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Detecting Dry Spells in Malawi

Learnings from developing an anticipatory action trigger

This note summarises the initial learnings from the development of the anticipatory action trigger for dry spells in Malawi. It was written by Josée Poirier from the Predictive Analytics Team of the UN OCHA Centre for Humanitarian Data, and published in June 2021. If you have questions please contact josee.poirier@un.org

Background

Since Fall 2020, local partners and the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) have been developing an anticipatory action framework (AAF) for Malawi. The AAF includes a trigger to alert to the likely occurrence of a shock using forecasts, which then prompts the pre-agreed disbursement of funds and implementation of activities to mitigate the shock's impacts. The Malawi Anticipatory Action (AA) team selected dry spells as the shock; the trigger thus should provide an early signal of a high risk of a short period of dry conditions that can negatively impact crops and water availability. The trigger design work benefited from the input of in-country stakeholders, scientific partners and OCHA headquarters. The learnings below are from the perspective of the OCHA Centre for Humanitarian Data's predictive analytics team, which performed the technical analysis for the trigger. This paper aims to share conceptual learnings that may inform other work leveraging predictive analytics to take early action against crises.

Established definitions may not readily lend themselves to Anticipatory Action.

A partner organisation provided a validated definition of dry spells that was endorsed by stakeholders: at least 14 consecutive days with no more than 2 mm of cumulative rainfall. It was consistent with the experience of local communities previously affected by dry spells as reported in a household survey by OCHA (results to be published summer 2021). However, there is no widely-agreed definition of dry spells: previous analytical efforts have relied on other options (eg: shorter periods, no requirement for consecutive days, rainfall amount allowed) with several exclusively referring to a lack of precipitation. The provided definition captured events that were too extreme to forecast (extremely low rainfalls) and represented only one variant of the shocks experienced by Malawians (dry spells due to precipitation deficits rather than high temperatures or a combination of the two). While the role of factors other than low precipitation had been acknowledged early on, the rainfall-focused definition was selected because of the validation work previously done by the partner and for its simplicity in this early stage of the pilot.

The Centre's trigger development work aimed, perhaps for the first time, to predict the onset of an individual dry spell using precipitation forecasts and publicly available historical rainfalls. The attempt suffered from the current limits of data products, which do not have the ability to measure or predict such small amounts of precipitation with great accuracy. The selected definition of dry spells resulted in a limited ability to relate indicators to shocks, and to develop a reliable predictive alert for dry spells. Alternative definitions might be better suited for the task of alerting to an impending shock and should therefore be evaluated specifically for this purpose.

'Sudden' or 'slow' onset crises aren't the only two options.

Dry spells occur fairly rapidly with little to no warning, and are typically considered sudden onset shocks. However their impact varies in severity (depending on when they occur during the crop growth cycle) and builds over time: they can destroy crops (immediate impact), which will result in food insecurity (lagged and slow build-up over up to 6 months.) Triggers should distinguish the timeframes of both the shock and its impact. Crisis timelines that include the unfolding of the expected impact are critical to devise triggers that will alert at a time opportune for anticipatory action. Terminology should be clear to avoid conflation of phenomena and confusion in discussions, for instance between dry spells and drought (one shock has a sudden onset and the other, a slow onset but the impact of both builds over time.)

The unfolding of the impact may be an appropriate basis for the trigger.

In circumstances where a shock is difficult to predict with sufficient lead time and the impact evolves over time, the AAF may be more effective at mitigating a humanitarian crisis by targeting the onset of the *impact* rather than or in addition to the shock itself (in accordance with the concept of *impact-based forecasting*). Observational data confirming the occurrence of a shock and/or the onset of its impact may still be timely to mitigate the severity of the crisis. It may also be unnecessary to predict individual shocks where the impact slowly develops (e.g., a specific dry spell). It might suffice to project if a period is at risk of those shocks (e.g., at least 1 dry spell during a 3-month period), as actions may be taken after the shock and still mitigate its impact.

Two otherwise comparable shocks may vary in impact depending on when they occur.

Crisis timelines should also explicitly indicate if and how a shock's impact may differ depending on its timing. For instance, dry spells that occur shortly after planting or around flowering will gravely affect crops; however, crops are more resistant to dry spells during other phases of growth. Therefore a trigger alerting to an impending dry spell should take into consideration the growth phases of crops. A challenge with dry spells (and perhaps other sudden-onset shocks with longer impact timelines) is measuring the direct impact of an individual shock. Food insecurity is not available at a sufficient (temporal and spatial) granularity. More proximal indicators of crop health would be better suited, if measured frequently during the growth phase and rapidly made publicly available for analysis. Without a precise linking between shock and impact, it becomes much harder to design an adequate trigger.

Local knowledge and quantitative data are complementary, and may at times be at odds. Neither should be disregarded.

An AAF is anchored in local knowledge that is itself encoded in a trigger mechanism. The goal of an automated, quantitative trigger is to minimise the subjectivity and divergence of human judgements in determining when to act. Common knowledge or experience (e.g., perceived relationship between two climatic phenomena) should be substantiated and may at times not be borne out in the data. In turn, empirical inferences (e.g., scarcity of events in a given period) should be validated and contextualised by local partners and communities. The trigger should leverage both empirical evidence and local knowledge: local context may not be fully discernible in the available data, data may correct misconceptions influenced by cognitive bias, local experience may point to explanations of spurious patterns.

A simple trigger both provides and requires increased transparency.

A simple trigger is easily understood, even by non-technical stakeholders. Its inner workings are clear and its implications stated. It facilitates alignment and buy-in by stakeholders. However simplicity means making things less complex by omitting nuances or important factors (e.g., the role of heat in dry spells). These tradeoffs should be explicitly and frequently acknowledged, as well as transparently documented to ensure that all stakeholders are aware of and accept the tradeoff. The simplifications may end up creating confusion if unstated and may explain inconsistencies in data analysis (e.g., between two analyses only one of which included heat-related dry spells.)

Technical limitations in predicting or measuring a phenomenon can create a demand for new data products.

Local data products (from national meteorological agencies, for examples) likely offer the best accuracy and expertise on the phenomena being modelled. Trigger mechanisms should aim to take advantage of their offerings, as well as be validated against a ground truth dataset of the shock and its impact and the list of worst historical years for this shock. Local data products can be complemented by or supplemented with global or regional products. The technical challenges in data limitations, downscaling forecasts and/or reconciling diverging datasets should not be underestimated and should be addressed with technical partners with relevant scientific expertise. This collaboration can help the scientific community understand applications of their research, creating a demand for new products and specific improvements to existing ones that may enable more or better applications in the future.

Conclusions

These learnings from developing a trigger for dry spells in Malawi point to aspects of planning anticipatory action that had not yet been encountered or spelled out. They should provide guidance on factors that should be considered when formulating future forecast-informed projects.