How much are you willing to pay for a forecast?

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This is an adapted online version of the game presented in Arnal et al. (2016). Read the instructions below carefully before playing it with a group.

1. Overall concept of the game

This is a willingness-to-pay game embedded in a risk-based decision-making experiment. The game was designed to understand the role of probabilistic forecasts in decision-making processes and to look at the perceived value of the forecasts by the decision-makers. This is done by giving the participants a set of probabilistic forecasts of their river level, with which they will have to decide whether to buy flood protection. The participants' willingness-to-pay for probabilistic forecasts is evaluated during the game through an auction, where forecasts are no longer given but sold, and in a limited number.

In the game, all participants are competing for the position of the head of the flood protection team of a company. Their task is to manage the flood protection activities of a river (it is the same river for all participants). The participants have to make the right decisions in order to keep inhabitants safe of floods and lose as little money as possible from the initial budget they have. The participant(s) with the highest amount of money in their purse at the end of the game is/are hired as head of the flood protection team.

Based on this storyline, the game develops according to the flowchart shown in Figure 1. Each participant is given an initial budget of 20,000 tokens prior to starting the game. The game is structured in two rounds of five cases each. For each case, participants are given the river's current level as well as a forecast river level (in the form of a probabilistic forecast represented by a boxplot) (see Figure 2). Based on this information, the participants have to decide whether they want to buy flood protection. They are informed that a flood occurs if the river level reaches 90

and that flood protection costs 2,000 tokens. After all participants made a decision, they are shown the observed river level. If a flood happened and the participants had not bought flood protection, they have to pay 4,000 tokens of damage cost. Otherwise, if a flood occurs and they had paid flood protection, no additional cost has to be paid by the participants.

For round one, there are three different probabilistic forecast types: "good", "overestimating" and "underestimating" forecasts. For the "good" forecasts, the forecast median equals the observed flow. For the "overestimating" forecasts, the forecast median overestimates the observed flow. For the "underestimating" forecasts, the forecast median underestimates the observed flow. The participants should not be told about the different types of forecast quality before or while playing the game.

After the five cases of round one have been played, the participants are told that they will now have to pay to have access to the probabilistic forecasts for round two. They are also told that there is only a limited number of forecasts to be sold and only about 30% of them will have access to those forecasts. An auction is then organised to sell the probabilistic forecasts for round two. These are sold to approximately 30% of the participants with the highest bids. All the forecasts sold for round two are "good" forecasts. The participants should not be made aware of this either during the game. Participants who have not bade enough to purchase a forecast set for round two during the auction will not have any forecasts to base their decisions on during the second round of the game.

Once the five cases of round two have been played, the participant(s) with the highest amount of money in their purse at the end of the game is/are hired as head of the flood protection team.

The game was played at many conferences and workshops in 2015 and a paper (Arnal et al., 2016) was written from the results of its applications.
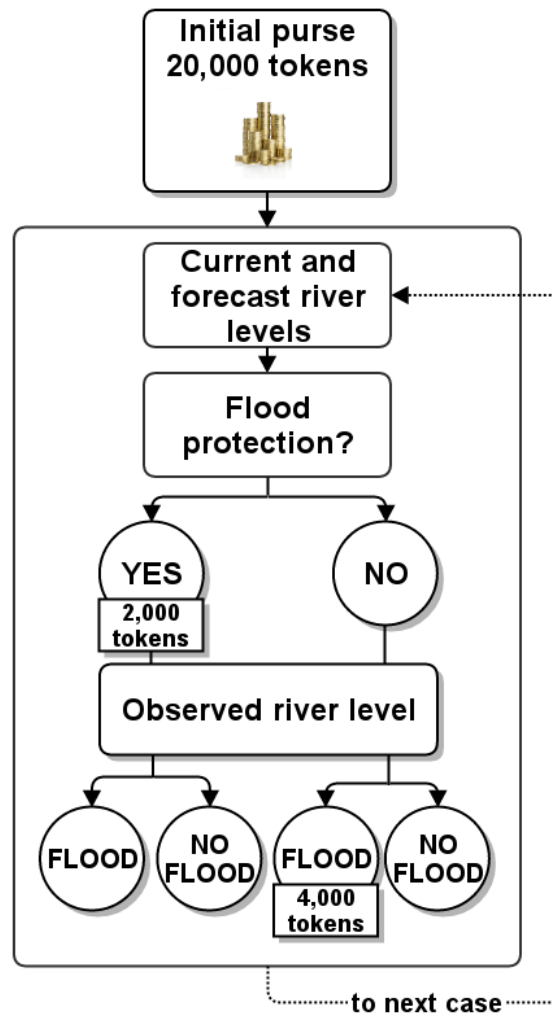
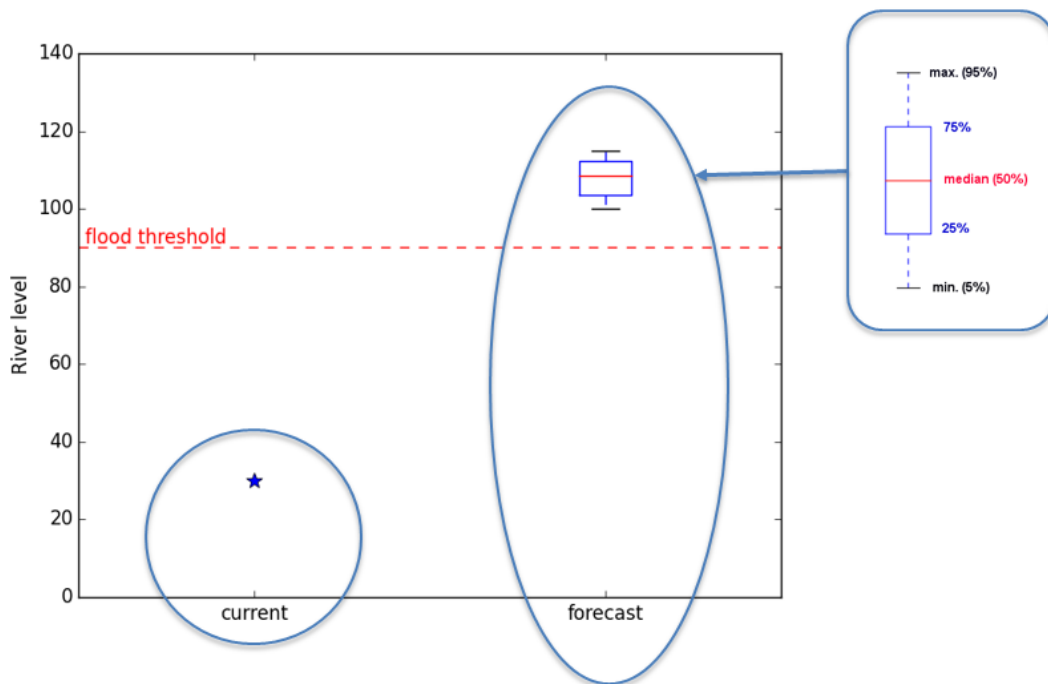*Figure 1 Flowchart of the game decision problem for one case.*

Figure 2 Information given to the participants for each case: the current and forecast river levels.

2. Online game set-up

This is a description of the online version (as google forms) of the flood game "How much are you willing to pay for a forecast?". Participants need to have access to internet and a valid email address to be able to play the game.

a. Round 1

REMINDER: For round one, there are three different probabilistic forecast types: "good" forecasts, "overestimating" forecasts and "underestimating" forecasts. The participants should not be made aware of the different forecast types before or while playing the game.

The game organiser should first randomly distribute a web link to each participant to play the first round (each participant should have one of the three links shown in Table 1, but without knowing to which type of forecast the link belongs).

Each link redirects them to a google form where they will be able to play the game. The participant will have to fill in their email address on the google form prior to the start of the game. Using this email, the google form will automatically send the participant an email at the end of the first round, with their round one final purse and a link to play round two. The email should arrive within a couple of seconds to minutes. It is however not recommended to use a work email address as the email might get blocked.

Table 1 Links to be randomly distributed among all participants to play round one.

Type of forecast	Links
"good" forecasts	http://goo.gl/forms/Rs6HjfZXPU
"overestimating" forecasts	http://goo.gl/forms/NJeiiZCGuk
"underestimating" forecasts	http://goo.gl/forms/ULImq57jjq (the third letter is a capital i)

b. Round 2

At the beginning of round two, the game organiser should carry out a live auction to sell access to the probabilistic forecasts for round two. The participants' bids are for all the five probabilistic forecasts of round two. The organiser will distribute a password (giving access to the probabilistic forecasts) to the participants with the highest bids (see Table 2). About 30% of the participants should have access to the forecasts for round two. The rest of the participants will play the second round with no forecasts at all (this should be clear to all participants before starting the auction), following the link they received in their email inbox after playing round one (no password is required in this case). At the end of the round, the participants will receive an automatic email with their final purse.

Table 2 Link for round two and password to be distributed to about 30% of the participants with the highest bids (i.e. participants who bought the forecasts during the auction) to play round two.

Link	Password
http://goo.gl/forms/dbFYaOVCV9	132465

3. Follow up discussion

At the end of the game the participant(s) with the highest purse is/are announced as winners of the game. This/these participants can be given a prize.

The main objective of the game is to prompt discussion on the value of forecasts for decision-making in the field of flood protection. In order to apprehend some perceptions of the participants during the game, a few questions were included in the game worksheet. They are not exhaustive and a broader discussion could therefore be organised at the end of the game in order to complement those questions and discuss further issues. Questions that could be asked to the participants during this discussion are, for instance:

- Did you use the forecasts you were given in round one?
- Did you notice the bias in the forecast for round one? If so, how did this affect the way you used the forecasts (in rounds one and two)?
- What were your reasons for not purchasing a second forecast set to play round two?
- What were the strategies adopted by those who were without forecasts for round two?
- Have those playing with forecasts for round two made all the right decisions? If not, what is/are the reasons?
- How about the winner(s)? What were their strategies? Have they purchased a second forecast set?

4. General rules

The game should not be played with more than 50 persons per day as the google form cannot send more than 100 automatic emails per day. For educational purposes, we recommend playing the game in teams, not individually, as this may foster interesting discussions among the players.

And most importantly, ENJOY and HAVE FUN!

We are interested in receiving feedback from your experience in playing the game. For this, you may contact us at: louise.arnal@ecmwf.int; maria-helena.ramos@irstea.fr or florian.pappenberger@ecmwf.int.