# Towards a Training Framework for GOES-R LST Downscaling

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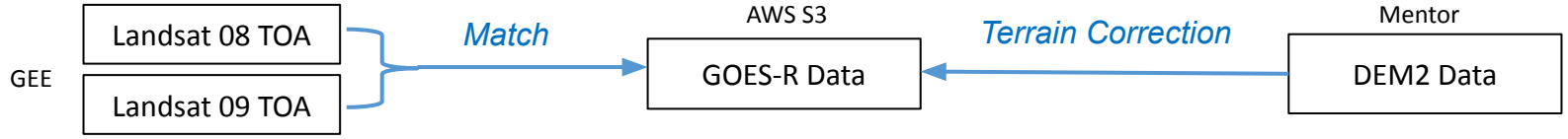
## Objectives

- Apply and evaluate the GOES-R LST downscaling algorithm in urban environments to assess accuracy and resolution improvements.
- Streamline and optimize the program workflow to transition it from beta to a fully efficient, high-performance system, enabling seamless expansion to additional regions and supporting commercial-scale operations.

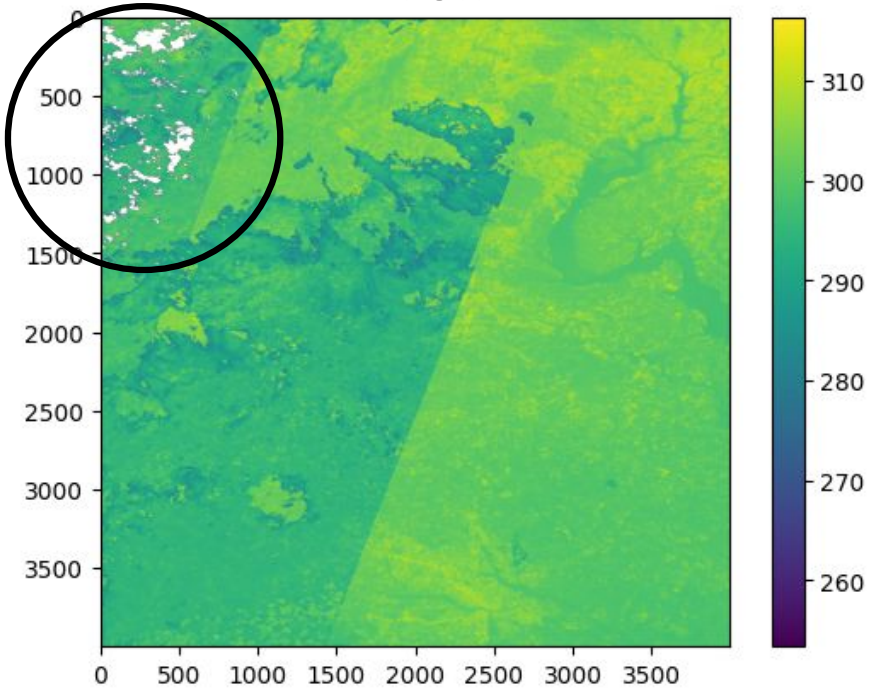
## Outcomes

- Improved **data collection** through implementing more focused data collection (implemented Landsat 9 and Landsat 8).
- Integrated elevation data for **terrain correction**, significantly improving GOES-R accuracy and **better spatially matching** with Landsat data.

## Improving Data Collection For Model Training

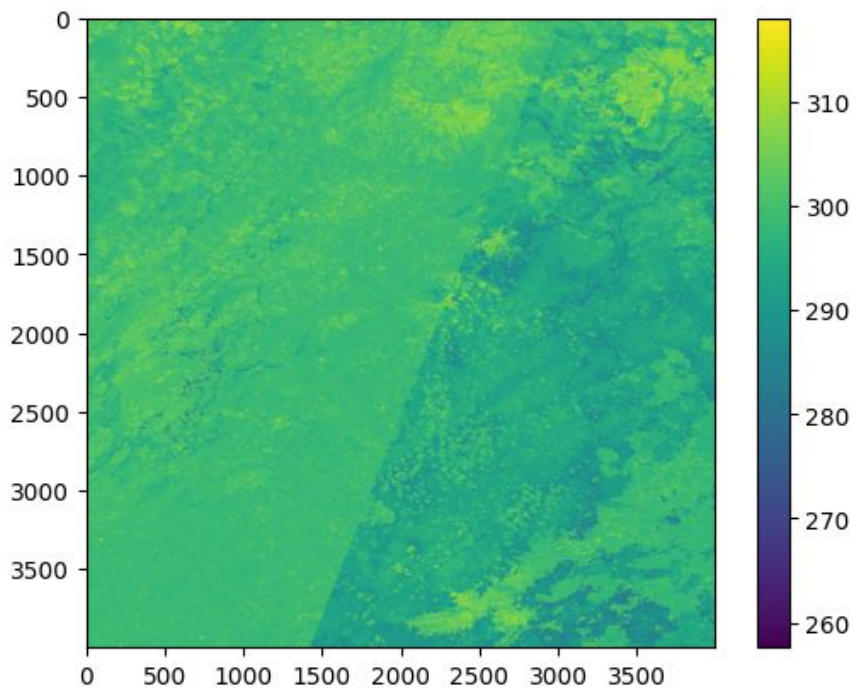



BEFORE




This tile is covering Washington DC, is composited from clear-sky observations in July, from 2021 to 2024 using **only Landsat 09**

AFTER




This tile, covering Washington, D.C., is composited from clear-sky observations in July between 2021 and 2024, using **data from both Landsat 8 and Landsat 9** with the same criteria.

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## Problem

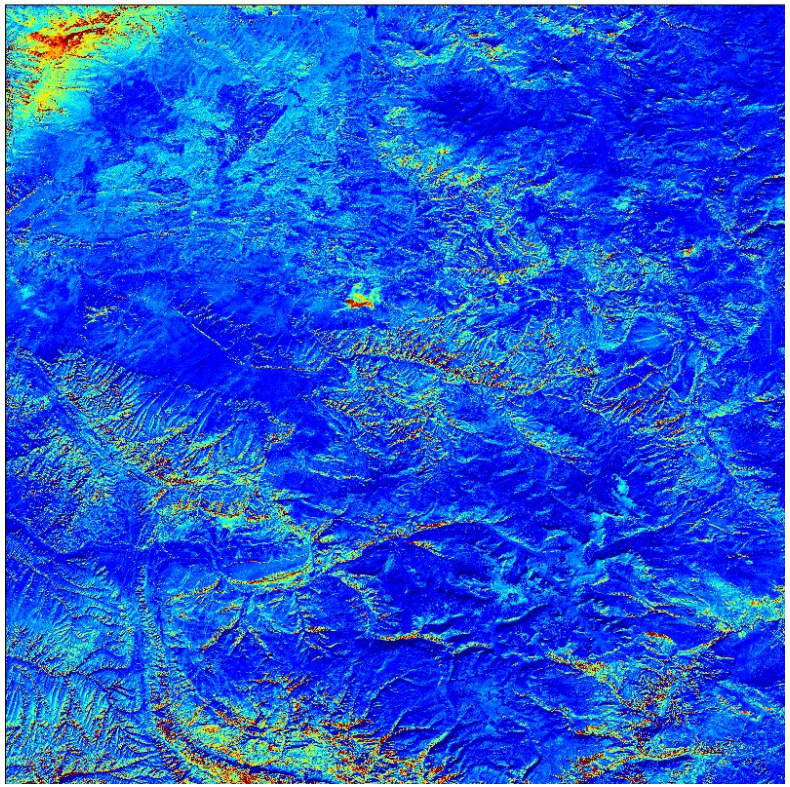
- GOES-R's data imaging mode causes **displacement over mountainous regions**, but the official latitude and longitude information does not account for this effect.
- As a result, when registering GOES-R data with other datasets, such as Landsat, **spatial offsets occur**, limiting operational capabilities.

## Solution

- Implemented **Digital Elevation Model (DEM) integration to correct terrain-induced displacement** between the two datasets, which is essential for accurate geometric matching.
- The example tile shows the left side processed with DEM and the right side without it.

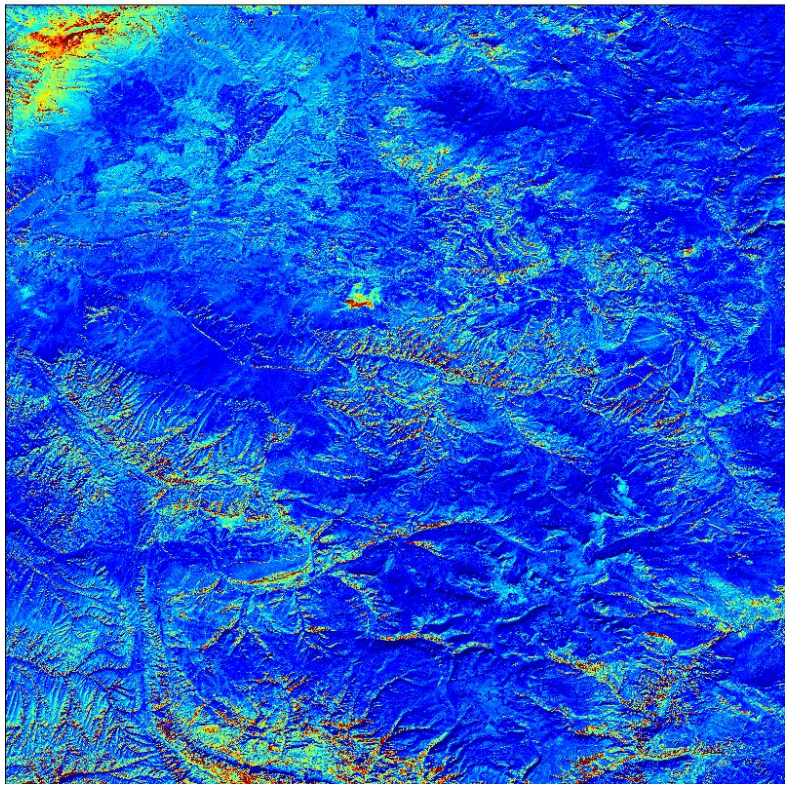
## Terrain Correction

Landsat Band 6
2024-01-02T17:49:55



Terrain-corrected GOES-R data overlaid on a Landsat image shows strong geometric agreement, with the two datasets aligning closely when overlaid.

Landsat Band 6
2024-01-02T17:49:55



Without terrain correction, GOES-R data overlaid on a Landsat image shows noticeable displacement and misalignment.

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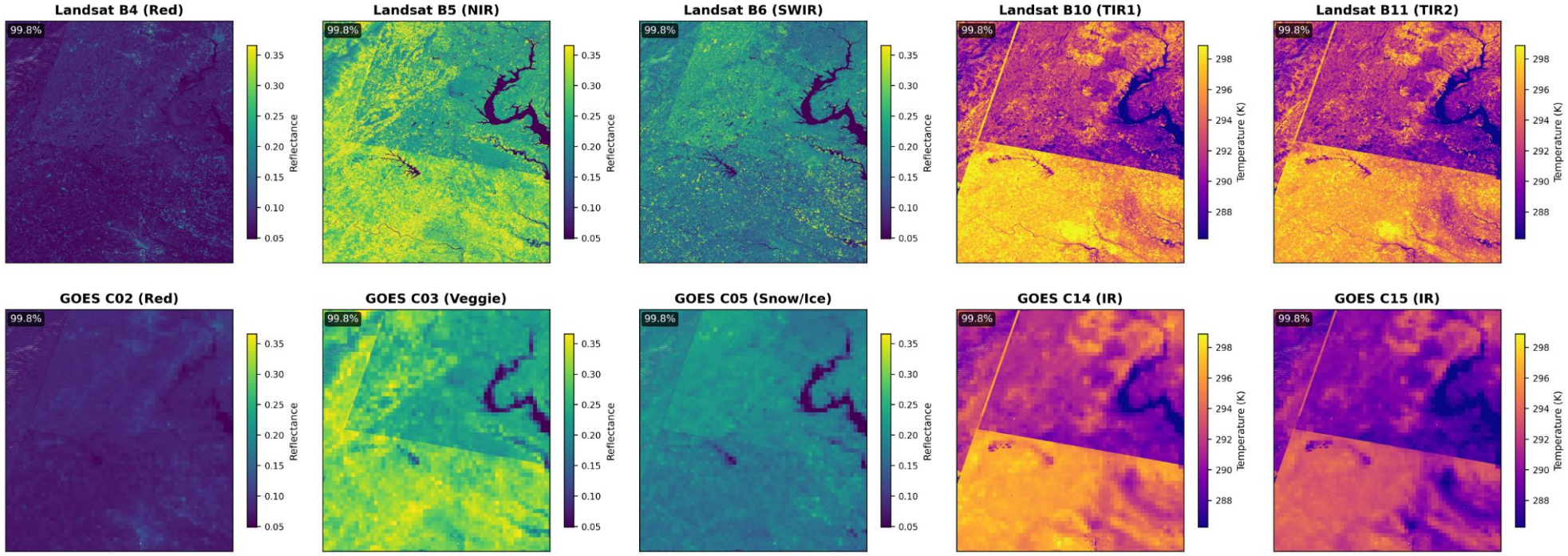
## Process

1. Find available clear-sky Landsat images over the target area
2. Transform each Landpixel pixel fror Lat/Lon to GOES-R viewing angles. According to its timestamp, search NOAA's AWS bucket for closest GOES-R file.
3. Store Landsat tile in NetCDF file with date/time metadata.

## GOES-R Tile Creation




## Outcome

- **Developed a framework** to spatially and temporally match Landsat and GOES-R observations for enhanced monitoring capabilities.
- **Generated high-quality training datasets** for machine learning model development.

## References


[1] Bah, A. R., Norouzi, H., Prakash, S., Blake, R., Khanbilvardi, R., & Rosenzweig, C. (2022). Spatial Downscaling of GOES-R Land Surface Temperature over Urban Regions: A Case Study for New York City. Atmosphere, 13(2), 332. https://doi.org/10.3390/atmos13020332

[2] Chang, Y., Cao, Y., & Weng, Q. (2024). Generating hourly 70-m land surface temperature from GOES-R observations: A comparison of statistical downscaling and deep learning methods. IGARSS 2024 - 2024 IEEE International Geoscience and Remote Sensing Symposium, 918–920. https://doi.org/10.1109/IGARSS53475.2024.10640401