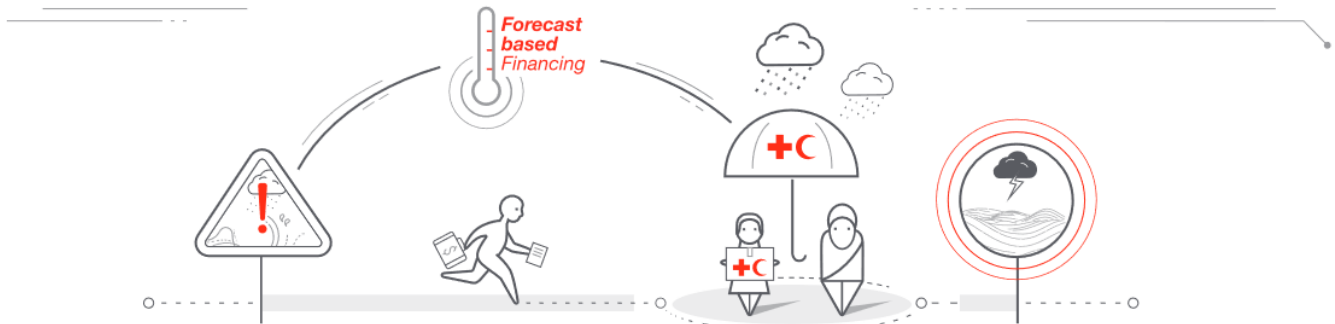




The Trigger Protocol for Heatwaves in Hanoi



German Red Cross



WHEN TO ACT?

In July and August in Hanoi, VNRC and GRC took anticipatory actions to reduce human health risks associated with extreme heat. VNRC positioned several community cooling centers and buses in the most at-risk wards in Hanoi. When anticipatory actions will be taken is decided according to **weather forecasts or triggers that exceed predefined threshold values (danger levels)**. As soon as the forecast reaches the specific threshold, preparations and implementations of the Early Actions start.

For conducting a risk analysis and to develop the trigger for heatwaves in Hanoi, a partnership with the Institute of Meteorology, Hydrology and Environment of Vietnam (IMHEN) was established. The IMHEN is a governmental research institute and has the main functions to undertake scientific studies and to provide consulting services in support to the formulation of development strategy, legal system and policies on the field of Meteorology, Hydrology, Environment and Climate Change. The IMHEN conducted a study on historical

events recorded (i.e. 1961-2018) and the future trends for heatwaves in Hanoi which shows that the **frequency and duration of heatwave events have increased** in the past 58 years and are projected to further increase (Figure 1).

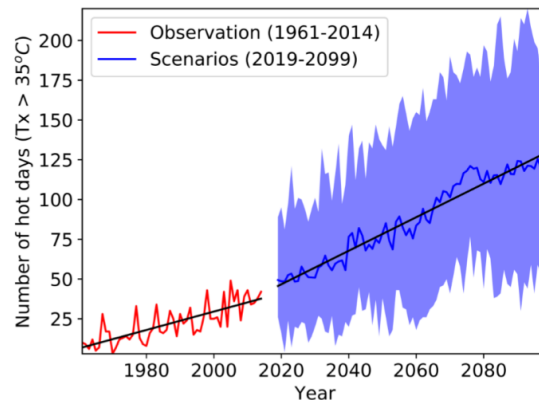


Figure 1 The observed (red line) and future projection (blue line) of the number of hot days (defined as days with maximum temperature exceeding 35°C) in Hanoi according to the climate change scenarios for Vietnam (MONRE 2016)

FORECASTING HEATWAVES

To forecast heatwaves, and hence to know when the specific trigger has been reached, heatwave related indices are generally being used. In Vietnam no heatwave related index was being forecasted before the start of the “FbF-Ready” project. Before only temperatures were used for the forecasting of heatwaves. However, it is important to take the **relative humidity** into account, since it has a large influence on how we perceive the temperature. Moist air feels hotter because it makes sweating less efficient, which results in a lower rate of cooling down the human core body temperature, hence a higher change on heat-related illness and a heatstroke.

Since no heat related index was being forecasted in Vietnam, the IMHEN developed a

detailed weather model for Hanoi to forecast the temperature and relative humidity to calculate the **Heat Index**. The Heat Index calculates the perceived temperature with combining the temperature and relative humidity. Thus, it is a better **predictor for a heatwave** than merely the temperature.

In addition, the IMHEN developed a tool whereby the Heat Index forecast and threshold are presented and updated automatically. Figure 2 captures the main figure of the tool developed by the IMHEN. The graph contains the forecasts of the temperature, relative humidity and the Heat Index of Hanoi for the current day and the next six days. The black horizontal line in Figure 2 is the threshold value for the Heat Index.

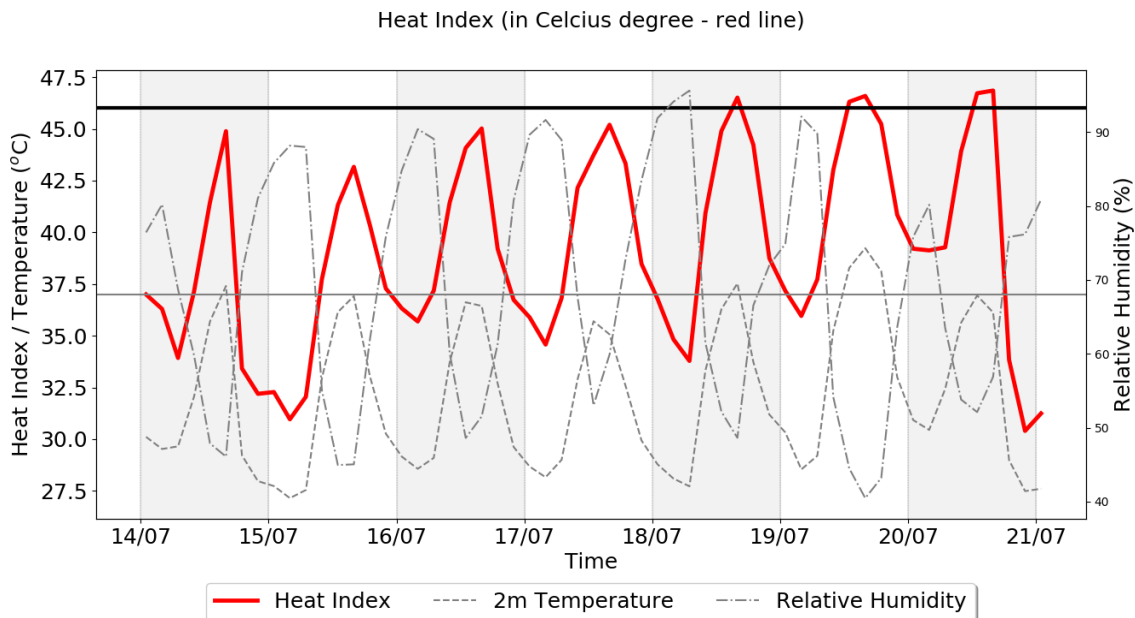


Figure 2 Heat Index forecast provided by the IMHEN. In red is the 7-days forecast of the Heat Index, while in solid black is the 99th percentile-based threshold

TRIGGER DEVELOPMENT AND TRIGGER PROTOCOL

Normally with Forecast-based Financing projects the trigger should be related to impact. However, no detailed impact data of heatwaves in Vietnam is available. Due to lack of knowledge of heat health effects, heatstroke or heat-related illnesses are often not recognized as the cause of death. In addition, data of heat-related deaths and hospitalization is difficult to access and complicated to gather. Since no heatwave related impact data is available, the IMHEN did a detailed risk analysis and looked at the most extreme historic heatwaves in Hanoi. Finally, a **2x2 trigger protocol** is established based on two forecast sources (Figure 3).

The first component of the trigger is based on the **99th percentile value of the Heat Index**. The 99th percentile-based threshold value says that 99% of the time, the Heat Index is below this specific value. Only in 1% of the time, the Heat Index is above the threshold value, which means that the Early Actions are only being implemented with the **most extreme heatwaves**. In addition to the Heat Index, a **maximum temperature of 37 degrees** is also used as a threshold, since 37 degrees is defined as a 'very hot day' according to the Vietnamese National Centre for Hydro-Meteorological Forecasting.

The trigger-protocol has **two different lead-times**, which is the length of time between the issuance of a forecast and the occurrence of the disaster is forecasted to happen. With a **lead-time of 6 days**, we can see if the Heat Index forecast by the IMHEN surpasses the **99th percentile values for 2 consecutive days**, like it does in Figure 2. If the Heat Index

surpasses the threshold for 2 consecutive days, and the maximum temperature forecast is higher or equal than 37 degrees, the first part of the trigger has been reached. Preparations start for the anticipatory actions, i.e. the procurement of goods.

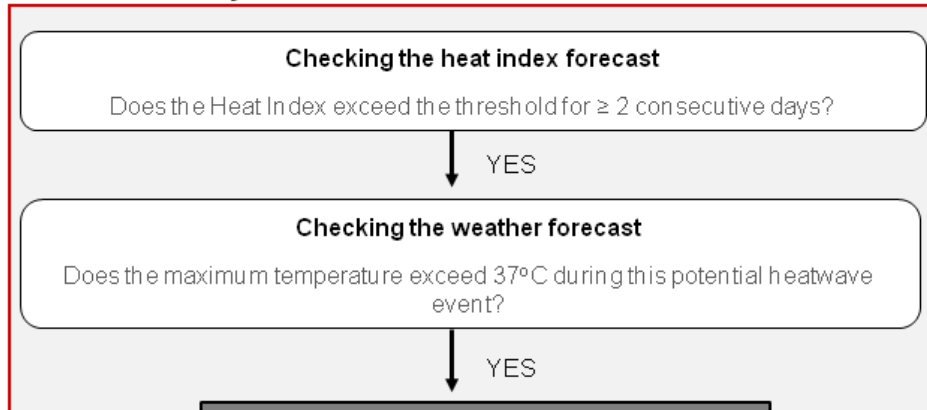
If the trigger is still being met with a **lead-time of 3 days**, the **Early Action Protocol is being activated** and funding is released. The community cooling centers are being set up, and the volunteers are being activated. When one or both of the thresholds are not being met, no funding will be released and no anticipatory actions will be implemented. All processes and preparations will be canceled.

When both thresholds are being met, an email is being automatically sent to VNRC and GRC, so that an extreme heatwave can never pass by unnoticed and the preparations can start on time.

COLLABORATION AND REPLICATION

The collaboration between VNRC, GRC and IMHEN contribute to reduce human suffering through the implementation of anticipatory actions for heatwaves in the urban context of Hanoi. With the expertise of the IMHEN on the weather-related content of heatwaves, and with the experience and capacity of VNRC and GRC in implementing anticipatory actions, we make sure that **action is taken on the right moment and on the right place**. In 2020, VNRC and IMHEN will start with replication of the "FbF-ready" project in several other cities in north and central Vietnam. In addition, IMHEN is looking forward to work on FbF for other disasters in the near future, as well as scaling up its efforts.

Lead-time: 6 days



PREPARING FOR EARLY ACTIONS



Lead-time: 3 days

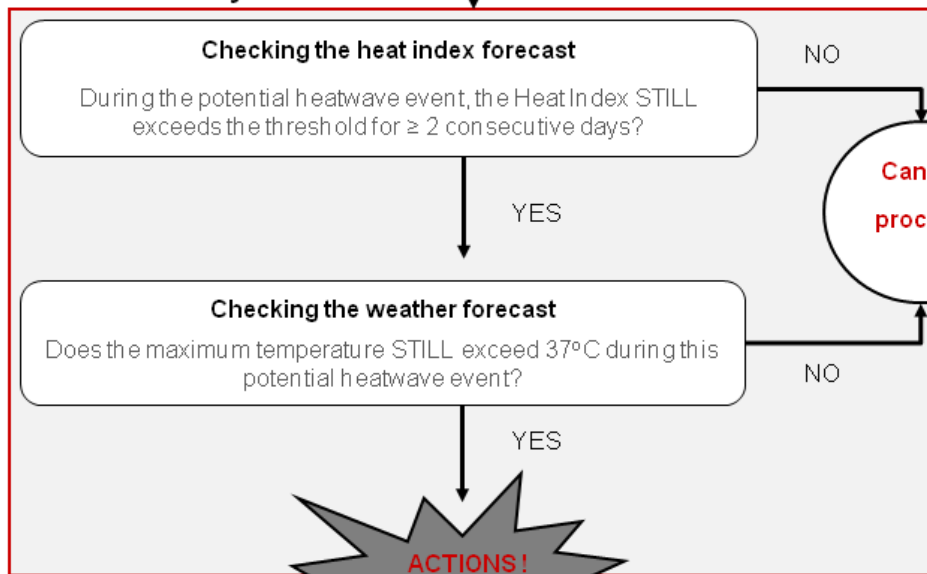


Figure 3 The 2x2 trigger protocol for heatwaves in Hanoi

