



Predicting Probabilistic Lightning Flash Density from the HREF Calibrated Thunder Guidance



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Background:

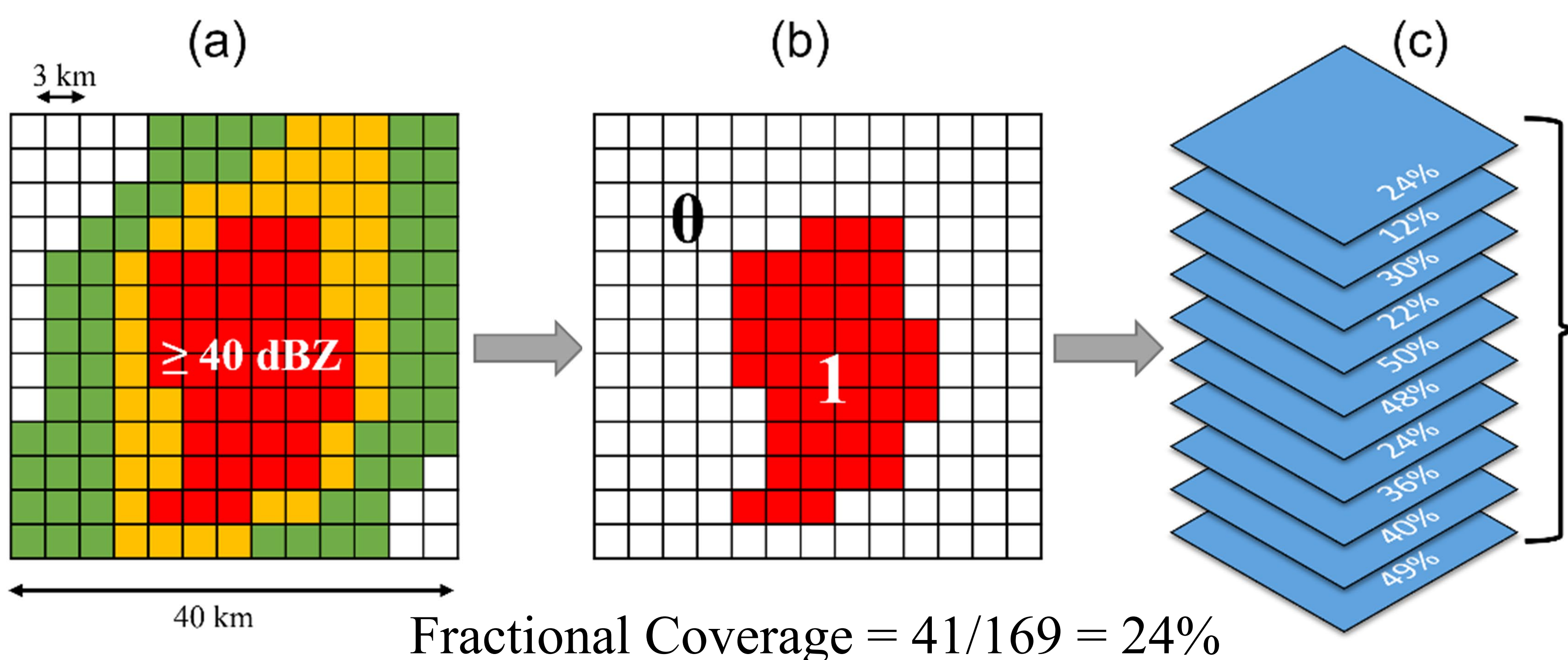
The HREF Calibrated Thunder guidance (HREFCT) predicts the probability of ≥ 1 CG lightning flash within 20 km of a location over a 1-h, 4-h, or 24-h period. While skillful, the guidance doesn't explicitly predict *how many* CG lightning flashes are expected. This information could be useful to fire weather forecasters, particularly in dry thunder environments or areas with dry fuels.

Our Solution:

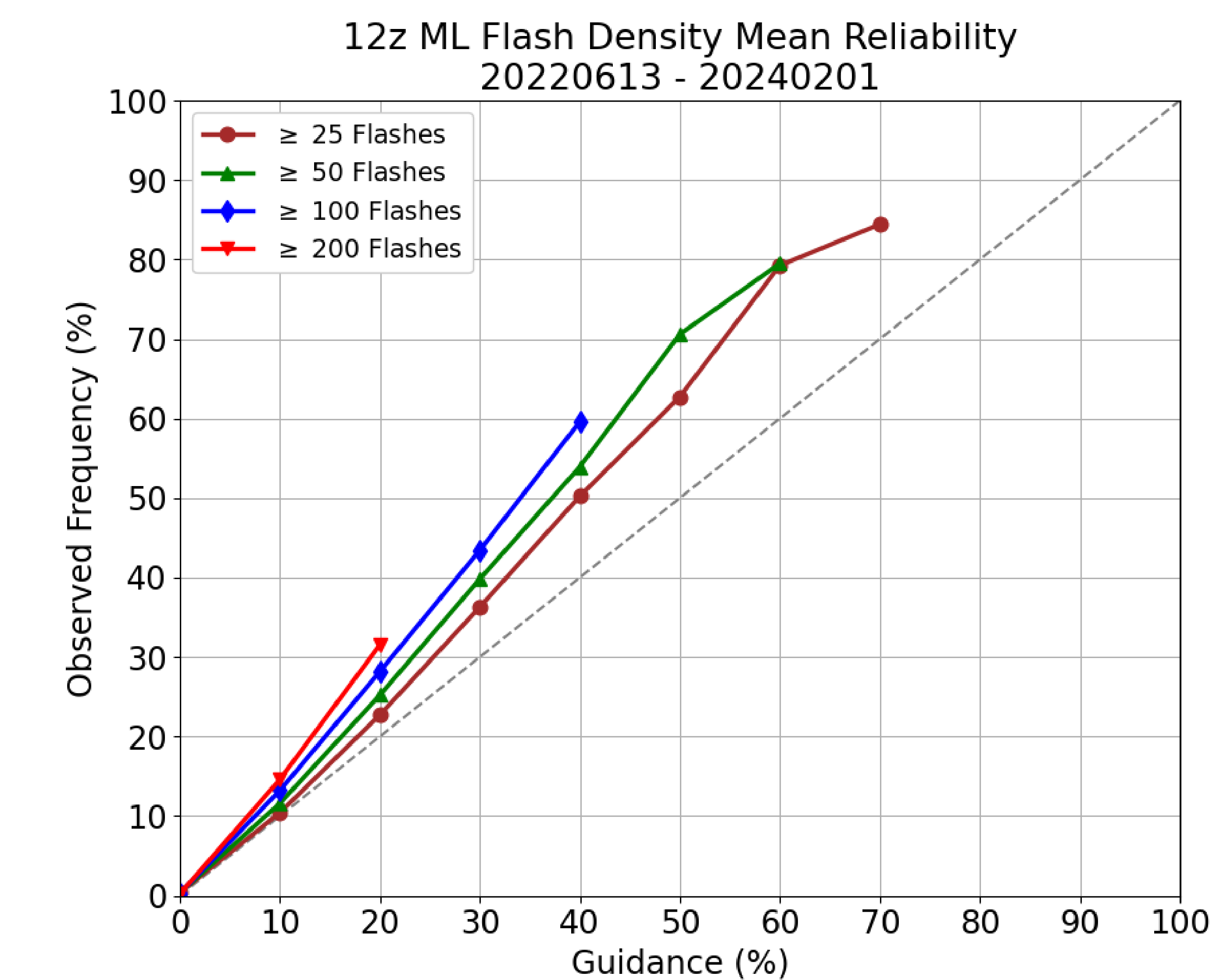
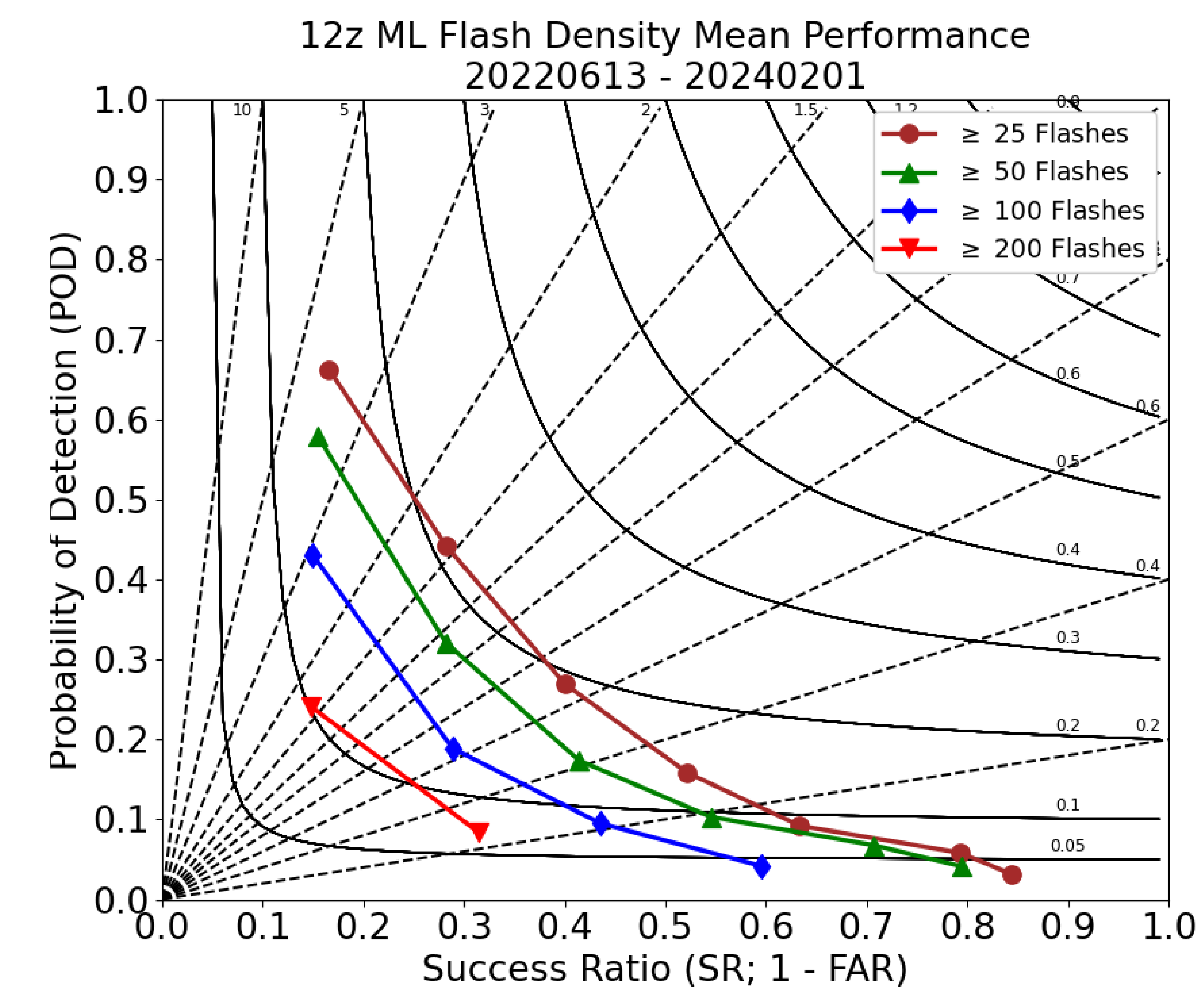
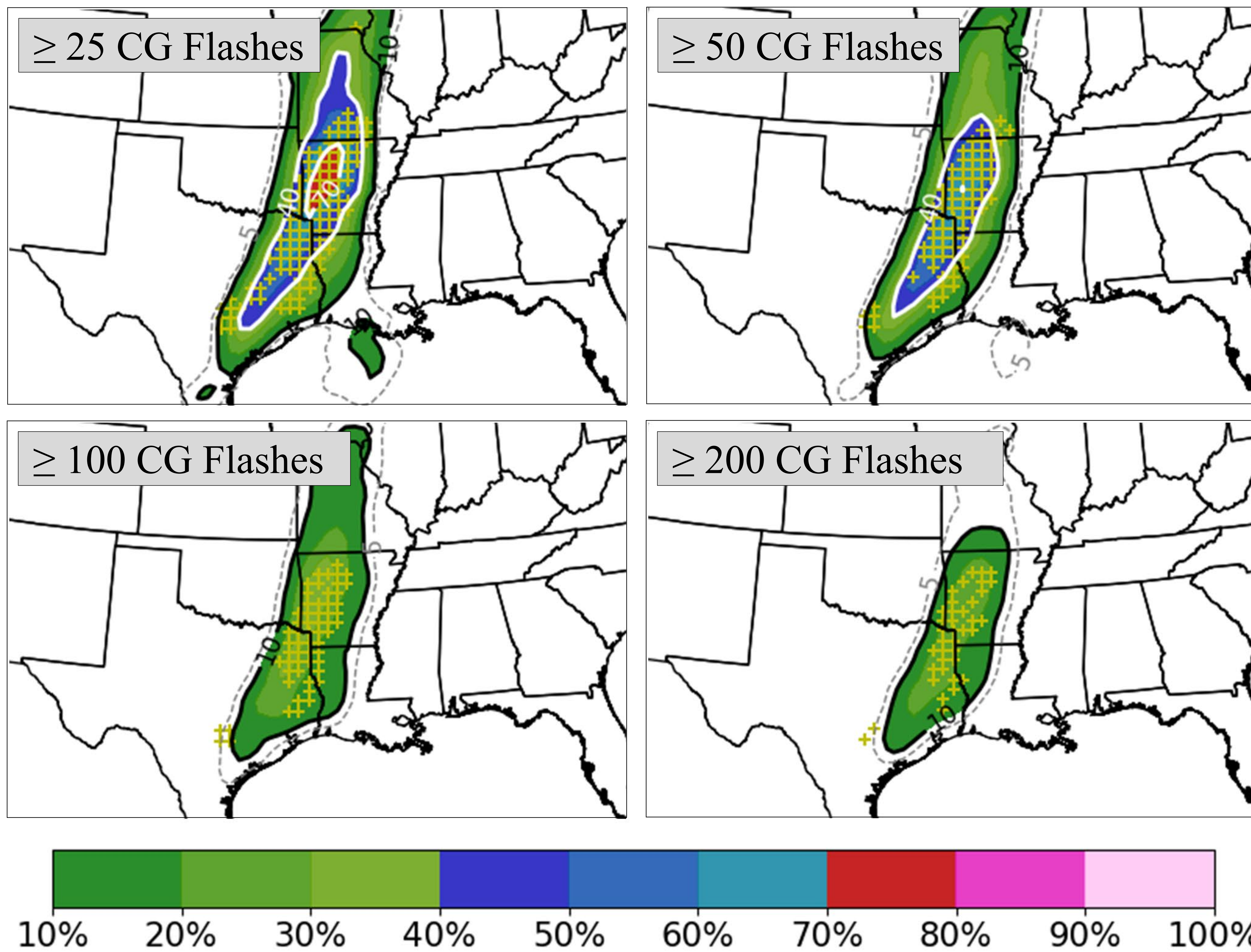
We used machine learning (ML) techniques to train four Gradient Boosting Classifiers on HREF/HREFCT data from 20200613 – 20220613 to predict the probability of $\geq 25, 50, 100,$ or 200 CG flashes within 20 km of a location over a 4-hour period.

Inputs:

- 4-h HREFCT
- Neighborhood Max UVV
- Z_{-10C} Mean Fractional Coverage
- Z_{-10C} Max Fractional Coverage



4-hour Probability of CG Flashes Within 20 km of a Point
November 4, 2022 00z – 04z



What is Fractional Coverage?

- Map HREF 3-km grid to 40-km grid.
- Set 1 where $Z_{-10C} \geq 40$ dBZ and 0 everywhere else. Then take the mean of the 40 km grid point.
- Repeat for all 10 HREF members. Take either the mean or the max at each grid point to get the ensemble fractional coverage.

Verification:

All four ML flash density models demonstrate skill out to 48 hours, although CSI decreases with increasing thresholds. The guidance tends to somewhat underforecast compared to NLDN observations, and additional calibration is planned. The guidance is currently being tested internally at SPC.

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