International Labour Organization

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August 2026

Employment impact assessment of Hurricane Melissa in Jamaica[1]

Key points

- Hurricane Melissa, a Category 5 storm, made landfall in Jamaica on 28 October 2025. The western and central parishes, particularly Westmoreland, Saint Elizabeth, Saint James and Trelawny, experienced the highest levels of building damage. Severe damage affected approximately 12 to 19 per cent of buildings across most of these parishes, rising to 31.0 per cent in Westmoreland.
- 0.5 million workers were exposed to hurricane force wind speeds (>120km/h), with 56.9 per cent of exposed workers in the informal sector. Building damage was extensive, affecting an estimated 209,666 structures, including 53,195 with minor damage, 55,526 with major damage, and 100,945 that were destroyed.
- National GDP loss: Estimated at ~2.9 per cent of annual output and 30,400 jobs, based on nighttime light (NTL) data and a production function approach. Local Level Impacts: Savanna-la-Mar: 9.7 per cent decline in economic activity, 2,990 job losses. Montego Bay: 7.3 per cent decline in economic activity, 3,770 job losses. Saint Elizabeth: 6.6 per cent decline in economic activity, 3,900 job losses.
- Innovative methodology: The assessment combines remote sensing data (e.g., NTL, building damage maps) with pixel-level production function modelling to estimate GDP and job losses. This approach provides high-resolution, real-time insights into economic disruptions.
- Recovery heterogeneity: Post-hurricane daily nighttime light data shows substantial variations in recovery strategies. While affected areas experienced decline in luminosity ranging from 25 to 75 per cent, recovery remained slow and uneven as of April 2026, indicating persistent economic disruptions.
- Long-term risks: Without targeted interventions, the hurricane could lead to long-term unemployment, poverty traps, and structural economic damage, particularly for informal workers and SMEs.
- Employment-centred recovery: Strengthen labour market policies to manage climate-induced disruptions and protect jobs, incomes, and enterprises.
- Sector-specific support: Prioritize tourism, agriculture, and construction with targeted strategies (e.g., cash-for-work programmes, SME financing).
- Informal sector protection: Extend temporary unemployment assistance and cash transfers to informal workers and households.
- Skills development: Invest in reskilling programmes for climate-resilient and adaptive skills (e.g., construction, agriculture).

[1] This brief was produced as part of a broader compendium of analytical reports prepared in support of the National Employment Policy (NEP) diagnostic process for Jamaica. It was produced by a team including Research Associate Huanyue Hu, Senior Economist Matthieu Charpe (Employment, Skills and Sustainable Enterprises Department – ILO – charpe@ilo.org) and Employment specialist Abdelmalik Muhummed (ILO Decent Work Team and Office for the Caribbean – muhummed@ilo.org). We would like to thank Tian Lee, Zhe Zhu and Zhuosen Wang for running the VZA-COLD algorithm on daily satellite images for Jamaica. We would like to thank Melissa Haynes and Sudiana Murray from the Office of the Prime Minister, Gillian Corrodus from the Ministry of Labour and Social Security as well as Alicia Edwards from the Ministry of Economic Growth and Infrastructure Development.

Context

Hurricane Melissa made landfall in Jamaica on 28 October 2025 as a Category 5 storm and caused severe nationwide destruction. According to the World Bank, direct physical damage was estimated at approximately US$8.8 billion, equivalent to 41 per cent of 2024 GDP, making Melissa the costliest hurricane in Jamaica's recorded history.[2]

The damage was severe and geographically concentrated with the heaviest impacts in the western and central parishes, especially Saint Elizabeth, St James, Westmoreland, Trelawny and Manchester. Residential damage alone is estimated at US$3.68 billion, non-residential damage is US$1.77 billion, infrastructure damage at US$2.92 billion, and agricultural damage at US$389 million.[3]

Hurricane Melissa also negatively affected Jamaica's labour market by causing job and income losses in key sectors such as tourism, agriculture, and construction, with small businesses and vulnerable workers being the most affected.

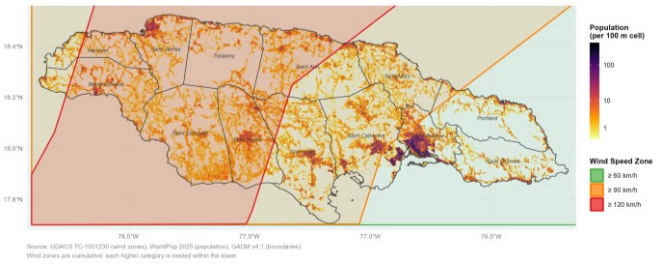
This brief draws on geospatial data, satellite-derived building damage footprints, gridded population, night-time lights, and harvested crop area, combined with national labour force survey statistics, to provide a preliminary assessment of where people, jobs, and economic activity were most exposed to the hurricane, especially the wind speed zones.

The brief then estimates directly affected workers based on i) a remote sensing augmented production function approach as well as ii) performing detection change using daily satellite image of luminosity at night. Drawing attention to the conditions of workers in the aftermath of the Hurricane intends to inform policy makers and to support better targeted relief, recovery and reconstruction measures.

Counting people and jobs exposed to high wind speed

Based on GDACS wind-hazard polygons for MELISSA-25 (Bulletin 32, 29 October 2025, 09:00 UTC), the Hurricane's hazard footprint covered the entire national land area of Jamaica within sustained winds of at least 60 km/h.[4] In order to give an indication of the exposure of population to the Hurricane, we classify the wind speeds into three categories: strong for speeds comprised between 60km/h and 90 km/h, storm-force for speeds comprised between 90km/h and 120 km/h and Hurricane-force for speeds above 120 km/h. Overlaying wind speed zones with WorldPop 2025 gridded population data reveals that approximately 1.06 million persons (37.5 per cent of the island population) were exposed to winds of 60–89 km/h, some 822,000 persons (29.0 per cent) to winds of 90–119 km/h, and roughly 952,000 persons (33.5 per cent) to winds of 120 km/h or above, the latter group concentrated in the southwestern parishes (see Figure 1; Table 1).[5]

▶ **Figure 1: Population distribution and GDACS wind-speed zones**



Note: This figure displays gridded population data at a resolution of 100m as well as the different wind-speed zones (60km–89km, 90km to 119km, >119km).

Employment

The total number of jobs within the directly affected area is estimated by applying national labour market parameters to the population exposed to wind speed zones. Based on a working-age population share of 81 per cent and a national employment rate of 65.6 per cent,[6] approximately 506,209 workers are estimated to reside within the highest wind speed zone of which 288,033 are informal workers, 60,740 are young workers and 232,850 are women workers. The medium wind speed band gathers 436,986 workers including 248,645 informal workers, 52,433 young workers and 201,008 women workers. While the lowest wind speed zone is populated by 566,004 workers of which

[2] World Bank, *Sustainable and Resilient Recovery DPF and CAT DDO Scalable Financing Document*, 11 March 2026. This approach measures the value of the stock of building and the stock of infrastructure damaged by the Hurricane. It is a measure of the value of the stock of physical capital impacted. In contrast, our approach adopts a perspective in terms of flows, measuring the impact on economic activity (i.e. GDP).

[3] World Bank. 2025. Global Rapid Post-Disaster Damage Estimation (GRADE) Report: Hurricane Melissa 2025 Jamaica. Washington, DC: World Bank and Global Facility for Disaster Reduction and Recovery.

[4] www.gdacs.org - /datareport/resources/TC/1001230/

[5] This assessment of the population in the different wind corridors is similar to the assessment made by UNOSAT. https://experience.arcgis.com/experience/c4a17cbf128c422ea6e07f92defe7395/page/UNOSAT

[6] These numbers are derived from Jamaica Labour Force Survey 2024 microdata.

322,056 are informal, 67,920 are young workers and 260,360 are women workers (see Table 1 for a summary). This represents a provisional estimate of the number of jobs potentially at risk from physical co-location with high wind-speed zone and should be read as an upper bound as many workers in the vicinity of affected area will continue to work.

▶ Table 1: Population exposed to MELISSA-25 wind-speed zones

Wind speed band	Population exposed	Share of island population (%)	Jobs exposed	Informal jobs	Nighttime light (%)
60–89 km/h	1,064,550	37.5	566,004	322,056	33.8
90–119 km/h	821,891	29.0	436,986	248,645	30.9
≥120 km/h	952,087	33.5	506,209	288,033	35.3

Economy

In the absence of regional and district GDP estimates, the geographical distribution of GDP is proxied by luminosity at night. Nighttime light is a popular and well accepted proxy for economic activity.[7] Night-time lights within the high wind speed band account for approximately 35.3 per cent of total observed island-wide radiance. Scaling this share to Jamaica's 2024 nominal GDP of US$ 22.0 billion, the economic activity co-located with the impacted footprint corresponds to an order of magnitude of US$ 7.8 billion in value at risk. This estimate should be understood as a static accounting measure of the economic activity physically overlapping the wind speed zone, rather than a prediction of realized output loss, which is discussed in the next section. Actual macroeconomic effects will depend on the duration of disruption, the extent of infrastructure damage, and supply-chain spillovers beyond the immediate footprint.

Agriculture is a critical source of employment and livelihoods in the parishes most directly affected by Hurricane Melissa, particularly Saint Elizabeth, which is among Jamaica's most important food-producing regions, and Westmoreland. Overlaying the different wind speed band with crop data disaggregated at the local level reveals severe impact on agriculture sector.[8] In total, some 46,709 ha of harvested area was exposed, of which 24,628 ha, 52.7 per cent of the national total, lay in the zone experiencing winds of 120 km/h or above, and a further 18,828 ha (40.3 per cent) in the 90–119 km/h band (Table 2). Among the eight major crop kinds, cocoa, yam and maize record the highest proportional exposure in the most intense wind band, with 65 per cent of their respective national harvested areas lying in the 120 km/h or above zone. The prevalent exposure across these crops threatens both short-term agricultural incomes for farm workers, and the supply of food and agro-industrial inputs into downstream value chains.

▶ Table 2: Harvested area by crop and wind-speed zone

Crop	National total (ha)	60–89 km/h (ha)	90–119 km/h (ha)	≥120 km/h (ha)	≥120 km/h (%)
Coffee	10,015	403	3,169	6,443	64
Cocoa	998	44	303	650	65
Sugar cane	11,469	901	7,093	3,475	30
Banana	7,386	1,036	2,524	3,825	52
Yam	9,309	324	2,912	6,073	65
Sweet potato	2,797	95	909	1,792	64
Maize	1,770	57	570	1,144	65
Pumpkin	2,965	391	1,347	1,227	41
All crops	46,709	3,252	18,828	24,628	53

Estimating GDP and jobs lost

Not all individuals and workers are affected within the high-impact zone. To refine our estimate of impacted workers and to assess the hurricane's effect on GDP, we utilize two distinct yet complementary estimation methods.

The first approach relies on an assessment of damaged buildings and projects the impact on GDP by modelling the reduction in capital stock through a production function.

The second approach utilizes 130 daily observations of nighttime luminosity recorded since the hurricane to detect

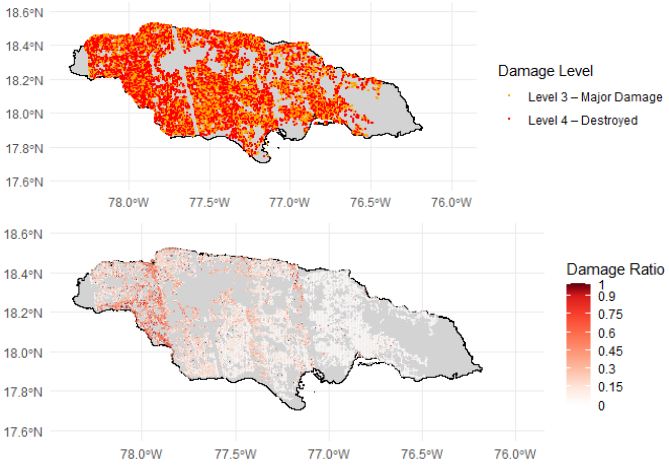
[7] Night-time light radiance is taken from the VIIRS Black Marble satellite product.

[8] GDACS wind-hazard polygons are combined with CROPGRIDS v1.08 harvested area data for eight key crops.

changes at the pixel level.

Potential losses based on a remote-sensing augmented production function estimation

▶ Figure 2: Building damage



In terms of building damage, based on governmental data, 209,666 buildings have suffered either minor damage, major damage or are destroyed. This represents 13.5 percent of the buildings in Jamaica. Out of the damaged buildings, 100,945 (48 per cent) are assessed as destroyed, 55,526 (26.5 per cent) as major damage, and 53,195 (25.5 per cent) as minor damage (see Table 3).

The geographic distribution of damage is heavily concentrated in the two parishes most directly in the storm's landfall path. Westmoreland accounts for 33,415 buildings classified as major damage or destroyed. St. James records 25,263 buildings and Saint Elizabeth 25,046 buildings falling into major damage or destroyed categories.

Among the six most affected parishes presented in Tables 3 and 4, the next highest numbers of heavily impacted buildings are recorded in Clarendon (16,253), St. Ann (13,109) Manchester (10,917) and Trelawny (10,586). This indicates that significant damage has also occurred in the central part of Jamaica. All six parishes record severe damage affecting close to or more than 10 per cent of their building stock (see Tables 3 and 4; Figure 2).

▶ Table 3: National building damage counts by class

Damage class	Number of buildings	Share of national total (%)
Destroyed	100,945	48
Major damage	55,526	26.5
Minor damage	53,195	25.5

▶ Table 4: Building damage by parish

Parish	Destroyed	Major Damage	Minor Damage	(Major & Destroyed) % all buildings
WESTMORELAND	22,915	10,500	7,544	31.0%
HANOVER	5,187	3,398	2,992	19.0%
SAINT JAMES	16,079	9,184	8,410	19.0%
SAINT ELIZABETH	17,251	7,795	6,260	18.0%
TRELAWNY	6,985	3,601	3,267	18.0%
ST. ANN	7,937	5,172	5,797	12.0%

One of the primary transmission channels of the hurricane's economic impact is the reduction in capital stock due to damaged buildings. A conventional method to estimate GDP losses involves using a production function to project the impact of reduced capital stock on GDP.

The innovation introduced in this brief is the use of a remote sensing-based production function analysis. Rather than relying on national account data for capital and labour at the country level, we proxy capital and labour at the pixel level using building counts and gridded population data. Nighttime light data serve as a proxy for GDP.

In detail, this estimation involves regressing the log-transformed nighttime lights on the log-transformed population and building counts across Jamaica's national grid. Shocks to informal employment within the exposure zone and damage-weighted building stock are treated as disturbances to labour and capital, respectively.

This approach yields a potential national GDP impact of approximately 2.9 per cent of annual output and 30,400 jobs (of which 3,640 young workers and 13,980 women workers), which aligns in magnitude with the nighttime light (NTL) scaling results and captures the combined labour and capital disruptions implied by the observed damage patterns.[9] ECLAC forecasts a 2.7 percentage points decline in GDP over the calendar year 2025, followed by a

[9] Our estimate is in line with contemporaneous external assessments. The Inter-American Development Bank projected a 4.5 percent contraction in Jamaica's GDP in fiscal year 2025/26 following Hurricane Melissa, while the Bank of Jamaica projected a decline in the range of 4.0–6.0 percent for the same period.

1.9 percentage point decline in 2026. [10] Some methodological differences explain this gap. This study relies on a reduced form estimation between identified damages and a proxy for GDP at the pixel level, rather than a national account-based approach. Our approach also is centred on service and manufacturing impacts in urban areas and only captures agriculture indirectly. Last, our approach does not factor in contagion effects, that would result from the damage located in a given pixel and its impact on the neighbouring pixels.

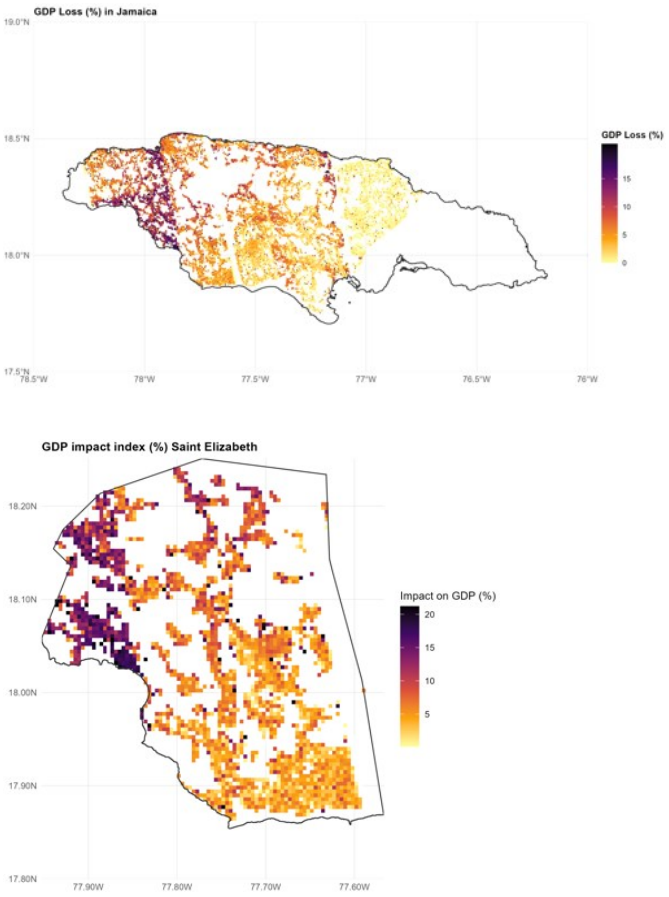
The magnitude of the effects is also in line with national account-based estimates of natural disasters on GDP. While academic literature stresses the heterogeneity of the effects, the GDP impact from a reduction in the stock of capital is estimated to range between 0.5 per cent and 3.0 per cent in a number of studies.[11]

Overall, the damage considered for this analysis corresponds to those falling within the highest wind speed zone with a buffer of 35km, covering the western half of the island. The area covered leaves Kingston, the main economic centre of Jamaica, out of the impacted zones, hence the above magnitude at country level.

The potential decline in economic activities in the affected localities is much larger than the national aggregates. For instance, Savanna-la-Mar is expected to go through a 9.7 per cent decline in GDP together with 2,990 job losses. In Montego Bay, the decline in GDP could reach 7.3 per cent, corresponding to 3,770 job losses, while Saint Elizabeth could go through a 6.6 per cent drop in GDP and 3,900 job losses.

The spatial pattern of estimated jobs impact within the agglomerations of Saint Elizabeth, Savanna-la-Mar and Montego Bay at pixel level is illustrated in Figure 3. Regarding Saint Elizabeth, the projected impact is most pronounced in the western and coastal parts of the area, near Black River, where the storm made landfall and where the density of mapped building damage is highest. Values in the most affected cells exceed 15 per cent of losses in economic activity at pixel level, while large portions of the centre area show more moderate but still significant exposure around 5 per cent percent of economic activity losses. In Savanna-la-Mar, the projected decline in employment is concentrated around the city centre but also extends towards the outskirts of the city in the North and in the East. In Montego Bay, the projected GDP impact is distributed in the city centre and in the southern part leaving the northern part of the city less impacted. These maps are illustrative of spatial heterogeneity within a single agglomeration.

▶ Figure 3: Pixel-level estimated GDP impact - Saint Elizabeth, Savanna-la-Mar and Montego Bay



[10] ECLAC 2026, Assessment of the Effects and Impacts of Hurricane Melissa in Jamaica.

[11] Cavallo, E., Galiani, S., Noy, I., & Pantano, J. (2013). Catastrophic natural disasters and economic growth. American Economic Review, 103(6), 2427–2451. https://doi.org/10.1257/aer.103.6.2427

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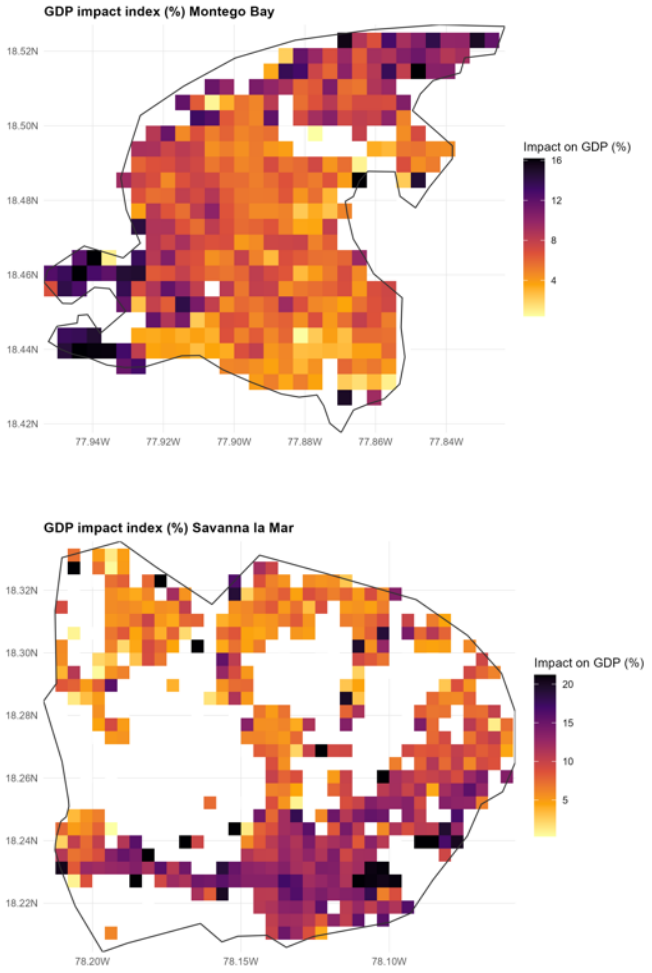
Hallegatte, S., & Dumas, P. (2009). The economics of natural disasters: A review of the literature. Review of Environmental Economics and Policy, 3(1), 77–96. https://hal.archives-ouvertes.fr/hal-00716643/document

Loayza, N., Olaberría, E., Rigolini, J., & Christiaensen, L. (2012). Natural disasters, growth, and the role of institutions. World Bank Economic Review, 26(2), 197–228. https://doi.org/10.1093/wber/lhr050

Raddatz, C. (2007). Are exogenous shocks to output permanent or temporary? Evidence from natural disasters. IMF Working Paper No. 07/145. https://www.imf.org/external/pubs/ft/wp/2007/wp07145.pdf



Note: Pixel-level employment impact index (%), estimated using Jamaica-wide pixel level OLS regression coefficients (ln(1+NTL) on ln(1+population) and ln(1+building count)) and a NTL-to-GDP elasticity of 0.85. The index combines a labour shock within the damage cell, and a damage-weighted capital shock derived from government data. Darker colours indicate higher estimated local GDP impact. Source: authors' calculations; NTL from VIIRS Black Marble VNP46A4 (2024); buildings from Jamaican government data/Copernicus EMS analysis; population from WorldPop 2025.

Shape of the recovery using daily nighttime light data

The maps produced using the production function approach represent projected effects and do not constitute an actual measure of post-hurricane adjustments. Instead, they provide an estimate of potential economic activity losses based on identified damages. However, these estimates do not clarify the nature of the losses, whether they are temporary or permanent.

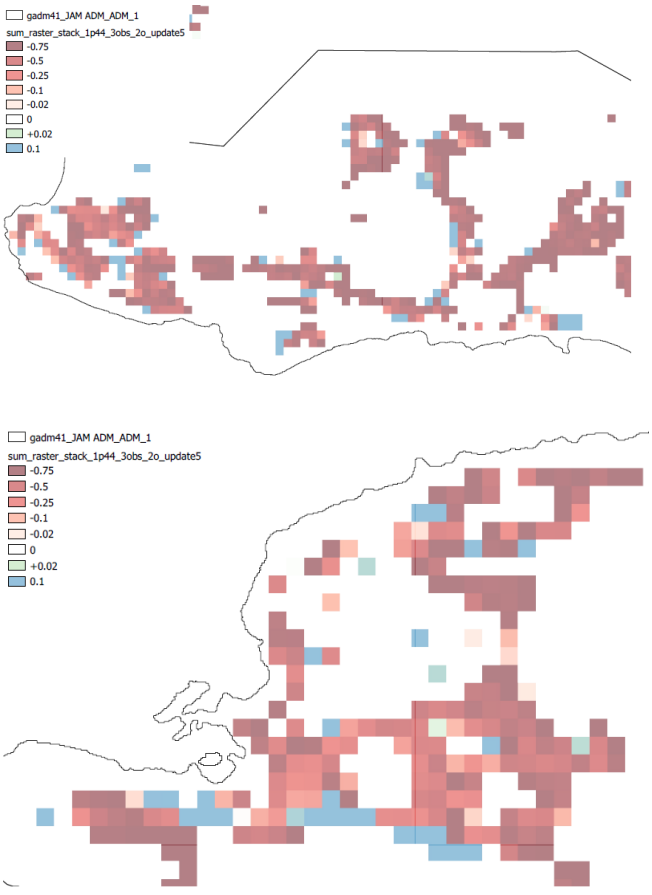
A range of factors may influence the shape of recovery. The long-term impact of the hurricane on the economy and the labour market depends on multiple elements, including: reconstruction efforts, financial and technical constraints, productivity effects and regional spillovers.

Given the short time elapsed between the hurricane and the current assessment, it is challenging to measure the economic impact of the natural disaster in real time. Collecting and constructing macroeconomic indicators or household survey data to track the economic downturn is also time-consuming and costly.

To partially address this gap, we can rely on daily nighttime light data, which have been available since the hurricane occurred. Our focus is on assessing the magnitude of the drop in nighttime light following the hurricane and characterizing the shape of any subsequent recovery.

Although high-frequency remote sensing data do not provide a direct observation of economic activity or the labour market, they can be used to build proxies that indirectly reflect economic conditions and the world of work.

▶ Figure 4: Average % radiance variation for Savanna-la-Mar, Montego Bay



To achieve this, we utilize the 130 daily observations available since the hurricane and apply the VZA-COLD

algorithm developed by Tian et al. (2022) [12] to detect changes in nighttime light at a spatial resolution of 500 metres by 500 metres.

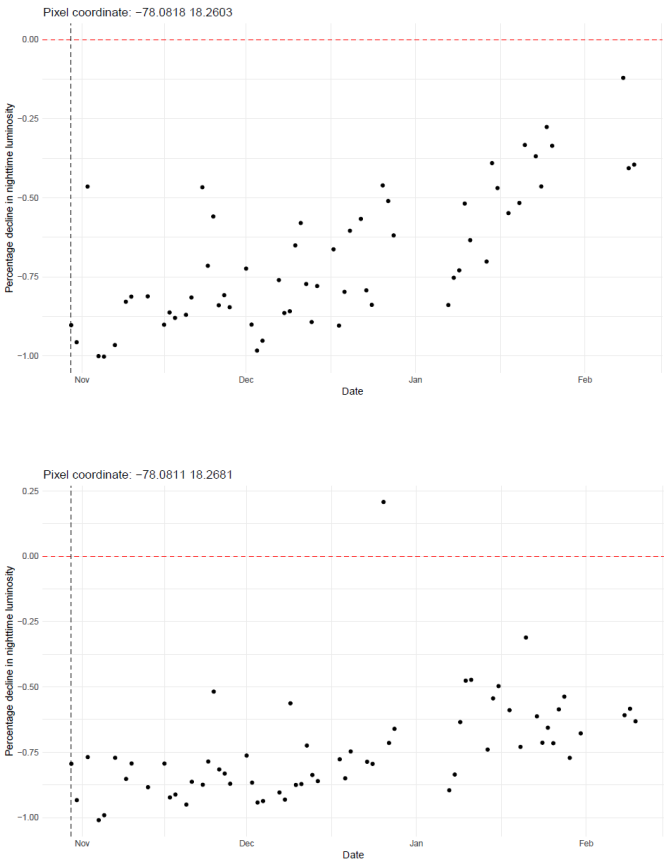
Figure 4 illustrates the cumulative significant variations in nighttime light for the town of Savanna-la-Mar and for the city of Montego Bay. The map overlays the significant nighttime light variation with the damaged buildings map. Regarding Savanna-la-Mar, the results indicate that significant changes in nighttime light are predominantly negative and closely associated with building damage. The magnitude is large as many pixels display a drop in luminosity exceeding 50 per cent and 75 per cent.

While some pixels in the city centre exhibit a significant decline, the largest cumulative reductions occur on the outskirts of the city. This pattern may reflect differences in construction types, such as buildings versus houses, as well as variations in construction quality. Additionally, highly localized wind forces could contribute to these observed disparities. Differentiating between the three different types of damage assessment (destroyed, major damage and minor damage), the decline in light is associated with the category of destroyed buildings, that show a smaller concentration in the city centre.[13]

Beyond the magnitude of the decline of luminosity, the pattern of adjustment offers valuable insights into whether the changes are permanent or temporary, as well as the dynamics of the recovery process.

For example, examining the time series of luminosity variation for a selected pixel reveals the trajectory of radiance since the hurricane. As depicted in Figure 5, right after the Hurricane, the blackout leads to a decline in light by 100 per cent in most cases. The pixels remain mostly dark throughout 2025 and luminosity recovers slowly starting in 2026. The two pixels in Figure 5 show a contrasting situation. In pixel 1, luminosity increases up to February 2026 although remaining at least 25 per cent below pre-hurricane level. In pixel 2, the recovery is very limited and the deficit in luminosity is comprised between 60 per cent and 75 per cent.

▶ Figure 5: Shape of light adjustment at pixel level following the Hurricane



The analysis of daily nighttime light data provides real-time, high-resolution insights into the immediate economic disruptions caused by Hurricane Melissa. By detecting significant declines in luminosity, exceeding 50–75 per cent in some areas, this approach captures the spatial and temporal dynamics of recovery, or lack thereof, in the aftermath of the disaster. The observed patterns, such as the slow recovery in luminosity through 2025 and into 2026, suggest persistent economic challenges, particularly in areas with severe building damage. Furthermore, the heterogeneity in recovery trajectories, with many pixels showing partial recovery only, highlights the uneven nature of post-disaster adjustments.

While daily nighttime light data do not directly measure economic activity or employment, they serve as a powerful proxy for tracking the pace and spatial distribution of

[12] Tian Li, Zhe Zhu, Zhuosen Wang, Miguel O. Román, Virginia L. Kalb, Yongquan Zhao, Continuous monitoring of nighttime light changes based on daily NASA's Black Marble product suite, Remote Sensing of Environment, Volume 282, 2022, 113269, ISSN 0034-4257, https://doi.org/10.1016/j.rse.2022.113269.

[13] Maps available on request.

recovery. This method complements traditional economic assessments by offering timely, granular insights that can inform policy responses before more comprehensive data (e.g., household surveys or national accounts) become available.

Key recommendations

As preliminary evidence notes, Hurricane Melissa was not only a natural disaster but a profound labour market crisis too. Its impact disrupted employment, earning and business operations, particularly for vulnerable workers and enterprises. An effective recovery process therefore requires an employment-centred approach that explicitly protects jobs, incomes, and enterprises. The following are key policy recommendations:

- **The employment policy framework should serve as a key policy instrument for improving resilience of the labour market in light of climate change and the risk of recurring disasters**: Employment policy governance must be fully mandated and adequately resourced to manage climate-induced labour market disruptions, ensure effective cross-institutional coordination, and strengthen labour market resilience and social protection systems in line with the decent work agenda.[14]
- **Implement targeted sector-specific job recovery strategies**: the tourism, agriculture and construction sectors have borne the brunt of the hurricane's labour market impact and therefore require targeted policy action to restore agricultural livelihoods, accelerate tourism job recovery, and generate more jobs from construction using a "build back better" approach. These strategies should be integrated into the ongoing National Employment Policy (NEP) to ensure coherence and scale. Furthermore, local employment recovery hubs can be established in the hardest-hit areas.
- **Prioritize targeted support to informal workers and enterprises in recovery measures**: the government should extend temporary unemployment assistance for informal workers, expand unconditional cash transfers for impacted households, and support informal enterprises to transition to formality. The temporary versus permanent nature of the costs associated with the Hurricane, may also call for additional policy responses. If destruction generates long-term income and employment losses, structural labour market policies may be needed.
- **Support MSMEs as driver of job recovery and economic diversification:** While informal enterprises have been the hardest hit, micro, small and medium-sized enterprises were also disproportionately affected by the Hurricane. Targeted support should include integrated instruments such as concessional finance or grants, business continuity assistance, business and management training, and productivity-enhancing support. Priority should be given to enterprises operating in the most affected sectors and parishes, while strengthening market linkages, value chains and supply-chain resilience to foster sustainable enterprise recovery, growth and job creation.
- **Scale up emergency employment programmes in the most affected parishes:** Given the long-term effect of the hurricane on employment and income, the government should expand employment-intensive programmes to stabilize livelihoods and support recovery, whilst rehabilitating critical infrastructure, e.g. roads and agricultural land, in the most severely affected parishes such as Saint Elizabeth and Westmoreland.
- **Promote skills development and workforce adaptation:** reconstruction and recovery efforts typically require rapid reskilling programmes in construction trades, agriculture, repair and maintenance. These programmes should prioritize disaster-resilient and climate-adaptive skills, aligned with labour market needs.
- **Strengthen the labour market data and monitoring systems:** while Jamaica has a well-established geo-spatial data infrastructure, its use within the labour market institutions remains limited. It is therefore imperative to build the capacity of the Ministry of Labour and Social Security and social partners to effectively utilize geospatial data and tools for anticipating, monitoring, and responding to the labour market impacts of climate change and natural disasters, thereby supporting evidence-based policy response in the absence of in-situ surveys. Further

[14] ILO (2025) "A green economic growth model for Jamaica: Scenarios for fostering green growth", International Labour Organization, https://www.ilo.org/publications/green-economic-growth-model-jamaica-scenarios-fostering-green-growth

work could include an update of the daily satellite images analysis one year after the Hurricane. Additional work could rely on vegetation health imagery to monitor the impact on the agriculture sector.

- **Climate-smart agriculture support**: Support climate-resilient agricultural recovery through rehabilitation of productive assets, support to smallholder farmers, restoration of agricultural value chains, and promotion of climate-smart agriculture practices.
- **Policy responses should be conflict-sensitive**: Recovery measures need to take into account real and perceived inequalities within communities and be cognisant of pre-existing vulnerabilities of certain groups.

▶ Annex: Methodology and figures

This annex describes the data sources and core methods underlying the exposure estimates presented above.

Spatial footprints

Wind-hazard polygons are taken from the GDACS geojson file for MELISSA-25 (Bulletin 32, 29 October 2025, 09:00 UTC). Building-damage surface layers are from the Government of Jamaica, with damage grades harmonized to three classes (destroyed, major damage, minor damage). The surface of the damage layer constitutes the directly impacted polygon used for the economic exposure analyses.

Population and employment

Gridded population estimates are from WorldPop Jamaica 2025, 100 m resolution. The working-age population share is set at 81 per cent, consistent with World Bank WDI estimates for Jamaica. The national employment rate of 65.6 per cent is derived from Jamaica Labour Force Survey 2024 weighted microdata. Jobs at risk are estimated as: population in footprint × working-age share × employment rate.

Economic activity: NTL proxy

Economic activity is proxied using VIIRS Black Marble nighttime lights (VNP46A4, 2024 all-angle snow-free composite radiance). The empirical relationship between nighttime lights and GDP is well documented in the literature[15]; an elasticity of 0.85 is applied in the production-function exercise. [16] An elasticity between light and employment of 0.7 is applied.

Production-function approach to estimate impact on GDP

A pixel-level OLS regression of ln(1+NTL) on ln(1+population) and ln(1+building count) is estimated across Jamaica's national 15 arc-second grid (n = 42,839 observations). Building counts are from an Open Buildings dataset[17]; population is aggregated from WorldPop to the NTL resolution. The regression treats nighttime lights as a proxy for local economic output, population as a proxy for the labour input, and buildings for the capital stock (see Table A1 for regression results). Informal employment exposed in the damaged polygon-approximated as: exposed population × working-age share × employment rate × informal employment share[18]-constitutes the labour shock. Capital shocks are measured by assigning a severity weight to each building-damage surface-1.0 for destroyed structures and for major damage, and 0.75 for minor damage, following the spirit of damage-level multipliers used in UNDP debris-estimation methodology. Aggregating the weighted surface as a ratio of building surface at the pixel level yields a per-cell index of capital stock impairment.[19] The implied local GDP loss rate in each pixel is derived by applying these shocks through the estimated coefficients and the NTL-to-GDP elasticity. The national aggregate is the NTL-share-weighted mean of pixel-level loss rates-equivalent to a GDP-weighted average since NTL proxies GDP.

▶ Table A1: OLS regression results at pixel level - ln(1+NTL) on population and buildings

Dependent variable: ln(1+NTL)	(1)
ln(1+population)	0.155***
	(0.004)
ln(1+building count)	0.095***
	(0.004)
Observations	42,839
R^2	0.433

Notes: OLS. Standard errors in parentheses. *** p < 0.001.

Crop area

Crop harvested area data are from CROPGRIDS v1.08, a global gridded dataset at 0.05° (~5.6 km) resolution.[20] Eight

[15] For example: Henderson, J.V., Storeygard, A. and Weil, D.N. (2012). Measuring Economic Growth from Outer Space. American Economic Review, 102(2), 994–1028. Donaldson, D. and Storeygard, A. (2016). The View from Above: Applications of Satellite Data in Economics. Journal of Economic Perspectives, 30(4), 171–198.

[16] Chen, X., & Nordhaus, W. D. (2011). Using luminosity data as a proxy for economic statistics. Proceedings of the National Academy of Sciences, 108(21), 8589-8594.

[17] https://sites.research.google/gr/open-buildings/

[18] Informal employment share is 56.9%, obtained from Jamaica Labour Force Survey 2024.

[19] https://geosmart.undp.org/arcgis/apps/experiencebuilder/experience/?block_id=layout_0_block_8&id=0804dbcb11994e9d8a566d2c300c36b0&page=Page#data_s=id%3AdataSource_2-0%3A7

[20] Tang, F. H., Nguyen, T. H., Conchedda, G., Casse, L., Tubiello, F. N., & Maggi, F. (2024). CROPGRIDS: a global geo-referenced dataset of 173 crops. *Scientific Data*, *11*(1), 413.

crops are included: coffee, cocoa, sugarcane, banana, yam, sweet potato, maize, and pumpkin.

VZA-COLD algorithm

The algorithm fits a sine and cosine function, along with a time trend, to the time series of daily observations starting in 2021. It then tests whether the model-estimated nighttime light is statistically different from the observed nighttime light post-hurricane. The criteria used to identify significant changes at the pixel level are a z-score threshold of 1.44 and at least 3 consecutive observations. The relatively low requirement for consecutive observations is justified by the prevalence of cloud cover, which reduces the number of usable pixels available for the analysis. The methodology is detailed in Tian Li, Zhe Zhu, Zhuosen Wang, Miguel O. Román, Virginia L. Kalb, Yongquan Zhao, Continuous monitoring of nighttime light changes based on daily NASA's Black Marble product suite, Remote Sensing of Environment, Volume 282, 2022, 113269, ISSN 0034-4257, https://doi.org/10.1016/j.rse.2022.113269.

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