Global Near Real-Time Daily Inundation Mapping using VIIRS Satellite Imagery and Deep Learning

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P07

The Conference on **C**omputational **M**ethods in **W**ater **R**esources

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THE UNIVERSITY OF ARIZONA

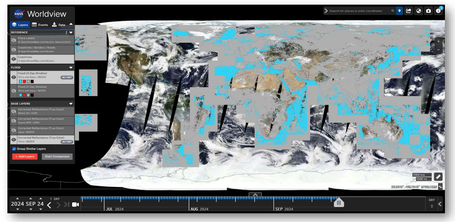
NASA

1) NASA provides daily near-global flood maps to the public using MODIS

→ 250-meter resolution detected from twice-daily overpass of the *Moderate Resolution Imaging Spectroradiometer* onboard NASA Terra and Aqua

→ Produced since 2012, the last 7 days available via NASA WorldView

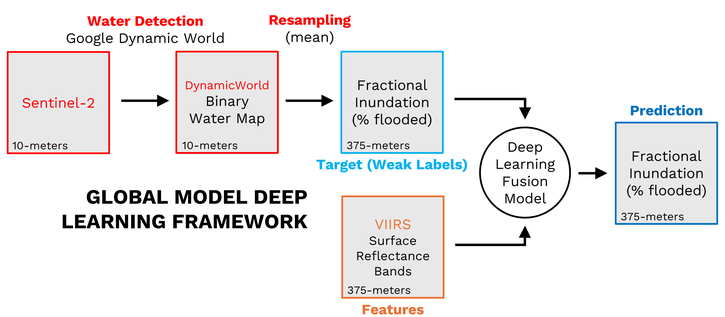
NEAR REAL-TIME FLOOD DASHBOARD



2) With MODIS data coming to an end, can we use VIIRS and deep learning to improve NASA's mapping services?

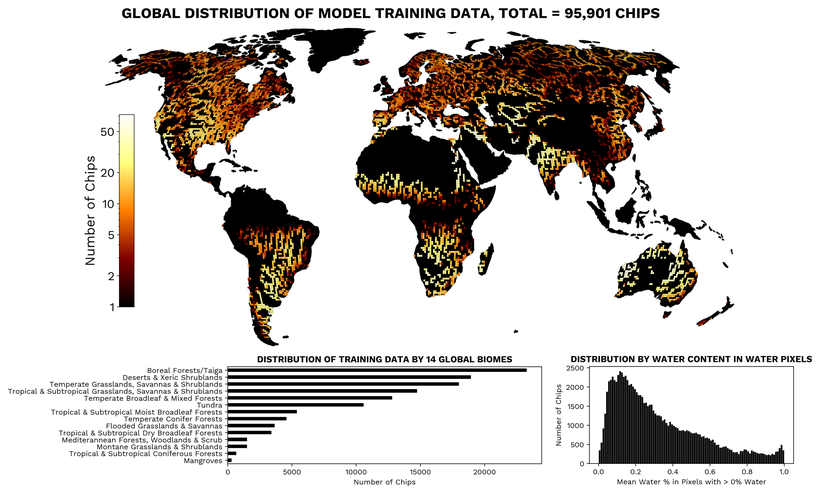
→ *Visible Infrared Imaging Radiometer Suite* (VIIRS) has similar sensor characteristics to MODIS offering potential for continuity

→ Deep learning has widely been shown to improve accuracy versus traditional "thresholding" approaches for flood mapping



GLOBAL MODEL DEEP LEARNING FRAMEWORK

3) Generating "weak labels" to train a global inundation model

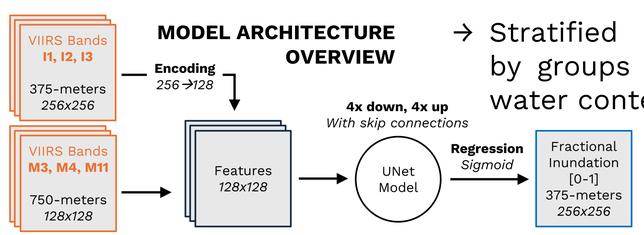


→ Weak labels from Google's DynamicWorld land-cover, taking scenes containing water and zero cloud cover

→ "Chips" of 256x256 pixels @ 375-meter resolution

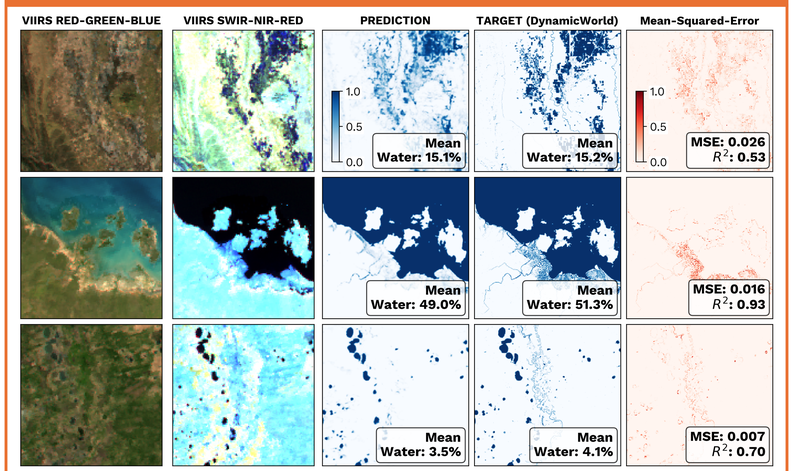
4) Training a UNet model with a fusion of input features at varying resolutions

→ Each feature ingested at its native spatial resolution, then fed into a UNet Convolutional Neural Network

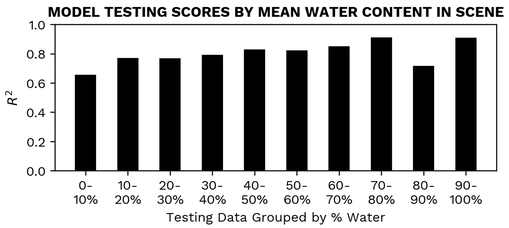


→ Stratified sampling by groups of mean water content

5) Using VIIRS surface reflectance bands to predict per-pixel fractional inundation



→ Overall global testing **R^2 = 0.85**



6) Challenges and next steps

→ Inconsistent predictions between adjacent chips and overly smooth predictions at water edges

→ Next: data augmentation and additional stratified sampling by permanent water content

→ Then: evaluation against existing global products: NASA MODIS Flood, NOAA VIIRS Flood

Acknowledgements

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