

PEAR/WWE Seminar Series: GREMLIN + LxCast

Christopher Smith

GOES-R Satellite Liaison: NWS WPC/OPC



EARTH SYSTEM SCIENCE
INTERDISCIPLINARY CENTER

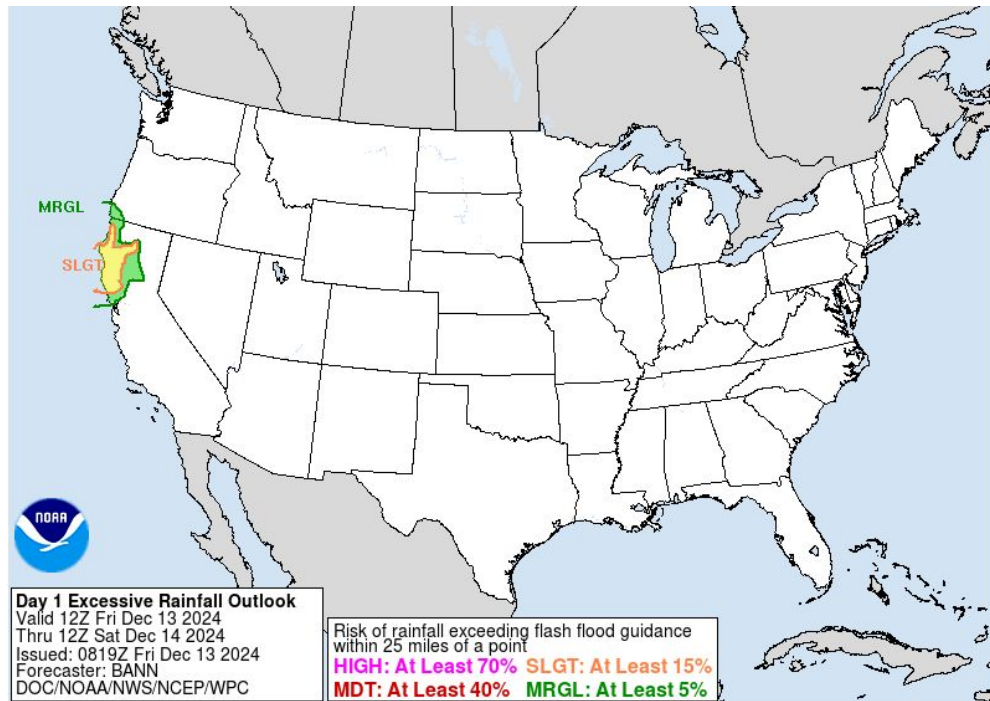


My Role

- Infuse satellite products (GOES & LEO) into NWS WPC and OPC operations - mainly through AWIPS-II
- R2O - O2R connection
- Develop outlets for testing new products and provide training on how to use them

WPC Overview

- The main desks using satellite products in the WPC Operations Forecast Branch are:
 - Excessive Rainfall Outlook (ERO) Desk
 - QPF Desk
 - MetWatch Desk
 - Surface Analysis Desk

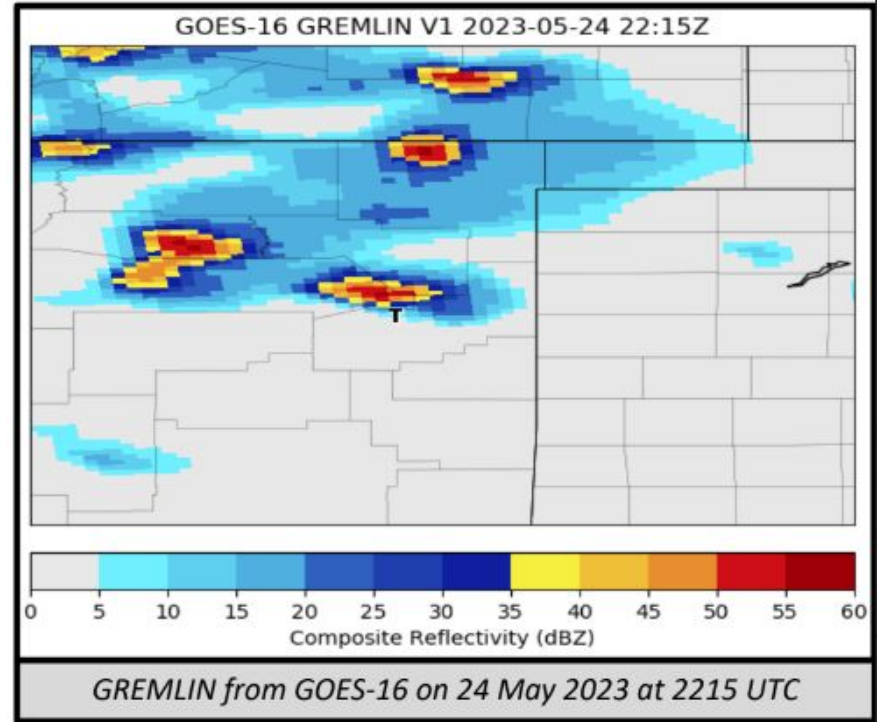




GREMLIN



- GOES Radar Estimation via Machine Learning to Inform NWP (GREMLIN) is a machine-learning product using ABI channels (7, 9, & 13), GLM Group Extent Density, and MRMS to simulate radar reflectivity
- GREMLIN has been trained over $\frac{2}{3}$ of CONUS, second version is being produced with MRMS training over Hawaii & Japan
- Best used for convective initiation, warm season, and with Ix
- Developer: Kyle Hillburn (CIRA)

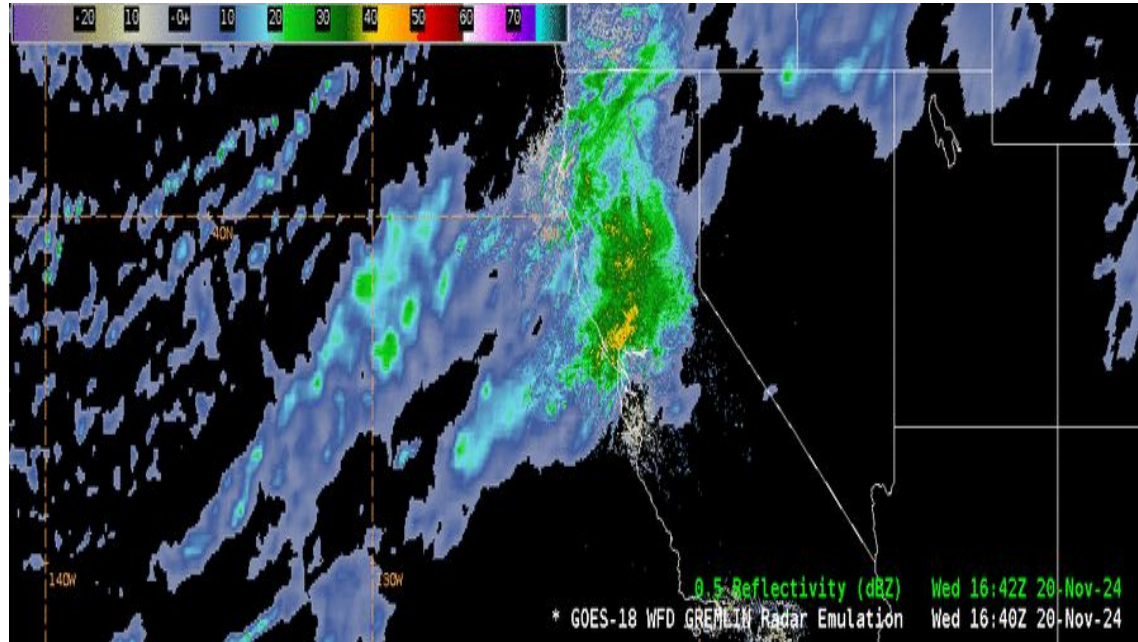




GREMLIN: ARs

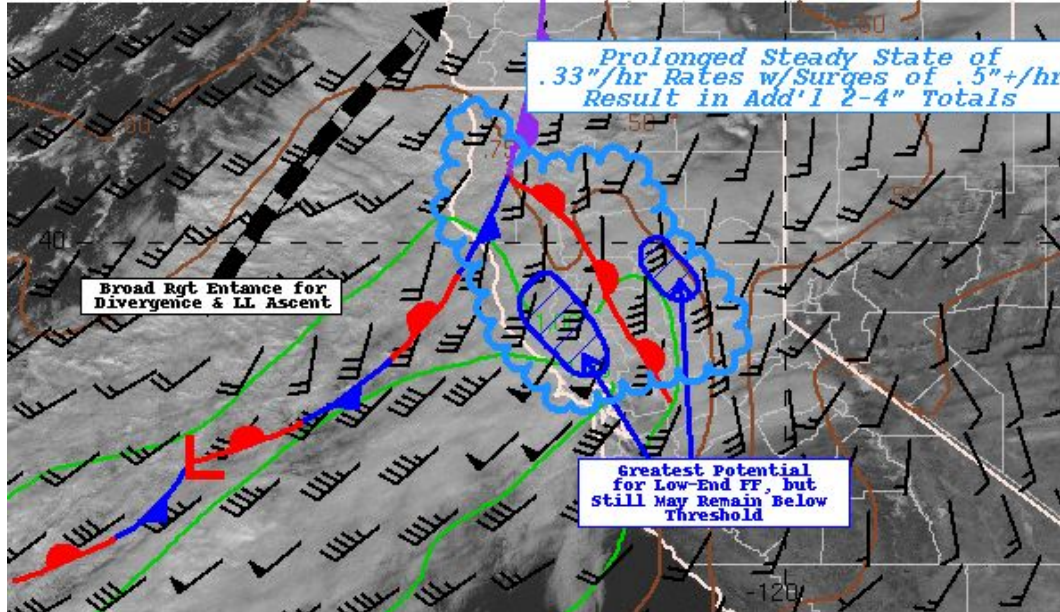


- GREMLIN in AWIPS
 - Overlaid with ground radar network
- Estimate precipitation rates moving onshore





GREMLIN Use: Mesoscale Precipitation Discussion



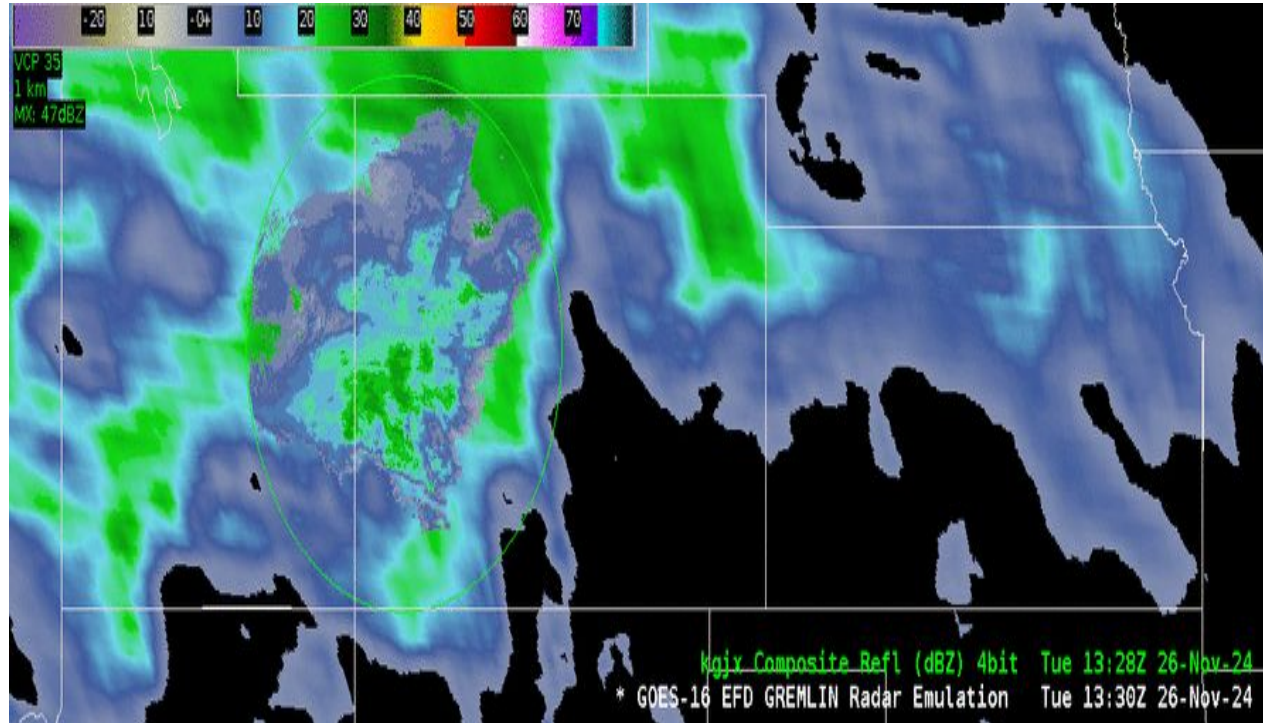
241120/2010 GOES18 CH02 VIS 0.64
RAP32 PRECIP WATER 241120/1900f004
RAP32 850 MB WINDS 241120/1900f004
WPC MPD #1161



GREMLIN: Winter Applications

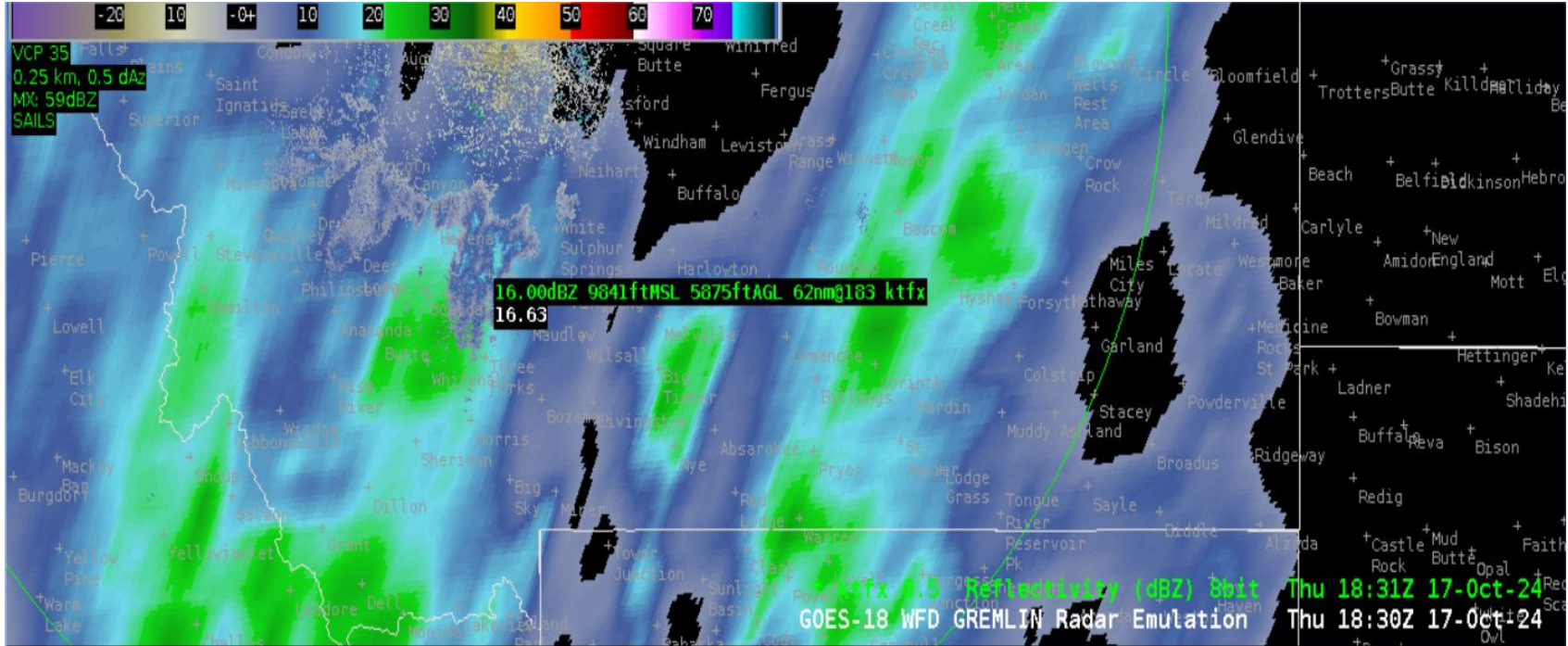


- GREMLIN can fill in radar gaps over mountainous terrain





GREMLIN: Winter Applications

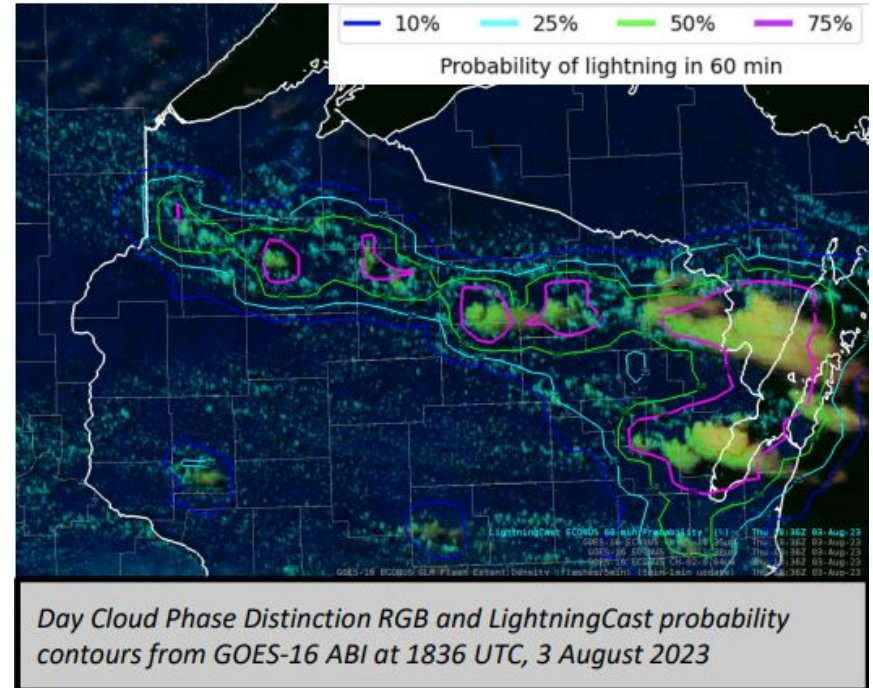




LightningCast



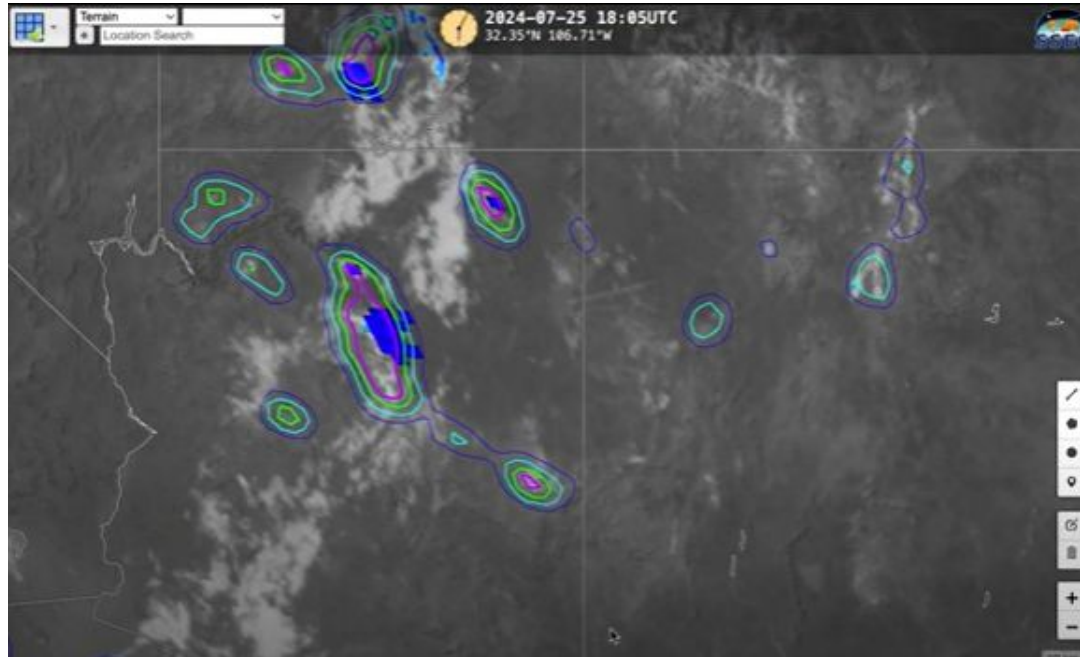
- Machine-learning model that uses ABI channels (2, 5, 13, & 15) to predict the probability that the GLM will observe lightning within the next hour
 - Display over Day Cloud Phase Distinction RGB during the day, Clean Longwave IR Window at Night
 - GLM Flash Extent Density (FED) overlaid
- LightningCast has been trained over CONUS, the Gulf of Mexico, Caribbean, American Samoa, & Guam
- Best used for convective initiation, warm season, and over land
- Developer: John Cintineo (NSSL)



Courtesy of [CIMSS](#)



LightningCast



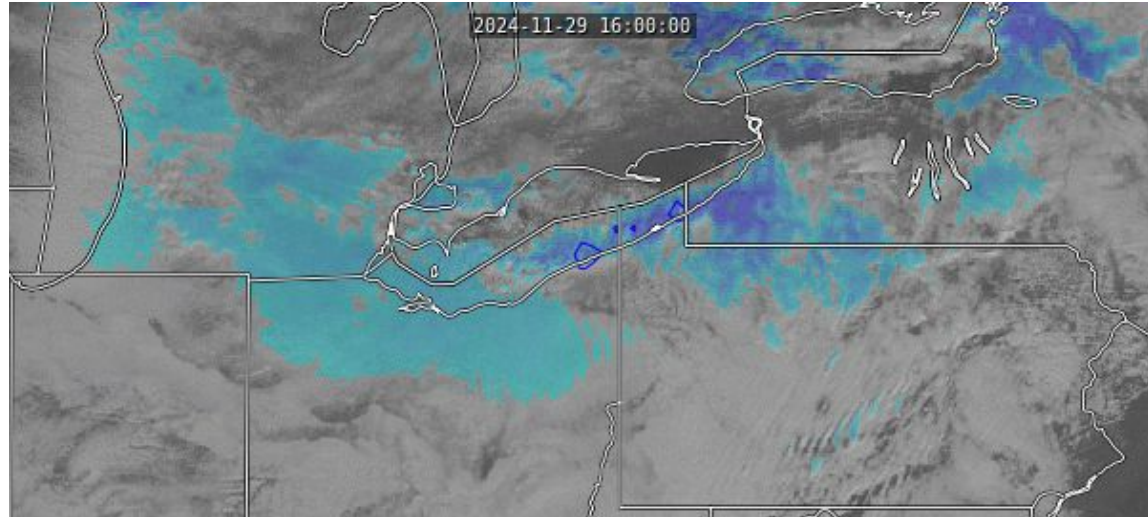
Source: SSEC RealEarth, UW-Madison



LightningCast: Winter Applications



- Available for AWIPS implementation
- LightningCast for this lake effect snow (LES) event focuses on colder cloud top temperatures



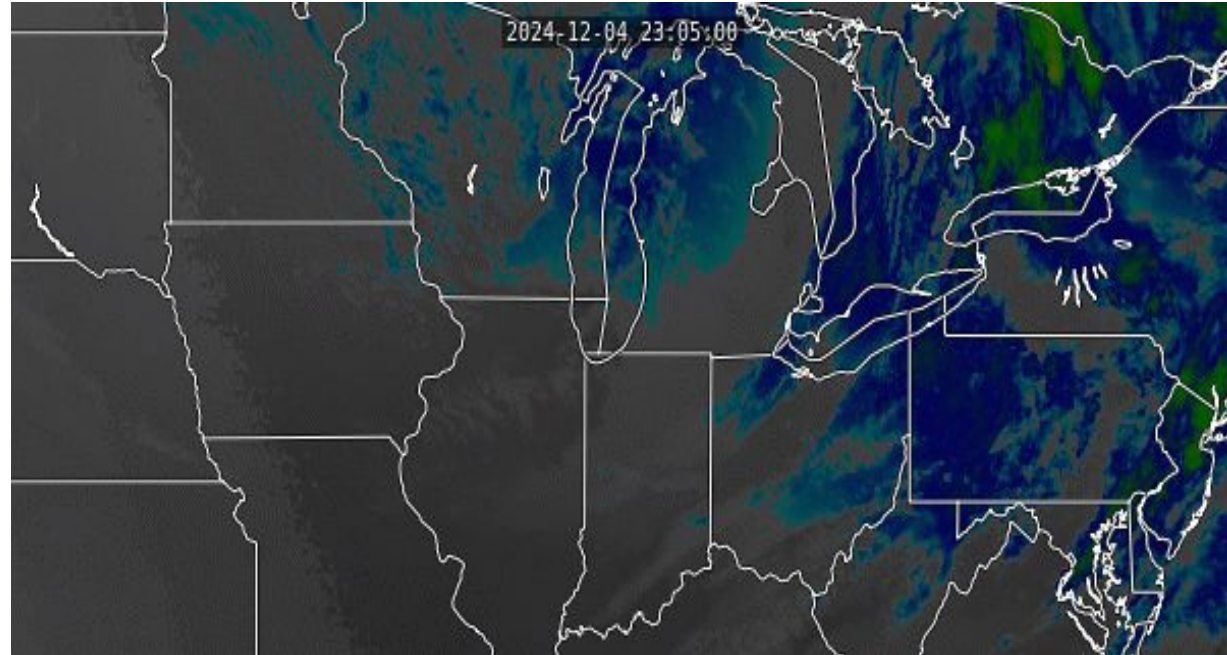
Source: SSEC RealEarth, UW-Madison



LightningCast: Winter Applications



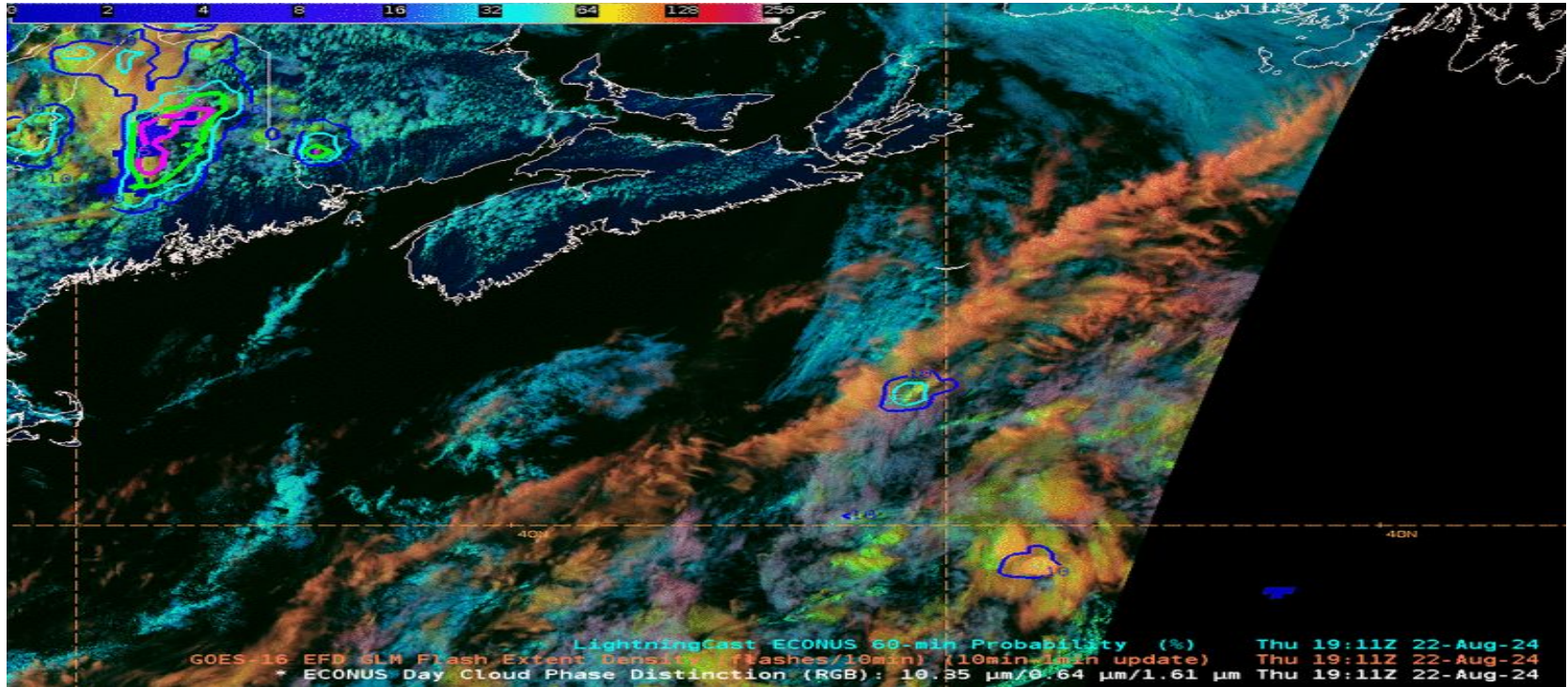
- Available for AWIPS implementation
- LightningCast lined up better for the snow-squall case where cold cloud top temperatures coincide with intense precip



Source: SSEC RealEarth, UW-Madison



LightningCast in AWIPS






LightningCast: Winter Applications



- Short-term key messages for heavy snowfall
- Verify WSSI parameters



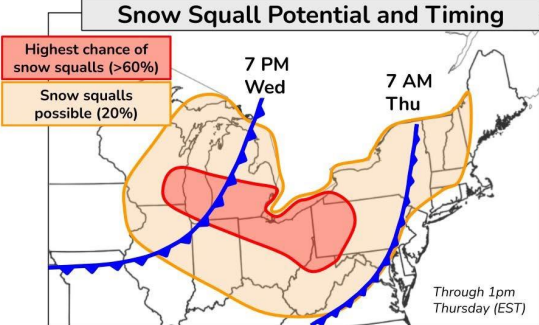
Key Messages for Arctic Front Wind and Snow

Updated Dec 4, 2024
3:00 PM ET

Snow squalls, strong winds, and periods of heavy snow to impact areas tonight through Thursday

- **Impactful Snow Squalls**
A powerful Arctic cold front will sweep across the Great Lakes this evening, the Ohio Valley and Mid-Atlantic tonight, and across the Northeast Thursday. Snow squalls along this front will be accompanied by intense bursts of heavy snowfall and gusty winds, producing dangerous travel conditions due to whiteouts and icy roads.
- **Widespread Strong Winds**
Wind gusts up to 50 mph will spread from the Northern Plains to the Great Lakes this evening, and reach the Central Appalachians, Mid-Atlantic, and Northeast by Thursday. These winds may cause power outages, down tree branches, and result in hazardous commutes.
- **Heavy Snow**
Snowfall totals of 1-2 feet are expected (>80%) in the lake-effect snow belts, with up to 1 foot likely (60-80%) along the Central Appalachians and across the higher terrain of interior New England. In the lake-effect snow belts and the Central Appalachians, this heavy snow will combine with strong winds to produce near-blizzard conditions.

Snow Squall Potential and Timing



Highest chance of snow squalls (>60%)

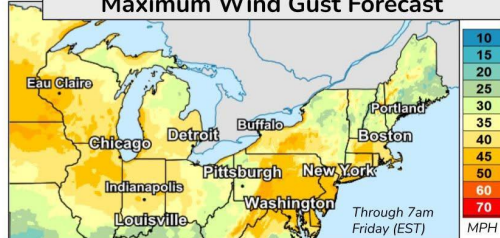
Snow squalls possible (20%)

7 PM Wed

7 AM Thu

Through 1pm Thursday (EST)

Maximum Wind Gust Forecast



10
15
20
25
30
35
40
45
50
60
70
MPH

Through 7am Friday (EST)

For more information go to: www.wpc.ncep.noaa.gov and www.weather.gov

National Oceanic and Atmospheric Administration
U.S. Department of Commerce

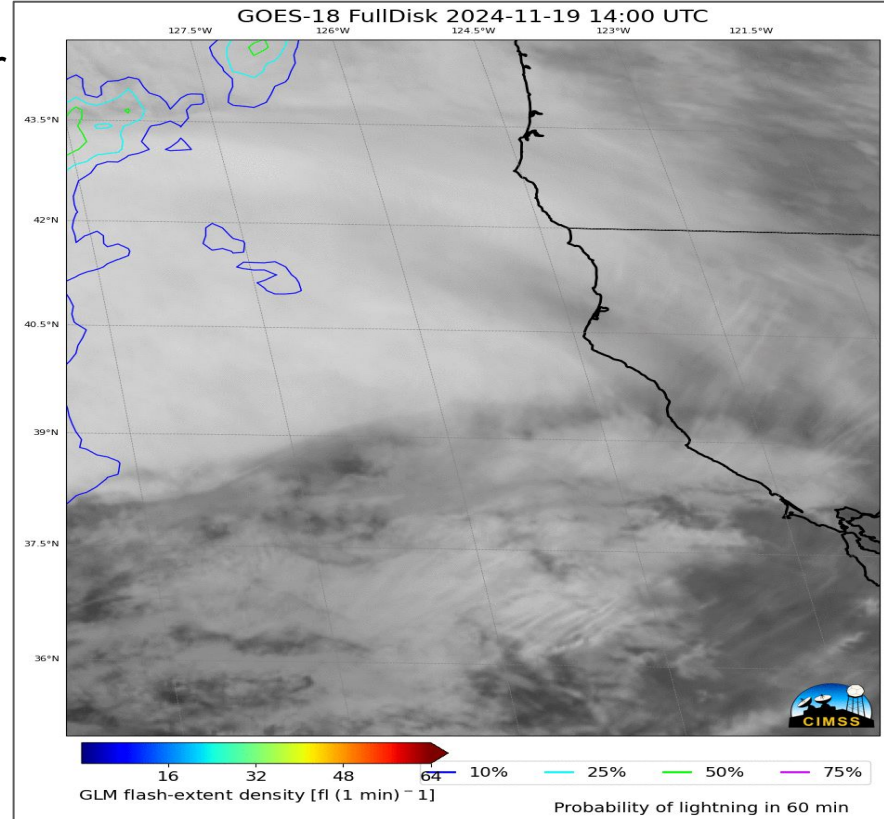
Weather Prediction Center
College Park, MD



LightningCast: ARs



- LxCast capturing atmospheric river convection

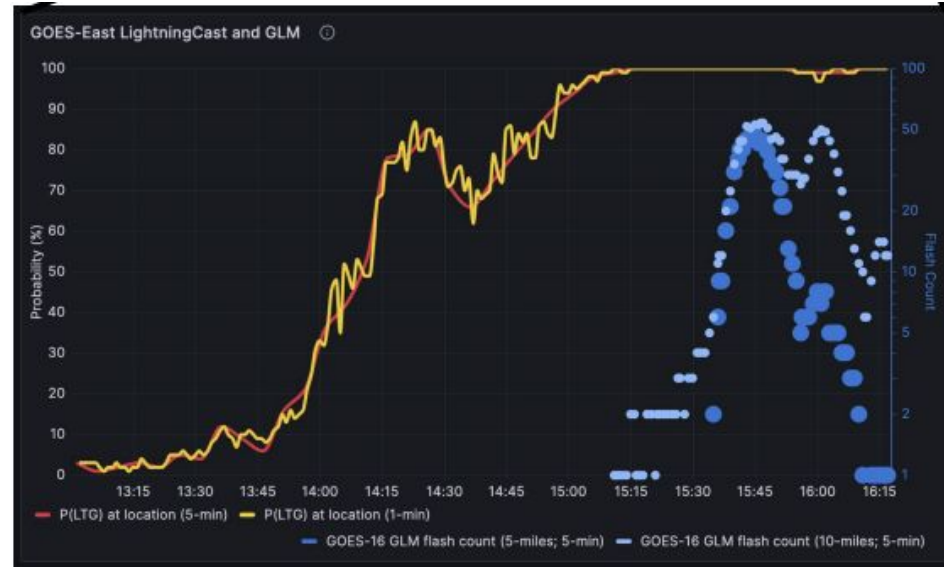




LightningCast Future Version



- Future version plans to:
 - Incorporate MRMS
 - Add additional lx networks (i.e. EarthNetworks)
 - Train on a sequence of satellite images (see where, how convection will be advected)
- Operational feed comes 2025
 - Replaces LDM feed out of CIMSS
- Dashboards still come from CIMSS





Summary



- GREMLIN can provide an estimate of precipitation rates for areas without radar
- LightningCast can signal intense convection in ARs and winter settings

DISCUSSION...The midday GOES-E Day Cloud Phase RGB in conjunction with visible imagery and the ML-driven LightningCast product suggests CI is imminent across areas of southern CO and northern NM including the Sangre De Cristo mountains. Additional areas of CI are imminent also across the higher terrain of eastern AZ. In all of these areas, there is close proximity to some weak MCV energy, and this coupled with the proximity of multiple differential heating boundaries will allow for the rapid development and expansion of heavy shower and thunderstorm activity over the next several hours.



Resources



1. [GREMLIN on CIRA Slider](#)
2. [CIMSS LightningCast](#)
3. [GREMLIN Quick Guide](#)
4. [LightningCast Quick Guide](#)
5. [CSPP-GEO: plot archived LightningCast cases](#)
6. [HWT Report](#)



Questions?

