptation intention is hypothesized to play a vital role in behavioral theories and used in research to draw policy recommendations. Empirical studies, however, shows a substantial gap between intention and behavior, referred to as the intention-behavior gap (IBG). Our research deploys a two-wave panel survey with 401 respondents from Vietnam to quantify the IBG, the role of intention, and comparability of influential predictors on intention and actual implementation of preparing devices and retrofitting homes in a six-month period. Results show that behavior and intention slightly reduce for preparing devices, whereas they increase for retrofitting houses. Behavior and behavioral change seem to be promoted by perceived behavioral control, risk perceptions, flood experience, housing situations, social norms, personalities, and socio-demographics. We found a huge intention-behavior gap where only 3.8 and 8.3% of respondents realized their intention while 3.9 and 9.4% of no-prior-intention respondents implemented at least a new measure in the subsequent wave for preparing devices and retrofitting homes, respectively. Whereas intention makes no difference for preparing devices, the strongest intention however significantly correlates with higher implementation of retrofitting homes. Very few factors such as social norms are found to be important for both; by contrast, various factors such as risk perceptions, financial capacity, housing situation, and age have significantly different influence on the intention and behavior. The findings suggest that data on intention should not be used as proxies for actual behavior nor to draw policy recommendations for certain adaptive measures.

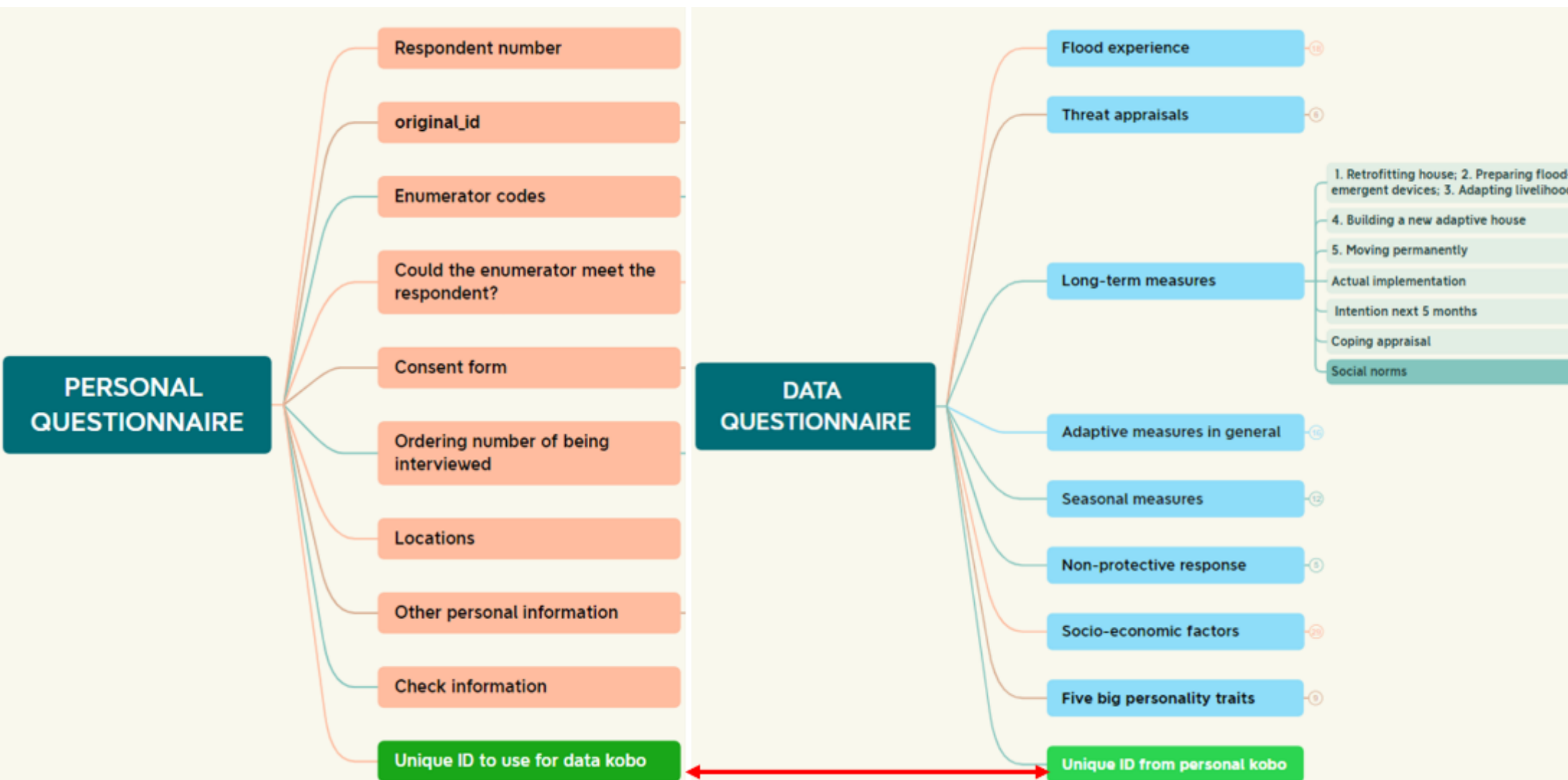


1. How big is the intention – behavior gap?
2. How do the adaptation intention and adaptation behavior change over time?
3. How does prior intention influence subsequent implementation?
4. What are the important factors that explain the adaptation intention and behavior?
5. To what extent could adaptation intention and behavior be explained by the same factors?



The questionnaires were designed and managed using Kobotoolbox.
The Personal Questionnaire collected personal information

3. Questionnaires



The Data Questionnaire collected information on research topics.

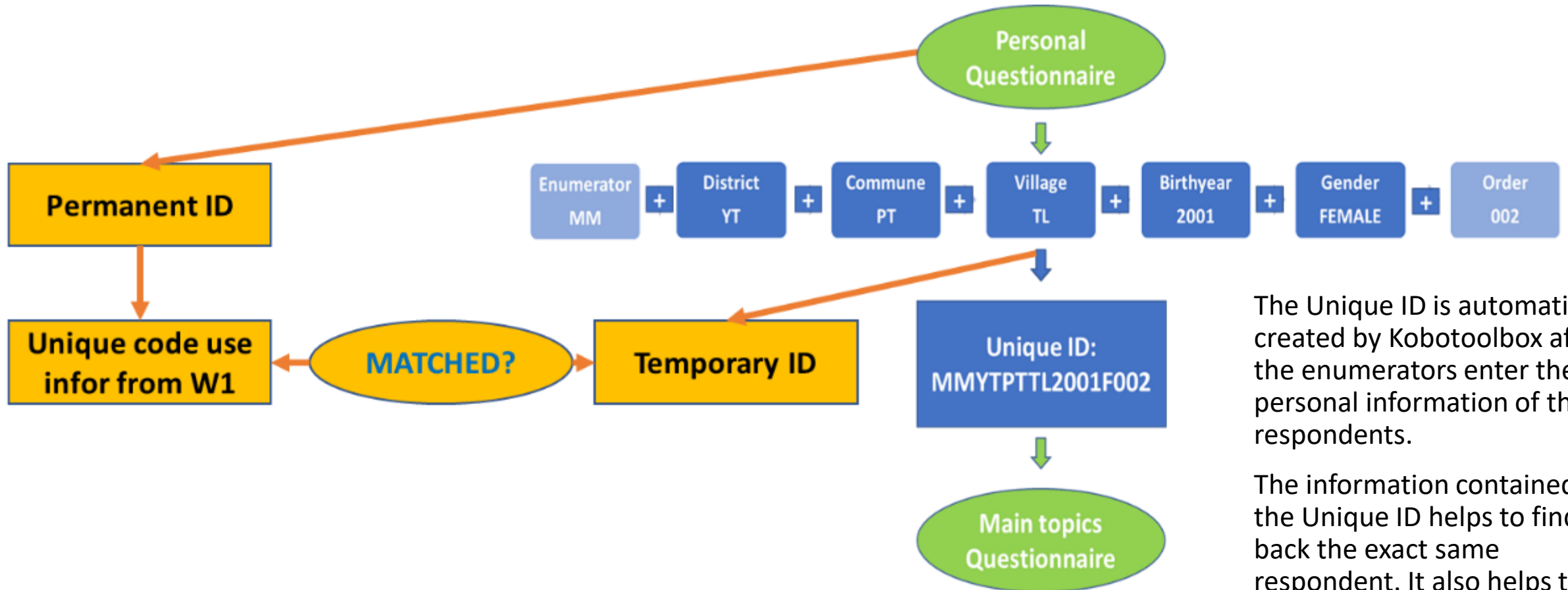
The two questionnaires are connected by the Unique ID.

Tracing back exactly the same respondents is extremely important to the success of a panel study.

From the information collected from wave 1, each respondent was randomly assigned a unique code which includes personal information.

This unique code is used to check whether the person doing interview is the same respondent that interviewed in the previous waves.

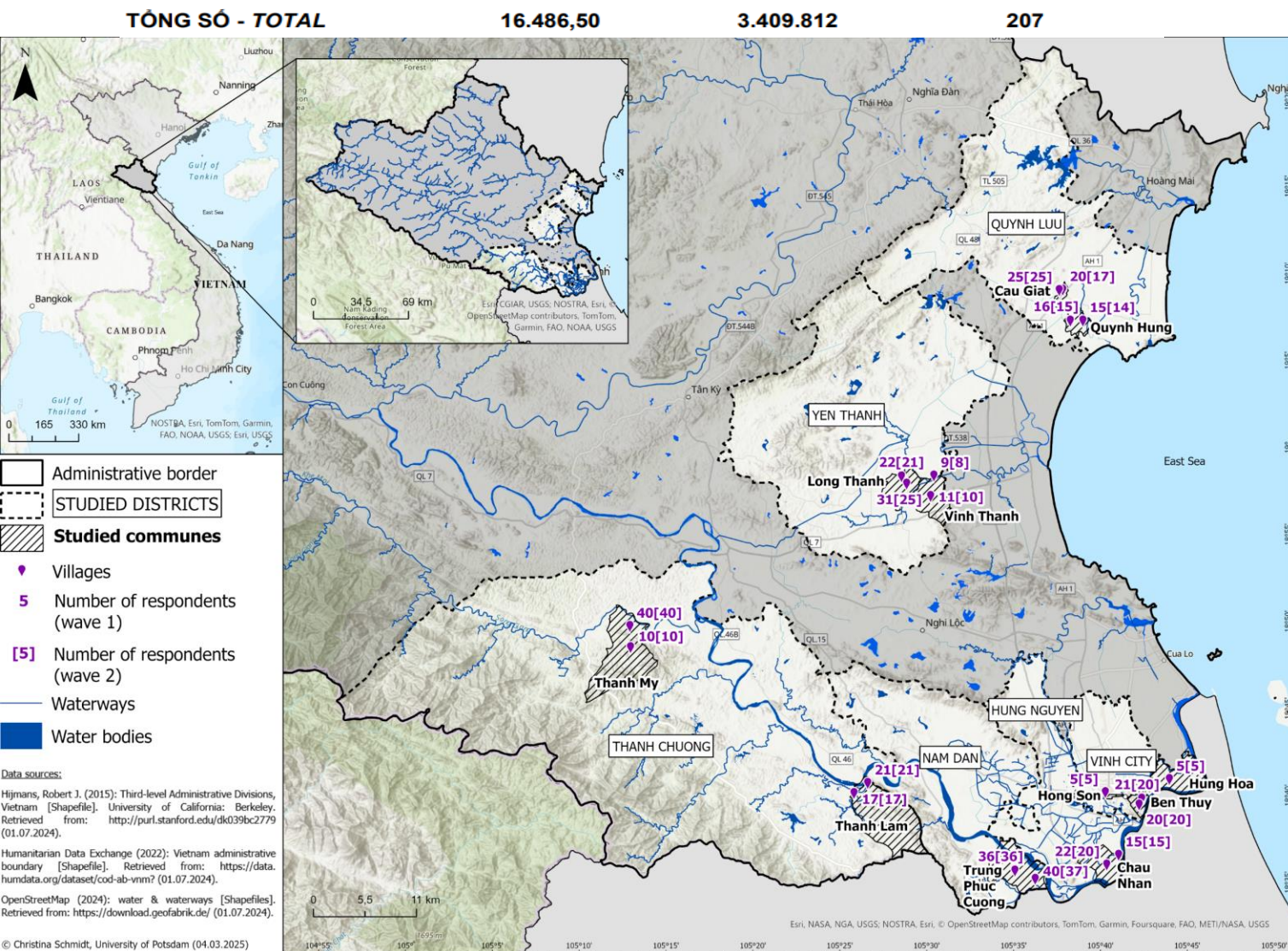
3. Questionnaires



The Unique ID is automatically created by Kobotoolbox after the enumerators enter the personal information of the respondents.

The information contained in the Unique ID helps to find back the exact same respondent. It also helps to manage the survey better.

4. Research areas



Vietnam is the sixth-most affected country worldwide by climate-related risks. Nghe An province is ranked number one in terms of flood risk among all provinces. Nghe An faces annual flooding from May to October. Multiple extreme floods causing severe damage have been recorded in different years.

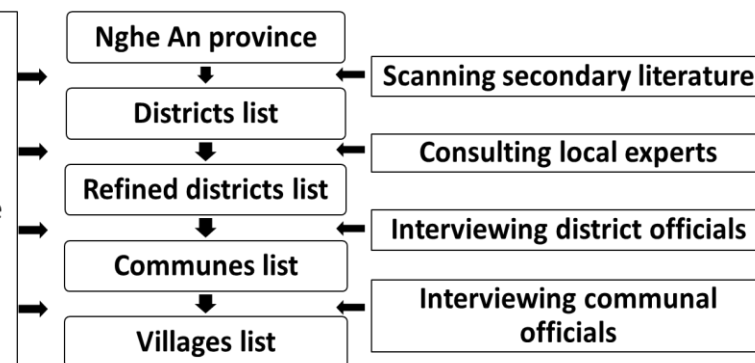
Specific surveyed areas were selected based on a number of steps.

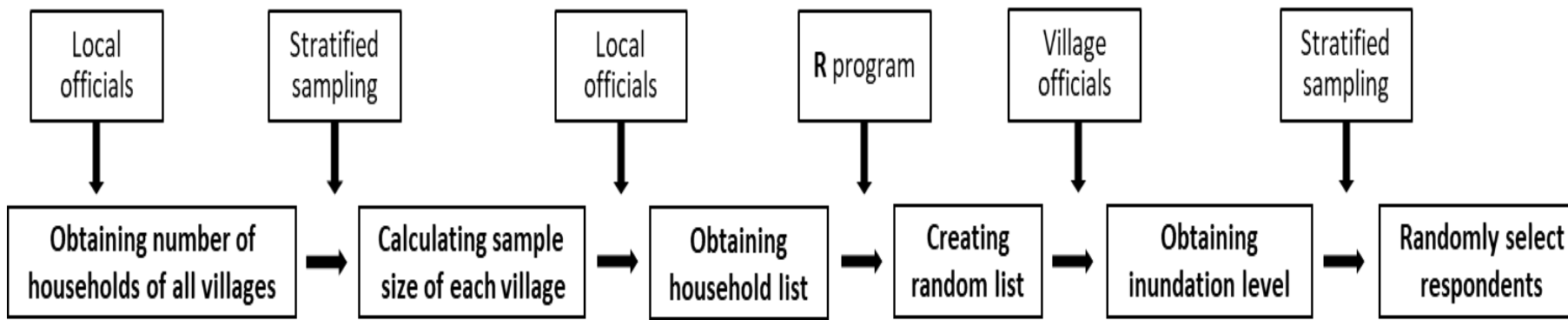
Five criteria were referenced during the selection.

Finally, 20 villages in 11 communes in 6 districts were selected.

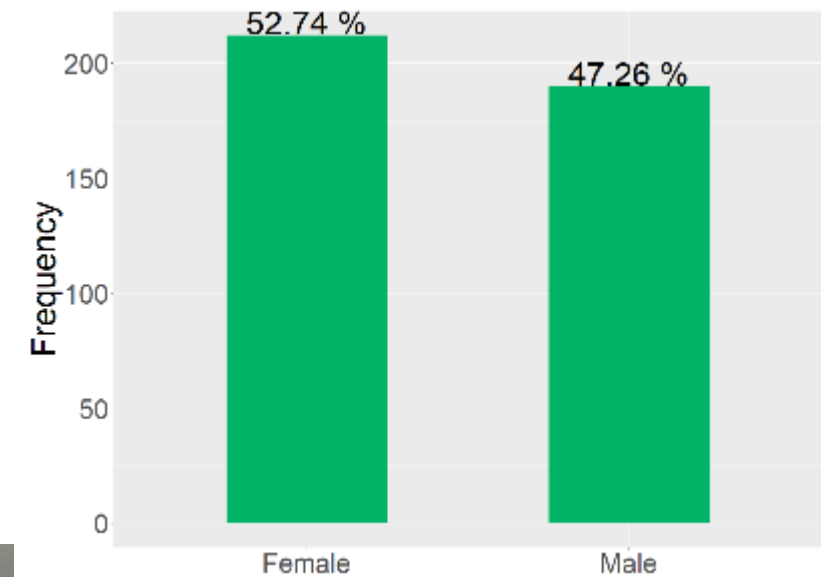
CRITERIA:

- Flood type
- Geographical diversity
- Flood experience
- Resources
- Surveying feasibility





5. Respondents selection

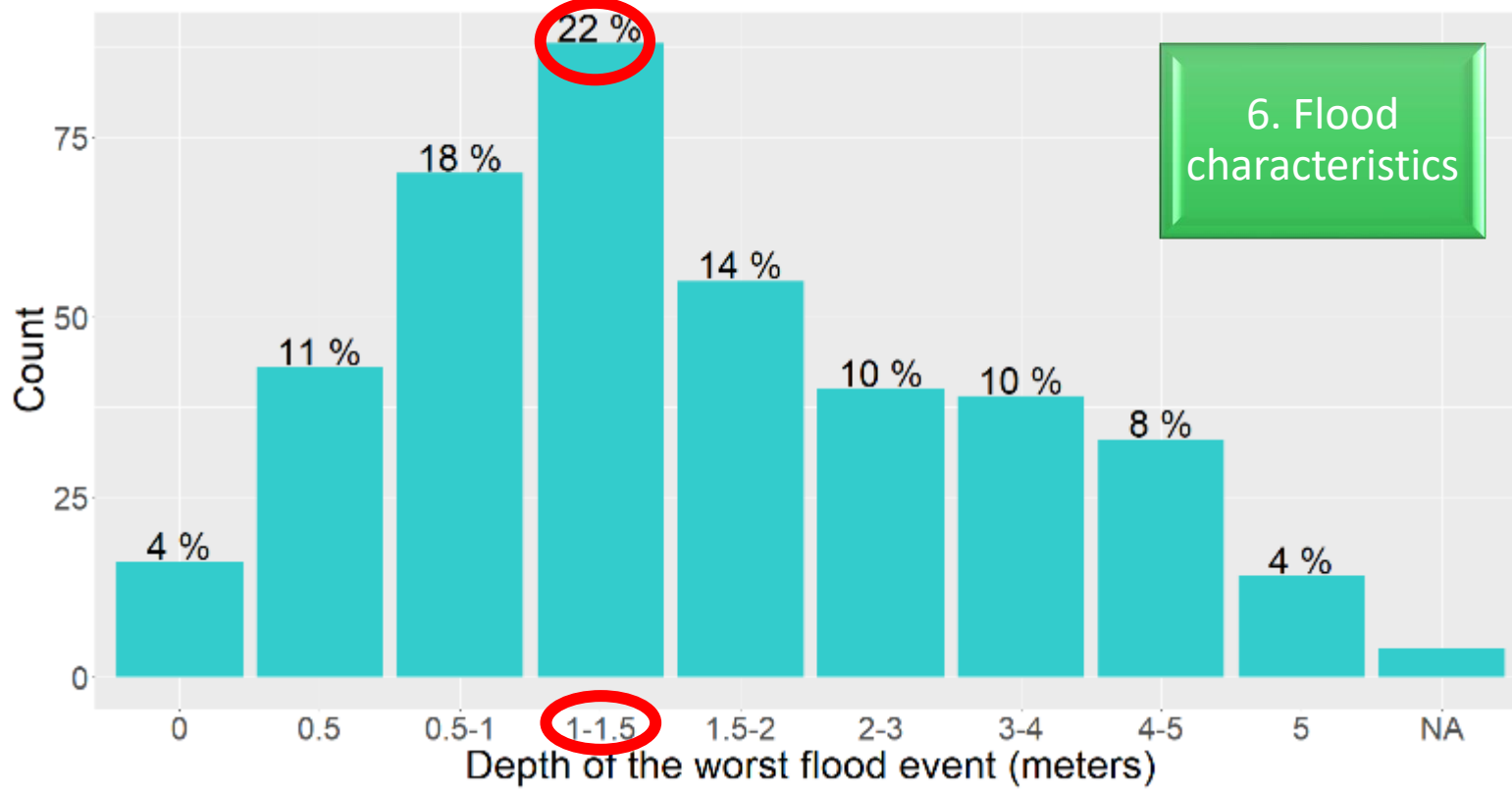


We applied stratified random sampling with equal probability using random respondent list generated from R software.

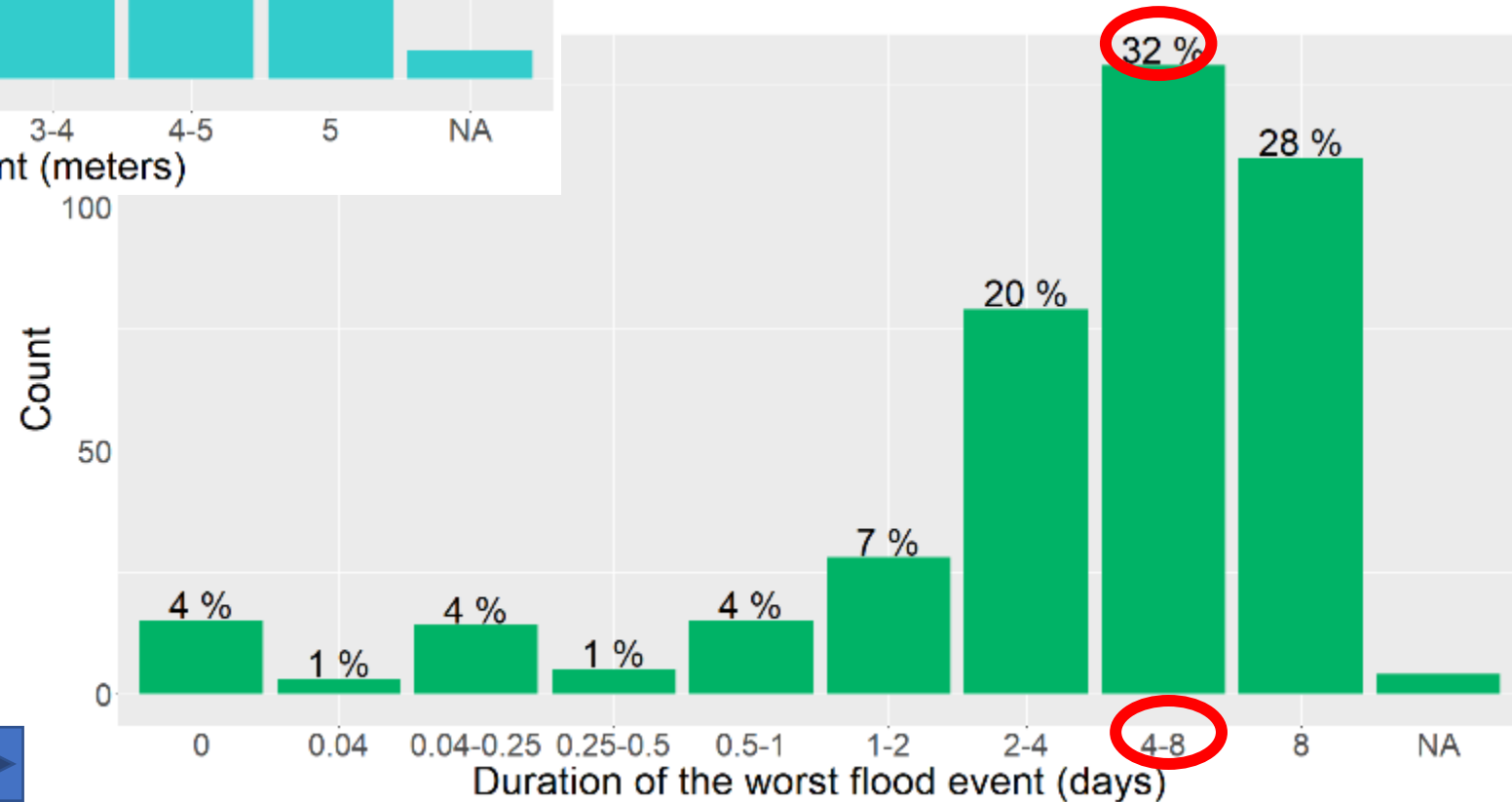
In total, we interviewed 401 people following random selection of the respondents. Our sample represent well the general population of Vietnam in terms of gender, age, total income, and household size.



Variable	Gender			
	N	Median	Min	Max
Age	401	59	24	91
Total income (US\$)	401	208	0	4,125
Household size	401	4	1	13



In the worst flood event, the most common flood duration is 4 to 8 days which was experienced by 32% of the sample. The most common flood depth is 1 to 1.5 meters which was experienced by about 22% of the respondents.





Distributions of inconsistencies in the dataset

The lack of clustering in individuals suggests that: (1) It is unlikely that some respondents cause the inconsistency; (2) It is less likely that one of the enumerators causes the inconsistency; (3) It is less likely that the exactly same respondents were not kept track of; (4) The size difference (factor 2) between devices and retrofit suggests that: (4) It is less likely that transcription errors cause the inconsistencies.

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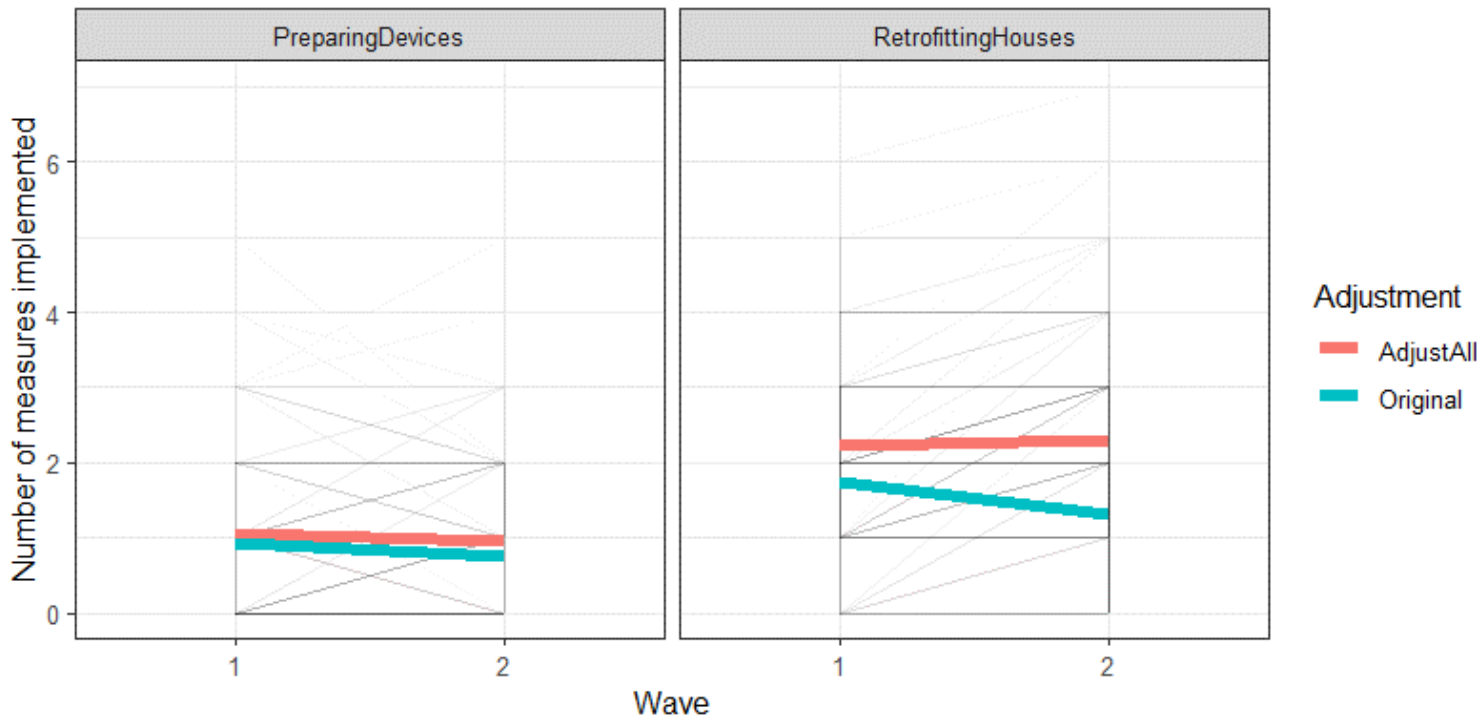


8. Adaptive measures

Local people have various ways to deal with flood: having flood shelters in their house, wooden boats, barrels, and life jackets.

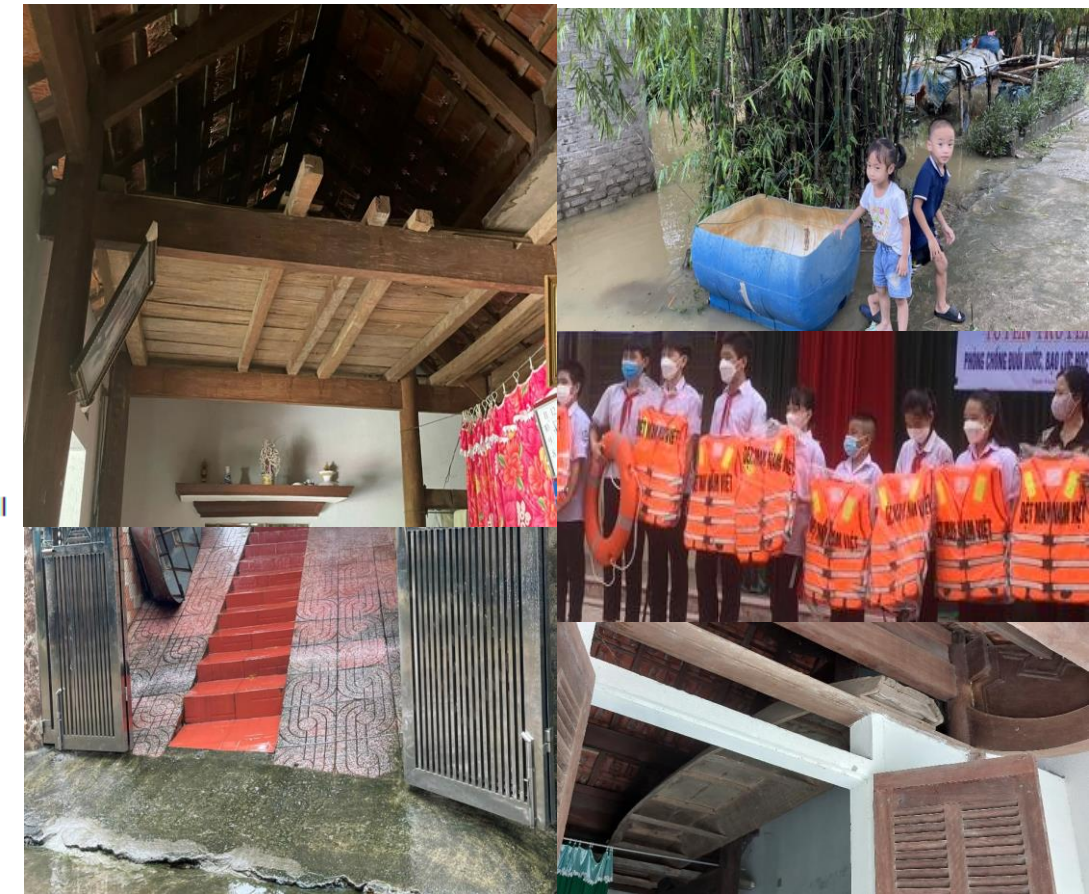
About 89% of the sample already retrofit their houses, 64% preparing devices.

The number of implemented measures slightly increase for preparing devices whereas decrease for retrofitting houses, after adjustment.



**Retrofitting
houses: 89%**

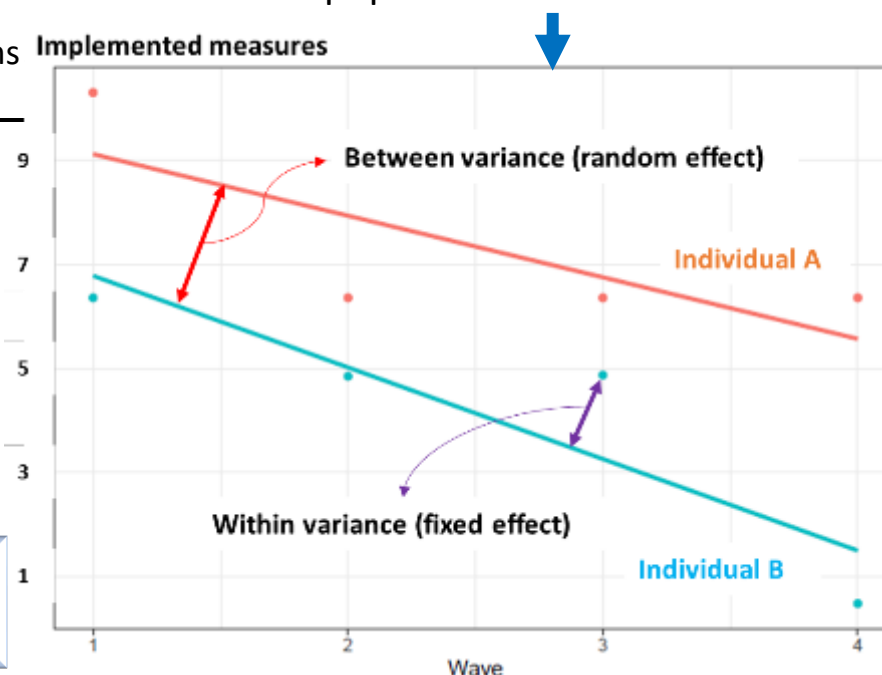
**Preparing
devices: 64%**



Name	Aims	Outcome variables	Predictors/Inputs	Type	Dataset
MChanBe	Change over time of behaviour	Behaviour	Time	Linear mixed model (LMM)	381
MChanIn	Change over time of intention	Intention	Time	Descriptive analysis	
	Intention - behaviour gap The influence of prior intention on behaviour	Behaviour wave 2	Intention wave 1	Kruskal-Wallis	
MFacBe	Explaining behaviour and behavioural change	Behaviour	Time + 35 independent variables + Time*each independent variable	LMM	369
MFacIn	Explaining intention and intention change	Intention			
MBivB-I	The influence of the same predictors on behaviour and intention	Behaviour + Intention	The superset of the output predictors of MFacBe and MFacIn	Bivariate LMM	
MComp	Comparing the coefficients of the same predictors		MBivB-I	Multiple comparisons for LMM	

We repeatedly survey the same individuals over two waves; thus, the dataset is hierarchical with two main sources of variance: (1) between variance, i.e., random effects, due to the differences between the randomly selected respondents; and (2) within variance, i.e., fixed effects, which is the variance within the respondents that is caused by different predictors assuming to have fixed unknown values on the whole population.

Linear mixed model (LMM) is a specific type of hierarchical model that is an extension of regression with group-structured data. LMMs have several advantages: (1) LMMs can deal better with uncertainty in data such as outliers or extreme data points due to the shrinkage effect, i.e., the estimate is shrunk towards the mean value of the behaviour of the whole population, thus reducing the impact of outliers and could yield more robust estimates in case of missing values; (2) traditional methods for repeated-measures-data analysis, e.g., ANOVA, could yield biased results if some conditions are not met, e.g., sphericity, whereas LMMs can be less biased. Therefore, the LMM is applied in our research.



Predictors	Preparing devices		Retrofitting houses	
	Behaviour	Intention	Behaviour	Intention
Change over time	MChanBe	MChanIn	MChanBe	MChanIn
Intercept	1.018***	1.28***	2.189***	1.082***
Time	-0.06+	-0.148	0.098***	0.259*

Criterion (%)				
ICC	75.21	30.45	96.3	20.46
Marginal R2	0.1	0.26	0.13	0.72
Conditional R2	75.23	30.63	96.3	21.03

When considering only time factor, the behavior and intention seem to decrease at each passage of time for preparing devices; however, with very small (-0.06) and marginally significant ($p < 0.1$) effect sizes for behavior or insignificant for the intention.

By contrast, both behavior ($p < 0.001$) and intention ($p < 0.05$) of retrofitting houses increase.

10. Results



Among 105 (28.5%) and 84 (22.8%) respondents who stated some levels of intention to implement at least a new measure in wave 1, only 3.8% and 8.3% had realized their intentions in the subsequent wave for preparing devices and retrofitting homes, respectively.

Respondents with the strongest intention (definitely will) to retrofit houses had implemented the most measures (five out of 19).



Strength Of Intention	Preparing devices			Retrofitting houses		
	New	Realized *	Not	New	Realized	Not
Definitely no 0	3	0	181	17	0	202
Very unlikely 1	3	0	71	5	0	57
Rather unlikely 2	1	0	17	1	0	14
Rather likely 3	7	3	71	5	2	51
Very likely 4	0	0	6	1	0	8
Definitely will 5	1	1	20	6	5	13
Intention NA	0	0	0	0	0	1
Unrealized intention	96.2 (%)			91.7 (%)		

(*) "Realized" is a subset of "New"



10. Results

Overall, respondents with different levels of intention show significant differences in implementing new measures for retrofitting their homes. Specifically, the post-hoc tests show significant differences between the respondents with the strongest intention (definitely will coded as 5) and those with definitely no, very unlikely, or rather likely intention

By contrast, the medians of new device implementation are not significantly different among the intention groups. This is further confirmed in the post-hoc test where all adjusted p-values are insignificant.

Retrofitting houses									Preparing devices						
Group 1	Group 2	n1	n2	Statistic	p	p.adj	p.adj.signif	r	n1	n2	Statistic	p	p.adj	p.adj.signif	r
0	1	219	62	0.0874	0.93	1	ns	0.00521	184	74	0.902	0.367	1	ns	0.0561
0	2	219	15	-0.165	0.869	1	ns	-0.0108	184	18	0.814	0.416	1	ns	0.0573
0	3	219	56	0.346	0.73	1	ns	0.0209	184	78	2.8	0.005	0.0759	ns	0.173
0	4	219	9	0.304	0.761	1	ns	0.0202	184	6	-0.201	0.84	1	ns	-0.0146
0	5	219	19	3.49	0.000487	0.0073	**	0.226	184	21	0.696	0.486	1	ns	0.0486
1	2	62	15	-0.197	0.844	1	ns	-0.0225	74	18	0.293	0.77	1	ns	0.0305
1	3	62	56	0.213	0.832	1	ns	0.0196	74	78	1.57	0.117	1	ns	0.127
1	4	62	9	0.255	0.799	1	ns	0.0303	74	6	-0.489	0.625	1	ns	-0.0547
1	5	62	19	3.13	0.00173	0.0259	*	0.348	74	21	0.147	0.883	1	ns	0.015
2	3	15	56	0.33	0.742	1	ns	0.0391	18	78	0.68	0.497	1	ns	0.0694
2	4	15	9	0.35	0.726	1	ns	0.0715	18	6	-0.604	0.546	1	ns	-0.123
2	5	15	19	2.54	0.011	0.165	ns	0.436	18	21	-0.127	0.899	1	ns	-0.0203
3	4	56	9	0.144	0.885	1	ns	0.0179	78	6	-1.09	0.275	1	ns	-0.119
3	5	56	19	2.95	0.00321	0.0481	*	0.34	78	21	-0.888	0.374	1	ns	-0.0893
4	5	9	19	1.81	0.071	1	ns	0.341	6	21	0.527	0.598	1	ns	0.101

Kruskal-Wallis with post-hoc test using Bonferroni correction. Group 1 and group 2 columns are different levels of intention coded as 0 (definitely not) to 5 (definitely will).

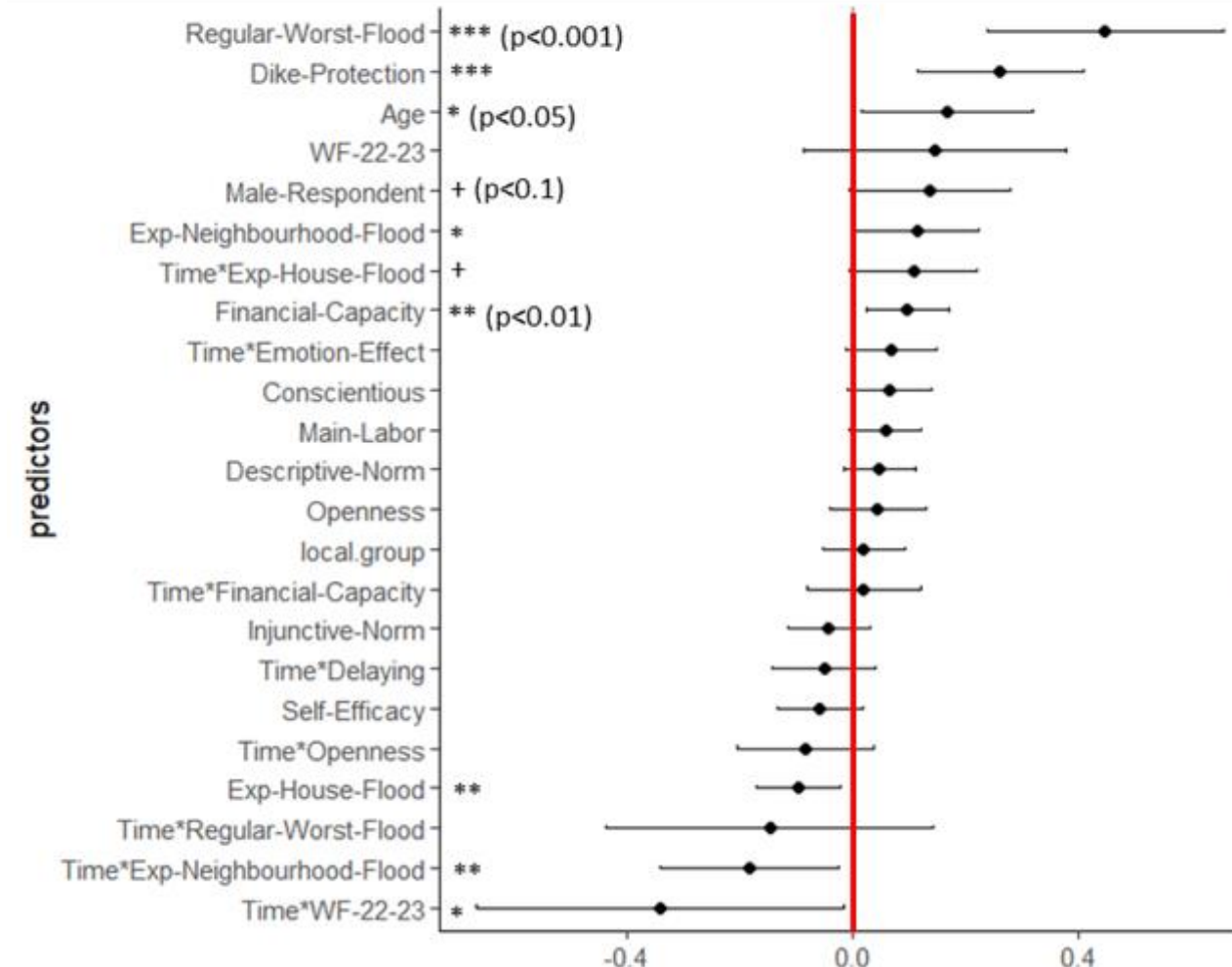
10. Results

Preparing devices

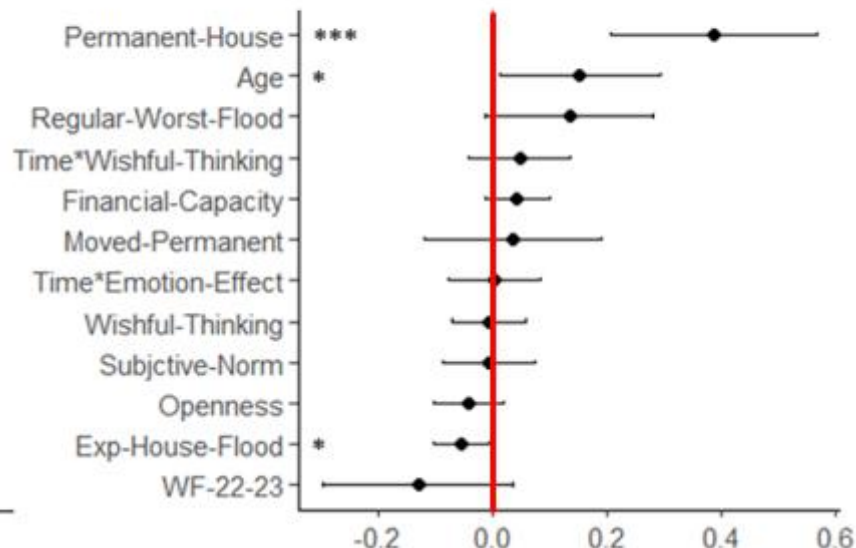
The closer the zero to the point estimate of a predictor, the more certain the predictor has the same influence on behavior and intention.

Zero excluded from or very close to the edge of the confidence interval means that the difference is significant with levels coded as in the figure, e.g., “+” means $p < 0.1$.

Predictors, especially those significant, will have a lower effect on behavior than on intention if their distributions are located on the left of the zero-line and higher if located on the right.



Retrofitting houses



Estimations and 95% confidence intervals of coefficients' difference of same predictors on behaviour and intention

11. Take home messages

Thank you for
your attention

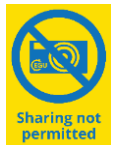
Behavior

What people actually do

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1. We found a huge intention-behaviour gap.
2. The strongest prior intention significantly correlates with higher subsequent implementation of retrofitting houses.
3. Intention and behaviour slightly reduce for preparing devices, whereas they increase for retrofitting houses.
4. Behaviour and behavioural change seem to be promoted by perceived behavioural control, risk perceptions, flood experience, housing situations, social norms, personalities, and socio-demographics.
5. Only a few predictors have similar influence on intention and behaviour such as social norms.
6. Various factors have significantly different influence on intention and behavior: risk perceptions, financial capacity, housing situation, and age.
7. Data on adaptation intention should not be used to draw policy recommendations nor used as a proxy for adaptation behavior.
8. Adaptation strategies should focus on beneficial predictors of behaviour.



The manuscript is under preparation



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