

How much are you prepared to PAY for a forecast? Game instructions

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1 Introduction

This is a willingness-to-pay game embedded in a risk-based decision-making experiment, based on a “Red Cross/Red Crescent, Climate Centre” game¹.

In the game, all participants are competing for the position of the head of the flood protection team of a company. The aim of the game is to protect inhabitants and keep them safe from flood events, while spending as little money as possible in flood protection. The participant(s) with the highest amount of money in their purse at the end of the game is/are chosen as head of the flood protection team.

Based on this storyline, the general concept of the game is as follows:

- each participant is assigned a river (River Blue, River Yellow or River Green) and receives an envelope with the corresponding material needed to play the game (see Section 2.2).
- Participants work independently and all start from the same initial purse.
- Knowing their initial river level, they have to make use of a probabilistic forecast of their river level increment after rainfall to decide if they want to pay for flood protection or not.
- A flood occurs if the sum of the initial river level and the river level increment after rainfall reaches a given threshold.
- The cost of flood protection is lower than the cost participants will have if a flood occurs and inhabitants are not protected against it.

¹<http://www.climatecentre.org/downloads/files/RCRCCC%20DDR%20Game%20Booklet%20P4P%20web.pdf>

The game is structured in two rounds, with 5 independent cases in each round. For the first round, each participant is given a forecast set, containing probabilistic forecasts of the river level increment after rainfall (see Section 2.2). For the second round, only a limited number of probabilistic forecasts are available. They are auctioned to the participants, who will then be able to show how much they are willing to pay for the forecasts (see Section 2.3).

This game is a contribution to the international Hydrologic Ensemble Prediction Experiment (HEPEX). It ultimately aims at promoting discussions around the topic of the value of forecasts for decision-making in the field of flood protection (see Section 3). This version of the game is licensed under CC BY-SA 4.0 (Creative Commons public license).

2 Game set-up

2.1 How to prepare the forecast sets?

1. **Print the forecast sets (file ‘forecasts.pdf’) and the ECMWF logo that will go at the back of the sets (file ‘forecasts_back.pdf’) (Figure 1).** There are 3 sets for each river: Blue 1 to 3, Yellow 1 to 3 and Green 1 to 3. The total number of sets to be printed should be equal to the number of participants one is expecting to have for the game (see Section 2.2). It is advisable that the minimum number of players is $3 \times 3 = 9$ participants.

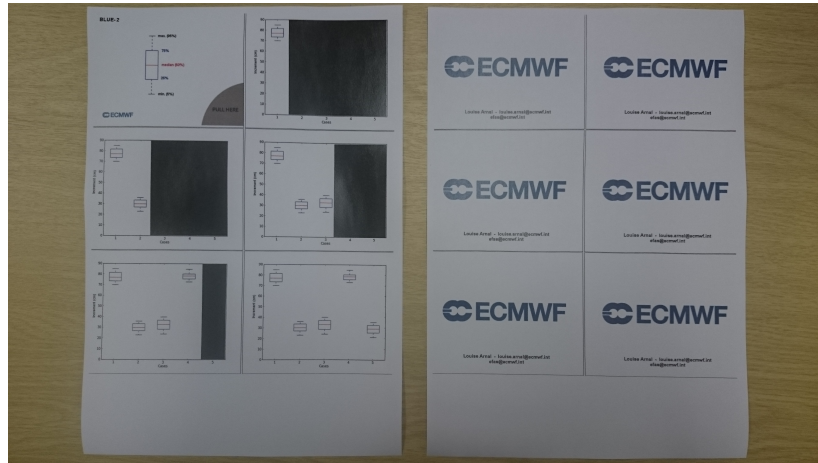


Figure 1: Printed forecast set ‘BLUE-2’ on the left and forecast set back (ECMWF logo) on the right

2. **Cut the forecasts sets and the ECMWF logos on the lines indicated (Figure 2).** The numbers in red on top of each piece of paper indicate the order in which you

should superpose the papers for the next step. Make sure not to mix the sets during this process!

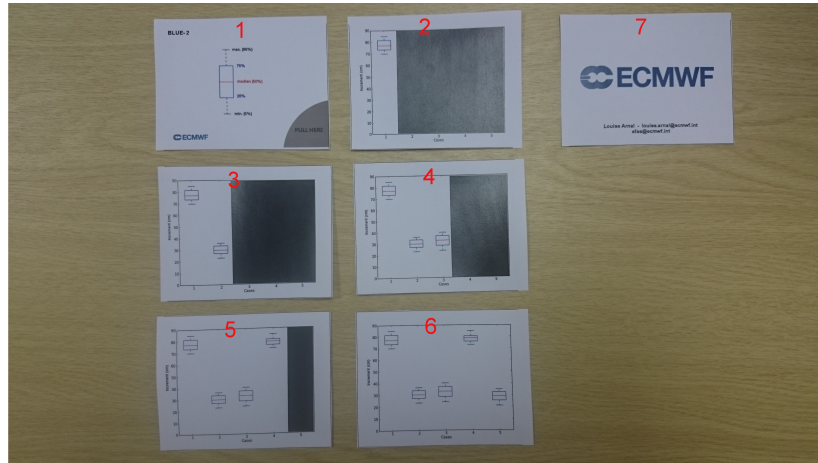


Figure 2: Cut forecast set 'BLUE-2' on the left and forecast set back (ECMWF logo) on the right

3. Superpose the different pieces of a forecast set in the order indicated by the numbers on Figure 2 and paste or staple the borders of the set highlighted in red on Figure 3. The piece numbered with a 1 on Figure 2 will be placed on the top, followed by piece number 2, piece number 3, and so on. The ECMWF logo will be the last piece of the pile, facing outside.

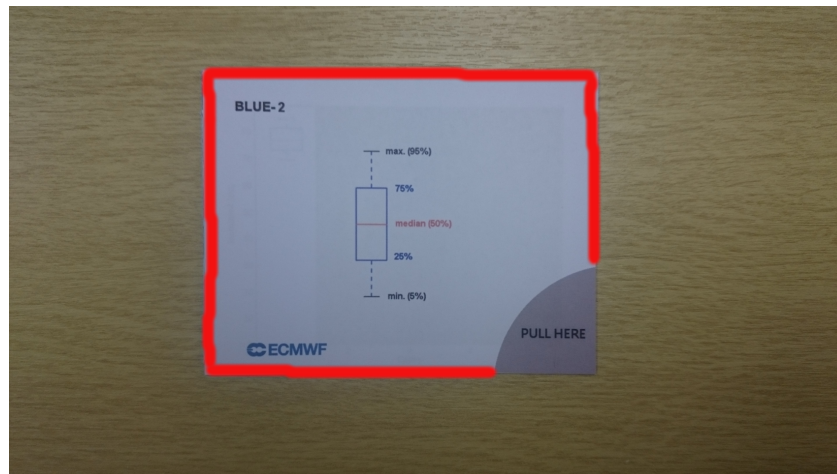


Figure 3: Borders to paste or staple together on forecast set 'BLUE-2'

This is how your final forecast set should look like (Figure 4).



Figure 4: Final forecast set 'BLUE-2'; on the left, top of the set and on the right, back of the set

NOTE: the 4th forecast sets should also be prepared as indicated above. However, they should not be distributed in Round 1. They are kept for Round 2, as explained in Section 2.3.

2.2 Round 1: what to distribute?

Prior to the start of the game, one should distribute to each participant:

- a forecast set (numbered 1 to 3; forecast sets 4 will be distributed for the second round of the game),
- a game worksheet (with the same label as the forecast set) (file 'worksheet_<river name><forecast set number>.pdf').

IMPORTANT: the forecast sets as well as the worksheets are labelled. The labels contain a river name (Yellow, Blue or Green), which should correspond to the river assigned to the participant. They also contain a number from 1 to 3. The different numbers represent different forecast qualities. Sets number 1 are constantly overestimating the river level increment, sets number 2 are reliable forecasts and sets number 3 are constantly underestimating the river level increment. However, participants should not know about the quality of the forecasts they are receiving. It is part of the results to see the influence of the different forecast qualities on the participants decisions. Forecast sets numbered with a 4 are distributed during Round 2 only!

In Round 1, one should try to distribute an equal number of each river-number combination, to have a good sample of all forecast quality types among participants.

2.3 Round 2: bidding process

For round 2, forecast sets with the label 4 should be distributed to approximately one third of the participants, based on a bidding process.

The bidding process is as follows: first, each participant will have to write down on their worksheet the amount they are willing to pay for a forecast set for the entire second round. After all the participants have written down that number on their worksheet, the auction can begin.

The speaker will start the auction by asking the audience who wrote down an amount equal or superior to 10,000 tokens. A set is distributed to each participant having their hands up.

The speaker then lowers the amount to 9,500 tokens, then 9,000 tokens and so on, until all forecast sets are distributed to participants who pay the most. The auction should continue until forecast sets are distributed to approximately one third of the participants.

IMPORTANT: the river colour of the forecast set distributed during this round should correspond to the colour of the river the participant already had for Round 1.

The second round can then begin!

3 Discussion

The main objective of this 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 raised during this discussion are, for instance:

- What were the main factors that drove participants to buy a flood protection?
- How valuable were the probabilistic forecasts for their decisions?
- How did they use the probabilistic forecasts in their decisions?
- What influenced the bidding amounts of participants for the auction?
- Why did/didn't participants want to buy a forecast set in Round 2?

4 A few important points

- Before the game starts, make sure that each participant has a worksheet and a forecast set with the same label.
- The speaker should stress the fact that a flood protection will cost the player 2,000 tokens, regardless of the flood occurrence.
- At the moment of the auction, participants should be reminded that they are bidding for a forecast set containing forecasts for all the five cases of Round 2.
- Before the second round starts, participants must transfer the rest of their tokens from Round 1 to Round 2. They should not start from 20,000 tokens again.

And most importantly, **ENJOY!**

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.