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PROTECTION CIVILE HAÏTI

## Gang violence in the Plaine du Cul-de-Sac, Haïti

July 2022

Flowminder Foundation

AFD AGENCE FRANÇAISE DE DÉVELOPPEMENT

WILLIAM + FLORA Hewlett Foundation

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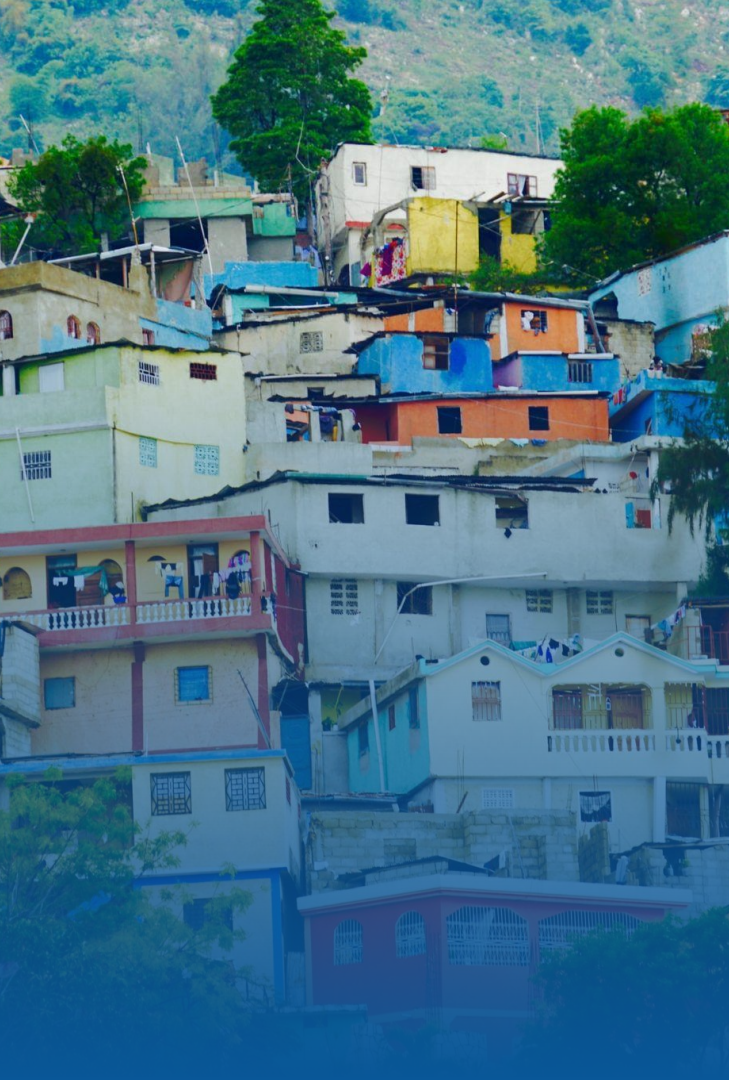
# Authors & contributors

This report was authored by the **Flowminder Foundation**, a non-profit foundation specialising in the analysis of anonymous mobile operator data, satellite imagery and household survey data for humanitarian and development purposes. Flowminder provides insight and strengthens the capacity of governments, mobile network operators, national and international agencies and researchers to use big data for humanitarian and development purposes. www.flowminder.org



# Acknowledgements


- This report was made possible thanks to the pseudonymised Call Detail Records (CDR data) provided by Digicel Haiti on the Flowminder Foundation server hosted behind Digicel Haiti firewalls in Port-au-Prince, Haiti.
- This work was coordinated and funded by the International Organization for Migration (IOM), thanks to funding received by IOM from the European Union's Instrument contributing to Stability and Peace.
- This work builds on Flowminder's OPAL programme for Mobile Network Operators Data in Haiti funded by the Agence Française de Développement and the William and Flora Hewlett Foundation which focuses on enabling the increased access to and use of mobile operator data, in Low- and Middle-Income Countries, in ways that are ethically sound, financially viable, and sustainable.
- The United Nations Office for the Coordination of Humanitarian Affairs in Haiti is acknowledged for feedback on earlier drafts of this report.

# Executive summary 1/2

- Widespread violence between two gangs started on Sunday 24 April 2022, spread over six communal sections in the north of Port-au-Prince before the situation progressively stabilised after 06 May (sources: media and humanitarian stakeholders). Between 23 April and 20 May, IOM's Displacement Tracking Matrix (DTM) and the Haitian Directorate General of Civil Protection (DGPC) estimated 34,600 individual displacement movements. At least 188 deaths and 113 people injured were reported (OCHA), and at least 81 houses burned (RNDDH).

- Based on data from the mobile network operator (MNO) Digicel Haiti up to 18 July 2022, and using 21 January to 21 April 2022 as baseline period, this report provides further evidence of large-scale displacement and additional information on these population movements:
  - At least 27,200 Digicel subscribers left the affected area between 24 April and 8 May, with most of the likely internally displaced persons (IDPs) in the department of Ouest, Centre and Artibonite.
  - The 1ère section of St-Martin (Delmas commune) is the section which hosted the largest numbers of likely IDPs among Digicel subscribers, at least 6,500 as of 08 May;
  - A large share of the likely IDPs (60%) are spread across Haiti in small numbers, particularly to the north of Port-au-Prince;
  - Within the affected area, the 3ème Section de Bellevue (Tabarre Commune) experienced the largest drop of residents among Digicel subscribers (at least 7,700) and for the longest period, as the number of residents remained below the baseline for 50 days;
  - Flows of Digicel residents out of the affected area take place in two stages: initially mainly from the 3ème Section Bellevue (Tabarre), and later also from the 1ère Section des Varreux (Croix-des-Bouquets) and the 2ème Section des Varreux (Croix-des-Bouquets);

# Executive summary 2/2

- Figures provided in this report are conservative estimates because:
  - They are based on the analysis of movements of Digicel SIM cards only, not of the whole population: for reference, in 2018 in Port-au-Prince, only 76% of the adult population owned a phone (source: DHS Haiti 2016/2017) and the latest public figures (2016) on Digicel market shares nationally are 74% (CONATEL, 2016).
  - Only the subset of Digicel SIM cards with sufficient activity for our analyses are included;
  - Therefore, the figures reported here are lower-bound estimates.

**Caveats:** For the sake of simplicity, *Digicel SIM cards are often referred here as people*, however: the **results are not representative** of the affected area's population because (1) not everyone uses a Digicel SIM cards nor uses it enough to be included in the analysis, (2) some SIM cards are shared within households, (3) not all movements are observed as the approximate location of a SIM cards is registered only when a call is made or received. The *delimitation of the affected area* does impact the results of the analysis. *Seasonal effects* may explain part of the results toward the end of the study period. Only significant changes are reported here. As significance thresholds vary between cell clusters and as the count of Digicel SIM cards of some cell clusters outside of the affected area is not detrended (see annex), the *significant decrease in Digicel SIM cards within the affected area (**21,500**) differs from the significant increase in Digicel SIM cards outside of the affected area (**27,200**).*

CDR-derived insights should never permit the identification of individual subscribers.

# Ensuring privacy and transparency

## Key principles

- GDPR and IOM's Data Protection Principles compliance throughout
- Transparency and peer review:
  - Detailed and open method descriptions
  - Open algorithms
  - Publications in peer-reviewed academic journals


Introduction
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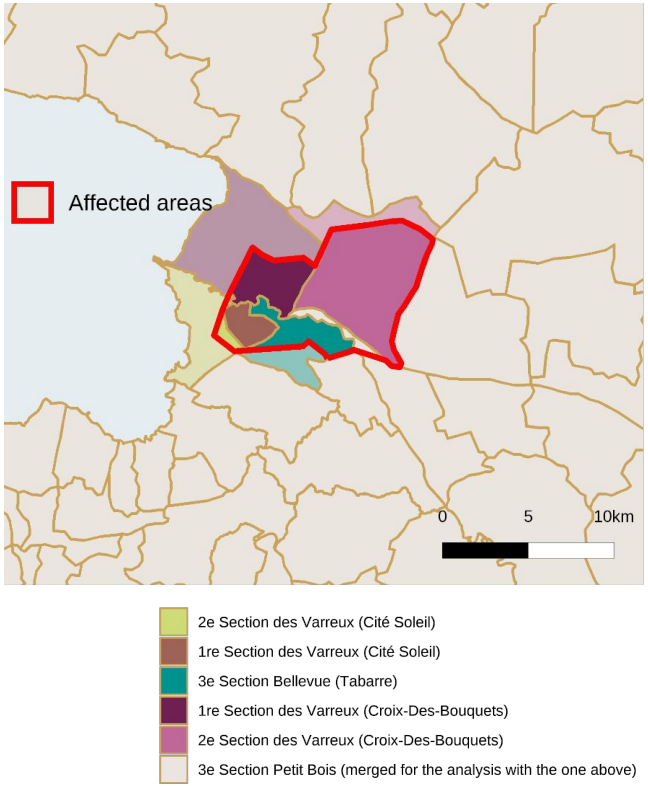
# Introduction | Context 1/2

- Gangs operating in Port-au-Prince and its surroundings have a large impact on people's lives in Haiti. Violent clashes between gangs lead to mass population displacements (e.g. August 2020 in Bel-Air, June 2021 in Martissant, April 2022 in Croix-des-Bouquets, July 2022 in Cité-Soleil), while ongoing insecurity drastically limits people's freedom of movement affecting their livelihoods and ability to access basic services. The number of kidnapping keeps increasing (225 in Q1 2022 and 326 in Q2 2022, Centre d'analyse et de recherche en droits de l'homme). Roads of strategic importance for the transports of goods, medical supply included, are regularly closed (e.g. the main road to the South peninsula is unsafe to travel since June 2021 because it crosses over 2km an area controlled by gangs). Gangs force businesses to pay them a proceed out of their revenues (National Human Right Defense Network).
- This violence is occuring in a challenging context: 52% of the population is below the poverty line, Haiti ranked ranked 170 out of 189 countries in the 2020 UN's Human Development Index (World Bank), nearly half of the population needs immediate food assistance while 1.2 million people suffer from severe hunger (World Food Program), political instability (e.g. assassination of President Jovenel Moïse in July 2021), recurrent tensions on the energy supply (e.g. in fall 2021, most petrol stations were out of stock while hospitals, health centres, banks, telecommunications networks and numerous businesses had to operate at reduced capacities) as well as large-scale natural disasters (e.g. 2010 earthquake, 2016 Matthew hurricane, 2021 earthquake and tropical storm).

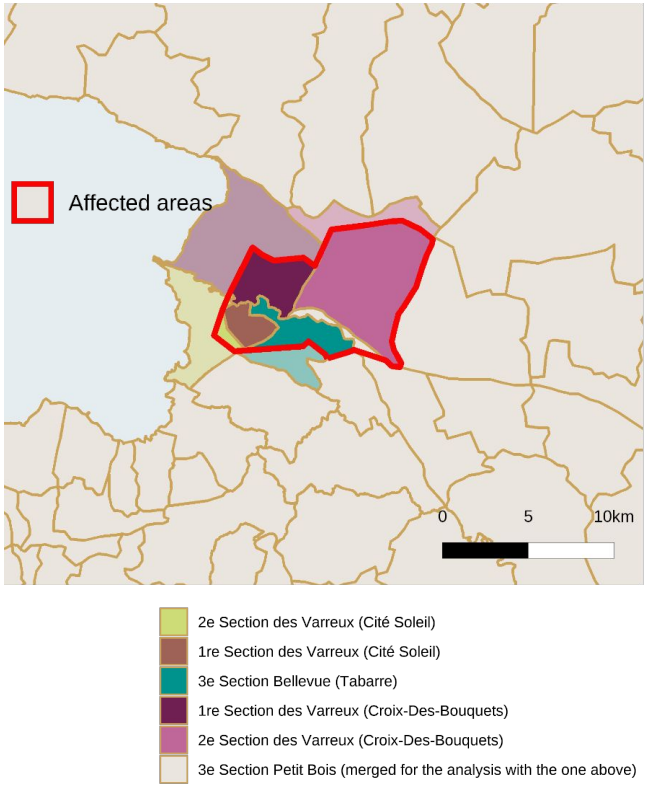
## Affected Area



# Introduction | Context 2/2

- This report focuses on population displacements caused by violence from the 24 April to 06 May 2022 between two gangs trying to establish their control over a territory in the northern part of Port-au-Prince (PaP), next to the international airport.
- This area covers part of six communal sections of the communes of Croix-des-Bouquets, Cité Soleil and Tabarre (see area delimited in red on the Map, sources: media and humanitarian stakeholders). This area has an estimated resident population of about 289,000 people based on the Facebook Connectivity Lab and Center for International Earth Science Information Network - CIESIN High Resolution Population Layer, uniformly adjusted for the total national population to equal the Institut Haïtien de Statistique et d'Informatique national population 2021 estimate of 11,905,897 people.
- Media organisations, humanitarian sources and NGOs have reported large-scale violence against the population from the 24 April to 06 May 2022: murders, rapes, beheadings and other mutilations; kidnappings for ransoms, organised large-scale searchs of inhabitants accused of supporting one of both criminal groups; burning of houses; thefts; and threats on social media against the population.
- Between 23 April and 20 May, IOM's Displacement Tracking Matrix (DTM) and the Haitian Directorate General of Civil Protection (DGPC) estimated 34,600 individual displacement movements as a result of the violence in the metropolitan area of Port-au-Prince.

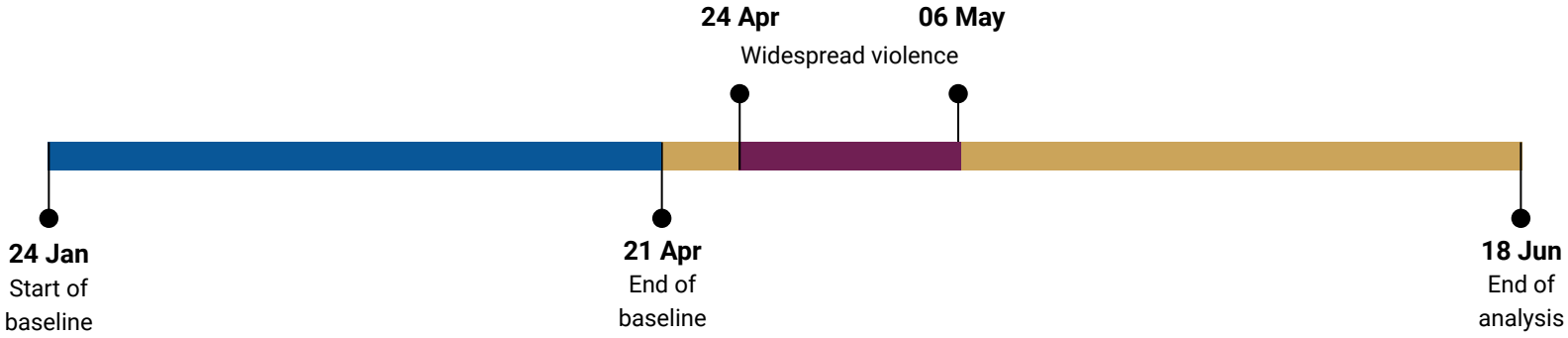
## Affected Area



# Introduction | Study period

## Timeline

- Baseline period: 24 Jan to 21 April 2022
- Widespread violence across the affected area: 24 Apr to 06 May 2022
- Remaining period of analysis: 07 May to 18 June 2022




The baseline period is used to defined the *normal* conditions. The baseline period is stopped on 21 April because some lower intensity confrontation between gang members already started on 22 April (RNDDH). During the baseline period, a decreasing trend in residents count is observed within the affected area as well as an increasing trend in residents count outside of the affected area. These trends may be linked to normal seasonal variations or to people relocating out because of the climate of insecurity (key informants reported some skirmishes in March and April already). The values reported in this report are hence detrended to show only the significant changes most likely attributable to this the 24 April - 06 May episode of violence (see annex). Without this correction, the estimated total number* of likely IDPs among Digicel subscribers is larger at the end of the study period.

*Also known as *stock* as defined by IRIS, Expert Group on Refugee and IDP Statistics (EGRIS), *The International Recommendations on Internally Displaced Persons Statistics (IRIS) have been developed by the IDP subgroup of the Expert Group on Refugee and IDP Statistics (EGRIS), led by the Joint IDP Profiling Service (JIPS), with support from the United Nations Statistics Division (UNSD), Statistics Norway and the Internal Displacement Monitoring Centre (IDMC).*

# Introduction | Definitions 1/2

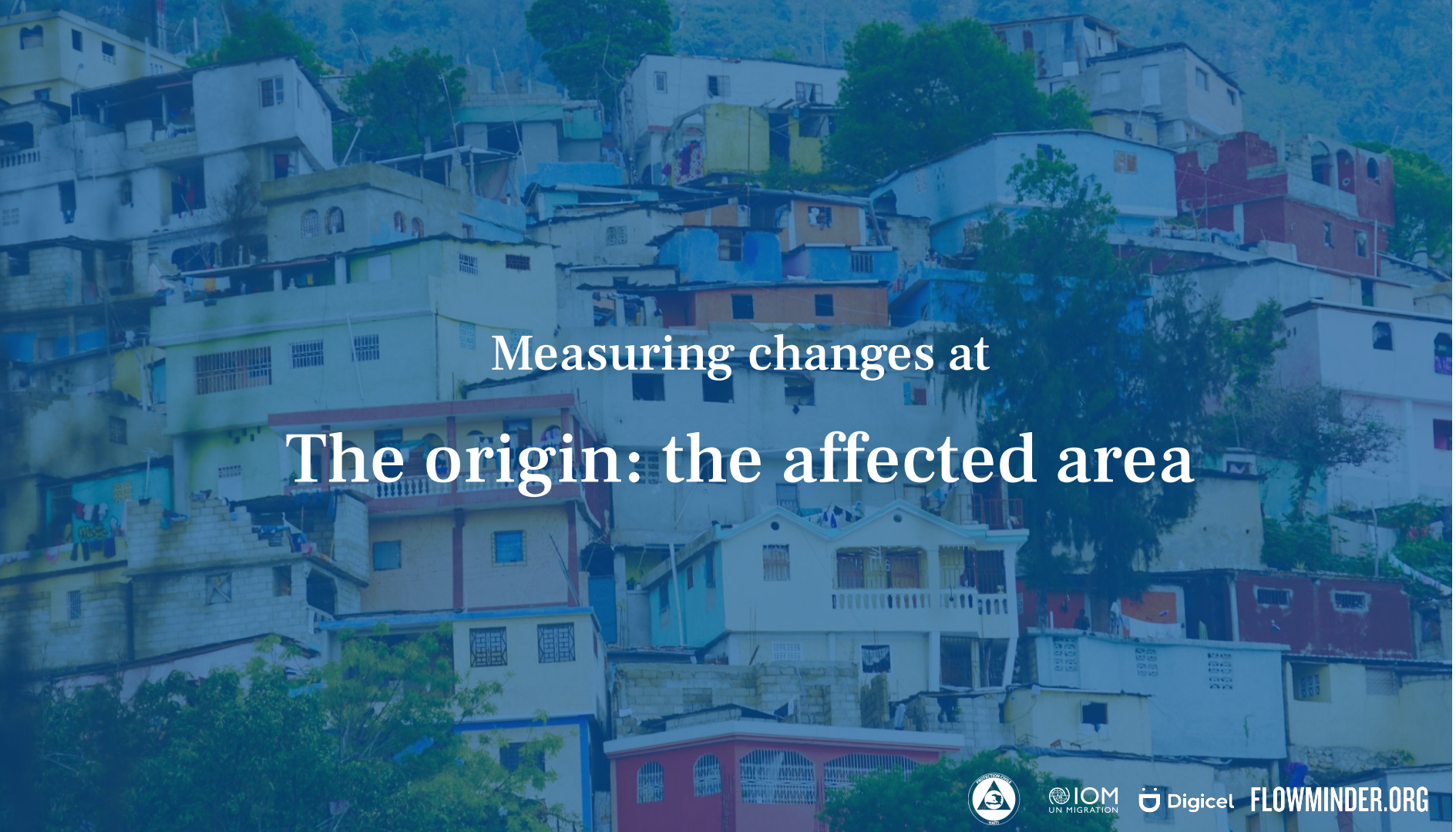
- **Digicel Haiti data:**
  - **Call Details Records (CDRs):** Call Detail Records are generated whenever a mobile phone subscriber makes or receives a call, sends or receives a text message, or uses mobile data (referred to as network events). We use here only CDRs from calls. By grouping the CDR data for a large number of people we can study patterns of mobility for the population as a whole while protecting individual privacy.
  - **Cell clusters:** Calls, SMS and internet data are routed across the territory via a network of cells placed on cell towers. Cell towers in close proximity are grouped together in clusters to limit biases, including those associated with call forwarding between nearby towers.
- **Sample**: Digicel SIM cards are included in the analysis if during the *baseline period* they are:
  - **Regularly active**: there is at least 2 days per 7-day window on average (median) with one call made or received;
  - **Likely to belong to a resident of the affected area**: their most frequent (i.e. modal) *home location* is within the affected area (red zone on map of slides 9 and 10)
- **Key concepts:**
  - **Baseline period:** the period running from 24 Jan to 21 Apr 2022 is used to define *normal* conditions and significant changes.
  - **Home location**: a Digicel SIM card home location is determined from the cell cluster which most frequently routed their last call of the day over the previous 7 days.
  - **Residents**: on any given day, residents of a given area are defined as the active *Digicel SIM cards* whose home locations are in this area.
  - **Relocations**: a change in the home location of a Digicel SIM card from one area to another between two subsequent days.
  - **Stock of likely internally displaced persons (IDPs)*:** sum of the significant change in the count of active Digicel SIM cards with *home location* outside of the affected area after the end of the baseline period and which had most frequent (i.e. modal) home location within the affected area during the baseline period. See *limitations* on next slide for the rationale of using the word *likely*.
  - **Flows of likely internally displaced persons (IDPs)*:** sum of the significant change in the count of active SIM cards *relocating* after the end of the baseline from the affected area to another area. See *limitations* on next slide for the rationale of using the word *likely*.

* The words ***stock*** and ***flows*** are used according to the International Recommendations on Internally Displaced Persons Statistics (IRIS), developed by the IDP subgroup of the Expert Group on Refugee and IDP Statistics (EGRIS), led by the Joint IDP Profiling Service (JIPS), with support from the United Nations Statistics Division (UNSD), Statistics Norway and the Internal Displacement Monitoring Centre (IDMC).

# Introduction | Definitions 2/2

- Significant changes:
  - A change is significant if it is large compared to the levels and variations observed in the baseline period (modified z-score, see Annex 1)
  - Significance threshold is set so that there is approximately a chance of 1 out of 1,000 to count a change as significant while it is not (see Annex 1).
  - Significance is computed at cell cluster level. Significant changes are then added-up at the communal sections, departments or affected area levels.
- Temporal resolution:
  - Daily figures cover a seven-day window: e.g. a count of 10,000 residents at a given date for a given area means that the area is estimated to have a resident population of 10,000 residents over the last seven days.
- Limitations:
  - **Causality**: significant numbers of relocations happening during the period of widespread violence and afterwards are *assumed* to be caused by or linked to these events; other causes cannot be assessed with the current data. Hence relocating subscribers are defined here *as likely IDPs*.
  - **Trends**: Normal relocation trends as well as seasonal trends (not controlled for because of the short length of the baseline period: three months rather than multiple years) may impact the results, particularly toward the end of the study period.
  - **Difference in significant changes detection within and outside of the affected area**: As significance thresholds vary between cell clusters and as the count of Digicel SIM cards of most cell clusters outside of the affected area is not detrended (see annex), the significant *decrease* in Digicel SIM cards within the affected area (21,500) differs from the significant *increase* in Digicel SIM cards outside of the affected area (27,200).
  - **No figure is provided for local displacement within the affected area:** Local displacement within the affected area is not reported because relocation flows are only analysed between the affected area and the outside of the affected area, i.e. not between cell clusters within the affected area.
  - **Representativeness**: In order for a person to be included in the sample, they must:
    - own a mobile phone, use Digicel Haiti SIM card;
    - and regularly make or receive a call from this phone during the baseline period (2 day per 7-day window on average).

  The likelihood of a person satisfying each of these criteria may be impacted by factors such as age, gender and socio-economic status. As a result, the sample of the population available for analysis may not be representative of the population as a whole.


Measuring changes at
The origin: the affected area
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# Decrease of residents in the affected area as a whole

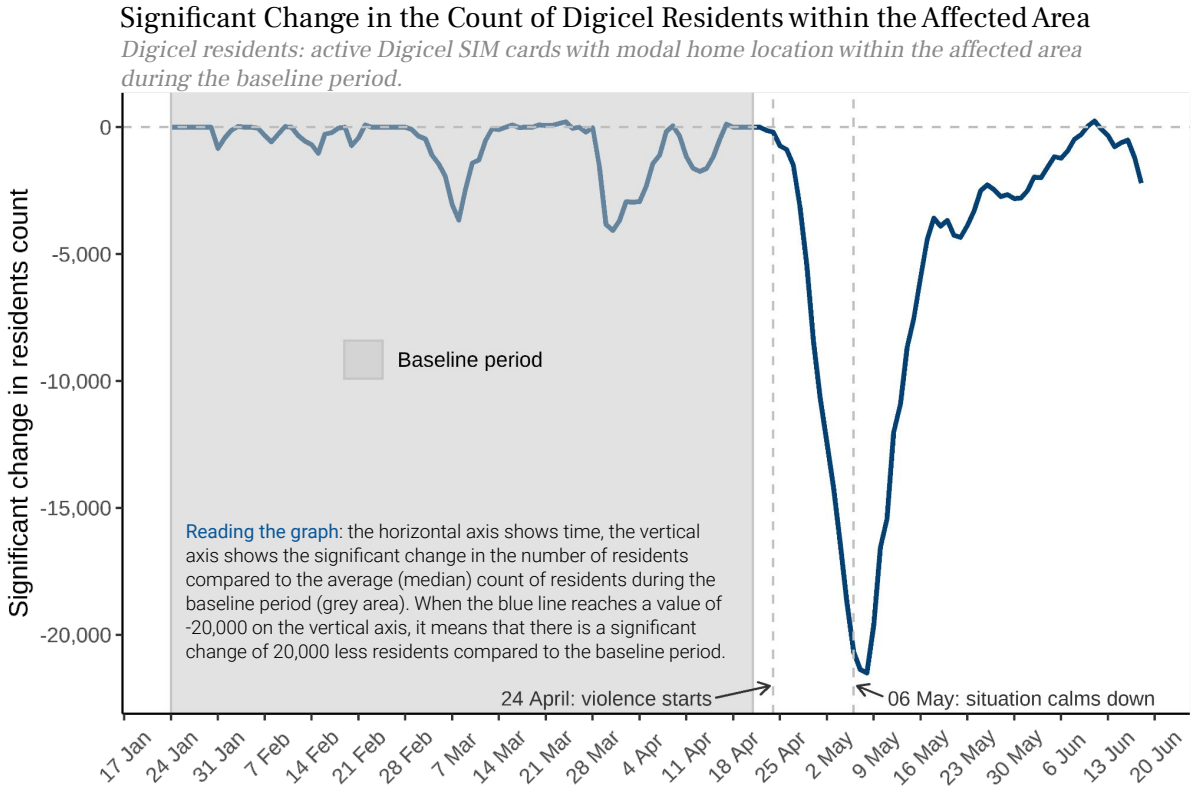
This graph shows the significant changes in in the residents count among Digicel subscribers within the affected area over the entire study period (24 Jan to 18 Jun).

Following the starts of violence on April 24, the number of residents of the affected areas decreases significantly: there are 21,500 fewer residents on 07 May than during the baseline period.

As the situation calms down from 06 May onward, the area recovers residents, which corresponds to media and humanitarian reports of families starting to return back and markets and roads reopening.

It takes another 47 days for the significant difference to reach 0 again. The climate of fear and apprehension instilled by gangs, notably via messages posted on social media explicitly threatening residents wishing to return, may have contributed to people preferring to remain outside of the area.

Limitations: As significance thresholds vary between cell clusters and as the count of Digicel SIM cards of most cell clusters outside of the affected area is not detrended (see annex), the significant decrease in Digicel SIM cards within the affected area reported here (21,500) differs from the significant increase in Digicel SIM cards outside of the affected area reported in the next section (27,200).



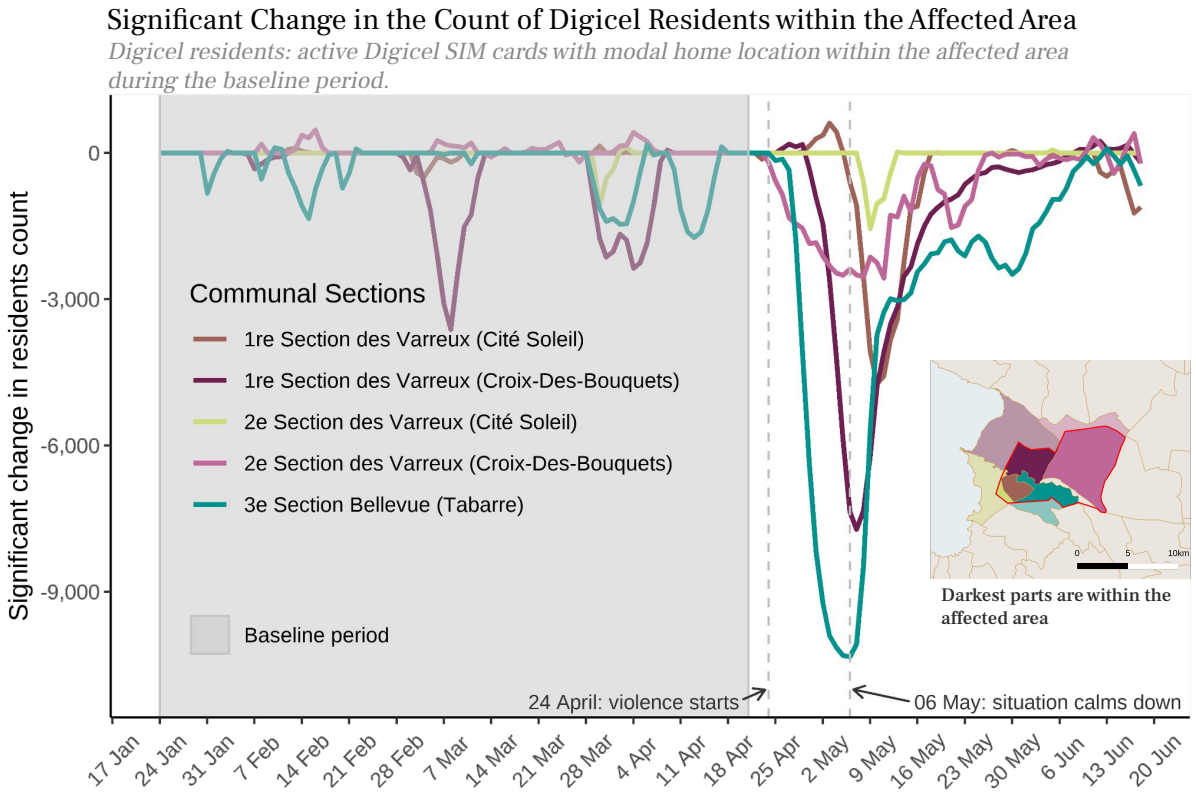

Data source: Digicel Haiti

# Decrease of residents in the affected area by sections

This graph shows the same results as those on the previous slide, but at communal section level. For each communal section, the results are computed on the area affected by the violence only, not on the whole communal section territory (see the highlighted area on the map).

The largest significant decrease in residents number occurs in the 3e section Bellevue of the Tabarre commune (10,300 fewer residents), the second largest in 1ere Section des Varreux of the Croix-des-Bouquets commune (7,700 fewer residents). 3e section Bellevue is also where the decrease is the largest in term of proportion of the resident population, except one day spike in 2eme section des Varreux of the Cité soleil commune.

The 3e section Bellevue was among the first to be affected and where the decrease was registered for the longest period: 50 days (24 April-10 June), the second being 1ere Section des Varreux in Croix-des-Bouquets, 40 days.




Data source: Digicel Haiti

# Significant increase of relocations *from* and *to* the affected area

The graph shows the significant change in relocations of Digicel subscribers from the affected area toward the outside of the affected area (the *outflows*), and the relocations from outside to inside the affected area (the *inflows*).

Following the start of violence on 24 April 2022, a large, significant increase in outflows of residents from the affected areas is registered.

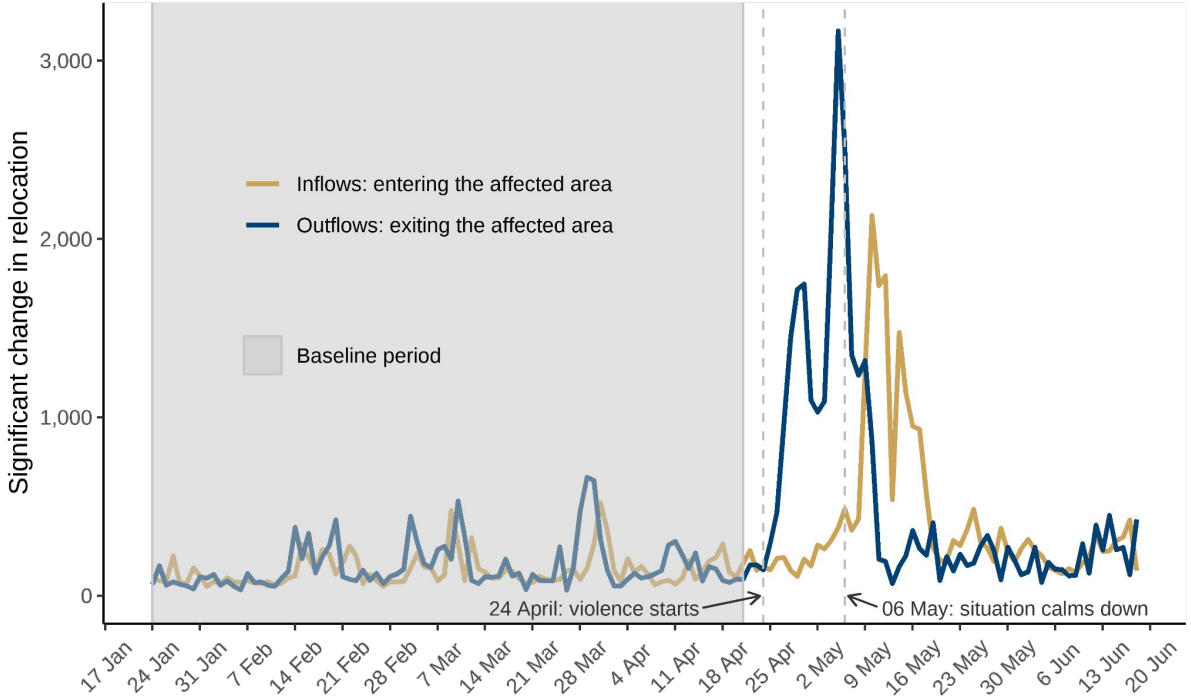
It is clearly two-phased with a first peak of outflows of about 1,700 SIM cards a day on 30 April and a second peak of close to 3,200 SIM cards a day on 05 May.

As the situation descalates on 06 May, significant outflows decrease while inflows increase, corresponding to reports from media and humanitarian sources that people are coming back.

The inflows are of lower magnitude than the outflows, possibly because fewer SIM cards are coming back than SIM cards left or because seasonal trends makes the inflows harder to estimates toward the end of the study period.

Significant Change in the Count of Digicel Residents Relocating from/to the Affected Area

*Relocations: active Digicel SIM cards with a change of home location*



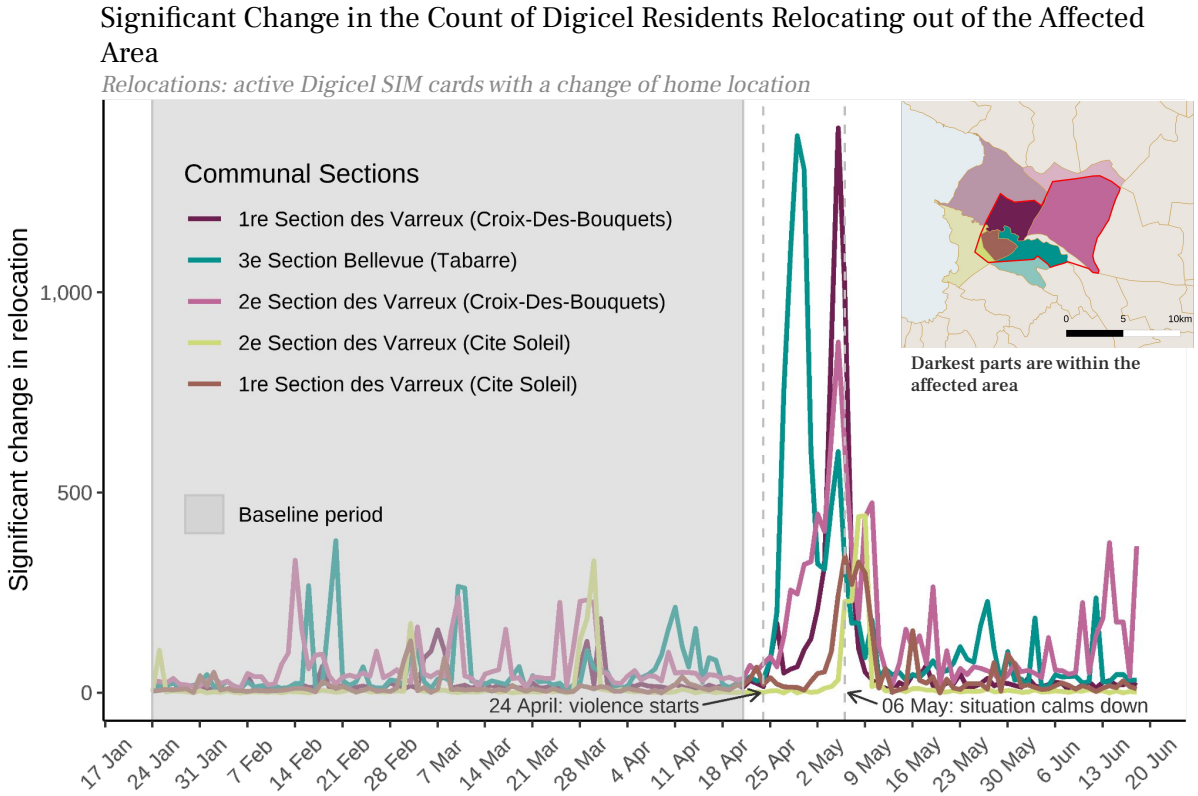

Data source: Digicel Haiti

# Significant increase of relocations *from* the affected area by sections

This graph shows the same outflow results presented on the previous slide (blue line on previous slide), but at communal section level.

Consistent with the results on the changes in residents count, most of the significant outflows in the first spike is originating from the 3eme Section Bellevue (Tabarre) while outflows from the 1ère Section des Varreux (Croix-des-Bouquets) and the 2ème Section des Varreux (Croix-des-Bouquets) contribute most to the second spike.

Flows between the affected area in Cite Soleil's communal sections and the outside of the affected area do not come out as major ones. This is consistent with evidence that a significant proportion of displacements in Cite Soleil was localized (IOM DTM/ DGPC) and are therefore not captured in these results.




Data source: Digicel Haiti


Measuring changes at
The destination of displacements
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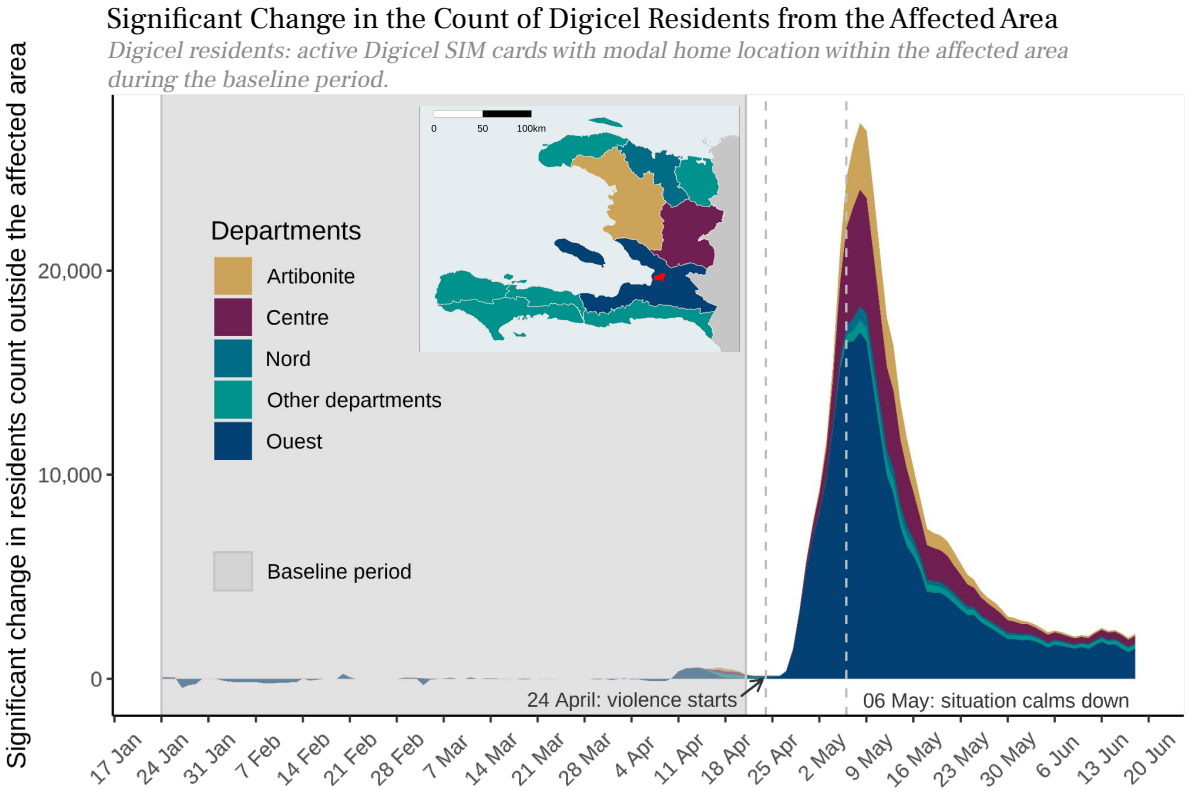
# Stock of likely IDPs among Digicel subscribers by departments

The graph shows the significant change in Digicel residents count outside of the affected area at department level. As the sample is limited to SIM cards with home location within the affected area during the baseline period, this count may be interpreted as a lower bound estimate of the stock of likely internally displaced persons (IDPs).

The total number of likely IDPs among Digicel subscribers reaches 27,200 on 08 May, most of them having relocated within the department of Ouest (17,000). Likely IDPs have also relocated in large numbers to the departments of Centre (7,000) and Artibonite (4,300).

The number of likely IDPs decreases to about 2,100 SIM cards toward the end of the study period, although this latter results may also be affected by seasonal trends.




Data source: Digicel Haiti

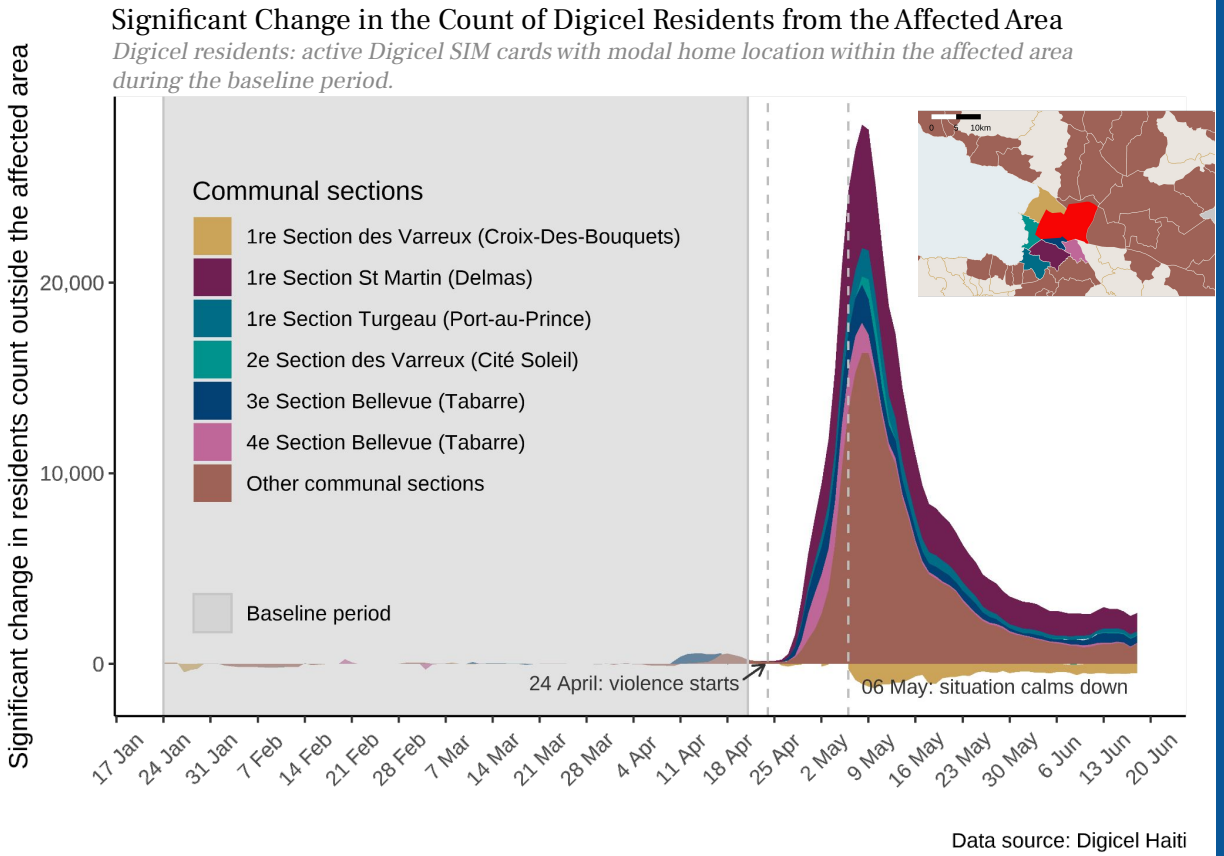
# Stock of likely IDPs among Digicel subscribers by sections

This graph shows the same results as the ones on previous slide, but at communal section level.

The 1ère section St-Martin of the commune of Delmas, to the south of the affected area, is hosting the largest number of likely IDPs among Digicel subscribers: up to 6,500 on 08 May, or about 25% of the likely IDPs, and 1,000 at the end of the study period. The other four top sections, also within Port-au-Prince, host a maximum of about 1,500 likely IDPs each on 08 May.

Although these five sections are all located in the vicinity of the affected area (see map on the right), close to 60% of likely IDPs are spread out in a large number of communal sections (see next slides).

Limitations: A significant *decrease* in the count of residents in the portion of the 1ere section des Varreux (gold on the map and graph) outside of the affected area is registered. This may be due to the boundaries of conflict area used to classify cell clusters (i.e. more cell cluster should have been classified as belonging to the affected area) as well as to seasonal trends.




Data source: Digicel Haiti

# Maps of the stock of likely IDPs among Digicel subscribers by sections

These maps show the stock of likely IDPs among Digicel subscribers across Haiti on 27 April, 30 April, 04 May, and 08 May. These are the same results as the previous slide but shown as maps. The darker the colour, the higher the number of likely IDPs among Digicel subscribers there are. The boundaries of the area affected by this episode of violence are shown in red.

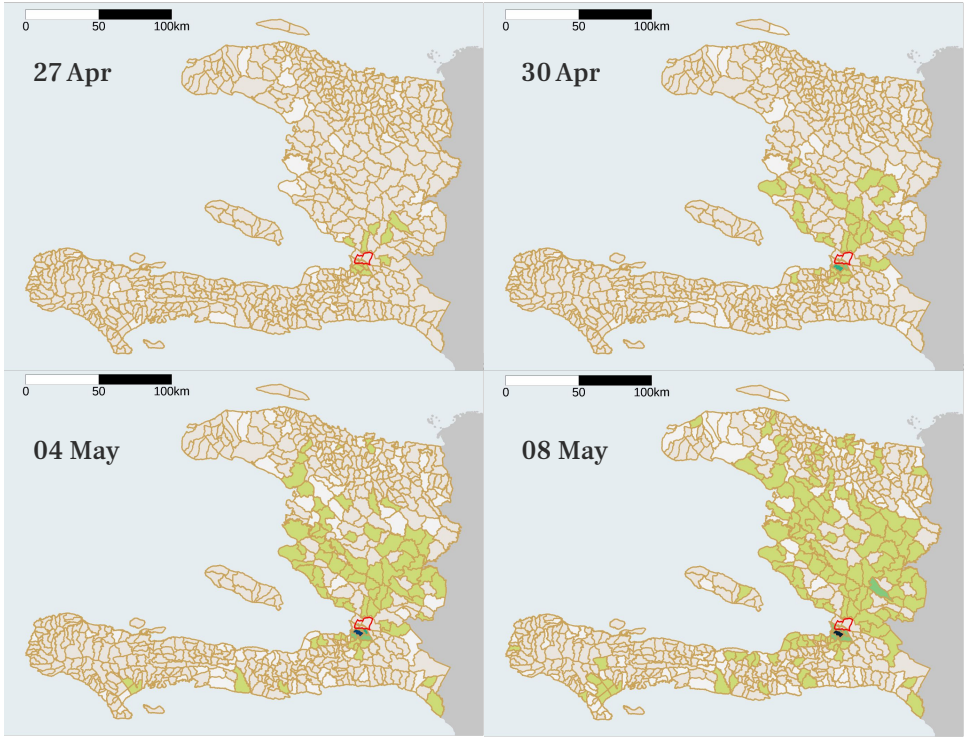
A gradual spread of likely IDPs among Digicel subscribers, particularly toward the north, is noticeable. The north may have been the best option for refuge as the southern peninsula is hard to reach, with some other gangs active on the roads leading to it, while the east of the conflict areas is controlled by one of the gangs engaged in this episode of violence.

The distribution of likely IDPs in small numbers across the territory concurs with accounts from humanitarian and media sources of the majority of the IDPs seeking refuge among family and relatives rather than in organised or spontaneous displacement sites.

These IDPs may be less visible to humanitarian stakeholders and hence not benefit from enough assistance. CDRs analytics may provide a useful source of complementary information to support the geographic targeting of activities aimed at addressing the needs of these less visible IDPs and their host communities.

Significant Increase in the Count of Digicel Residents from the Affected Area

*Digicel residents: active SIM cards with home location within the affected area during the baseline period.*

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# Direct arrival flows of likely IDPs among Digicel subscribers by departments

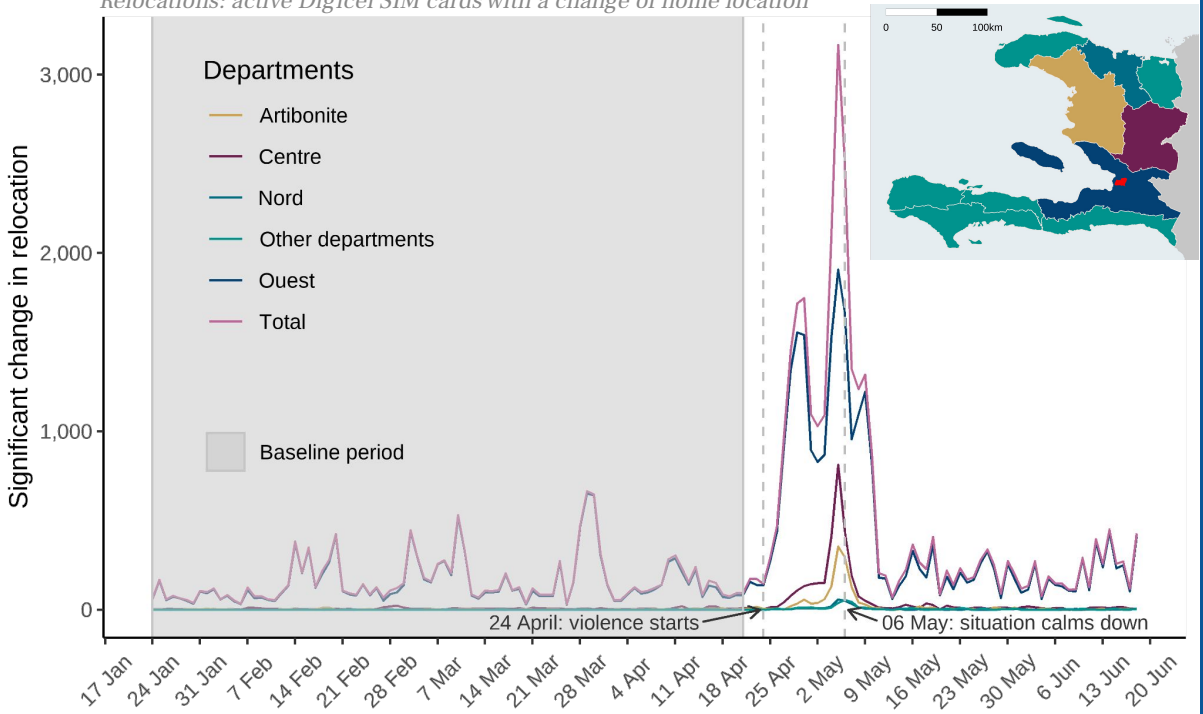
This graph shows the significant change in relocations of Digicel subscribers at department of destination level. As the sample is limited to SIM cards with home location within the affected area during the baseline period, this count may be interpreted as a lower bound estimate of the direct arrival flows of likely internally displaced persons (IDPs).

The first spike of displacement reaches approximately 1,700 people a day on 04 April. Most of the arrivals are registered for this day in the department of Ouest (1,400). The second spike reaches a maximum of close to 3,200 person a day on 08 May. The departments of Centre and Artibonite also become important destinations (peaks at 700 and 400, respectively). From 12 May onward, arrivals decrease sharply.

Limitations: These results show only the direct arrivals from the affected area. If a SIM card relocates from the affected area to a first location and then to a second location, the relocation to the second location won't be captured in the results shown here.

Significant Change in the Count of Digicel Residents Relocating from the Affected Area

*Relocations: active Digicel SIM cards with a change of home location*




Data source: Digicel Haiti

# Direct arrival flows of likely IDPs among Digicel by sections

This graph shows the same results than those presented on the previous slide, but at communal section level. These results may be interpreted as a low bound estimate of the direct arrival flows of likely IDPs among Digicel subscribers.

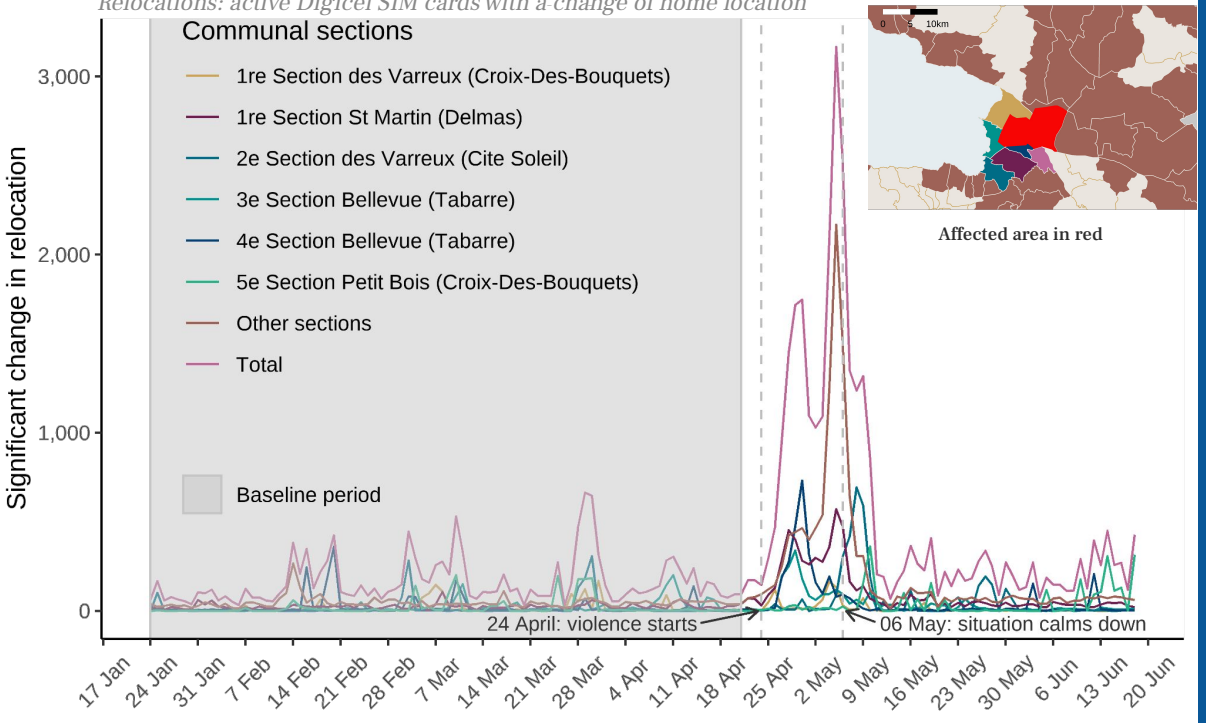
The 4ème section Bellevue (Tabarre) receives the largest arrivals flows on a single day (750 on 30 April). The 2eme section des Varreux (light blue, Cité Soleil) received the second most (660 on 08 May).

In the second spike, most of registered arrivals from the affected area are spread in small numbers across many communes (see next slide).

Limitations: These results show only the direct arrivals from the affected area: if a SIM card relocates from the affected area to a first location and then to a second location, the relocation toward this second location won't be captured in the results shown here. This may explain why 4ème section Bellevue (Tabarre), on the way from the affected area to 1ère section St-Martin (the commune hosting the largest number of likely IDPs), comes out as the top direct destination.

Significant Change in the Count of Digicel Residents Relocating from the Affected Area

*Relocations: active Digicel SIM cards with a change of home location*




Data source: Digicel Haiti

# Maps of direct arrival flows of likely IDPs among Digicel subscribers by sections

These maps show the sum of direct arrival flows of likely IDPs among Digicel subscribers from the affected area (shown in red) into communal sections. These figures show the same results as the previous slide as maps. The darker the colour, the larger the flow is. In communal sections in white, the flow is below 20. In those in beige, no significant change is recorded.

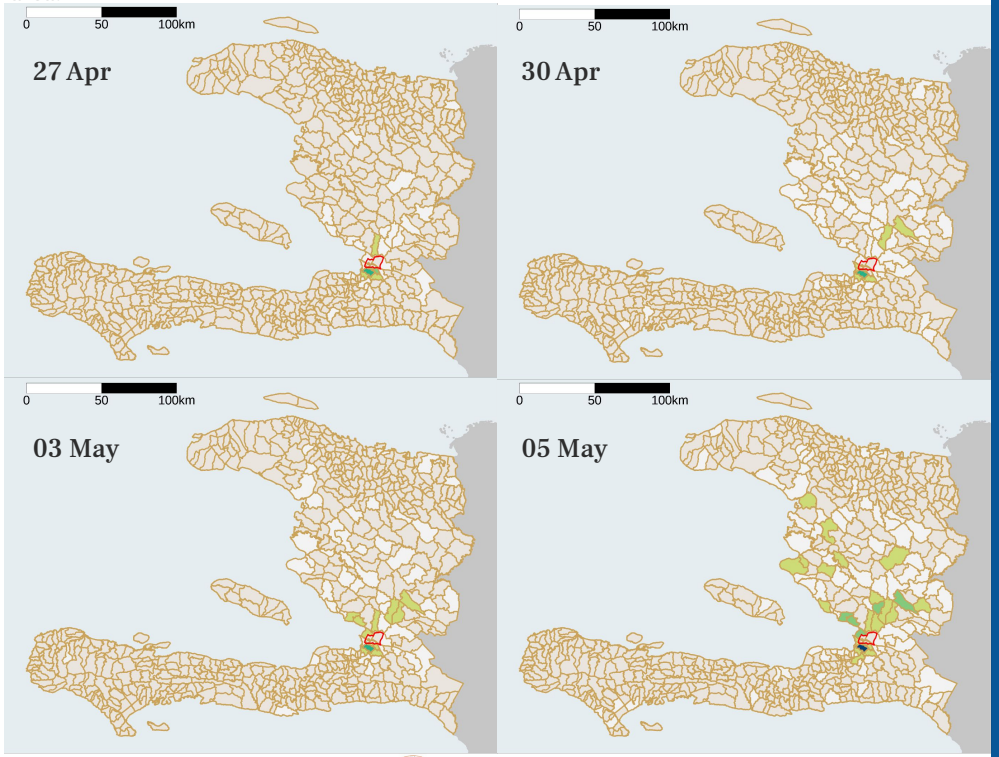
The gradual spread of IDPs towards the North is noticeable. Many communal sections register very small flows (below 20 SIM cards).

As these relocations happen in a small numbers and across a large territory, they may be hard to monitor with field data collection approaches, particularly in the challenging security context of Haiti.

Limitations: These results show only the direct arrivals from the affected area: if a SIM card relocates from the affected area to a first location and then to a second location, the relocation toward this second location won't be captured in the results shown here.

Significant Increase in the Count of Digicel Subscribers Relocations from the Affected Area

*Relocations: active SIM cards with a change of home location originating from the affected area.*



# Annex 1
# Methods

# Annex 1 | Significant change and trends

### Calculation of significant change

For each cells cluster, the:

1. median is calculated for the baseline period;
2. median is subtracted from each daily value, this is the change;
3. modified z-score is calculated for each day, setting the significance value at 3:
    a. a value of 3 corresponds approximately to a 99% confidence interval with a Normal distribution and 95% based on the empirical distribution of the residents count data in the baseline period;
4. change above the significance threshold is the significant change.

The significant change is then summed by communal section, department or affected area levels.

### Trend estimation

In order to take into account a decreasing trend in the number of SIM cards in the sample during the baseline period:

1. A trend is estimated in the baseline period and predicted for the remaining part of the analysis period
2. Residents values are then detrended

Estimation of the trend:

1. In the affected area: a segmented linear model with fixed effect on pooled data is fitted at cluster level
2. For cluster outside of the affected area with median residents count above 30 and consecutive data in the last 30 days of the baseline period: the same approach is adopted as in (1) above
3. For clusters outside of the affected area with median residents count below or equal to 30 or no consecutive data in the last 30 days of the baseline period: values are not detrended.

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