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Hydrology and Earth System Sciences
Discussions

Assessment of flood risk perceptions and adaptation capacity: a comparative study between rural and peri-urban areas in Greece

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Abstract. Focusing on flood risk and the information associated with it, developing risk management plans is often overlooking public perception of the threat. The perception of risk varies in many different ways, especially between the authorities and the affected public. It is because of this disconnection that many risk management plans concerning floods have failed in the past. This paper examines the private adaptation capacity and willingness with respect to flooding in two different catchments in Greece. The catchments of Evros and East Attica show recent flood events in the past 20 years. Two case studies were undertaken, comprised of a survey questionnaire focusing on 155 and 157 individuals, from a rural (Evros) and a peri-urban (East Attica) area, respectively, and they focused on those vulnerable to periodical (rural area) and flash floods (peri-urban area). Based on the comparisons drawn from these responses, and identifying key issues to be addressed when flood risk management plans are implemented, improvements are being recommended for the social dimension surrounding such implementation.

Keywords*: flood risk management; adaptation capacity; risk awareness; risk perception; sub-regional differences*

1 Introduction

Increasing flood losses throughout Europe have led the European Commission to issue the "Directive on the Assessment and Management of Flood Risks" (Commission of the European Communities, 2007) as one of the three components of the European Action Programme on Flood Risk Management (Commission of the European Communities, 2004). This directive requires the Member States to establish flood risk maps and flood risk management plans based on a nation-wide evaluation of hazards, vulnerability, and exposure. While in recent years, considerable efforts have been made towards flood risk maps, the requirements with respect to management plans are less-well studied (Hartmann and Spit, 2016). Of particular importance seems the paradigm of public participation in developing management plans, and the legal and institutional settings necessary therefore (Hartmann and Driessen, 2013). Public participation needs some basic understanding of the perception of flood risk among different parts of the population, i.e. citizens affected and the inhabitants of flood plains. A low risk awareness of residents living in flood-prone areas is considered among the main causes of their low preparedness, which in turns generates inadequate response to the threat (Scolobig et al., 2012). Risk perception 'denotes the process of collecting, selecting and interpreting signals about uncertain impacts of events' (Wachinger et al., 2013: 1049), and is a very complex framework with many influencing factors (Fischhoff et al., 1978; Slovic 1987, 2000; Plapp and Werner, 2006; Wagner, 2007). A general distinction is made between situational factors (such as individual experiences and socio-economic circumstances) and cognitive factors (such as personal and psychological components whose influence individual behaviour in decision-making process). Therefore, risk perception provides individual interpretation of flood hazards and

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Hydrology and Earth System Sciences
Open Access
Discussions

needs to integrate in the formal natural hazards decision-making process (Plattner et al., 2006; Barberi et al., 2008; Fuchs et al., 2009; Bradford et al., 2012). There are many studies to document the fact that personal experience is influenced by how exposed people perceive the likelihood of risks, and the magnitude of those risks, as well as their attitudes and beliefs concerning who is responsible for mitigation and loss compensation (Bubeck et al., 2012; Damm et al. 2013). In overall, risk perception and awareness demonstrate a central role in flood risk management discussion (Fischhoff, 1995; Renn, 1998; Slovic, 2000; Siegrist and Gutscher, 2006; Soane et al., 2010; Bradford et al., 2012; Bubeck et al., 2012, 2013; Wachinger et al., 2013; Pino González-Riancho et al., 2015; Kienzler et al., 2015; Babcicky and Seebauer, 2015). However, both terms are complex and controversially discussed, especially in terms of successful implementation of local structural protection measures (Karanci et al., 2005; Siegrist and Gutscher, 2006; Hall and Slothower, 2009; Jóhannesdóttir and Gísladóttir, 2010; Harries and Penning-Rowsell, 2011; Scolobig et al., 2012). The literature presents various myths and debates of both risk perception and awareness in flood risk management, especially the relationships between risk perception and awareness and the successful use of local structural protection measures and individual preparedness. Bradford et al. (2012), for example, demonstrate that the aspect of risk awareness shows no clear relationship with the individual preparedness in future flood events. Nevertheless, the authors found a clear relationship between flood experiences and preparedness. Similar results were also found by Harris and Penning-Rowsell (2011), Bubeck et al. (2013) and Kienzler et al. (2015), where people with flood experiences were more likely to undertake precautionary measures. Therefore, generally speaking risk perceptions influence the individual adaptation strategy (Bubeck et al., 2012). Nonetheless, experience of flood victims is only one aspect in the proactive action in flood risk management (Whitmarsh, 2008; Higginbotham et al., 2014). Whitmarsh (2008) argued that experiences have to be paired with the individual value and belief. Therefore, individual actions, can also be associated with other factors, such as home ownership (Grothmann and Reusswig, 2006; Burningham et al., 2008), socio-economic status of individuals (Kreibich et al., 2011; Duží et al., 2015) or effective risk communication (Soane et al., 2010; Meyer et al., 2012; Bubek et al., 2013). On the other hand, on the individual side – social networks and knowledge (social capital), which communicate that the precautionary measures are useful or effective – demonstrate a much higher likelihood to undertake precautionary measures compared to past experiences (Lo, 2013; Poussin et al., 2014; Babcicky and Seebauer, 2016). Nevertheless, other scholars (such as Kellens et al. (2011) and Duží et al. (2015)) demonstrate no clear significant relationship between one of these variables with the positive influence of individual preparedness. Further, on the other hand, high risk perception will not lead automatically due to successful implementation of local structural protection measures as presented by different scholars (Karanci et al., 2005; Siegrist and Gutscher, 2006; Hall and Slothower, 2009; Jóhannesdóttir and Gísladóttir, 2010; Soane et al., 2010; Bubeck et al., 2013). In general, the literature presented different explanations for this development, such as that people with experiences can underestimate the problem, because they feel helpless during the event (Soane et al., 2010). Other reasons may be the financial burden, difficulty to understand and locate the problem as well as the difficulties to install the local structural protection measures (Kreibich et al., 2011; Działek et al., 2013; Koerth et al., 2013; Kienzler et al., 2015) or lack of relationship between national authorities dealing with flood risk management and flood victims (Harris, 2013). In this line, a central aspect is the question of who is responsibility for flood risk management (Parker et al., 2007; Holub and Fuchs, 2009; Soane et al., 2010). In particular, the question about the implementation and payment of local structural protection measures seems to be crucial (Holub et al., 2012), as well as the overall concept used to reduce vulnerability and exposure (Fuchs, 2009; Fuchs et al., 2015). Additionally, there is also evidence that sub-regional differences play an important role in the use of adaptation strategies at household level (Higginbotham et al., 2014; Thaler and Priest, 2014).

Taking these findings as basis for discussion, the present paper explores differences of risk perception and individually response to flood risk management within two different sub-regional areas. Different actions undertaken across urban and rural farming populations characterised by different socio-economic conditions and due to different flood hazard types are studied, as well as their different response efficacy in flood risk management. This paper also links these self-assessed measures from individuals who belong to at-risk communities with direct experience with floods of previous years, as well as the profile demographic of the individuals in questions in terms of employment status, education level, and gender.

2 Materials and methods

We conducted a questionnaire survey between June and November 2012, based on a door to door survey technique, with flood victims in two different sub-regions in Greece. The core of the survey was formed according to past flood experiences, flood awareness and risk perception of individuals; an understanding of flood hazard processes; precautionary measures undertaken by individuals; and questions of responsibility in flood risk management.

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
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Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

The questionnaires were distributed in the research areas by researchers trained for this survey. The distribution of the questionnaires was based on geographical criteria in order to represent the research areas. To provide a good spread of answers, pre-coded and prompted nature with a meaningful Likert-type scale were used. Data were analysed separately for the two research locations (rural and peri-urban area) using SPSS (Statistical Package for the Social Sciences) for Windows, version 21.0 (IBM SPSS Statistics 21 Documentation, 2015). Statistical significance tests were used through Mann-Whitney U test (Mann and Whitney, 1947), logistic regression (Cox, 1958) and Recursive Partitioning Analysis (Breiman et al., 1984) in analysing the differences about the perception of individuals in the peri-urban and the rural area as well as for impacts of several variables on risk awareness. Further, the tests were conducted in order to analyse the impacts of past flood events on the individual risk perception and awareness as well as the impact of past events on the likelihood to undertake precautionary measures.

In this paper, we selected two different sub-regional areas in Greece characterised by two different types of flooding: low onset river flooding in the Evros catchment and rapid flash flood hazards in the East Attica region. Apart from these two different flood types, the selection of the case studies was made because of their contrasting socio-economic characteristics.

The river Evros is one of the largest in length of the Balkan peninsula. The total watershed area is 53,000 km^2 with 320 km river length and an average slope of 0.77%. About 66% of the total surface area is in the Bulgarian territory, about 28% in the Turkish territory and about 6% in the Greek territory. The Greek part of the river is a rural area of about 3,300 km^2 with a population of 85,000 concentrated in few small towns and villages. The river is known for a long series of serious and devastating flood events with high socio-economic costs and environmental impacts on the riparian communities and even on the national economies of the three neighboring countries (Skias et al., 2013). The area is dominantly rural oriented, where agricultural activities play a major role in the local economy. Besides the great importance of the river for the three riparian countries there are no common routes of collaboration between the states with respect to flood risk management. The complexity of the river is mainly due to political and historical reasons. Bulgaria, the upstream country, is a new EU member under transition period and a lot of institutional reforms are on the way. Greece, one of the two downstream areas, as an old member of EU has a strong dependency on upstream trans-boundary water bodies and on the same time the implementation of the European Floods Directive is a quite slow. Turkey, the other downstream area, is in open negotiations for joining EU and is not actually obliged to follow European Directives. Moreover, there is a quite slow progress on cooperation between the two EU member states which can be portrayed as unwillingness for cooperation especially from the side of the upstream country (Valvis, 2011). Additionally, the river's importance used from Bulgaria as a major reason for the expansion of political tensions between the three riparian countries (Valvis, 2011).

The second case study is the region of East Attica, which is characterised by flash flood events due to the prevailing climatic, geomorphologic, and anthropogenic conditions (Karagiorgos et al., 2016a). The region of East Attica is located east of Athens. The study area extends from the municipality of Oropos in the north to the municipality of Lavreotiki in the south and is subdivided into the provinces of Marathon, Mesogia and Lavriotiki. The district covers an area of 1,513 km^2 between sea level and 1,109 m a.s.l. with a plain hilly relief and a population amounting to 502,348 inhabitants (Hellenic Statistical Authority, 2011). The study area is characterised by extensive anthropogenic activities with settlements continuously growing. The economic development of this area is closely related to the construction of the international airport of Athens in 2001. In the period 1998-2010, the annual rate of increase of building development was within a range of 5% to 30% (Sapountzaki et al., 2011). As reported by Mantelas (2010) the province of Mesogia has developed faster than any other area in Attica during the last 20 years. Specifically the urban land cover increased from 60 km^2 in 1994 to 75 km^2 in 2000, and to 125 km^2 in 2007. In other words, while the urbanised area grew by 25% during 1994-2000, it grew by 66% during 2000-2007. The specific geographical settings of this region in combination with extensive anthropogenic activities repeatedly resulted in sudden flash flood events (Karagiorgos et al., 2016a, b).

3 Results

3.1Demographic characteristics

Demographically, our sample profiles of Evros and East Attica were compared in Table 1. The research sample was found to have an over-representation of males (75%), and older respondents (45%) for the Evros case study. The high retirement rate for Evros (41%) reflects the age bias, while the sample is under-represented in terms of unemployment (1%), which is also typical for the region with the result of a relative social homogeneity of the sample (similar to Steinführer and Kuhlicke, 2012). However, a wide range of age groups, education levels and employment statuses were represented, which when combined with the sample sizes (155 and 157 for Evros and

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
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Hydrology and Earth System Sciences
Discussions

East Attica, respectively) allowed the sample to be considered sufficiently robust for a generalisation of the findings.

[insert table 1 about here]

3.2 Causation belief

In the questionnaire we asked for the main causes of floods in two formats. First, we asked respondents to think up and list the factors that they believe can cause floods. Table 2 presents the results from the questioners, where a lack of structural measures being the most frequently listed reason for past flood events.

[insert table 2 about here]

Categorising the answers, 93.3% in Evros and 29.6% in East Attica identified the lack of protective constructions as one key factor for flood events. In Evros, the remaining 6.7% saw the lack of maintenance of protective constructions, while in East Attica, the remaining 70.4% is distributed among deforestation (25.4%), building in high-risk areas (15.5%), interventions on the riverbed (22.5%) and lack of maintenance of protective constructions (7.0%). However, most of the affected people listed anthropogenic factors as a central problem for past flood events. In East Attica, for example, more than 55.4% of the respondents stated that building in highly exposed areas is a main reason for flooding; in contrast to the low onset flood events in Evros. In Evros only 28.4% of the sample recognise their individually responsibility in flood risk management, which in turn means that more than 70% of the individuals believe that precautionary measures should be planned, financed and implemented by the governmental organisations responsible.

3.3 Risk perception and awareness

Figure 2 shows the results for the risk evaluation of individuals, disaggregating them according to whether they were seriously affected in the past. One should expect that people who were evacuated should report perceiving the risk significantly higher than those who were not evacuated. In neither region, however, there was a significant difference between the evacuated and non-evacuated groups with respect to the increase in risk perception (Mann-Whitney U tests using the difference in ratings between affected and non-affected people, $p = 0.453$ for Evros, $p = 0.489$ for East Attica). All the respondents in Evros and the majority in East Attica (53%) answered that they believe that a flood will happen again; from these respondents 69% in Evros and 63% in East Attica believe that a flood will happen in the next year, while 31% in Evros and 13% in East Attica believed that a flood will happen in the next two years. Risk communication processes embedded in local hazard knowledge (mainly from elderly people and flood experiences from neighbours and friends) and to a lesser extend also directly from the government through official training and information initiatives were the main reasons that respondents were aware of living in a dangerous area.

[insert fig. 1 about here]

Additionally, the Recursive Partitioning Analysis (Breiman, 1984), for the East Attica dataset showed that only the variable "income" has a significant impact on individual risk awareness; in fact, people with a higher income are more likely aware of the flood risk. Analysing the correlation between age and perception of the hydro-geological environment was found to be non-significant ($\tau = 0.063$ and $p = 0.355$ for Evros and $\tau = -0.019$, $p = 0.766$ for East Attica). In neither case, age demonstrate an increasing in risk perception.

3.4 Implementation of local structural protection measures

Table 3 and 4 presents the correlation matrixes for the different measured variables. A strong positive correlation can be find between the variables income and the use of local structural protection measures. In particular, the interviewees from East Attica responded positively between both variables ($r = 0.902$, $p < 0.01$). Also, the results from East Attica demonstrated a higher understanding of the event cause in comparison to the rural-area of Evros, where the interviewees mainly blame the state for not having undertaken sufficient structural flood defence schemes. However, the Evros results showed that suffering material damages in the past, interestingly, did not correlate with any other variables.

[insert table 3 about here]

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Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

[insert table 4 about here]

In rural communities of Evros, where the sample had various experiences with periodical flooding, risk awareness was found to be significant positively correlated to flood preparation (Kendall's tau correlation coefficient $\tau = 0.286$, $p = 0.000$). On the contrary, in the urban area of East Attica, the risk awareness was found to be uncorrelated to flood preparation ($\tau = -0.102$, $p = 0.120$). Nevertheless, the majority of respondents (72% and 67% for Evros and East Attica, respectively) stated that they feel safe against floods. In contrast, 25 % and 14% of the respondents, for Evros and East Attica respectively, consider their region being maximal at risk. However, only 24.8% of the sampling in Evros, but 73.4% of the respondents in East Attica undertook practical steps to protect their private property. Furthermore, in contrast to Harries (2013), fatalism play a much stronger role in the rural area of Evros compared to the semi-urban area of East Attica. In the latter case study, citizens are usually less likely involved in professions or skilled to response adequately and quickly to flood hazards, which typically can be found in rural areas. A key reason is the lack of relationship between a national authority dealing with flood risk management and flood victims with the outcome that flood victims take over the strategy of fatalism and blaming instead of increasing willingness to take precautionary measures (Harries, 2008, 2012). In particular, Tables 5 and 6 encourage this argument that in fact the public government has to lead the responsibility for the Greek flood risk management system. Main reasons for the low willingness are the low number of damages in the past (for East Attica see also Karagiorgos et al., 2016 a, b), historical socio-economic developments (especially for the Evros region as a periphery border region with strong state support in the past 30 years) and the missing link between risk perception, previous flood experiences and preparedness (Bradford et al., 2012). On the other hand, and similar to other studies, such as De Marchi et al. (2007) or Steinführer and Kuhlicke (2007), the role of the citizens is marginal.

[insert table 5 about here]

[insert table 6 about here]

These results show the classical free rider problem, because citizens request a flood protection scheme without contributing to the actual costs, which raise the challenge and conflict of social justice and equity in flood risk management (Johnson et al., 2007; Thaler and Hartmann, 2016). Having been evacuated during a flood event had no differences in this statement (49% of evacuated and 50% of non-evacuated people in Evros thought strongly that the state should pay, and 75% of evacuated and 79% of non-evacuated people in East Attica thought strongly that the state should pay). The Mann-Whitney U test for the difference in ratings between evacuated and non-evacuated people gave $p = 1.000$, both for Evros and East Attica. These results were in straight line with the question of which flood risk management strategy should be followed. They also showed that unlike the experts, respondents demonstrated a tendency to list hard flood defences, such as building new dikes and embankments, as more effective than non-structural flood risk management concepts, such as an improvement of the local land use management plan or individually preparedness (see also Table 7). Also other studies, such as Felgentreff (2000, 2003) and Plapp (2004), found similar results where residents see structural defences as the most useful instrument in flood risk management. In Evros the key conflict issues are related to the unsolved transboundary cooperation in the region (more than 86.3%).

[insert table 7 about here]

4 Discussion and conclusion

It is the findings within this study that have helped to advance the understanding of risk management and preparedness in flood risk management. However, this current study showed no correlation between preparedness and awareness levels for the urban area at risk that experiences flash floods (Table 8).As such, awareness has little in common with high levels of preparedness, which would help to enhance resilience (similar results can be found in Bradford et al., 2012).

[insert table 8 about here]

The results showed that with respect to the perception of the hydro-geological environment, a surprising 32% for Evros and 39% for East Attica thought that their environment is not at all dangerous. Nevertheless, all the respondents in Evros and the majority in East Attica (53%) said that they believe that a flood will happen again. On the other side, a correlation between age and perception of the hydro-geological environment was found to be insignificant; people did not seem to have more accurate perceptions for the environment they live in as they age.

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

Many respondents did underestimate the hazard associated with flooding, both in the rural area with periodical flooding, and in the urban area with flash floods. For many individuals, a recent event still vivid within their memories, would increase the personal perception of the likelihood of flood events taking place. This is known as the "availability heuristic" (Tversky and Kahneman, 1973, 1974). Asking for a retrospective assessment of the perception of risk, and indicating the related emotional experiences and effects of the flood, can lead to underlining the "affect heuristic" (Slovic et al., 2004). Due to the fact that there is a significant number of individuals without direct flood experience still remaining within exposed areas, action should be taken and appropriate methods should be developed by flood risk managers to best provide flood-related information in order to raise the appropriate awareness. Based on our findings, there is an increased challenge in areas where communities believe that it is the flood risk agencies and emergency responders being solely responsible for the implementation of preventative measures to protect exposed properties, and, in essence, that the self-protection of individuals is far less important. A larger emphasis was placed by residents upon measures to reduce the risk of flooding, rather than focusing on the improvement of better planning which could avoid certain activities (e.g. construction) in high-risk areas. This is also consistent with the need for residents to realise that they can control the risk, and that they can be comfortable living within these high-risk areas.

Flood risk management plans are becoming increasingly important as a requirement of the European Floods Directive. As these plans take in both the social factors and physical nature of risk, public perception of these risks must be at the core. Because of the different notion of risk between the general public and the scientific community, those who are responsible for developing flood risk management plans need to understand the ways in which those affected will discern the risk. It is due to a lack of understanding of the authorities in charge that flood risk management policies have failed in many places so far. This study represents a social approach and provides some explanations for this failure, and is targeted towards incorporating public perceptions in developing risk management plans. Although fear is often used to advocate an increase in risk perception, the results show that this is not a way to promote the desired response within the people; the majority feel safe against floods, while many people believe that their environment is not at all dangerous, both in the rural area with periodical flooding and the urban area with flash floods.

These conclusions can be summarised as follows:

1. Awareness by previous experience with floods can be taken from the flood victims and used as a resource.
2. Structural protection measures are an important measure to reduce flood risk.
3. The information on flood risk needs to fit the individuals it is intended for, especially for those individuals who have no prior experience with floods.
4. Safe routes and appropriate actions to take in times of flood events should be highlighted and become common knowledge.
5. Even if awareness does not help to increase preparedness, communication strategies should not resort to using fear in vulnerable communities.

Gathered through an innovative approach, the practical findings presented here will help to facilitate flood managers in their developments of plans that allow for the consideration and complexity of public perceptions, such as preparing risk communication strategies to raise awareness within the community.

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Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

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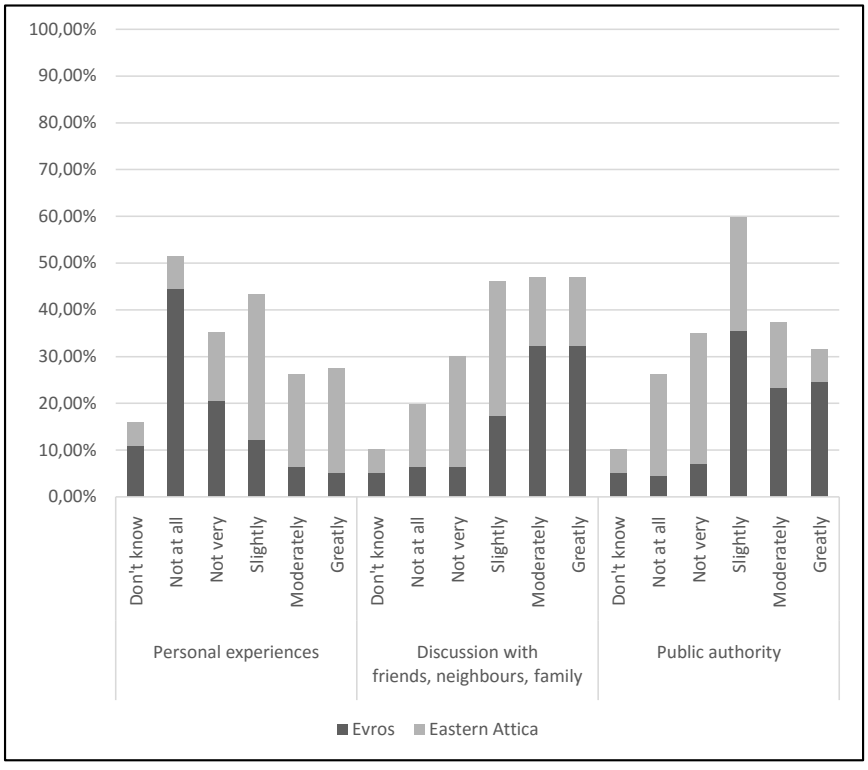

Figure 1. Local knowledge about hydro-geologically processes

5

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

Table 1. Demographic characteristics in the study sites of East Attica and Evros

Demographic variables		**East Attica**	**Evros**
Gender	Male	74.7%	51.9%
	Female	25.3%	48.1%
Education	1st level	49.0%	7.9%
	2nd level	45.0%	57.9%
	3rd level	6.0%	34.3%
Employment	Entrepreneur, free-lance, manager	8.4%	22.1%
	Trader, craftsman, farmer	27.1%	16.2%
	Teacher, employee, military	7.1%	29.9%
	Worker, store clerk, domestic collaborator	6.5%	10.4%
	Housewife	5.8%	1.9%
	Unemployed	1.3%	7.8%
	Retired	40.7%	3.9%
	Student or in search of first occupation	0.0%	7.8%
	Other	3.2%	0.0%
Age	<25 years	2.0%	5.1%
	25-35 years	4.7%	24.8%
	35-45 years	6.7%	24.2%
	45-55 years	14.0%	23.6%
	55-65 years	28.0%	15.3%
	≥65 years	44.7%	7.0%

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

Table 2. Respondents level of agreement as the causes of floods

Activities		**East Attica**	**Evros**
Deforestation	Don't know	100.0%	3.2%
	Not at all	0.0%	0.6%
	Not very	0.0%	3.2%
	Slightly	0.0%	12.7%
	Moderately	0.0%	18.5%
	Greatly	0.0%	61.8%
Building in risk areas	Don't know	6.5%	3.2%
	Not at all	27.1%	0.6%
	Not very	10.3%	5.7%
	Slightly	10.3%	17.2%
	Moderately	17.4%	17.8%
	Greatly	28.4%	55.4%
Lack of protective constructions	Don't know	2.6%	15.3%
	Not at all	18.7%	5.7%
	Not very	12.9%	21.0%
	Slightly	27.1%	16.6%
	Moderately	20.6%	14.6%
	Greatly	18.1%	26.8%
Lack of maintenance of protective constructions	Don't know	5.2%	14.6%
	Not at all	17.4%	8.3%
	Not very	9.7%	21.0%
	Slightly	32.9%	14.0%
	Moderately	20.0%	14.0%
	Greatly	14.8%	28.0%
Interventions on the riverbed	Don't know	6.5%	7.6%
	Not at all	17.4%	3.8%
	Not very	7.7%	5.7%
	Slightly	30.3%	5.7%
	Moderately	23.9%	18.5%
	Greatly	14.2%	58.6%

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Table 3. Correlation matrix East Attica

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Perception before last flood event	1	**-.209***	**-.293****	.102	.091	**.182***	-.032	.016	.044	.008	-.047	**.180***	**.232****	-.092	-.058	.122
2	Evacuated at the event		1	**.199***	-.064	**-.176***	.023	**-.230****	**-.248****	.032	-.113	-.057	.025	-.069	-.069	-.077	-.079
3	Suffered material damages			1	-.087	.035	.061	.040	.106	-.120	.088	**.250****	**.193***	-.024	.002	-.028	-.084
4	Personal experiences				1	**.460****	.155	**-.305****	**-.229****	**.191***	.120	.125	**.365****	**.377****	.109	.080	**.379****
5	Local knowledge					1	**.245****	**.210****	**.264****	**.165***	**.180***	**.220****	.030	.087	-.099	-.099	.091
6	Official training and information initiatives						1	.043	.048	-.036	.056	.132	.146	**.189***	**.163***	.099	.127
7	Personal precautions taken							1	**.902****	**-.265****	**.184***	**.323****	**-.362****	**-.396****	**-.192***	**-.161***	**-.402****
8	Sufficient household income								1	**-.185***	**.248****	**.417****	**-.332****	**-.378****	**-.211****	**-.191***	**-.363****
9	Period of living at the current residence									1	-.059	**-.203***	.010	.148	-.031	-.010	.110
10	Retrospectively preparedness level										1	**.520****	.043	-.031	.034	.058	.066
11	Present individual preparedenss level											1	-.061	-.124	-.063	-.113	**-.157***
12	Deforestation causing the problem												1	**.652****	**.400****	**.350****	**.504****
13	Construction of buildings in areas at risk causing the problem													1	**.373****	**.351****	**.635****
14	Lack of structural devices causing the problem														1	**.917****	**.502****
15	Lack of structural devices maintenance causing the problem															1	**.509****
16	Interventions on rivers bed causing the problem																1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Table 4. Correlation matrix Evros

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Perception before last flood event	1	**-.507****	**-.372****	.001	.006	.118	-.093	-.061	.125	.009	.060	.[b]	**-.249****	**-.204***	**-.217****	-.043
2	Evacuated at the event		1	**.363****	-.074	.065	.115	.013	.125	-.070	.055	-.004	.[b]	**.265****	**.209****	**.183***	.042
3	Suffered material damages			1	-.116	-.118	-.095	-.061	.106	-.146	.030	-.017	.[b]	.150	.043	-.086	-.147
4	Personal experiences				1	**-.286****	**-.251****	-.064	-.051	.132	-.075	-.121	.[b]	**-.300****	-.016	.066	.062
5	Local knowledge					1	**.643****	-.127	-.058	**.243****	**.379****	**.346****	.[b]	**.242****	.154	.028	-.129
6	Official training and information initiatives						1	-.058	.101	.103	**.260****	**.216****	.[b]	**.328****	.067	**.168***	.024
7	Personal precautions taken							1	-.020	-.050	-.134	**-.222****	.[b]	.083	.073	**.196***	**.194***
8	Sufficient household income								1	-.024	.127	.073	.[b]	.103	.060	-.007	-.103
9	Period of living at the current residence									1	**.167***	.135	.[b]	.055	-.031	-.136	-.101
10	Retrospectively preparedness level										1	**.523****	.[b]	.091	.125	.020	-.150
11	Present individual preparedenss level											1	.[b]	.072	.014	.022	-.071
12	Deforestation causing the problem												.[b]	.[b]	.[b]	.[b]	.[b]
13	Construction of buildings in areas at risk causing the problem													1	**.472****	.153	-.061
14	Lack of structural devices causing the problem														1	**.284****	.113
15	Lack of structural devices maintenance causing the problem															1	**.657****
16	Interventions on rivers bed causing the problem																1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

Table 5. Contributions to the costs for flood protection in East Attica

	N		***M***	**SD**
People at risk	157	1=strongly disagree; 5= strongly agree	2.401	1.386
Local authority	157	1=strongly disagree; 5= strongly agree	3.815	1.363
District	157	1=strongly disagree; 5= strongly agree	4.331	1.162
Government	157	1=strongly disagree; 5= strongly agree	4.503	1.180

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
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Discussions

Table 6. Contributions to the costs for flood protection in Evros

	N	Response scale	*M*	SD
People at risk	155	1=strongly disagree; 5= strongly agree	0.000	0.000
Local authority	155	1=strongly disagree; 5= strongly agree	1.761	1.305
District	155	1=strongly disagree; 5= strongly agree	3.226	1.506
Government	155	1=strongly disagree; 5= strongly agree	3.955	1.369

5

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

Table 7. Perception of the effectiveness of adaptation measures

Measures	**East Attica**	**Evros**
New protection works (such as levees or dams)	79.6%	2.0%
Ensure appropriate maintenance of existing protection works	13.8%	2.6%
Ensure better local land use management plans	3.9%	2.6%
Improve preparedness of people living in risk areas (e.g. information. training drills etc.)	2.6%	6.5%
Other	0.0%	86.3%

Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-298, 2016
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Published: 6 July 2016

Hydrology and Earth System Sciences
Discussions

Table 8. Overview of the main results between both sub-regions

	East Attica	**Evros**
Flood preparation	On the contrary, in East Attica (the urban area that experiences flash floods) risk awareness found to be uncorrelated to flood preparation.	In Evros, i.e. the rural area that experiences periodical flooding, risk awareness found to be positively correlated to flood preparation, i.e. the more aware, the more prepared.
Local structural protection measures	73.4% of residents in East Attica undertook concrete steps to protect their family and property	A posteriori, 24.8% of residents in Evros undertook concrete steps to protect their family and property
Main causes of floods	29.6% in East Attica identified lack of protective constructions. The remaining 70.4% is distributed among deforestation (25.4%), building in risk areas (15.5%), interventions on the riverbed (22.5%) and lack of maintenance of protective constructions (7.0%).	93.3% in Evros identified lack of protective constructions. In Evros, the remaining 6.7% identified lack of maintenance of protective constructions
Risk communication	The main reasons that respondents are aware that they are living in a dangerous area, where knowledge about hydro-geological phenomena is gained mainly by personal experience.	The main reasons that respondents are aware that they are living in a dangerous area, in Evros, are informal information, i.e. from family and friends, and formal information
Payments	77% in East Attica believe that the state should pay for mitigation measures, while people who were evacuated and people who were not did not seem to be different.	A remarkable 49% in Evros believe that the state should pay for mitigation measures, while people who were evacuated and people who were not did not seem to be different.