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EXPERT ADVISORY CALL-DOWN SERVICE (EACDS) LOT B:

STRENGTHENING RESILIENCE AND RESPONSE TO CRISES

PRODUCED FOR

GLOBAL CHALLENGE

RESOURCE FOR INNOVATION LAB

HOW COULD DATA BE USED TO CAPTURE REFUGEE FLOWS IN A FINANCING INSTRUMENT?

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SERVICE IMPLEMENTATION
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EXPERT ADVISORY CALL DOWN SERVICE – LOT B

STRENGTHENING RESILIENCE AND RESPONSE TO CRISES

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1 FREQUENCY OF DISPLACEMENT ONSETS

The UNHCR dataset tracking persons of concern is the most comprehensive record of refugee numbers and movements available. If we consider that the primary events of interest for financing needs are large displacements of refugees across borders into developing economies, then the data shows us the following.

1.1 HOST COUNTRY PERSPECTIVE

- If we consider a trigger threshold for a significant displacement into a country to be 100,000 persons, then data from the past 65 years indicates that a trigger would have occurred in more than 60% of years for developing economies. If we inflate historical migration in-line with global population growth (i.e. assuming the size of migration events increases with population growth), then a trigger would have occurred in more than 80% of years.

- Increasing that threshold to 250,000 persons produces trigger events in around 40% of years, increasing to over 50% of years when detrended for population growth.

- Increasing the threshold further to 500,000 persons reduces trigger events to just over 20% of years, increasing to around 30% when detrended for population growth.

- If we apply a second threshold for the *number* of developing countries experiencing a significant influx, the results are per charts 1)a) and 1)b) below. For example, if a significant displacement into a developing country is 250,000 or more persons, then two or more developing countries experienced a significant displacement in over 20% of years, increasing to over 30% of years if we detrend for population growth. Conversely, a significant displacement event is experienced in three or more developing countries in only 8% of years, increasing to 20% of years if we detrend for population growth.

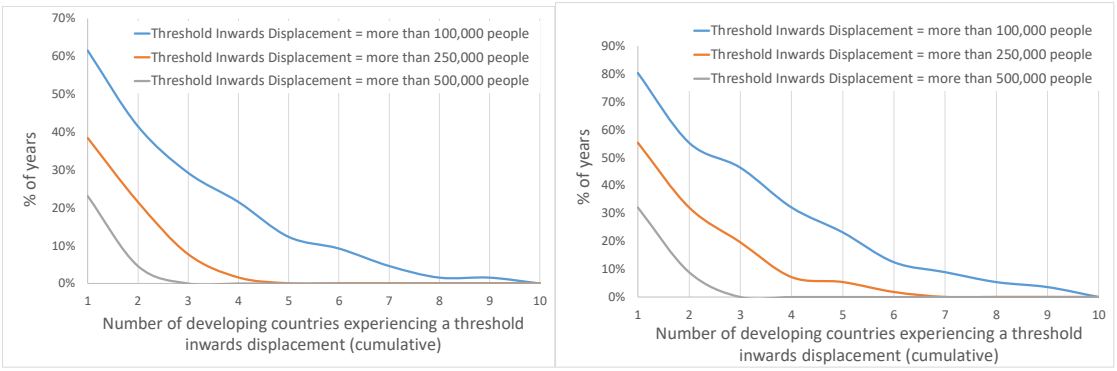


Figure 1a) and b) Historical frequency of developing countries experiencing a significant inflow of refugees above varying trigger thresholds

1)a) raw data, no detrending; 1)b) inflates historical movements in-line with global population growth to trend forwards to 2017[1].

[1] The methodology applied to consider how population change might impact a forward-looking view of displacement is a crude assumption that the size of displacements would change linearly with global population change. The author does not represent that this assumption is correct. However, the results of this approach provide some useful context to support a discussion on the propensity of large displacement events.

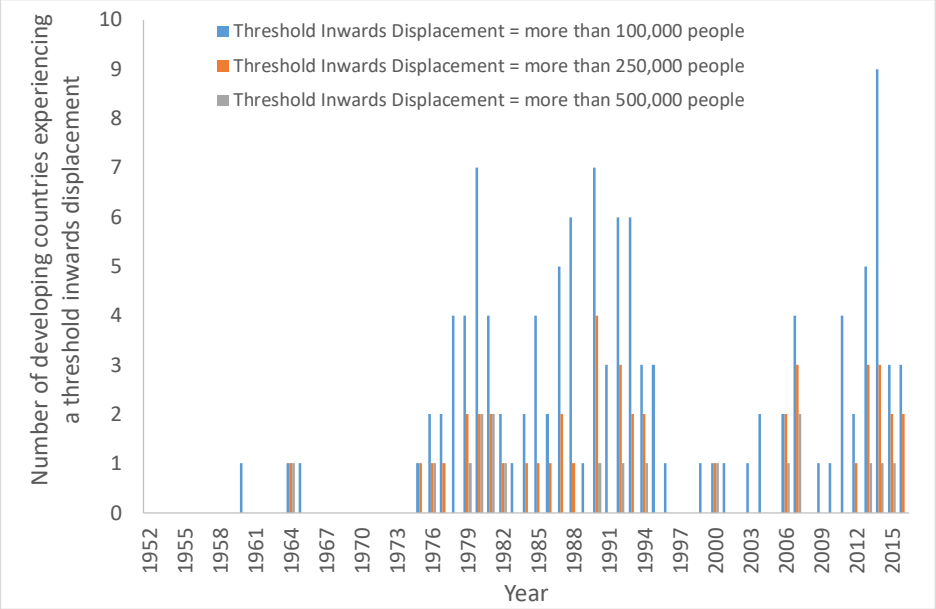


Figure 2 Number of developing countries experiencing inflows of refugees above varying trigger thresholds, by year[2]

1.2 GLOBAL PERSPECTIVE

- If we consider instead displacement events from a global perspective, with a focus on a crisis causing displacement out of a particular country, rather than into the host countries, we can apply trigger thresholds to the 'outflux' number.

- If we take a trigger threshold for a significant displacement **out of** a country to be 100,000 persons, then data from the past 65 years indicates that a trigger would have occurred in almost 70% of years. If we inflate historical migration in-line with the population growth in the country of refugee origin (i.e. assuming the size of migration events increases with population growth), then a trigger would have occurred in almost 90% of years.

- Increasing that threshold to 250,000 persons produces trigger events in more than 40% of years; a number that increases to more than 60% of years if we detrend for population growth.

- Further increasing that threshold to 500,000 persons reduces trigger events to around 30% of years; a number that increases to around 50% of years if we detrend for population growth.

- If we apply a second threshold for the *number* of countries experiencing a significant **outwards** displacement, the results are per the chart below. For example, if a significant displacement out of a country is 250,000 or more persons, then two or more countries experienced a significant displacement in just under 20% of years (increasing to 37% if we detrend for population growth). Conversely, a significant displacement event is experienced in three or more countries in just 9% of years (increasing to 25% if we detrend for population growth). There are no years in which four or more countries experience a 250,000 trigger event in the raw dataset, and no years in which six or more countries experience a 250,000 trigger event in the detrended dataset.

[2] Raw data, no correction for population growth

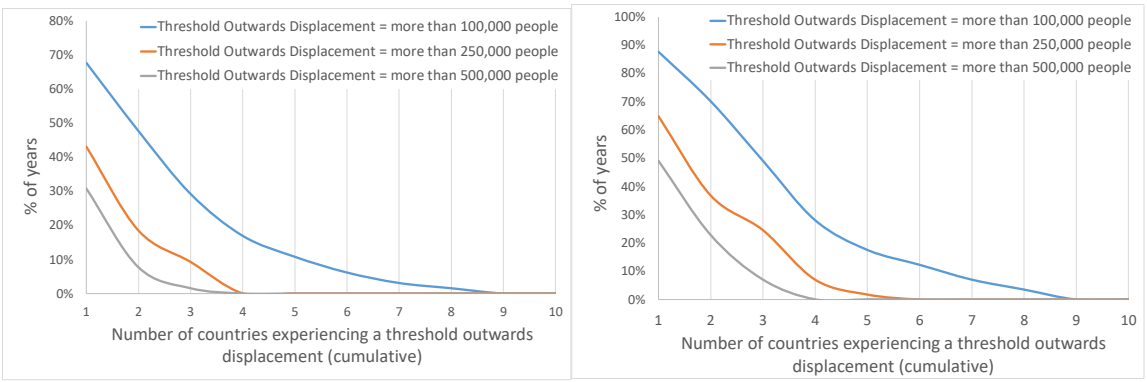


Figure 3a) and 3b) Historical frequency of countries experiencing an outflow of refugees above varying trigger thresholds

3)a) raw data, no detrending; 3)b) inflates historical movements in-line with refugee origin-country population growth to trend forwards to 2017[3].

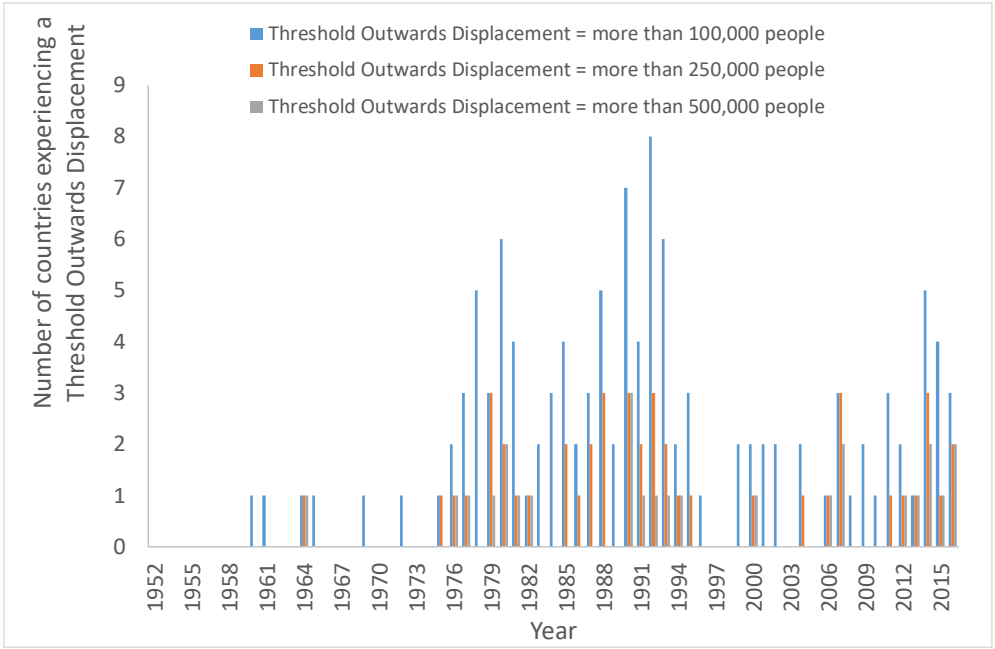


Figure 4 Number of countries experiencing outflows of refugees above varying trigger thresholds, by year[4]

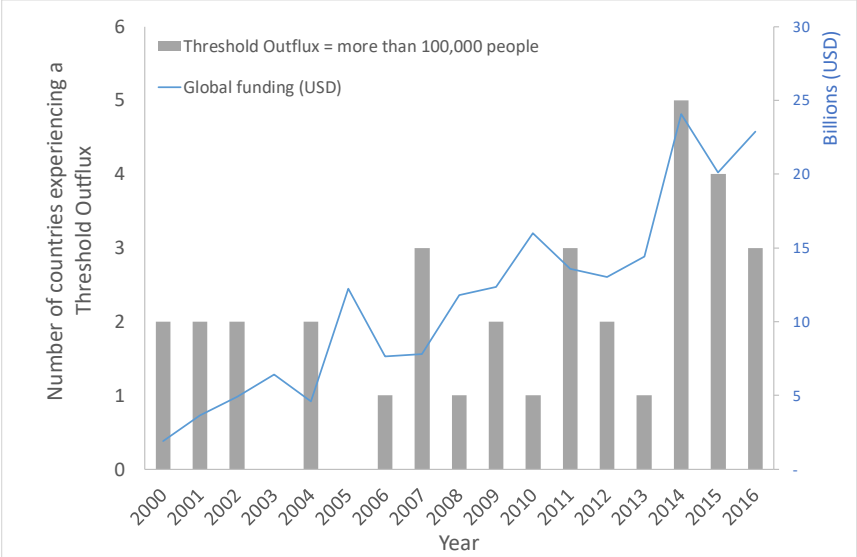
It is also possible to look at how global humanitarian funding flows have responded, alongside these definitions of 'trigger' events. The chart below shows total humanitarian funding flows plotted against new displacements of 100,000 persons or more. Although the data is not of sufficient granularity or length of time-series to draw definitive conclusions on the relationship between the datasets, the correlation is not strong[5]. This is expected,

[3] The methodology applied to consider how population change might impact a forward-looking view of displacement makes no attempt to differentiate between the causes of population change. A crude assumption is taken that the size of displacements would change linearly with population changes. The author does not represent that this assumption is correct. However, the results of this approach provide some useful context to support a discussion on the propensity of large displacement events.

[4] Raw data, no correction for population growth

[5] Pearson Product-Moment Correlation Coefficient around the 0.5 level, although the validity of drawing conclusions from such a short time-series is questionable.

as the FTS data takes account of the funding required to continue support displaced populations from prior years, which is not reflected in the trigger. The stronger relationship that appears in the Initial Evidence Summary[6] between the overall refugee population and UNHCR total funding, indicates the relative importance of funding for populations displaced in prior years.



Source: UNHCR and FTS

1.3 POTENTIAL IMPLICATIONS FOR FINANCING FOR REFUGEE SITUATIONS

- The individual occurrence of significant displacement events (arising from new crises, or upticks in existing crises) is of too high a frequency for risk to be transferred. The financing for these types of events needs to be managed on an almost annual basis – it's business as usual for the donors providing humanitarian aid, and the entities spending these funds.
- The probability of multiple developing countries requiring assistance to host refugee populations due to a significant influx is high. Similarly, the probability of multiple developing countries experiencing significant outwards displacement events is also high. The global agencies appear to be regularly dealing with two crises emerging in the same year, but concurrent occurrence of more than three significant crises in a year is at a frequency level that may justify consideration of contingent financing of some sort. The outstanding question is the number of crises at which the global humanitarian system struggles to respond effectively.
- The available financial data tells us little about how the global humanitarian system is responding financially to the occurrence of significant displacement events. There appears to be little correlation between the occurrence of new significant displacement events, and humanitarian funding flows. The correlation between total funding and the total refugee population appears higher, which is logical given that displaced populations from earlier years need sustained financing for many years. What this may tell us, is to exercise caution when focusing financing instruments solely on sudden onset, or sudden upticks in crises, as finding continued funding for prior crises is a substantial part of the problem.

[6] Document accompanying this note, as part of a package of documents released

2 CAPTURING OCCURRENCE OF DISPLACEMENT EVENTS – ARE THERE DATASETS?

Are there suitable existing datasets that could be used within a financial instrument to capture the occurrence of significant displacement events?

In order to prove suitable for use in this context, datasets need to fit criteria[7] of:

A. Accuracy; the data needs to correctly identify the types of significant displacement event that the financial instrument is designed to support.
B. Independence; the data needs to be from an agency that has no motive to alter reported numbers in any way. This includes being a counterparty on any financial instrument.
C. Rapid/frequent reporting; in order to pay out quickly following a displacement event, the data needs to be updated frequently.
D. Consistency and stability; the methodology used to identify significant displacement events must be consistent and produce stability in results over time.

Three main categories of dataset were identified that showed potential for use within a financial instrument. These are: satellite imagery; news tracking; and mobile phone and other ICT activity monitoring. Some of these datasets could be used directly, others are used as the basis of more complex forecasting models. The UNHCR dataset on registered refugees A review of available literature and datasets was consistent with the findings of the OECD stock-taking exercise on anticipating different types of migration movements[8] (2018, May), which indicated that:

"*early warning and alert systems are generally not well suited to estimate the scope of potential migration surges, the likelihood of secondary migration and, unless migration takes place in very specific corridors, the final destination of migrants on the move. As migrants themselves constantly adapt their strategies according to changing conditions in transit and in potential destination countries, it is important to complement early warning and alert systems with real-time analyses of diaspora and social networks*".

Even amongst the most sophisticated and already operationalised models for forecasting events of relevance, the risk of missing substantial displacement events, or of indicating a trigger in the absence of a displacement event is high. These models are achieving a level of accuracy and precision that makes them extremely valuable tools for monitoring and planning, but using them to trigger the release of financing would risk funds being mobilised in the absence of a crisis[9]. Therefore, the rationale for quick release of financing would need to be extremely strong to justify the potential diversion of funds within the humanitarian system towards an event that did not materialise.

Data and methods that do not forecast event occurrence, but can give an objective indication of a displacement crisis in its early phases could add value in the context considered here. Satellite and mobile phone activity tracking methods are such examples, with the potential to give an early indication of displacement occurrence, and also the scale of displacement. Studies on the use of satellite data show that it can give an indication of the size of a refugee population within a 2-5 day timeframe and typically to an accuracy of within 30% of the reference value of the population. Thus potentially providing an earlier and

[7] Transparency is an additional desired characteristic, but datasets can be used for opaque systems where there is adequate credibility and independence of the reporting agency.
[8] https://www.oecd.org/els/mig/migration-policy-debate-16.pdf
[9] For example, a recent short timeseries of ICEWS forecasting metrics indicate that precision varies substantially by the type of crisis (e.g. domestic, international, religious violence, insurgency) between 100% and 57%; the 57% precision achieved for domestic political crises, means that in 43% of cases, a crisis was forecast but did not occur.

more accurate indication of camp numbers in cases where the refugee registration process is slow. Mobile phone activity tracking has been demonstrated as effective at capturing internal displacement[10], and although the application of this methodology will be more challenging in cross-border refugee situations, the availability of cell phone coverage along large arterial transport routes suggests that this is worth investigating.

The team notes that the list of datasets and models considered herein is not exhaustive. We are aware of a number of initiatives underway to develop new forecasting and monitoring tools, but for which the data to undertake an evaluation was not available at the time of writing. These include IBM's Refugee & Migration Predictive Analytics Solution prototype.

2.1 SATELLITE DATA

A	Accuracy	Methods trialled involve the count of temporary structures in high resolution images, combined with an estimate of persons per structure taken from a range of complementary data sources (for example, registration data and structure counts from past sites). A 2013 exercise to assess camp populations across a number of countries using high resolution satellite data achieved results that varied significant by camp[11]. The highest accuracy achieved was an estimate within 2% of the reference population value; the lowest accuracy achieved was within 52% of the reference population value. The main challenges to accuracy in use of this data source arise from: - The presence of multi-story structures; - Poorly defined boundaries between individual temporary structures; - Context-specific variations in the average occupancy per structure; - Obscuration of structures by cloud cover for satellites that are not SAR[12]-equipped, (although there are multiple dataset options that come from SAR-equipped satellites). Satellite imagery also has applications in predicting displacement. It is already being used to show increased activity at border hotspots. Whilst the frequency of image capture prevents accurate capture of flows across borders,
B	Independence	The independence of the data from interested parties is not an issue. A range of publicly-operated (e.g. Sentinel) and privately-operated (e.g. Digital Globe) satellite constellations are capturing high resolution images.
C	Frequent reporting	Satellite revisit times are the determining factor in frequency of image capture, but there are multiple constellations capturing images more frequently than once a day. In the 2013 exercise, the interpretation of the images to arrive at a displaced population estimate was completed within 2-5 working days. International space agencies are already collaborating on the provision of satellite imagery for crisis mapping, albeit with a focus on natural disasters currently. For example, the International Charter for Space and Major Disasters[13]

[10] http://www.flowminder.org/case-studies/haiti-earthquake-2010

[11] Checchi et al. 2013. "*Validity and feasibility of a satellite imagery-based method for rapid estimation of displaced populations*", International Journal of Health Geographics.

[12] Synthetic aperture radar.

[13] Comprising: European Space Agency, Centre national d'études spatiales, Canadian Space Agency,Indian Space Research Organisation, National Oceanic and Atmospheric Administration, Argentina's Comision Nacional de Actividades

		activates the acquisition and analysis of satellite data from a range of constellations upon request from national disaster management offices.
D	Consistency and stability	Inconsistency could arise in the interpretation of the images where a manual approach is taken[14], or new availability of higher resolution images leading to higher accuracy. The length of available back catalogues of imagery varies by satellite, but a few catalogues go back as far as the early 2000s.

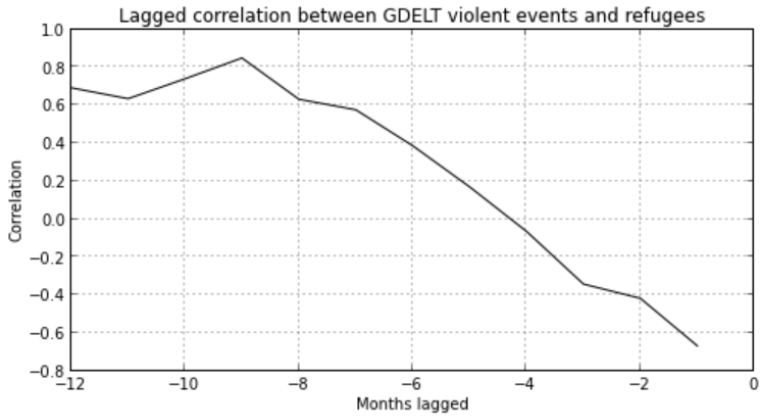
2.2 NEWS TRACKING

A	Accuracy	Sources that rely on monitoring of web and print reporting to indicate violent activity are subject to the issue of 'media fatigue', where reporting activity peaks with upticks in violent activity, but does not remain sustained. Thus, the correlation of news event databases coded for violent activity, and refugee data varies significantly depending on the length or section of time-series taken[15]. Analyses of the accuracy of the ICEWS, GDELT and ACLED datasets show: - The ICEWS forecasting model, which is based on coded news tracking, reports overall accuracy of 85% capture of political crisis and conflict events (e.g. insurgency, rebellion, domestic political crisis, ethnic or religious violence, international crisis). A short time-series study of model performance broken down into further detail showed that capture of events varied between 42% and 82% depending on the type of crisis. The precision of capture varied between 57% and 100%, indicating that false positive identification of events is very high for certain types of crisis. - GDELT analyses for the Syrian war show a correlation that improves when a time lag is added between the reported activity, and refugee numbers (see below, taken from Caerus Analytics, Studying the Syrian Civil War with GDELT). However, whilst the possibility of a strong correlation is indicated by the correlation coefficient presented, other analyses show substantial variation in the relationship depending on the section of timeseries taken. Therefore, the coefficients should be interpreted with caution.

Espaciales, Japan Aerospace Exploration Agency, US Geological Survey, UK Space Agency and DMC International Imaging, China National Space Administration, German Aerospace Centre, Korea Aerospace Research Institute, Brazil's National Institute for Space Research, European Organisation for the Exploitation of Meteorological Satellites, The Russian Federal Space Agency.

[14] A manual process is described in Checchi et al, involving an average taken across multiple counts of structures by individuals. Automated algorithms are being applied to the interpretation of satellite data in other fields. The authors cannot provide a view on the near-term feasibility of this for counting of structures, but welcome further discussion on this.

[15] Studying the Syrian Civil War with GDELT http://themonkeycage.org/wp-content/uploads/2013/07/GDELTFullSyriaAnalysis-v2.pdf

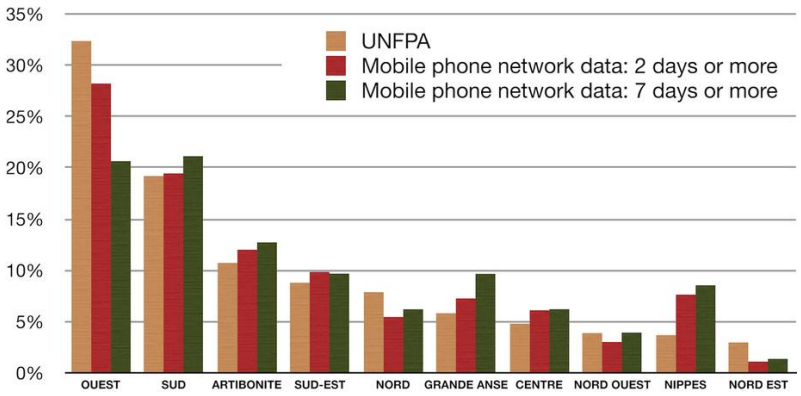
		 - Analyses undertaken for this piece of work looking at the correlation between reported deaths from the ACLED dataset, and changes in refugee numbers on an annual basis for Somalia and Myanmar, and a monthly basis for Syria[16], failed to find a strong relationship between the datasets[17], and further indicated that any relationship present between the datasets varied significantly according to the nature of the crisis.
B	Independence	The news tracking sources available are from entities independent of any of the actors involved in the financing chain for refugees, and the base information sources and methodology would be difficult to manipulate.
C	Frequent reporting	Frequency of reporting depends on the media sources that underlie the methodology. Daily updates are available for GDELT, weekly data is available for ACLED, the ICEWS dataset for public release has not been updated frequently in the past, but moving forwards will be updated every month or two[18].
D	Consistency and stability	One of the principal challenges in using news tracking sources as the base of a methodology for a financial instrument trigger is inconsistency between the historical catalogue of activity, and real-time assessments. The influence of various factors on media reporting of violent activity, means that the effectiveness of capture of violent activity varies over time. This issue has been identified within models developed to use these datasets to forecast violent activity. Note that ICEWS update their forecasting model annually to account for 'model drift' over time. The GDELT dataset is available back to 1979, ICEWS back to 1995, and ACLED data varies by country, with data back to 1997 for Africa, 2010 for some Asian countries, and only as far back as 2016/2017 for the Middle East.

[16] Time resolution determined by data availability

[17] The strongest correlation was r=0.7 for the monthly dataset for Syria, with a lag of 5 months between the deaths reported, and the refugee numbers. However, the short length of timeseries available in this case means that changes in the coefficient driven by adding in time lags may not indicate a stronger relationship.

[18] For ICEWS, more frequent data updates may be available through a custom agreement with the data provider.

2.3 MOBILE PHONE (AND OTHER ICT) ACTIVITY TRACKING

A	Accuracy	Mobile phone activity has been used successfully to track internal displacement in Haiti following the 2010 earthquake (see below, reproduced from Flowminder).  *Among the people who had left Port-au-Prince after the earthquake, the graph shows the proportion going to the various departments (provinces) in Haiti. The beige bars show the results of the UNFPA (United Nations Population Fund household survey. The red bars show the proportion of the mobile phone subscribers leaving Port-au-Prince for at least two days and the green bars the proportion leaving for at least a week*. Issues with capturing refugee movements using mobile phone activity arise from: - Bias in the population segment using mobile phones (i.e. children, the elderly and the very poor are not visible through this methodology). - Weaker performance in rural areas due to presence of cell phone towers. Figure 2.1 shows how this issue would impact refugee activity capture along the Myanmar-Bangladesh border near Cox's Bazaar. Other methods of ICT activity tracking have been examined for internal displacement, but are not suitable for refugee tracking due to the absence /poor levels of internet facilities/infrastructure in the areas of interest.
B	Independence	Independence of sources will depend on the network proving data. However, these datasets would be exceptionally difficult to manipulate due to the vast quantities of raw data.
C	Frequent reporting	Activity tracking is – in theory – available in real-time. Access to this data will depend on individual agreements with network providers.
D	Consistency and stability	The propensity for mobile phone use will increase over time, leading to changes in the relationship between the mobile phone activity data and refugee statistics.

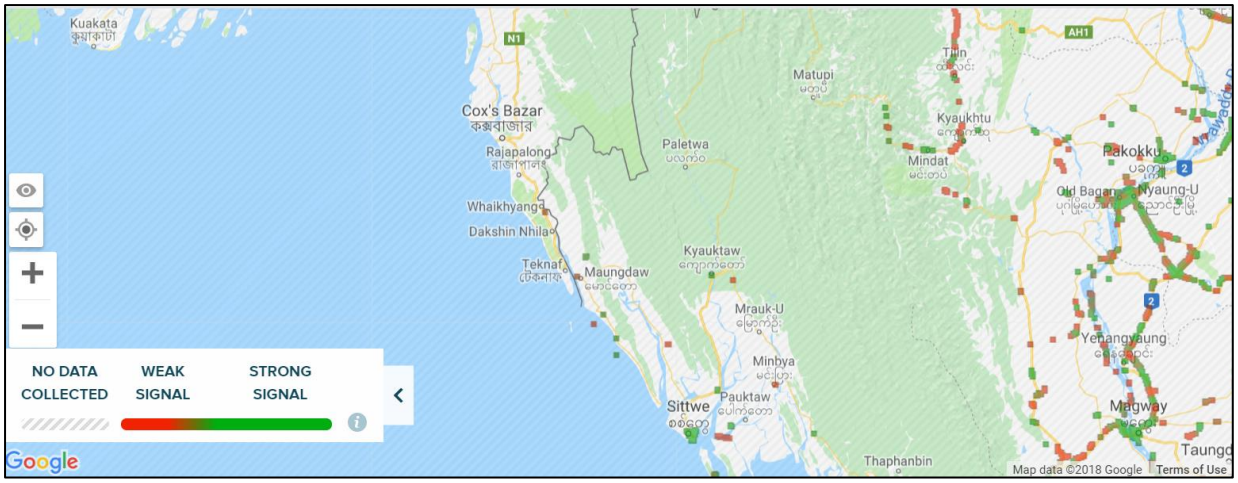


Figure 5 Mobile phone coverage in the area around the Myanmar-Bangladesh border. Note that outside of urban areas there is limited coverage and this is along transport routes

Source: Open Signal