GRIDDED CLOUD LAYER GUIDANCE TO SUPPORT THE TAF

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* The views expressed are not necessarily those of any governmental agency

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CLOUD INFORMATION IN TAFS

- TAFS can include multiple layers of cloud, both height and amount
  - International TAFS go to projection 36 hours
- LAMP provides only ceiling height and total opaque cloud amount to 25 hours
- Cloud information from numerical models is generally not well calibrated

PURPOSE OF PROTOTYPE WORK

- To continue to use the HRRR model output to improve on basic MOS and LAMP guidance
- To extend LAMP/HRRR Meld guidance from 25 to 36+ hours
- To forecast amount and height of multiple layers of cloud

PROGRESS TO DATE

- Ceiling height extended to 38 hours
- Probabilistic and categorical forecasts have been made of:
  - base height of total obscuration, overcast, and broken layers
  - non-ceiling layer (few/scattered)

This presentation covers only forecasting of ceiling height and its component types obscuration, overcast, and broken.

STATISTICAL METHOD

- Regression with binary predictands (REEP)
- Probability of each of several cumulative categories of the height estimated (e.g., < 1,000 ft.)
- Thresholds developed to give specific value forecasts
  - To maximize the threat score with a bias near unity

STATISTICAL METHOD

- Generalized MOS equations developed at 1552 stations in the CONUS
- Results applied to stations for verification
- Results applied on a grid for gridded forecasts
  - Requires gridding the observations and the MOS and LAMP probability forecasts for input
    - BCDG method of gridding used

DATA SAMPLE

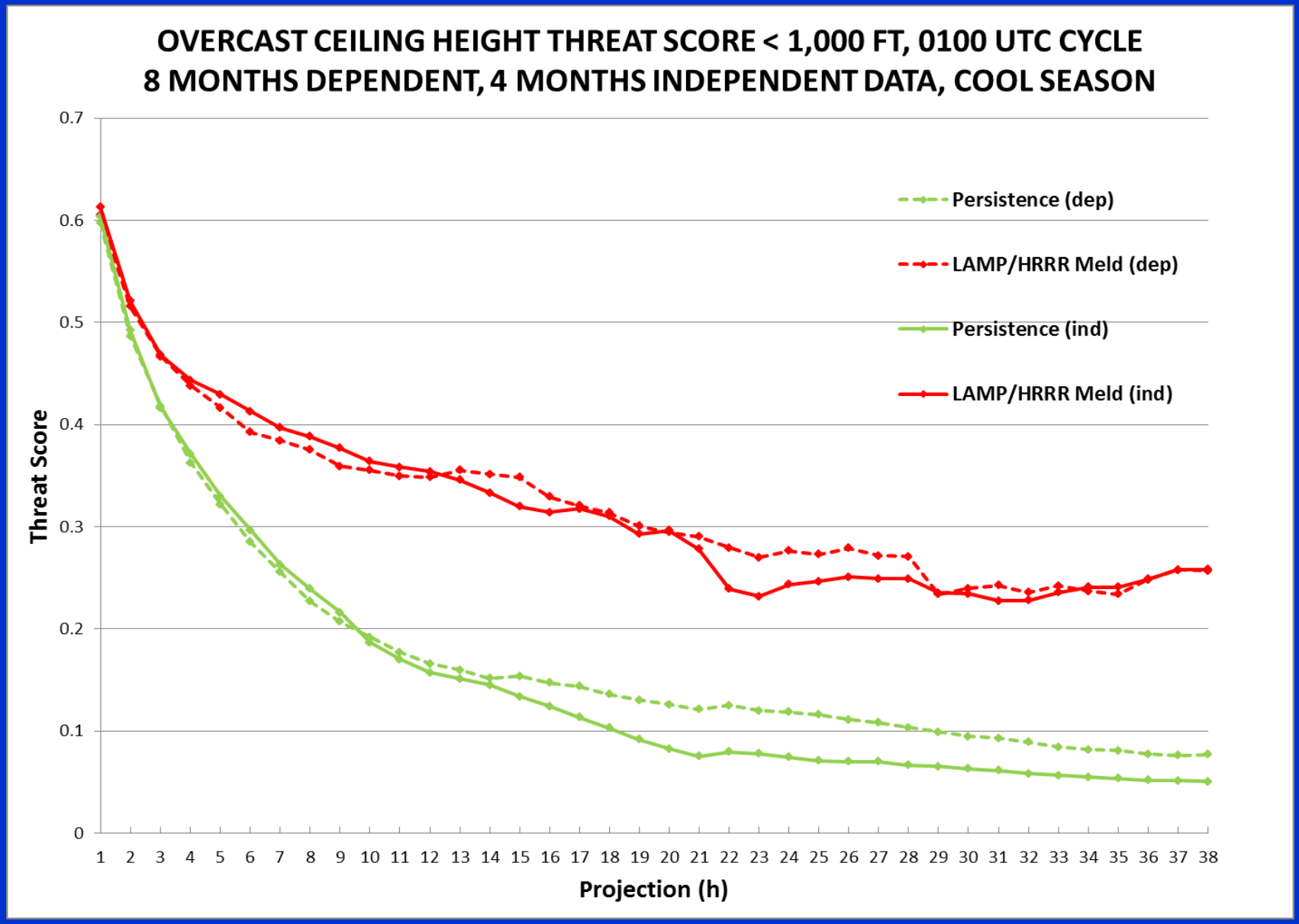
- Two cool seasons (Oct. - Mar.), 0100 UTC cycle
  - 8 months used for development
  - 4 non-consecutive months used for testing

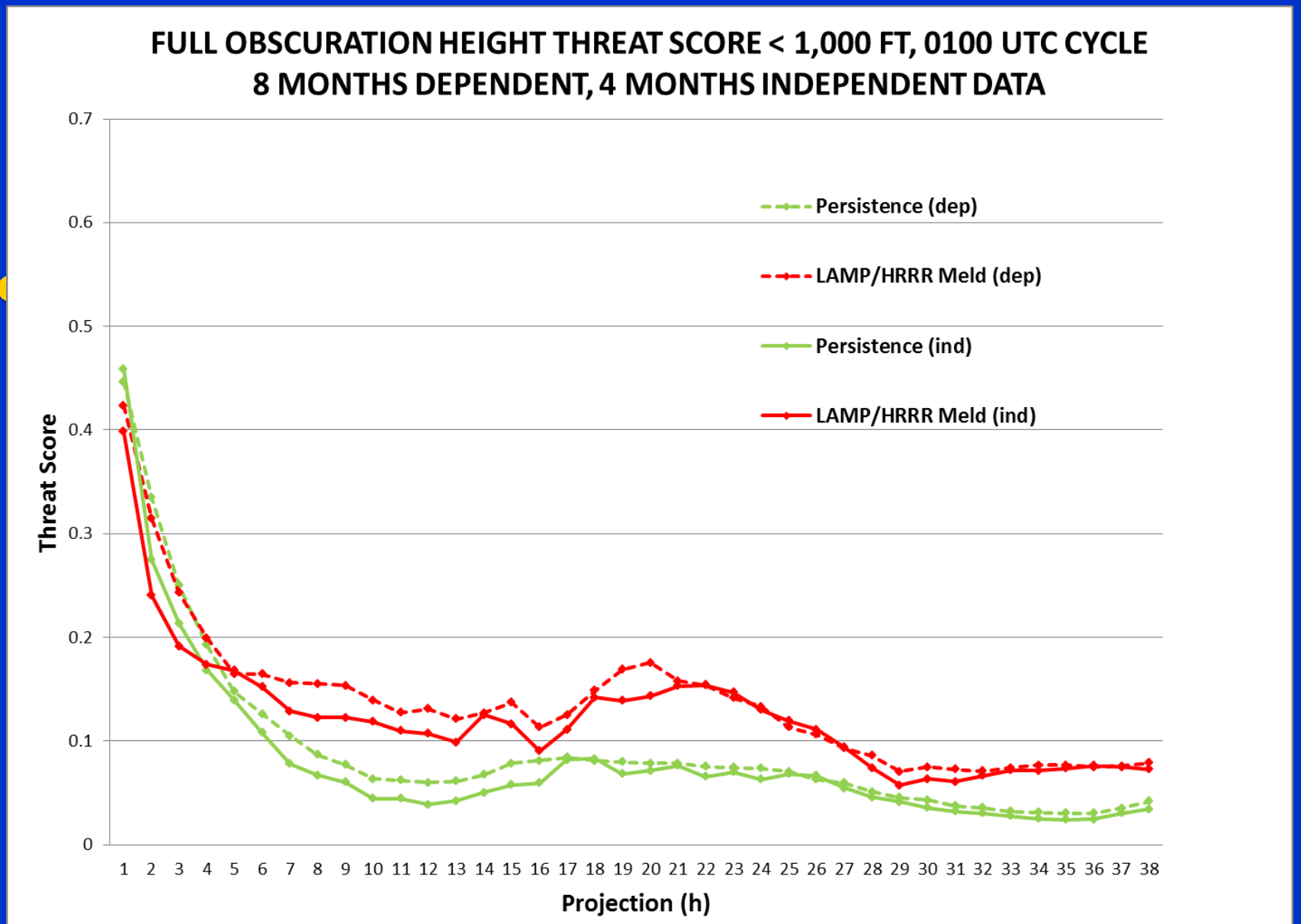
CEILING HEIGHT AS TOTAL OBSCURATION, BROKEN, AND OVERCAST

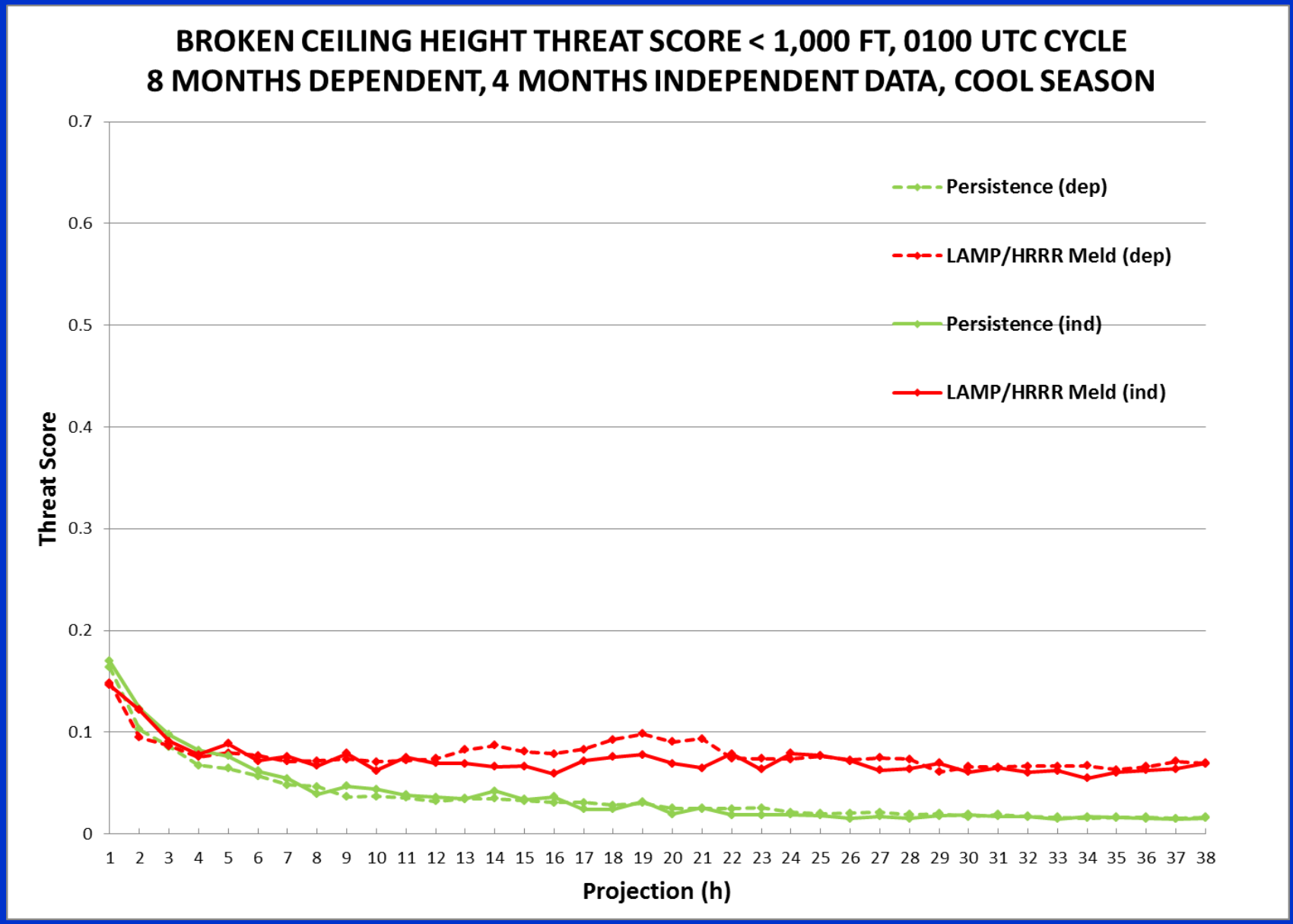
- Predictands
  - Total obscuration in 13 height categories
  - Lowest broken in 24 height categories
  - Overcast in 24 height categories
- Relative Frequency of predictands
  - Obscured < 2%
  - Broken ~ 15%
  - Overcast ~25%

CEILING HEIGHT AS TOTAL OBSCURATION, BROKEN, AND OVERCAST

- Predictors:
  - LAMP ceiling height probabilities to 25 h
  - MOS ceiling height probabilities to 38 h
  - HRRR ceiling height probabilities (3-h lagged ensemble to 17-h
  - Observations: Height of:
    - total obscuration,
    - lowest broken,
    - and overcast


OVERCAST CEILING HEIGHT THREAT SCORE < 1,000 FT, 0100 UTC CYCLE
8 MONTHS DEPENDENT, 4 MONTHS INDEPENDENT DATA, COOL SEASON
Threat Score
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
Projection (h)
Persistence (dep)
LAMP/HRRR Meld (dep)
Persistence (ind)
LAMP/HRRR Meld (ind)


FULL OBSCURATION HEIGHT THREAT SCORE < 1,000 FT, 0100 UTC CYCLE
8 MONTHS DEPENDENT, 4 MONTHS INDEPENDENT DATA
Threat Score
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
Projection (h)
Persistence (dep)
LAMP/HRRR Meld (dep)
Persistence (ind)
LAMP/HRRR Meld (ind)


BROKEN CEILING HEIGHT THREAT SCORE < 1,000 FT, 0100 UTC CYCLE
8 MONTHS DEPENDENT, 4 MONTHS INDEPENDENT DATA, COOL SEASON
Threat Score
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
Projection (h)
Persistence (dep)
LAMP/HRRR Meld (dep)
Persistence (ind)
LAMP/HRRR Meld (ind)

- Graphs shown are for forecasts of each type of ceiling, each type without regard to the others.
- Conflicts (more than one type of forecast for the same point in time and space) have to be resolved.
- The three types together must be as good as ceiling forecasts produced directly.

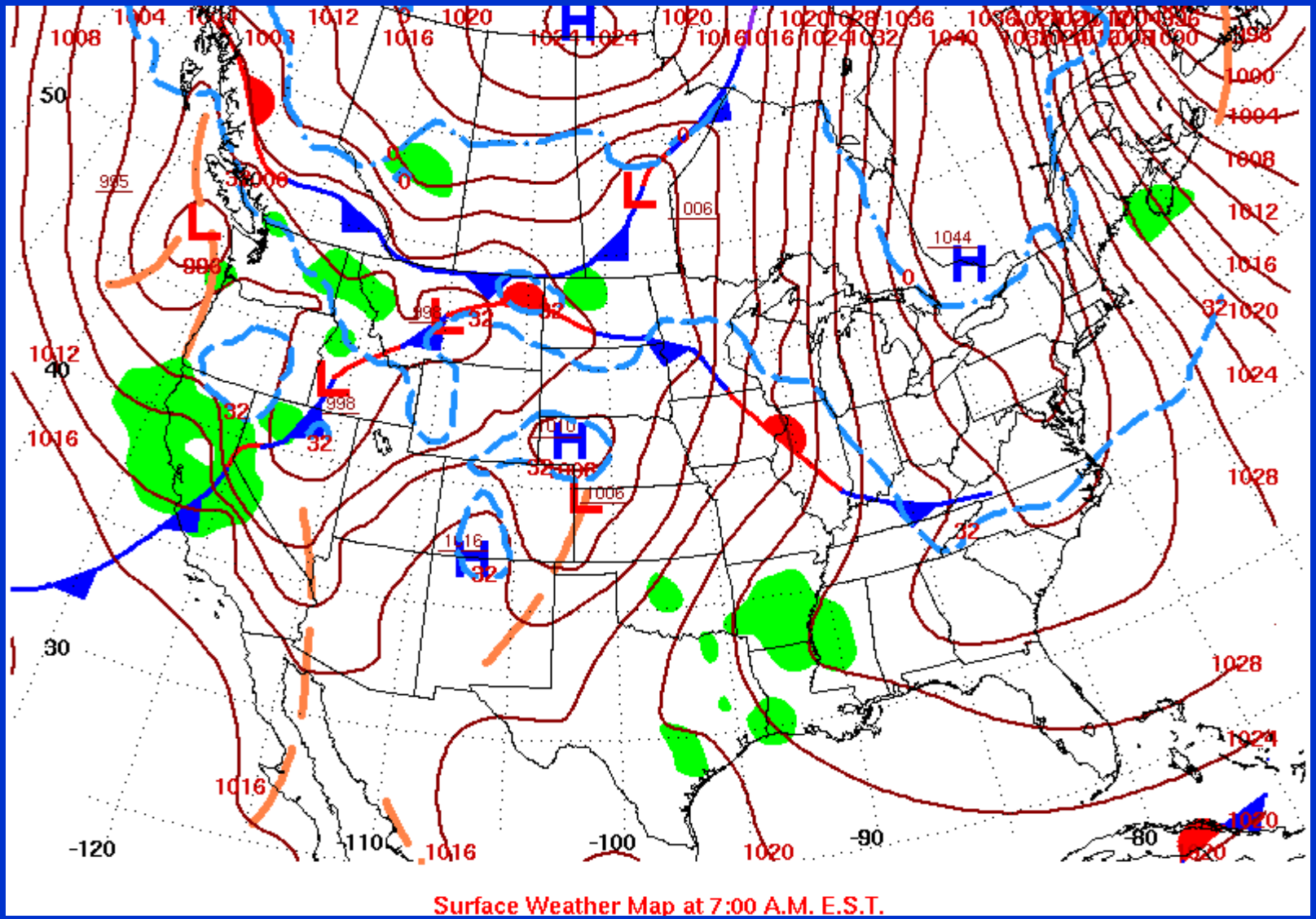
CATEGORICAL FORECASTS MUST BE MUTUALLY EXCLUSIVE

- Make forecasts in sequence is one option
  - Obscured
  - Overcast
  - Broken

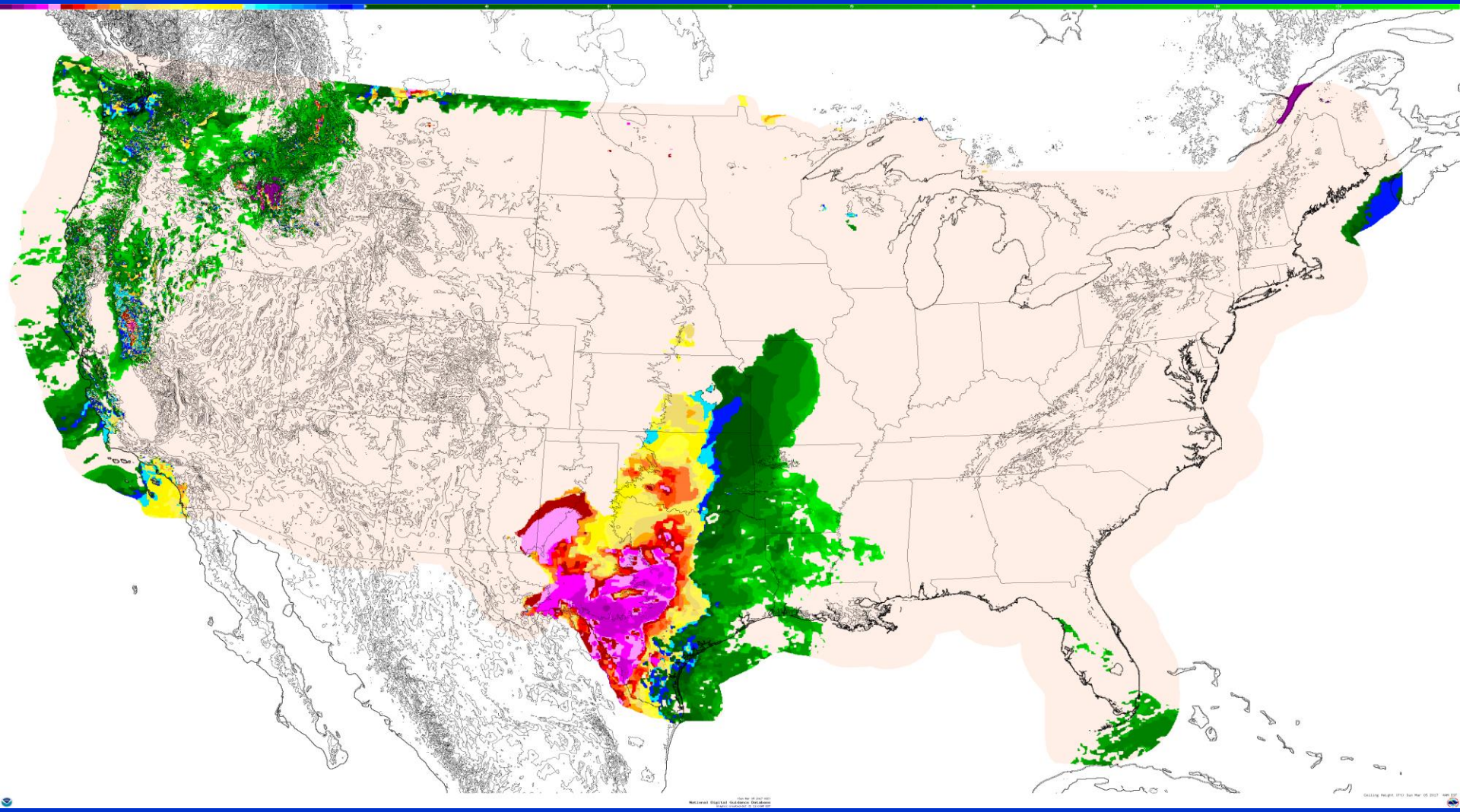
FORECASTS SHOWN ARE FOR

MARCH 5, 2017,
8-H FORECASTS
FROM 0100 UTC

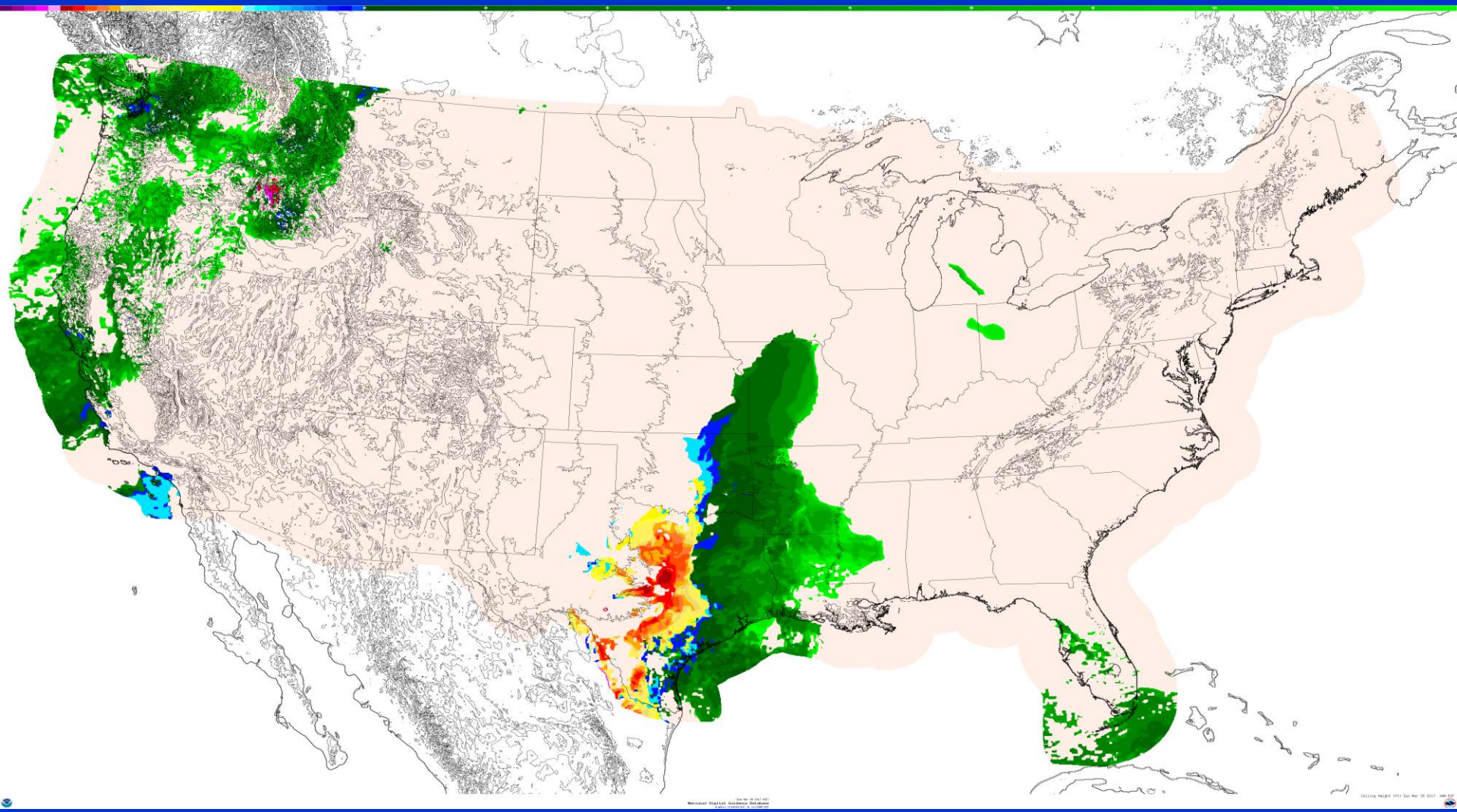
MARCH 5, 1200 UTC



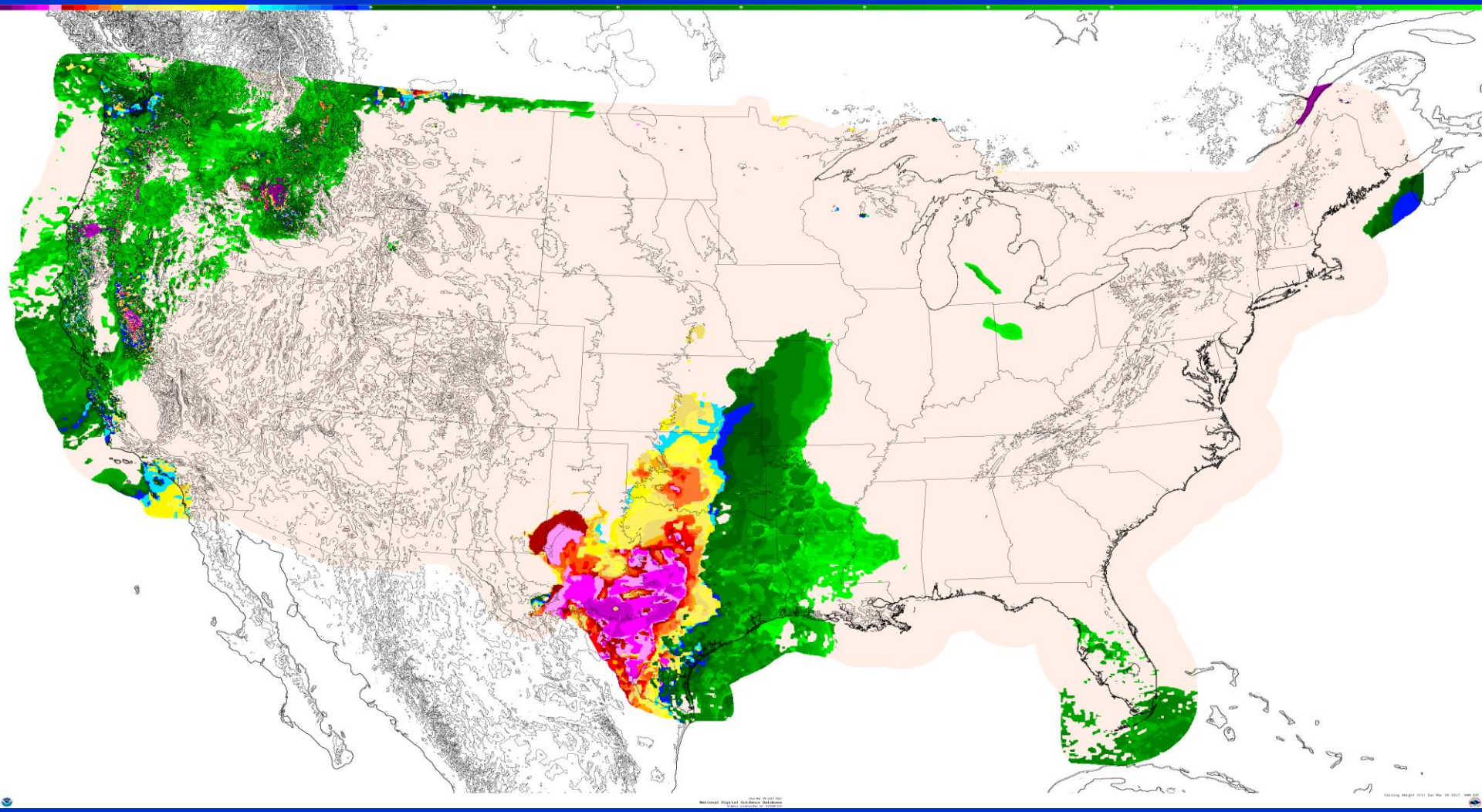
OVERCAST CEILING HEIGHT



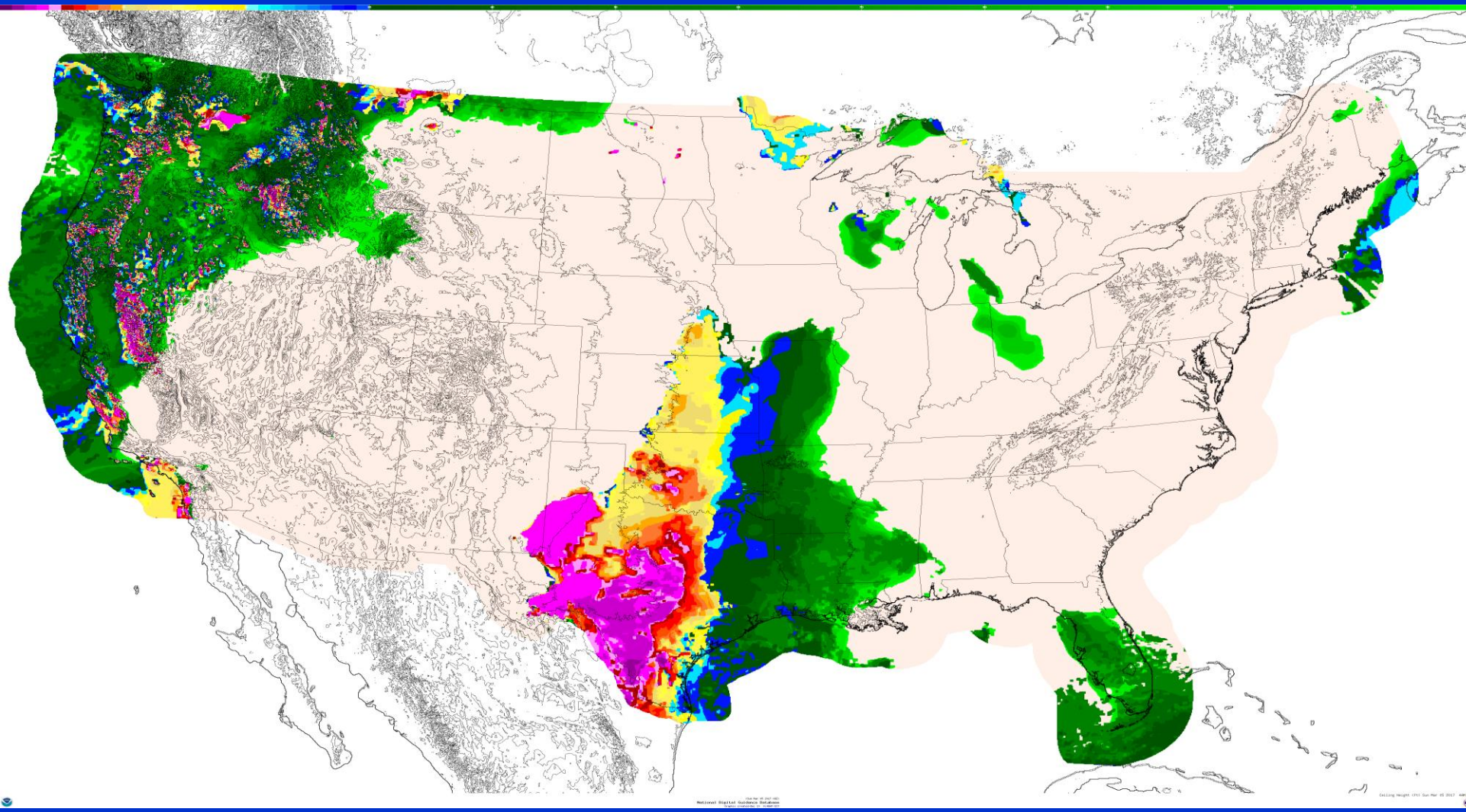
BROKEN CEILING HEIGHT



FORECAST CEILING HEIGHT, COMBINATION OF OBSCURED, OVC, BKN



DIRECT CEILING HEIGHT FORECAST



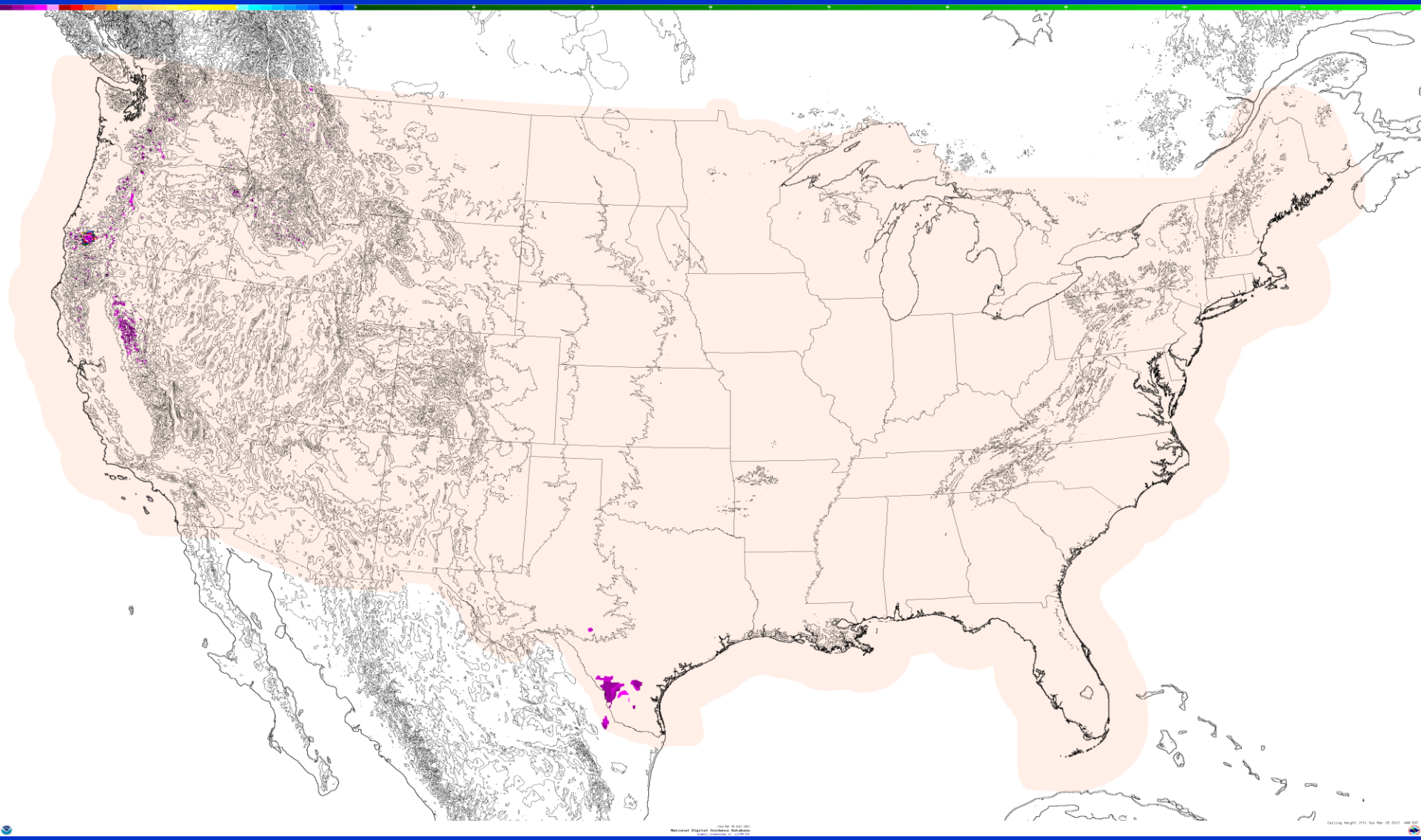
CRITIQUE

- Method of combining types to produce a ceiling forecast not satisfactory
  - Ceiling had low bias
  - Ceiling verification not assured to be as good as a ceiling forecast produced directly.

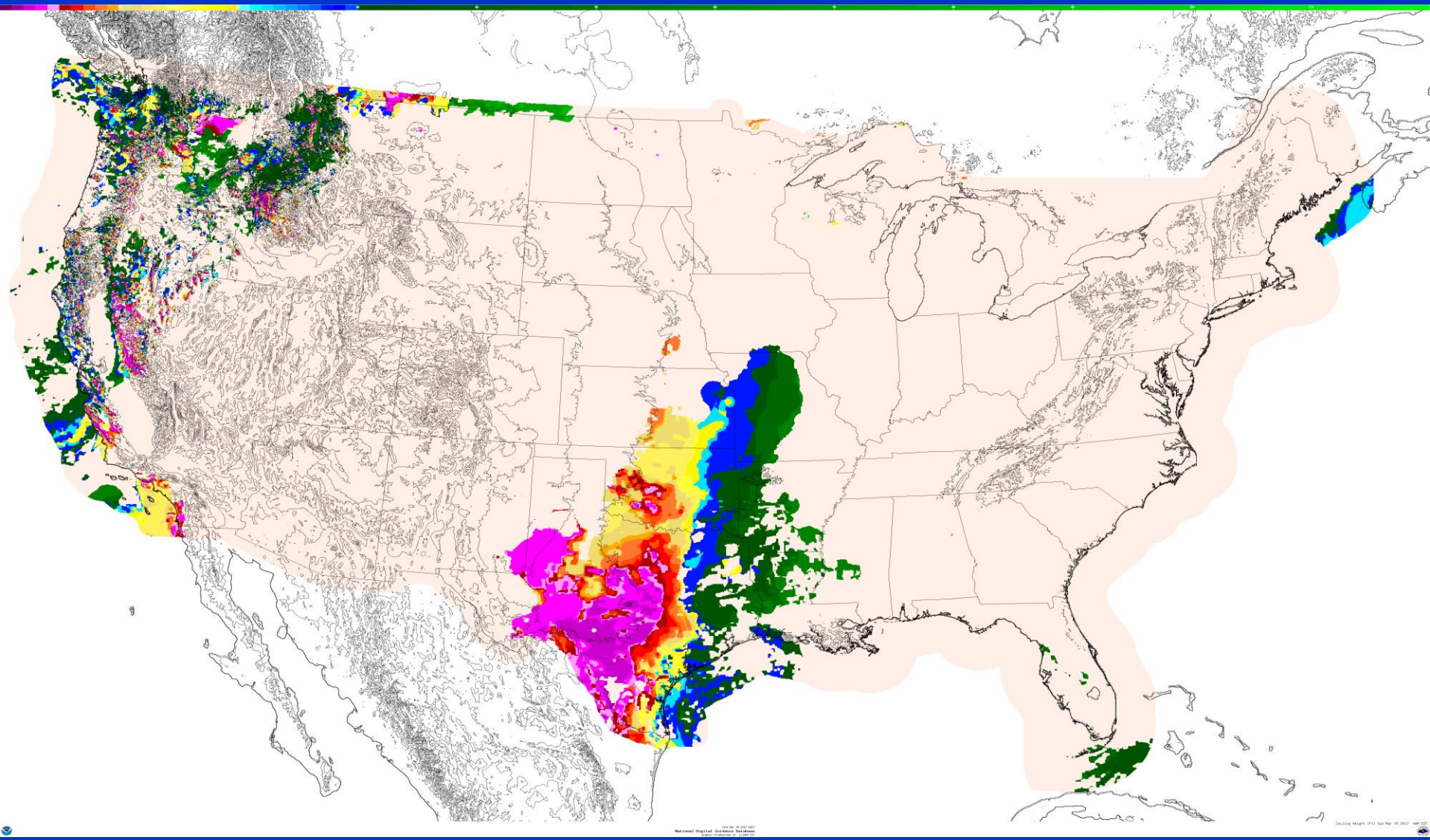
ALTERNATE DECISION METHOD

- Instead of just combining types, assure ceiling is also forecast and use the height of the ceiling height rather than the heights from the types
  - Leaves total ceiling forecast untouched, and divides it into components

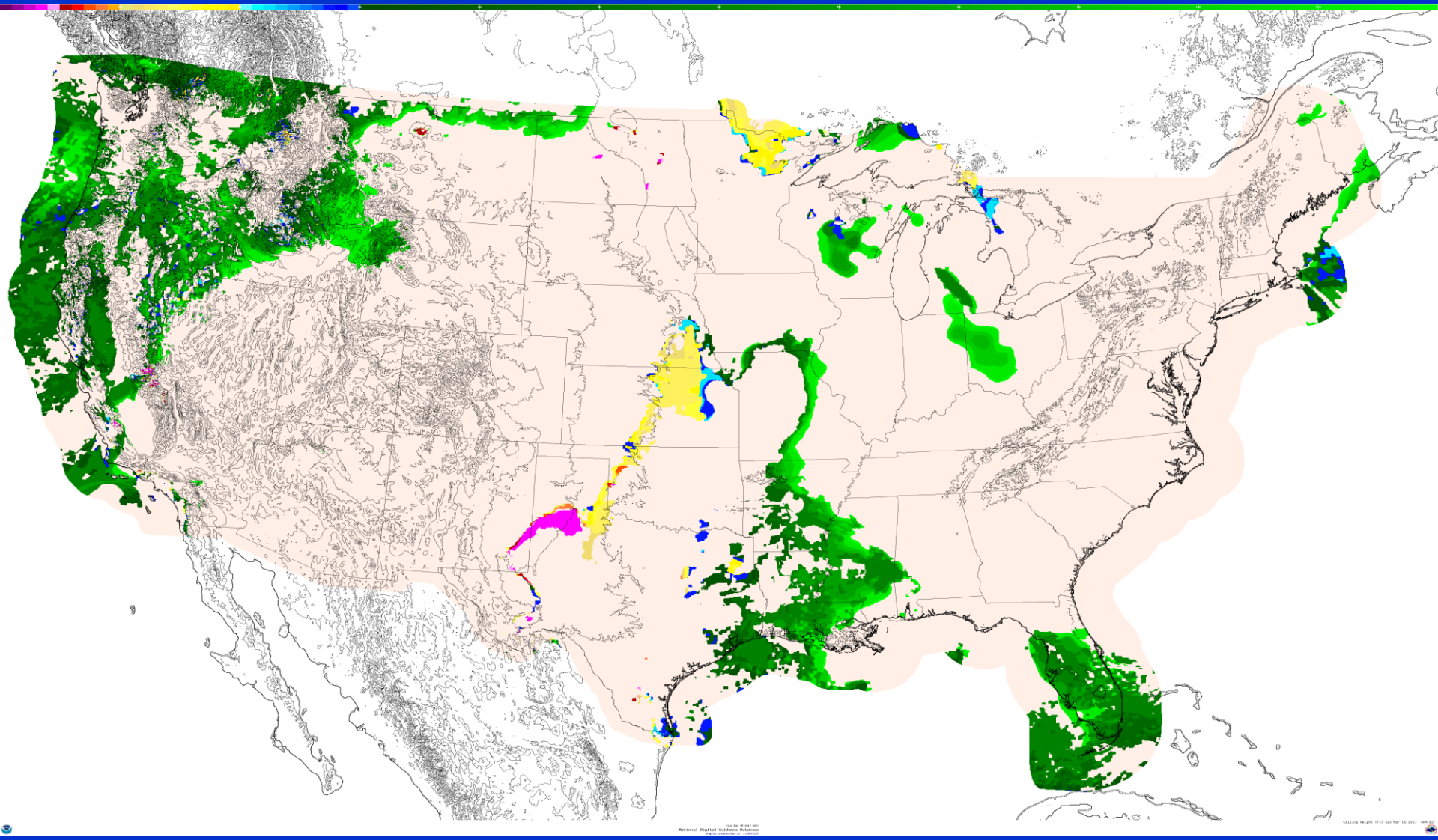
TOTAL OBSCURED, WITH CEILING



OVERCAST, WITH CEILING, BUT NOT OBSCURED



BROKEN (CEILING, BUT NOT OBSCURED OR OVERCAST)



SUMMARY AND CONCLUSIONS

- Demonstrated LAMP/HRRR Meld can provide guidance out to 36 hours to support the International TAF
- LAMP/HRRR Meld process shows promise to provide cloud layer bases for guidance for the TAF
  - Obscured, Broken, Overcast
  - Few/Scattered

SUMMARY AND CONCLUSIONS

- Direct forecasting of ceiling height better than a combination of obscuration, broken, and overcast.
- Breaking ceiling into components gave better results.
- More specific model output is needed for results to be improved substantially.
- Still a work in progress, but results are encouraging.