# Convection Cell Tracking Using AI/ML Models

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## Objectives

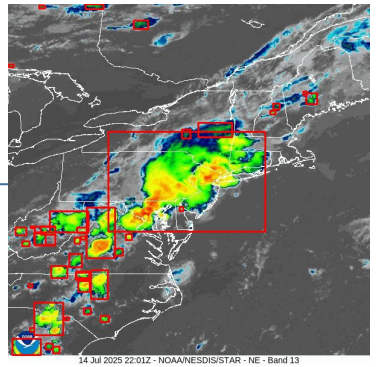
- Use Convolutional Neural Network (CNN, YOLOv11) AI/ML object detection model to detect convection cells and cloud types on GOES-19 Advanced Baseline Imager (ABI)
- Focus on the Band 13 (longwave Infrared window channel) at 10.3µm
- The trained model will be used to support satellite sensor Cal/Val with DCC (Deep Convective Clouds).

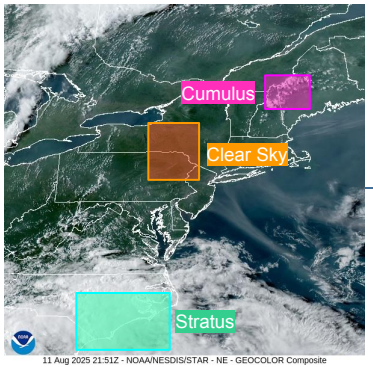
## Results

- Trained YOLO model to detect convection cells. Visualized and quantified their attributes.
- Simplified short-term nowcasting based on convection cell detection and motion.
- Detected cloud types and clear sky over Railroad Valley Cal/Val site.

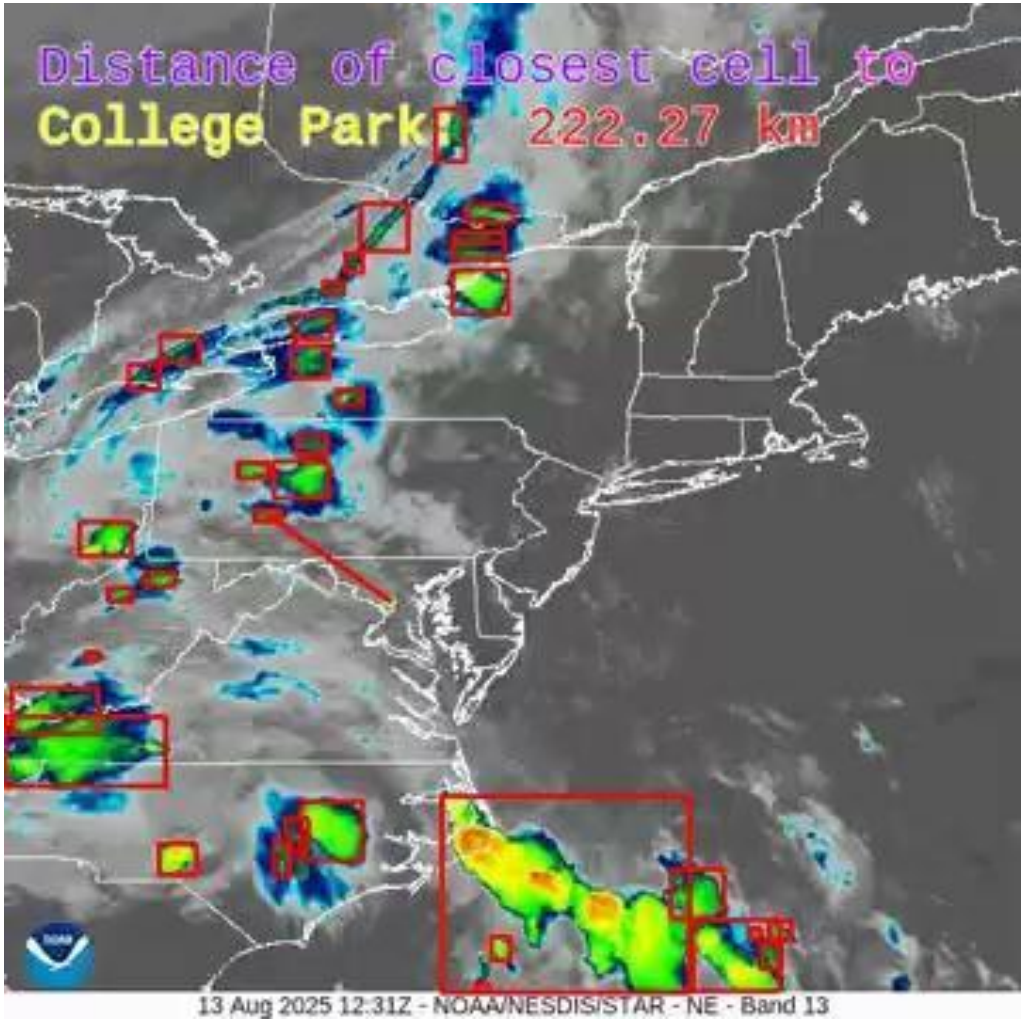
## Convection Cell & Cloud Type Detection

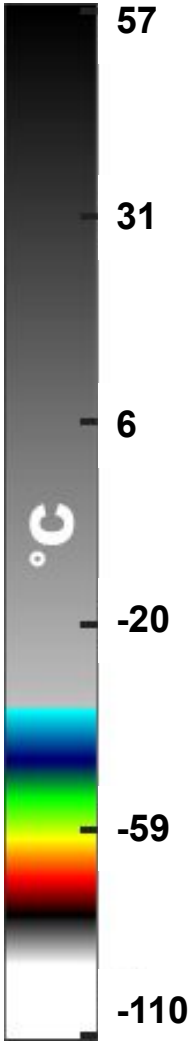
1) Detected Convection Cells on GOES-19 ABI Band 13:
- Colors correspond to the brightness temperature of the convection cell tops.
- Calculated size, speed, linear trajectory, distance from College Park.




2) GEOCOLOR for cloud type detection:
- Composited from the ABI VNIR Channels
- Developed training data for detecting Cumulus, Stratus, Cirrus, & Clear Sky.


Distance of closest cell to
College Park: 222.27 km
13 Aug 2025 12:31Z - NOAA/NESDIS/STAR - NE - Band 13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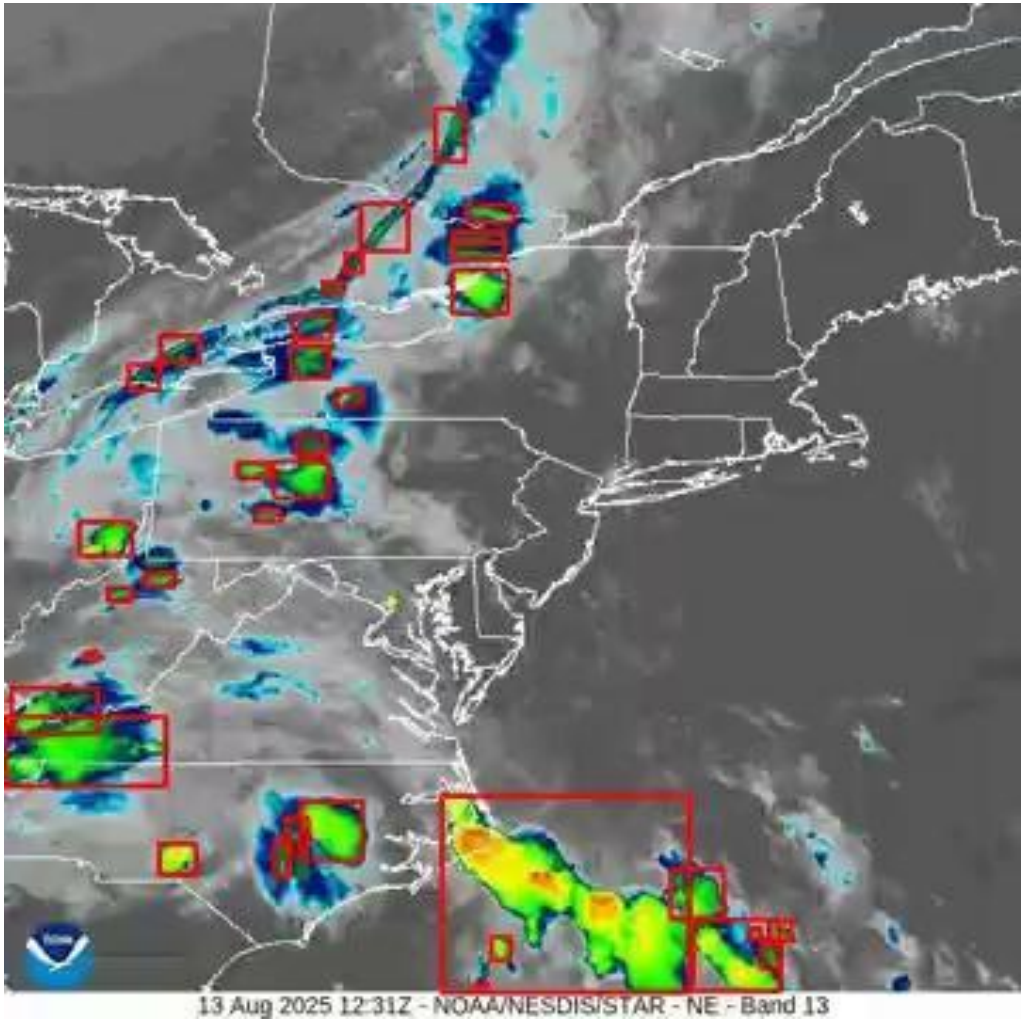
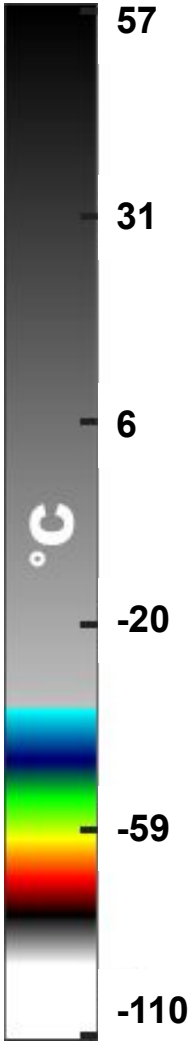

13 Aug 2025 12:31Z - NOAA/NESDIS/STAR - NE - Band 13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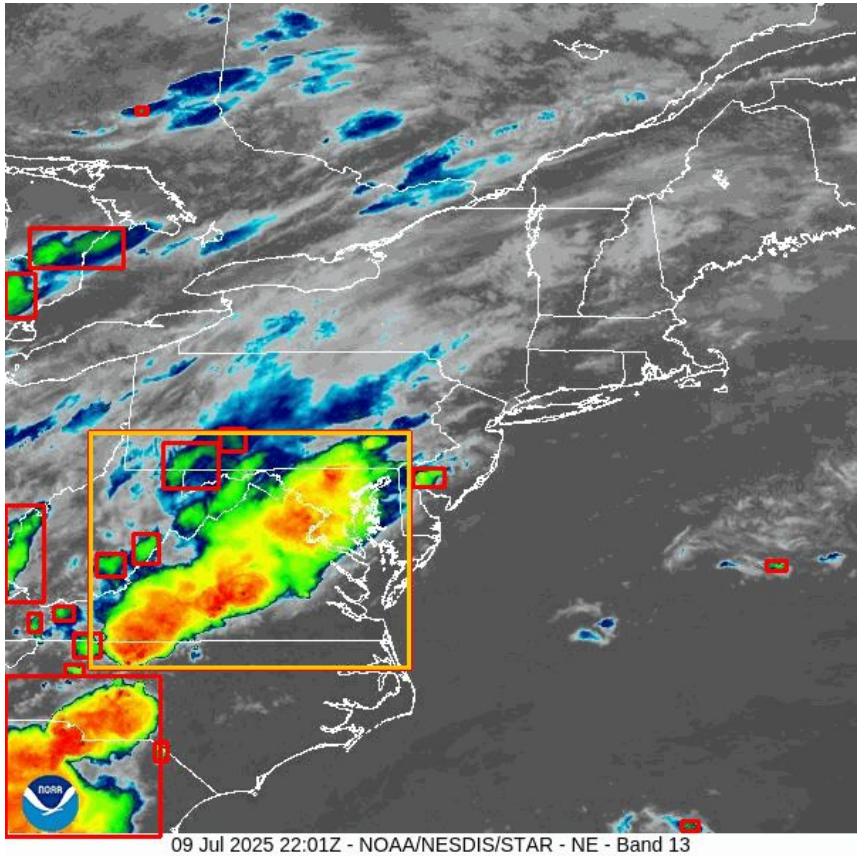
# Limitations & Future Steps




Model Accuracy

- Training data is sufficient, but not ideal (~200 samples, need ~2,000).
- Data is naturally biased against larger cells.

ABI Infrared Channel-Based Nowcasting

- Short-term nowcasting only accounts for the size and position of existing cells.
- Precipitable water and non-linear trajectory are not yet factored in.
- Only useful to predict the next 1-2 hours (short-term nowcasting).

Limitations of satellite infrared observations (Band 13)

- Infrared is unable to penetrate the cloud to determine precipitable water.
- More reliable nowcasting would require integration with more sophisticated technologies such as Doppler radar, and weather models.