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► **To cite this version:**

Michel Werner, Maria-Helena Ramos, F. Wetterhall, M. Cranston, S.-J. van Andel, et al.. Weighing costs and losses: A decision making game using probabilistic forecasts. EGU General Assembly 2017, Apr 2017, Vienna, Austria. Geophysical Research Abstracts, 19, pp.1, 2017. hal-02606228

HAL Id: hal-02606228

<https://hal.inrae.fr/hal-02606228>

Submitted on 16 May 2020

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Weighing costs and losses: A decision making game using probabilistic forecasts

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Probabilistic forecasts are increasingly recognised as an effective and reliable tool to communicate uncertainties. The economic value of probabilistic forecasts has been demonstrated by several authors, showing the benefit to using probabilistic forecasts over deterministic forecasts in several sectors, including flood and drought warning, hydropower, and agriculture. Probabilistic forecasting is also central to the emerging concept of risk-based decision making, and underlies emerging paradigms such as impact-based forecasting. Although the economic value of probabilistic forecasts is easily demonstrated in academic works, its evaluation in practice is more complex. The practical use of probabilistic forecasts requires decision makers to weigh the cost of an appropriate response to a probabilistic warning against the projected loss that would occur if the event forecast becomes reality.

In this paper, we present the results of a simple game that aims to explore how decision makers are influenced by the costs required for taking a response and the potential losses they face in case the forecast flood event occurs. Participants play the role of one of three possible different shop owners. Each type of shop has losses of quite different magnitude, should a flood event occur. The shop owners are presented with several forecasts, each with a probability of a flood event occurring, which would inundate their shop and lead to those losses. In response, they have to decide if they want to do nothing, raise temporary defences, or relocate their inventory. Each action comes at a cost; and the different shop owners therefore have quite different cost/loss ratios.

The game was played on four occasions. Players were attendees of the ensemble hydro-meteorological forecasting session of the 2016 EGU Assembly, professionals participating at two other conferences related to hydrometeorology, and a group of students. All audiences were familiar with the principles of forecasting and water-related risks, and one of the audiences comprised a group of experts in probabilistic forecasting. Results show that the different shop owners do take the costs of taking action and the potential losses into account in their decisions. Shop owners with a low cost/loss ratio were found to be more inclined to take actions based on the forecasts, though the absolute value of the losses also increased the willingness to take action. Little differentiation was found between the different groups of players.