FLOODING FROM HURRICANE IOTA IN SULA VALLEY, HONDURAS
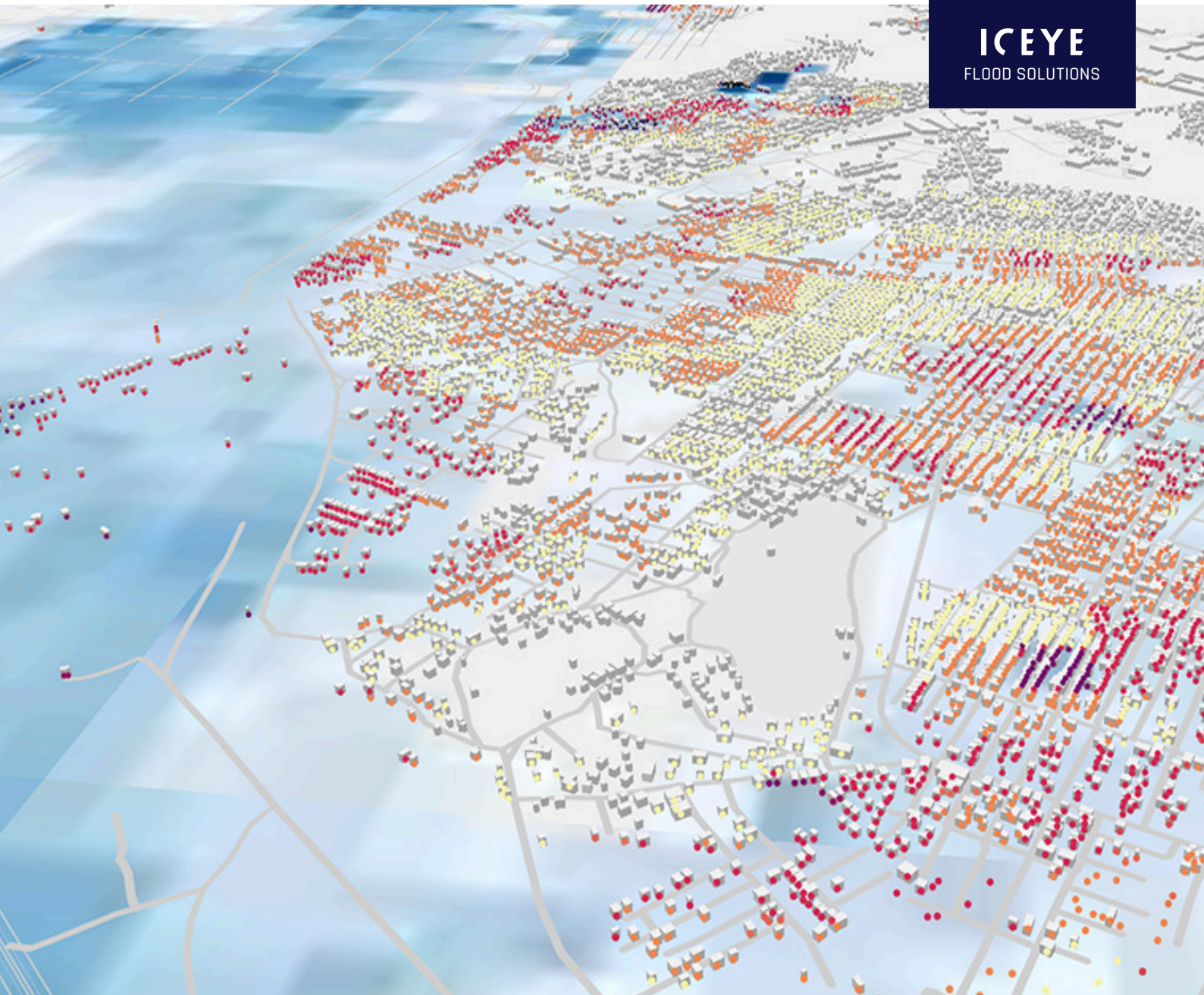
FLOOD BRIEFING SERIES
WITH ICEYE SAR SATELLITE CONSTELLATION DATA

Release Date: December 7th, 2020
Event Type: Hurricane / Riverine / Pluvial

ICEYE
FLOOD SOLUTIONS

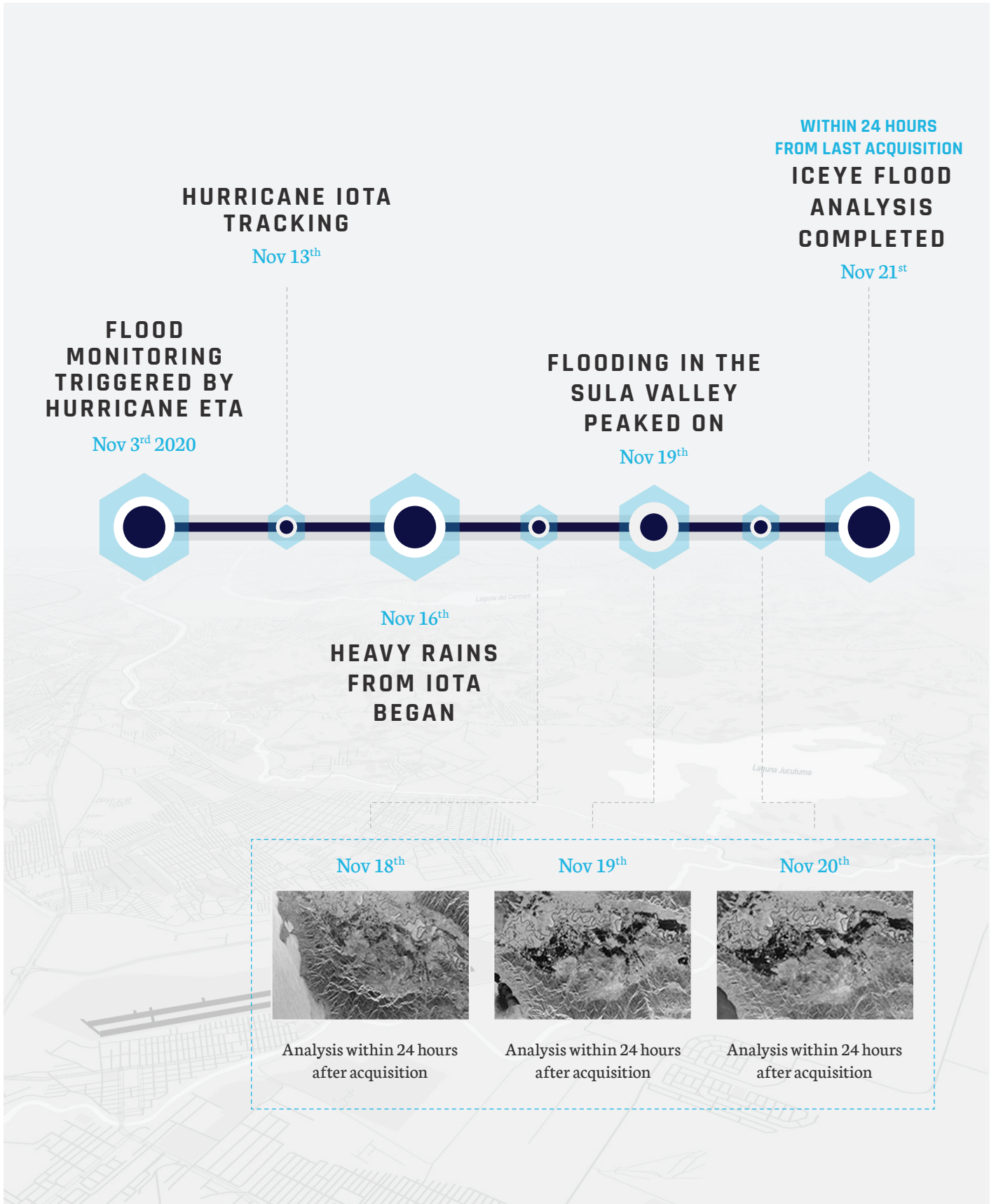## ICEYE ANALYTICS ENGINE:

ICEYE SAR IMAGERY

+

DEM DATA

+

POPULATION & LAND USE DATA

EXECUTIVE SUMMARY

▶ Hurricane Iota caused severe floods in Honduras in November 2020. Monitoring the flood situation in the Sula Valley region with SAR data, ICEYE generated flood extent and flood depth information **within 24 hours** after each image acquisition, as well as an overall progression analysis after the last acquisition.

▶ The flood extent and depth analysis have shown that the monitored area was flooded at a depth between **1m and 2m** on average. In one of the hardest hit municipalities, La Lima, ICEYE estimated that over 38,000 residents - almost half of the population - were directly impacted by flooding.

▶ Approx. **475 km²** of the observed area was inundated. Combined with land use information, ICEYE's flood profile revealed that **45%** of all agricultural area in the study site were flooded.

▶ Utilizing the **multi-image color composite** approach, ICEYE was able to identify locations of probable levee breaches or riverbank overtopping where fast-moving, high-intensity flood waters were spilling into the surrounding areas.

TIMELINE OF HURRICANE IOTA AND ICEYE FLOOD WORKFLOW

WITHIN 24 HOURS FROM LAST ACQUISITION

ICEYE FLOOD ANALYSIS COMPLETED

Nov 21st

HURRICANE IOTA TRACKING

Nov 13th

FLOOD MONITORING TRIGGERED BY HURRICANE ETA

Nov 3rd 2020

FLOODING IN THE SULA VALLEY PEAKED ON

Nov 19th

Nov 16th

HEAVY RAINS FROM IOTA BEGAN

Nov 18th

Analysis within 24 hours after acquisition

Nov 19th

Analysis within 24 hours after acquisition

Nov 20th

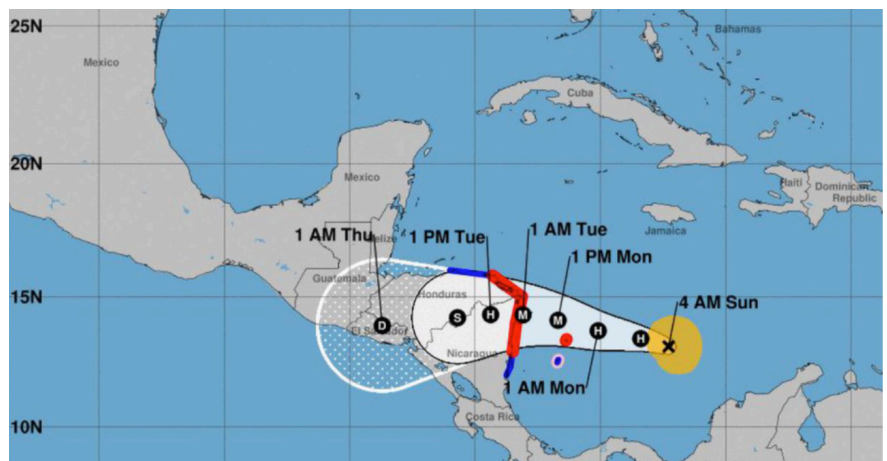Analysis within 24 hours after acquisition

EVENT OVERVIEW

CATASTROPHIC FLOODING IN HONDURAS CAUSED BY HURRICANE IOTA

In November 2020, Hurricane Iota impacted Honduras only two weeks after Hurricane Eta devastated the area with heavy rainfall. **Nearly 100 people have lost their lives, hundreds of thousands of people have been displaced, and property and infrastructure damage estimates are roughly 10 billion dollars[1].**

The area of the Sula Valley in the northwest of Honduras, where 30% of Honduras' population lives[2], was heavily affected. For several days following the landfall of Hurricane Iota, heavy rain, which was enhanced by the hurricane's strong northerly winds and local orographic effects, funneled into the valley basin. Prior to the landfall, the area had been already-saturated by heavy rainfall from Hurricane Eta. These circumstances led to the overflow of the Ulúa river and its tributaries causing severe flooding in the valley[3].

Large swaths of farmland were wiped out, levees were breached, and buildings and other infrastructure were destroyed. Much of San Pedro Sula, the country's second-largest city and industrial center, and the city of La Lima were covered in water.

The map illustrates the forecasted track of Hurricane Iota as of 15 November 2020.
Source: National Hurricane Center (NHC/NOAA)

References

[1] Euronews. https://www.euronews.com/2020/11/21/hurricanes-iota-and-eta-deal-honduras-a-catastrophic-double-blow

[2] USAID, Fact Sheet #2, Fiscal Year (FY) 2021: Latin America - Storms, November 22, 2020.
https://www.usaid.gov/sites/default/files/documents/2020_11_22_USAID-BHA_Latin_America_Storms_Fact_Sheet_2.pdf

[3] Washington Post, The Americas: Battered by back-to-back hurricanes, Honduras braces for a long recovery.
Post https://www.washingtonpost.com/world/the_americas/hurricane-eta-iota-honduras-central-america/2020/11/25/8cd11e98-2e75-11eb-bae0-50bb17126614_story.html

COURSE OF ACTION

ICEYE'S FLOOD MONITORING APPROACH

ICEYE's **flood early warning** identified the potential for flood days before the hurricane made landfall, targeting the flood-prone Sula Valley as an area very likely to see flooding. ICEYE initiated a flood analysis plan focused on the city of San Pedro Sula and the municipality of La Lima. The analysis is based on a time series of images over three days.

MULTI-TEMPORAL ANALYSIS

ICEYE produced a **multi-temporal analysis** of the flooding from the Hurricane Iota flooding by acquiring SAR images with the ICEYE satellite constellation across three consecutive days. The objective of the analysis was to monitor progression of the flooding by capturing the start, peak, and recession of the flood.

MULTI-IMAGE COLOR COMPOSITE

ICEYE utilized a **multi-image color composite** approach to uncover unique signatures that become visible when SAR imagery across multiple days is combined into one image.

LAND USE INFORMATION

ICEYE also combined its flood depth and extent analysis with land use data from Copernicus Service Information to estimate the impacts to the agricultural areas which are fundamental to the livelihood of the local population.

ICEYE

FLOODING SITUATION IN SULA VALLEY
ON 18TH, 19TH, AND 20TH NOV. 2020

The three image color composite illustrates the flood (blue) and probable levee or riverbank breach locations (red).

RIVERBANK OVERTOPPING / LEVEE BREACH

**RIVERBANK OVERTOPPING / LEVEE BREACH**
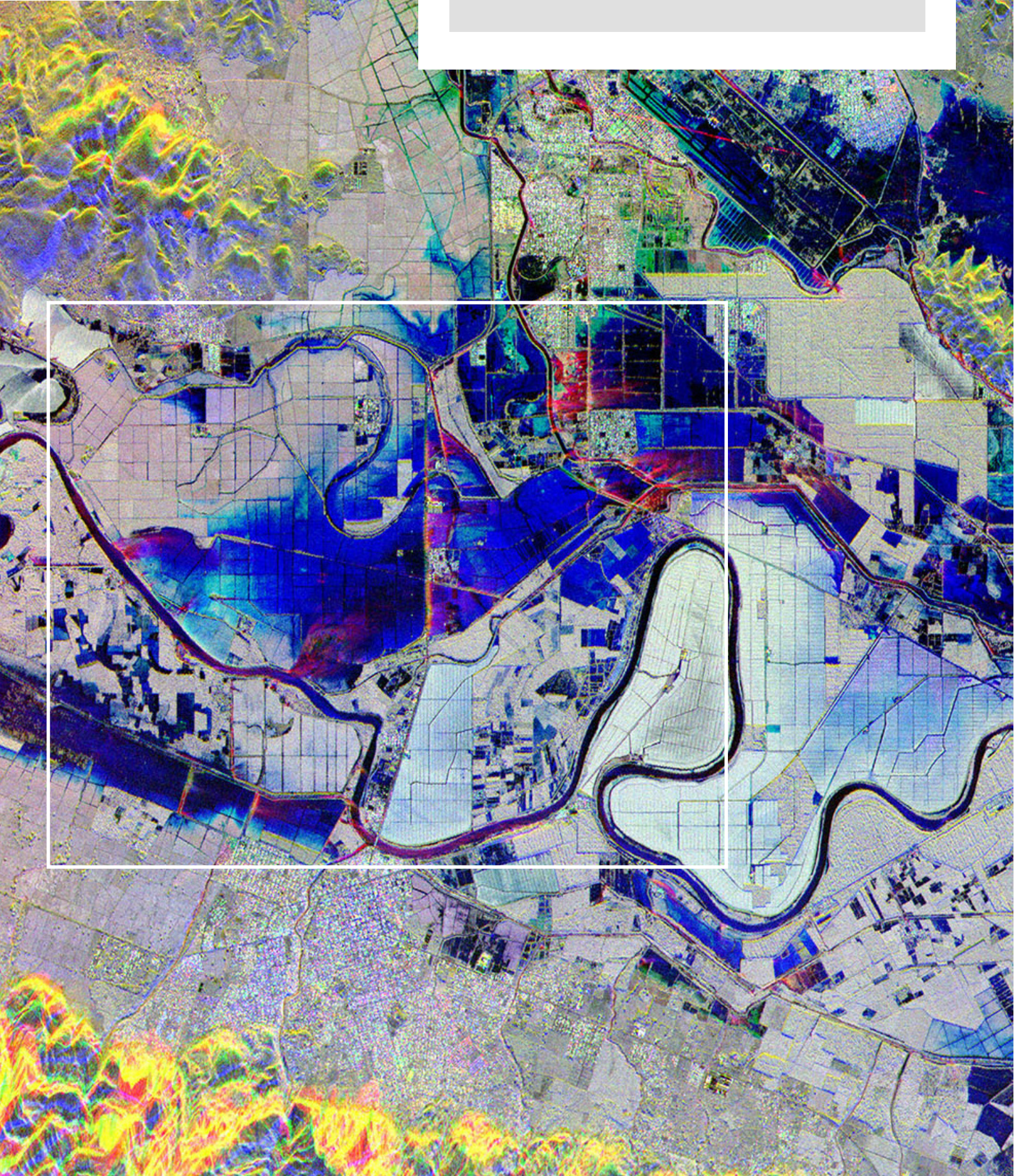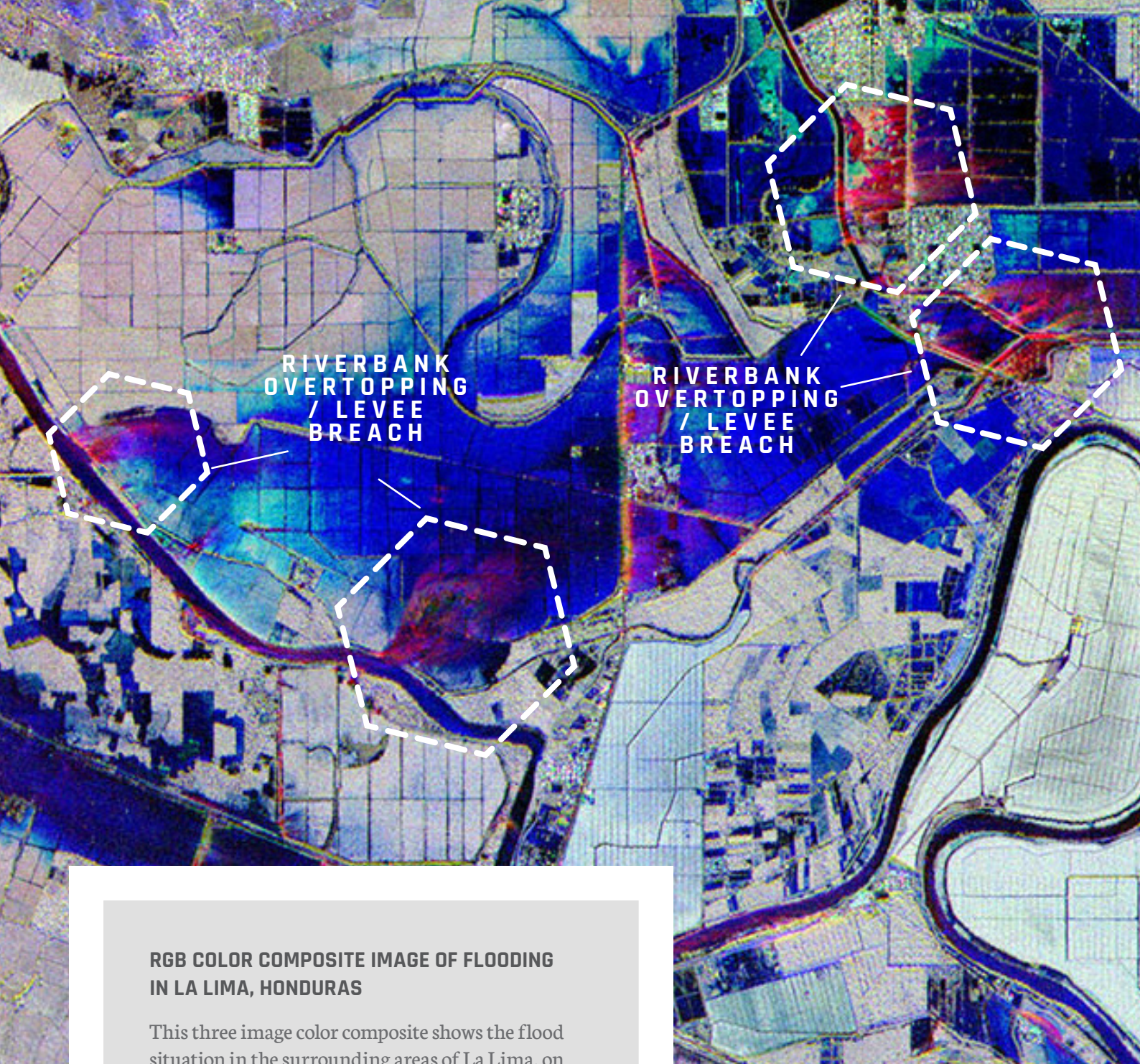
RGB COLOR COMPOSITE IMAGE OF FLOODING IN LA LIMA, HONDURAS

This three image color composite shows the flood situation in the surrounding areas of La Lima, on November 18th, 19th, and 20th.

▶ White indicates areas with little or no changes of the 3-day time period.

▶ Blue is assigned to the pre-flood imagery (18 Nov). Therefore, blue areas are where water was absent on day 1 but present on later days.

▶ Red is assigned to the image taken during the peak of the flood (19 Nov). Strong returns on this 2nd day image, indicated by red streaks, show areas with highly turbulent flood water breaching river banks/levees.

▶ Green is assigned to the final image (20 Nov).
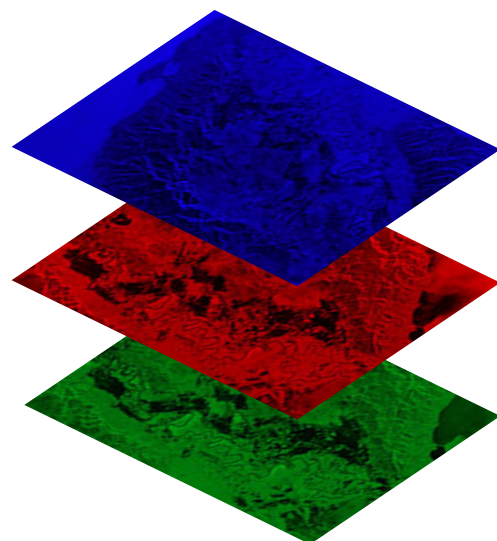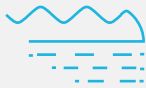
ICEYE

ANALYSIS

ICEYE FLOOD ANALYSIS WITHIN ONE DAY

ICEYE completed the flood analysis for each SAR image of the time series in less than 24 hours after receiving each image. The analysis included the calculation of the flood extent and the flood depth.

FLOOD EXTENT AND DEPTH EVOLUTION

ICEYE performed the flood extent and flood depth analysis as soon as each image was acquired. The three image acquisition dates were linked to the predicted three critical stages of the flood event: start of flooding, near peak of flooding, and flood waters beginning to recede. For calculating the water depth ICEYE sourced MERIT digital elevation data.

FLOOD IMPACT TO POPULATION AND CROPLAND

The impact of the flood was quantified by using population and land use data. Large parts of the Sula Valley were flooded; **475 km²** in the observed area were completely inundated. **82%** of this flooded area was cropland and 1.8% built-up areas. In addition, **45%** of all agricultural areas in the study area were flooded.
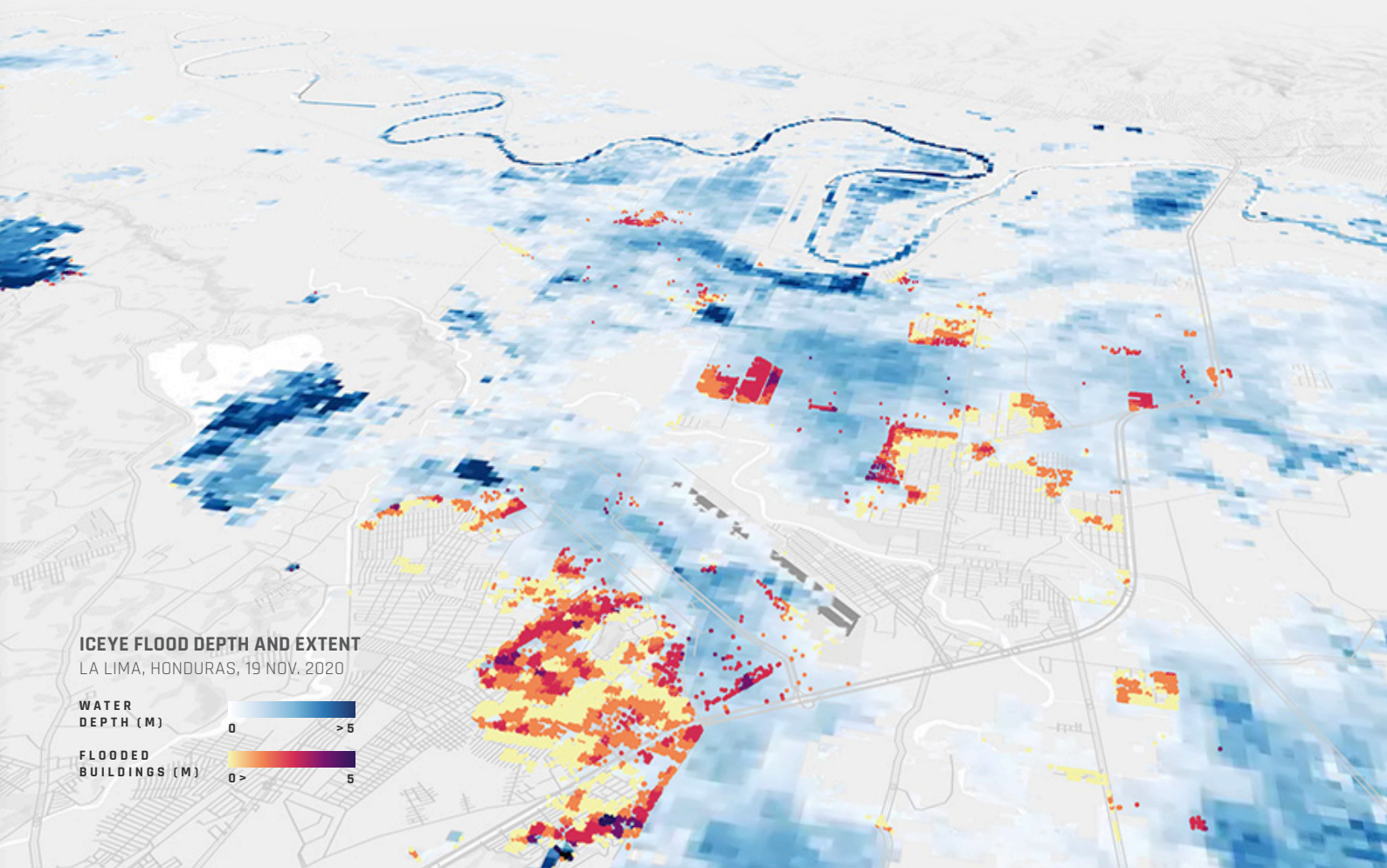
In the flooded area, 43% was covered with at least 0.5m of water, and 29% with at least 1m of water. In Residencial Valle Escondido, a housing area in San Pedro Sula, water depths were between **0.8 and 2.3m**.

FLOOD HAZARD TO INFRASTRUCTURE

With the multi-image color composite analysis, ICEYE found signatures identifying locations along the Ulúa River and its tributaries where levees and riverbanks were breached and flood waters were actively pouring into the surrounding landscape. These findings show that ICEYE's flood solution can be used in near-real-time to identify potentially damaged flood defense infrastructure before it is feasible to assess damage from the ground or air.

1 - 2 M
avg. depth of flood coverage
in the Sula Valley

475 KM²
or nearly half of the entire
observed area, were flooded
during the peak of the event

56%
of La Lima city
was flooded

45%
of all agricultural areas
in the study area were
flooded

MONITORING FLOOD DISASTERS WITH ICEYE SAR SATELLITE DATA

▶ ICEYE high quality and precision flood analysis is available anywhere in the world, including data-scarce markets, within hours.

▶ Multi-temporal analysis allows for quantifying the evolution of flood extent and the exposure of properties to different flood depths.

▶ Multi-image color composite enables precise identification of potential damage to flood protection infrastructure in near-real-time.

▶ The flood analysis includes estimation of impacts to both population and agriculture or other land use types.

▶ ICEYE rapid flood monitoring analysis supports insurance related activities such as assessing & quantifying the impact damage, allocating resources, validation of claims, and underwriting of new policies.

ICEYE FLOOD DEPTH AND EXTENT
LA LIMA, HONDURAS, 19 NOV. 2020

WATER DEPTH (M)   0   > 5

FLOODED BUILDINGS (M)   0 >   5

THE VALUE ICEYE BRINGS TO THE INSURANCE INDUSTRY

ICEYE, World-leading SAR satellite imagery provider, offers differentiated near real-time flood mapping and analysis based on SAR image, to help the insurance industry improve the understanding and managing of global flood risk worldwide.

ICEYE satellite imagery-based flood analysis helps insurers in speeding up claim cycle times and lowering claims expenses as remote sensing data enables an understanding of a disaster's scope in hours.

ICEYE's time series image approach allows for efficient and precise directing of field resources during and after flooding. SAR satellite imagery can pave the way for parametric products and offerings over time.

ABOUT ICEYE

ICEYE is building and operating its own commercial constellation of radar imaging satellites, with SAR data available to global customers since 2018. With the company's unique satellite constellation capabilities, ICEYE empowers others to make better decisions in governmental and commercial industries. The company is tackling a tremendous global need for timely and reliable information, with world-first aerospace capabilities and a New Space approach. ICEYE's radar satellite imaging service, designed to deliver very frequent coverage, both day and night, helps clients resolve challenges in sectors such as maritime, disaster management, insurance, and finance. For more information, please visit: www.iceye.com

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www.ICEYE.com/flood