EARTH INTELLIGENCE ENGINE

EARTH SCIENCE FDL 2020

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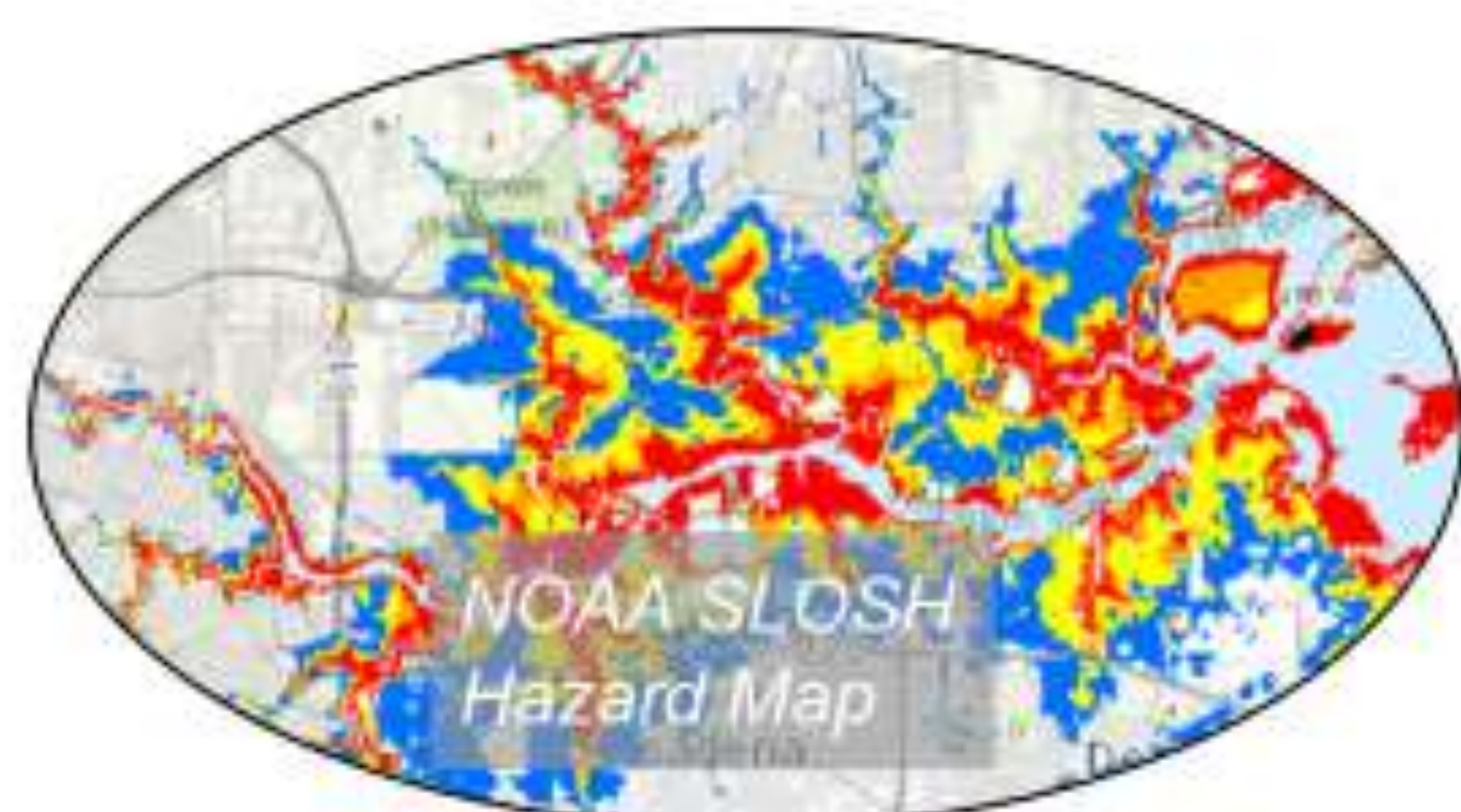Natalia · Christian · Farrukh · Océane · Chedy · Aaron · Brandon · Björn · Yarin · Alex

See flood impacts before they happen

### Enabling experts to advocate for climate resilience

Today's flood visualizations are either informative or intuitive -- but not both

NOAA SLOSH Hazard Map

Schmidt, et al. 2019

NOAA's SLOSH model visualizes flood extent, but outputs are not high resolution
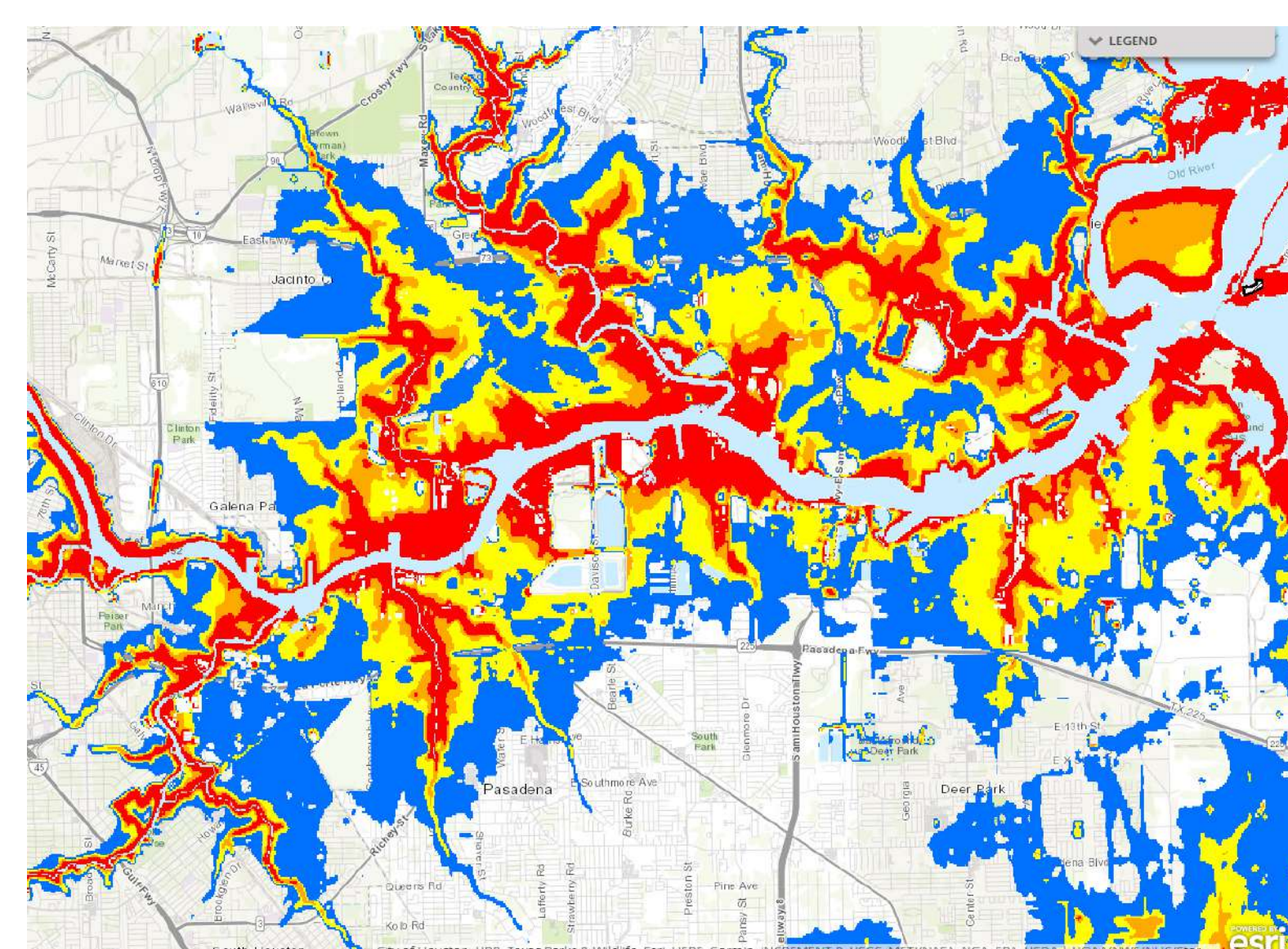
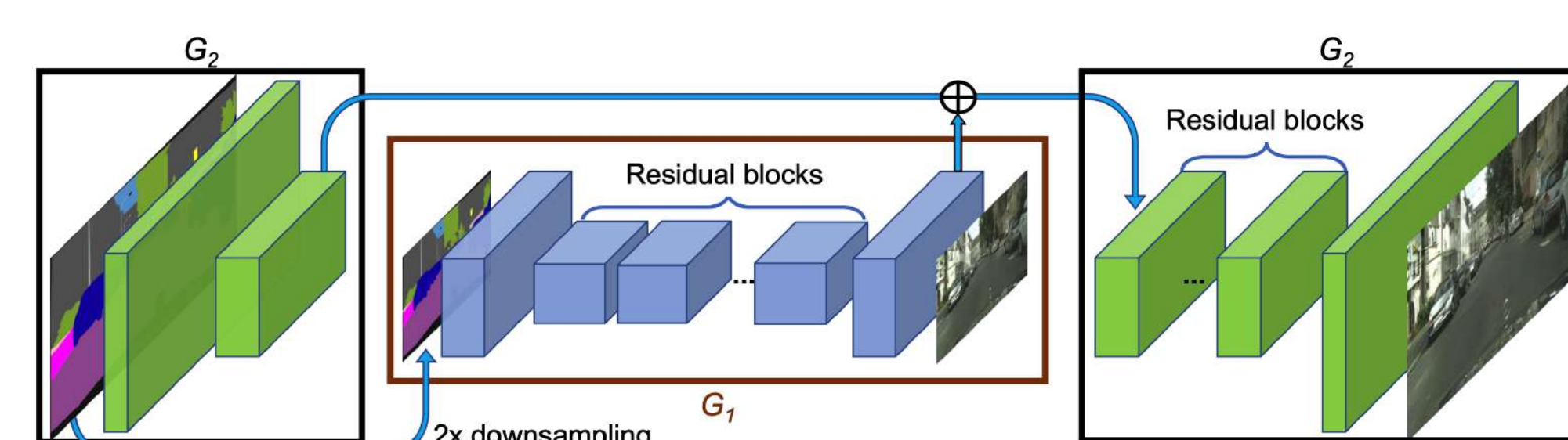Unconditioned GAN adds flooding to an image, but w/o physical inputs, it adds water randomly

Pre-flood → Generated w/o physics-constraints 🚫 → Ground Truth (Post-flood) ✅
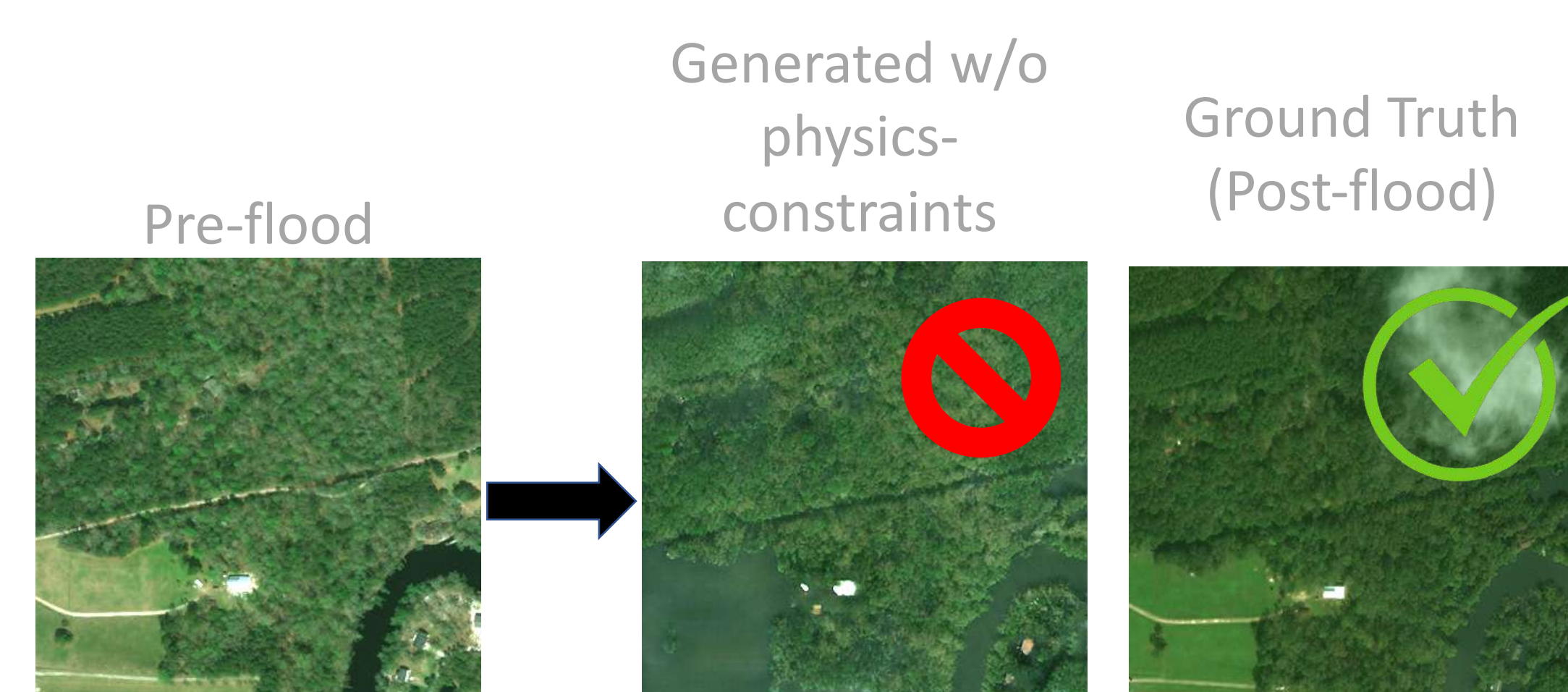
Pix2PixHD: Wang, et al. 2018

We used a set of pre- and post-disaster images as the basis for training

Pre-flood   Post-flood

Pix2PixHD is a GAN that performs image-to-image translation

We generated and evaluated the **first physically-constrained**, **photorealistic** visualization of future flooding events
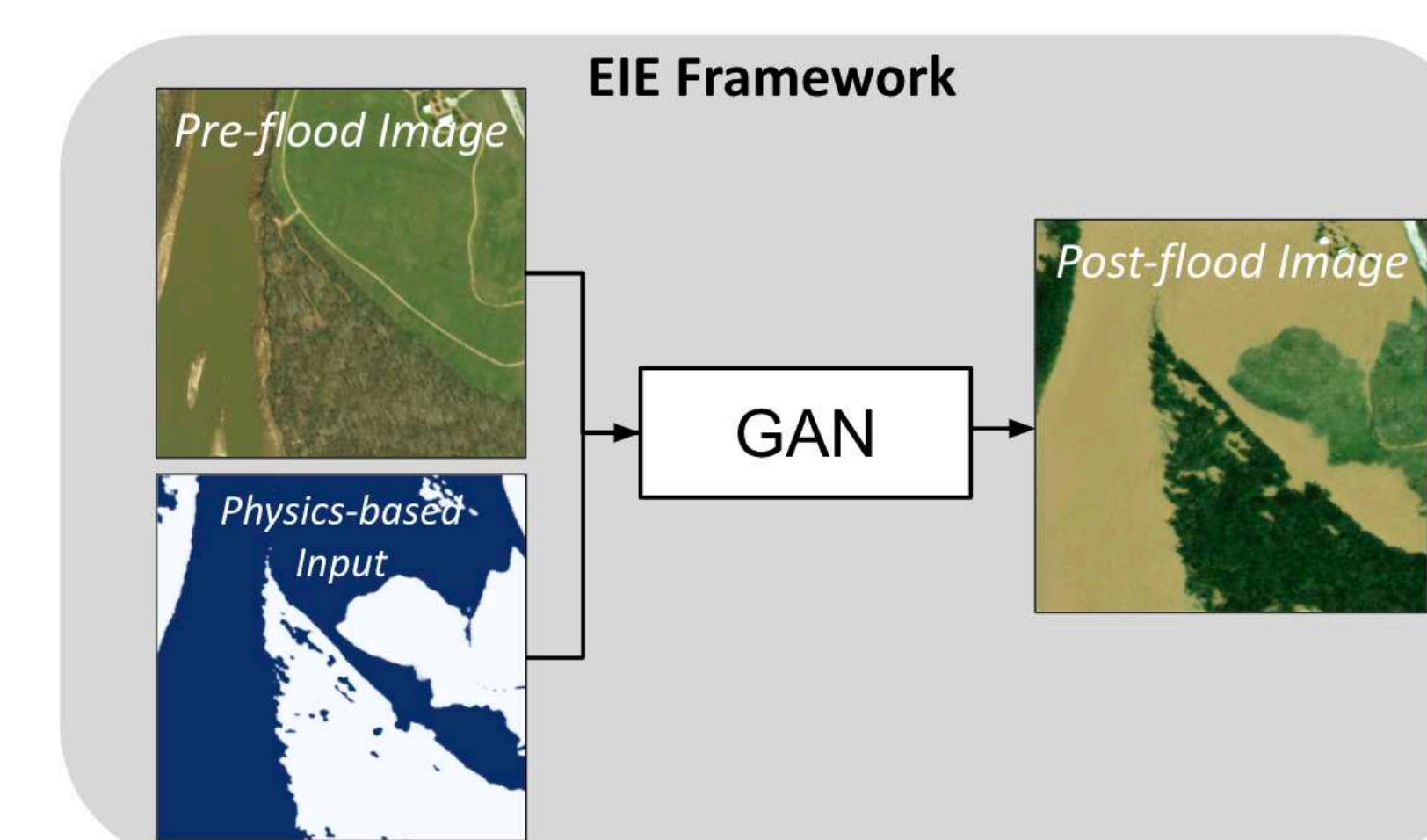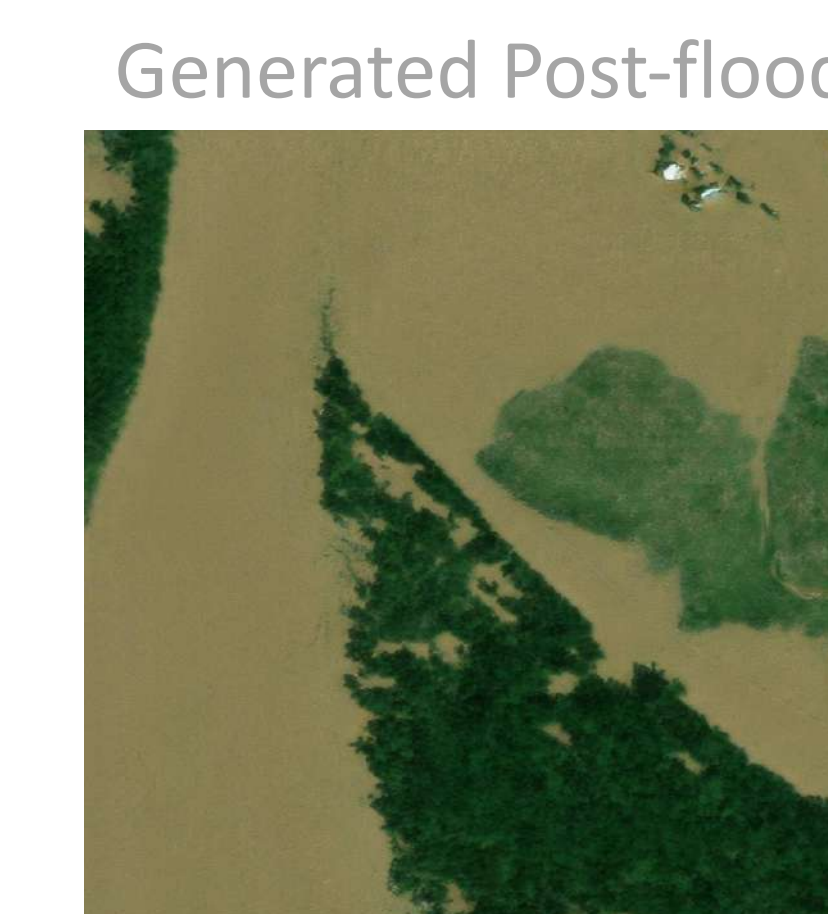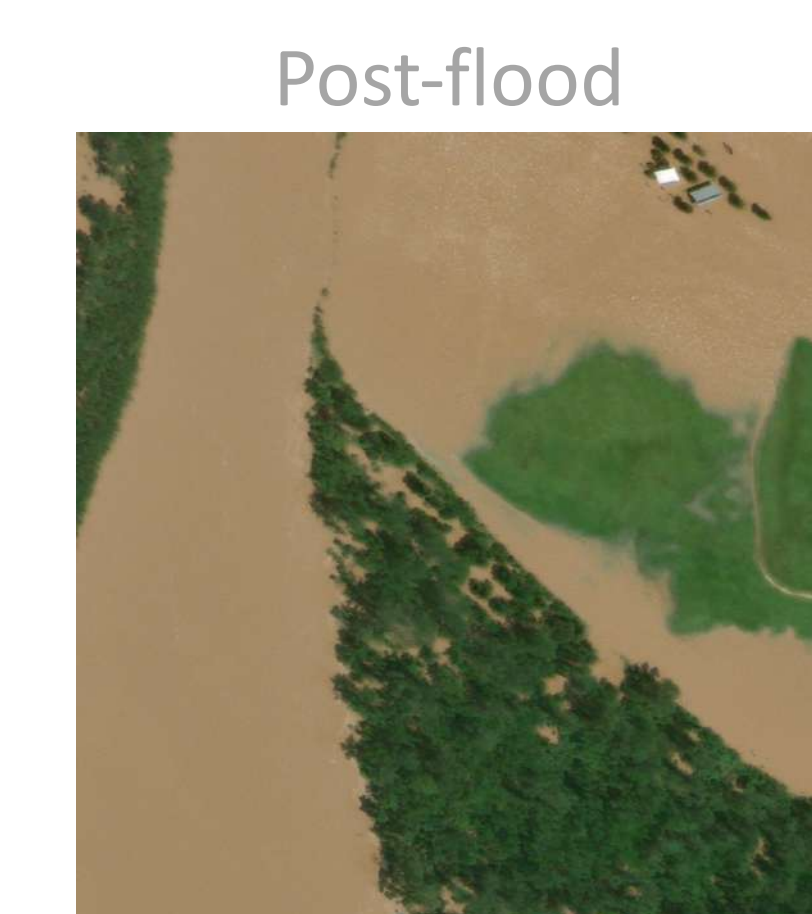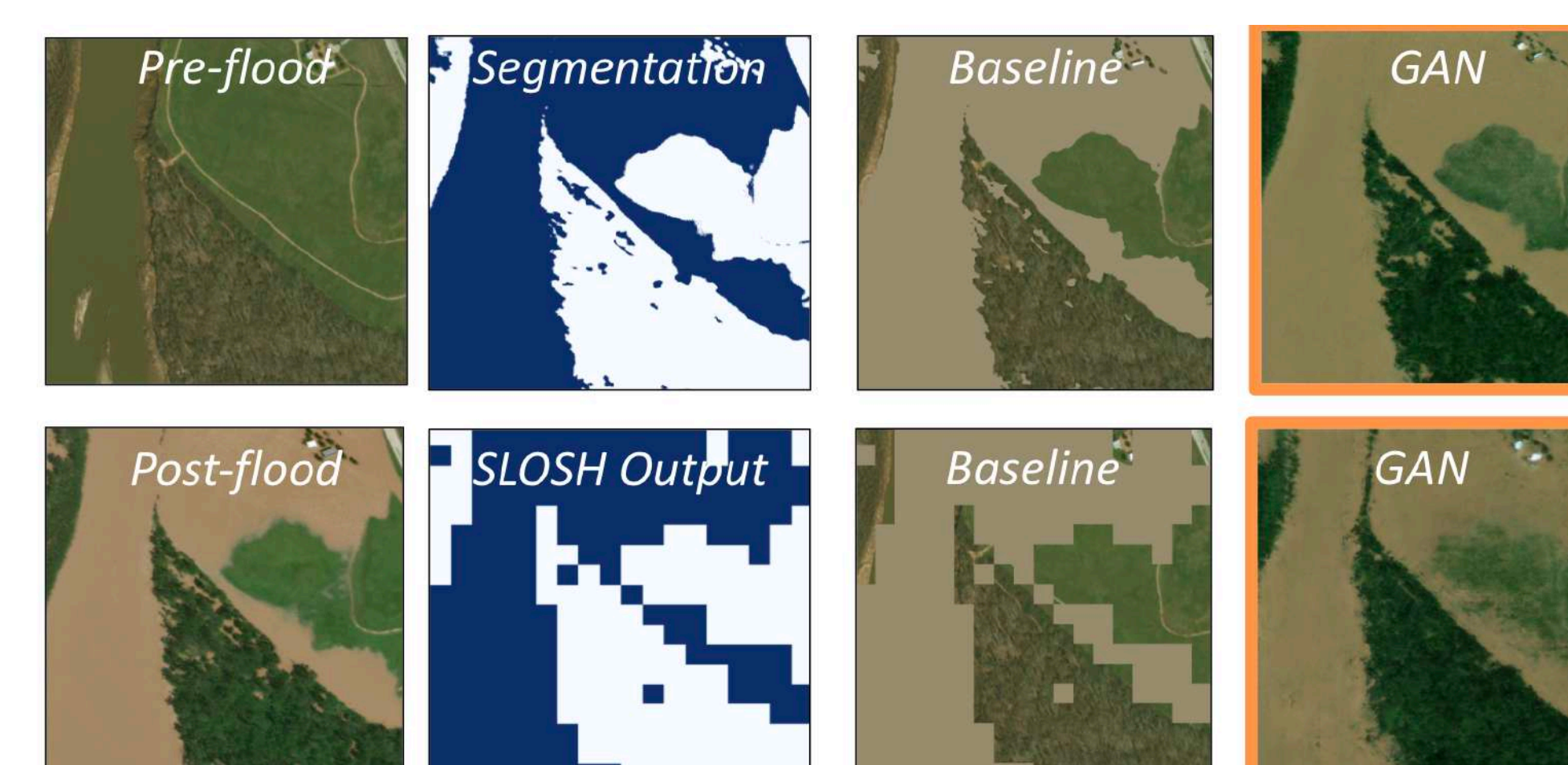
EIE Framework

Pre-flood Image / Physics-based Input → GAN → Post-flood Image

Image sources: xBD data: Gupta, et al. 2019

Post-flood   Generated Post-flood

We generated baseline images for comparison with our GAN-generated images

Pre-flood | Segmentation | Baseline | GAN

Post-flood | SLOSH Output | Baseline | GAN

Flood Visualization Plausibility Score (FVPS) balances physical consistency with photorealism

$$FVPS = \frac{n}{\frac{1}{IoU+\varepsilon} + \frac{1}{1-LPIPS+\varepsilon}}$$
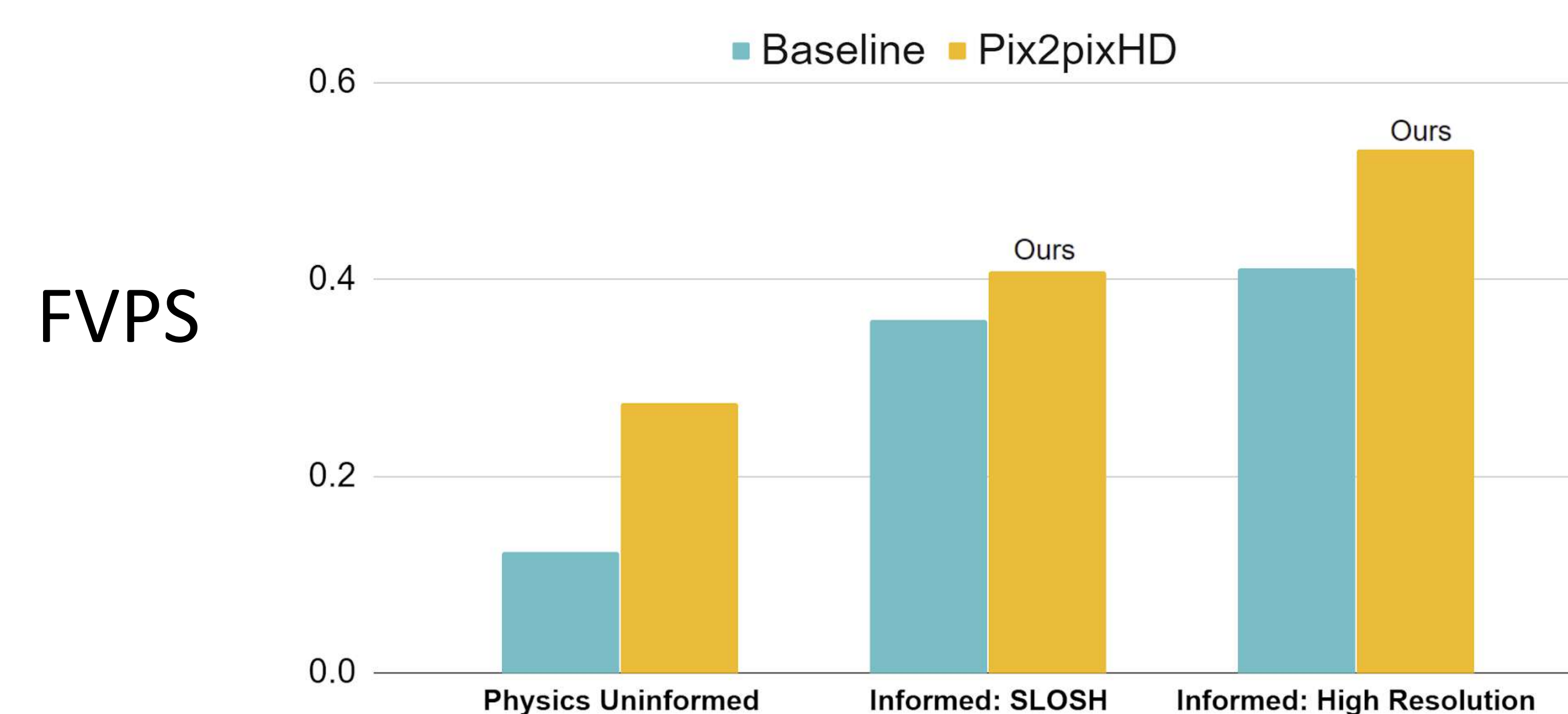
FVPS sets two sub-objectives to evaluate performance on the challenge.

Harmonic mean of:
- IoU: Intersection over union of the flooded areas (physical accuracy)
- LPIPS: Learned Perceptual Image Patch Similarity (photorealism)

LPIPS: Zhang et al, 2018

Our flood imagery scores higher in FVPS than the baseline

FVPS

Legend: Baseline · Pix2pixHD

X-axis: Physics Uninformed | Informed: SLOSH (Ours) | Informed: High Resolution (Ours)

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