Using Cloud-to-Ground Lightning Climatologies to Initialize Gridded Lightning Threat Forecasts for East Central Florida

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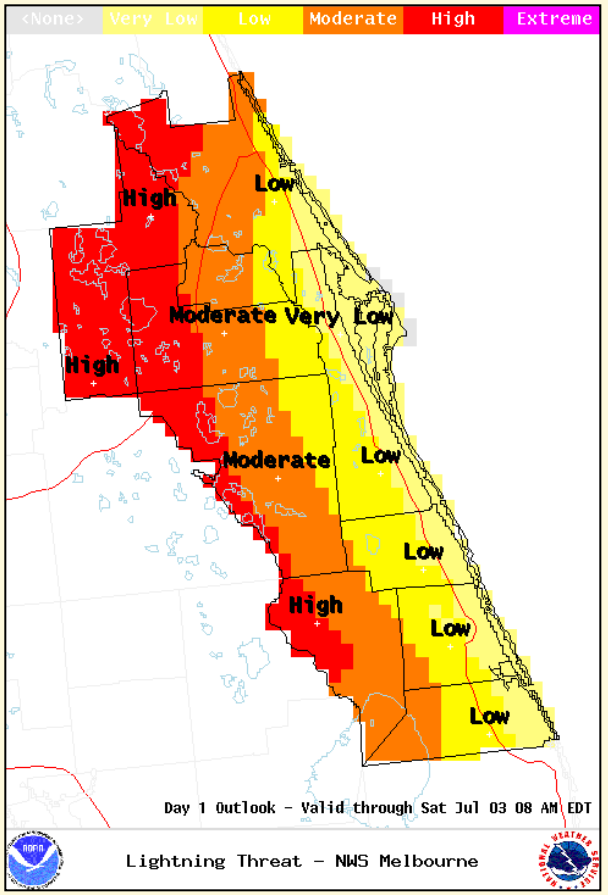
Current Lightning Threat Index

- Cloud-to-Ground (CG) Lightning Threat Index Map at NWS Melbourne
  - Issued daily at 1200 UTC
  - 5 color-coded threat levels at 5 x 5 km
    - Probability of thunderstorm occurrence
    - Expected amount of CG activity
- Created manually on AWIPS/GFE from a blank field
- Current map based on subjective assessment based on distribution of thunderstorm formation parameters

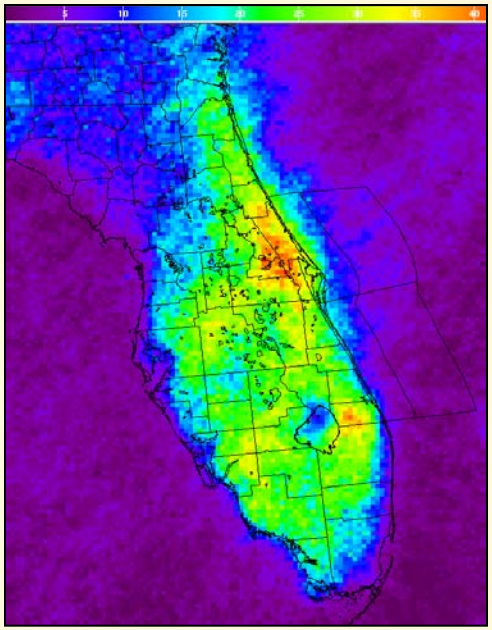


Lightning Threat Indices

- Threat levels in map depend on
  - Probability of thunderstorm occurrence
  - Expected amount of CG
- Ranges of probabilities and CG amounts within each level

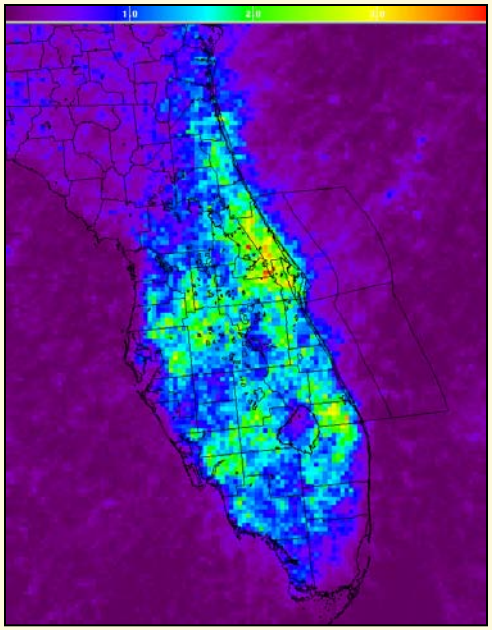
Threat Level	Threat Level Descriptions
Extreme	50% probability with excessive CG 60 - 70% probability with frequent CG 80 - 90% probability with occasional CG
High	30 - 40% probability with excessive CG 50% probability with frequent CG 60 - 70% with occasional CG
Moderate	10 - 20% probability with excessive CG 30 - 40% probability with frequent CG 50% probability with occasional CG
Low	10 - 20% probability with frequent CG 30 - 40% probability with occasional CG
Very Low	10 - 20% probability with occasional CG
None	No Threat

First Guess Threat Index Map



Climatological Probability of Lightning Occurrence

x



Climatological Number of Strikes

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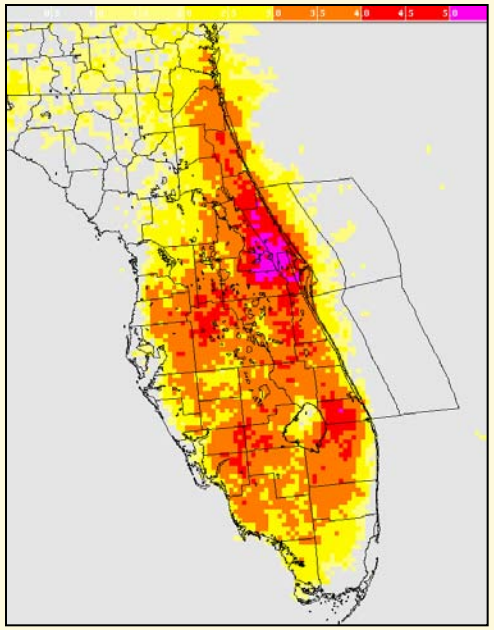
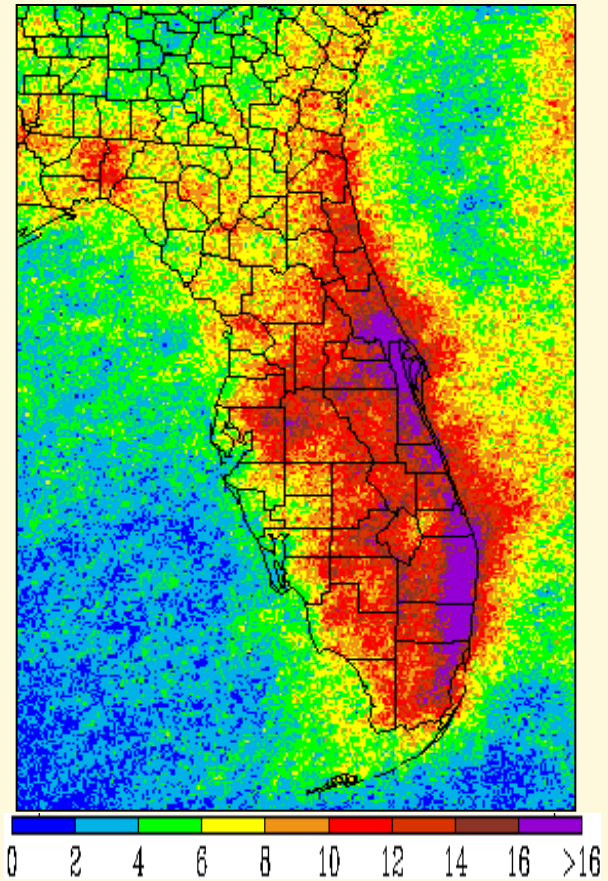


First Guess Lightning Threat Index Map

Motivation

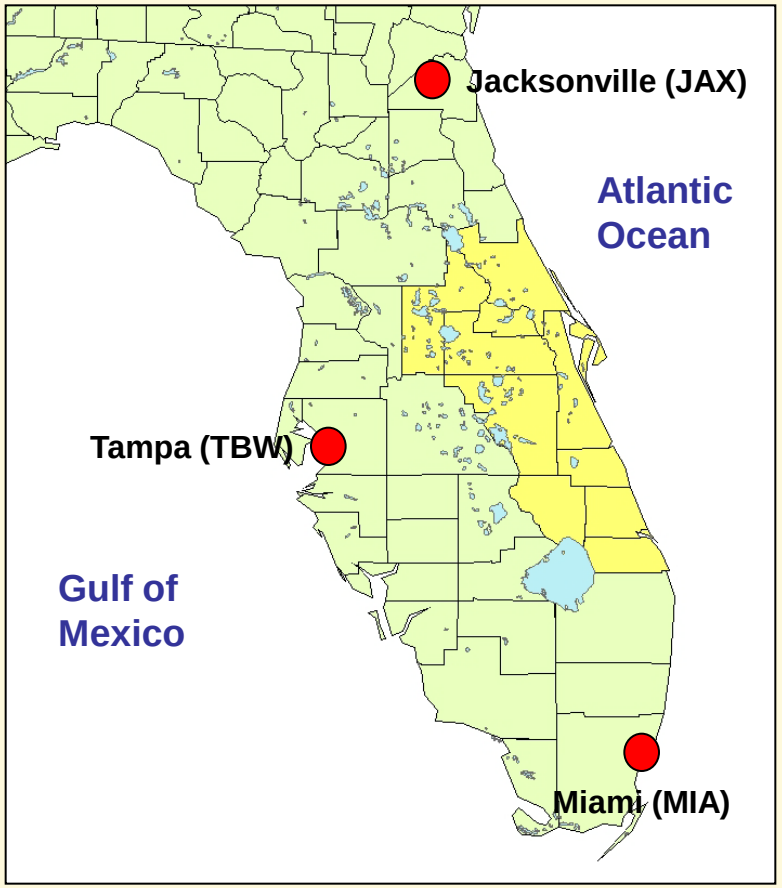
- NWS MLB requested climatologies of CG probability and amount to create first guess field
  - Increase efficiency
  - Improve consistency
- Climatologies stratified by synoptic flow regime and time intervals
  - Previous work shows connection between flow regime and CG occurrence
  - Increase time resolution of map to show threat for different time periods of the day

24-hour CG Probability for Southwest Flow (Stroupe 2003)



Flow Regimes

- 1000–700 mb average wind direction 1200 UTC soundings at MIA / TBW / JAX
- Combination of 3 directions determined flow regime
- 7 flow regimes:
  1) Ridge south of MIA
  2) Ridge btwn MIA/TBW
  3) Ridge btwn TBW/JAX
  4) Ridge north of JAX
  5) Ridge over Florida Panhandle
  6) Northwest flow
  7) Northeast flow

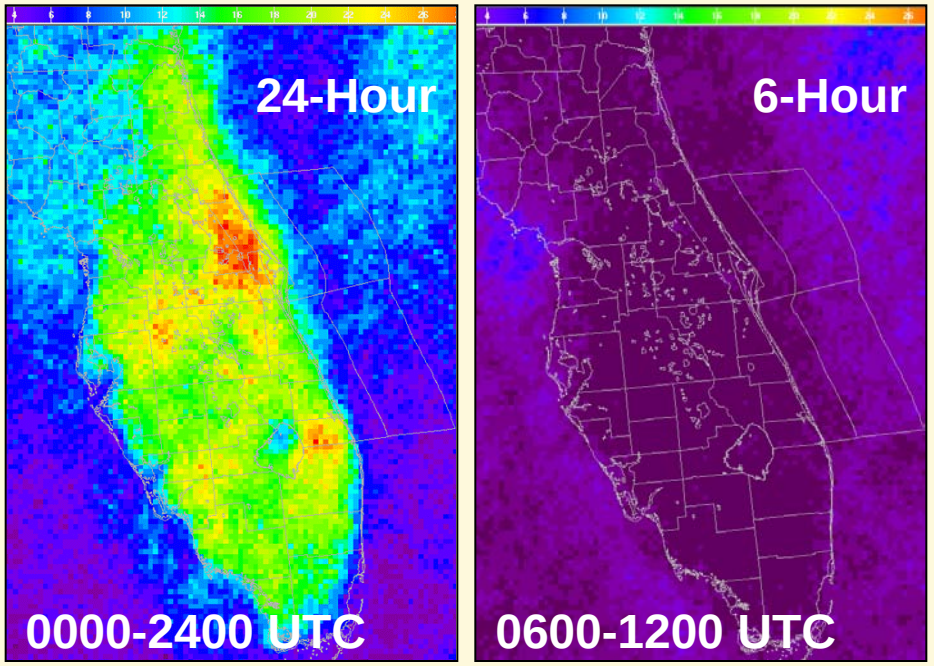


Data

- Warm season (May – September) 1989 – 2004
- Previous studies at Florida State University (FSU) and NWS Tallahassee (TAE) with similar goals
- FSU and NWS TAE provided:
  - Lightning data grids
    - Created from NLDN data
    - Hourly CG counts on 2.5 x 2.5 km grid
    - Covers state of Florida and adjacent waters
  - Flow regime dates of occurrence
  - Code to read and process lightning grids

Climatologies

- Stratified gridded CG data
  - By daily flow regime
  - 24- and 6-hour intervals
- Calculated values for each 2.5 x 2.5 km grid box
  - Probability of CG occurrence per regime
  - Mean number of CG strikes per regime



Probability of CG Occurrence

Climatologies

- Stratified gridded CG data
  - By daily flow regime
  - 24-, and 6-hour intervals
- Calculated values for each 2.5 x 2.5 km grid box
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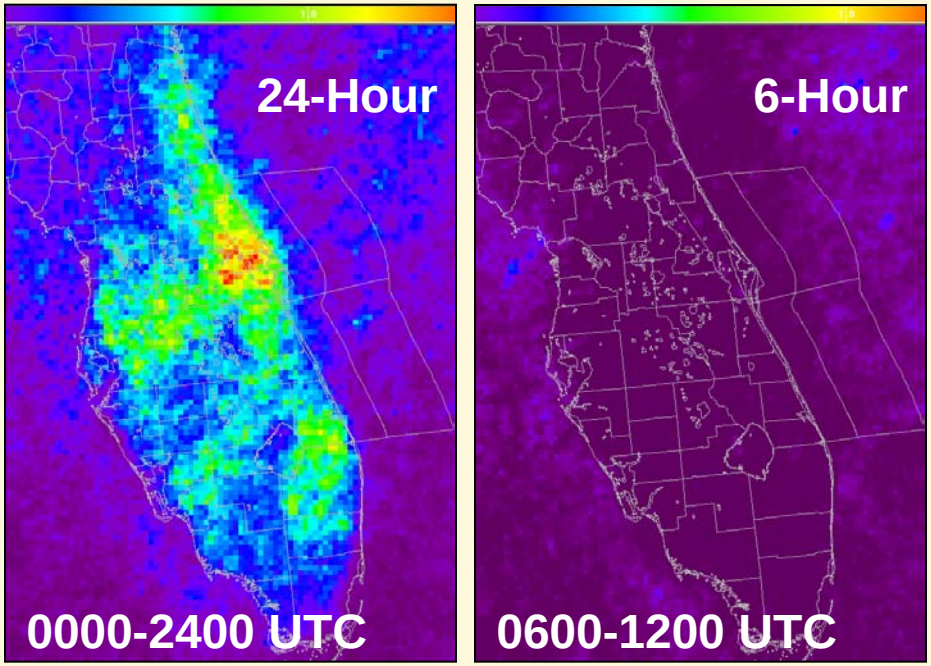
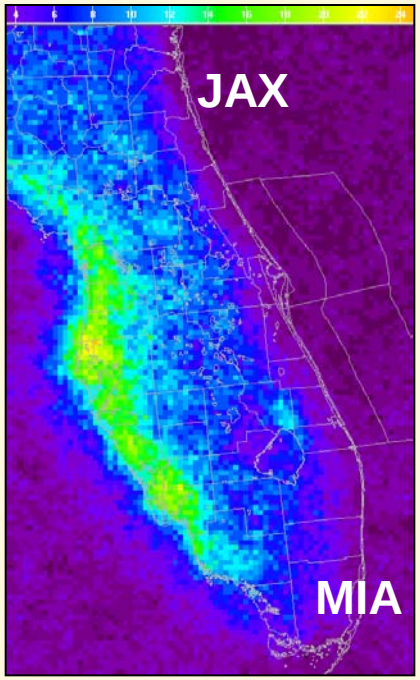
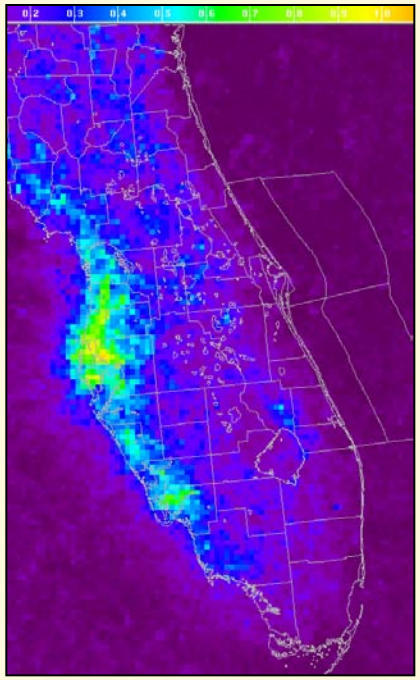
  - Mean number of CG strikes per regime



Mean Number of CG Strikes

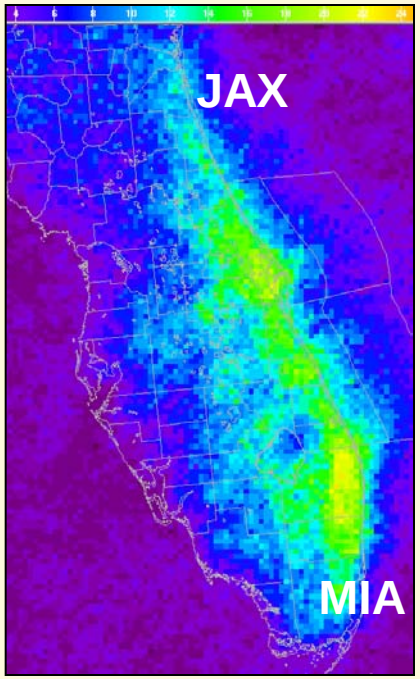
Flow Regime Differences
1800-2400 UTC

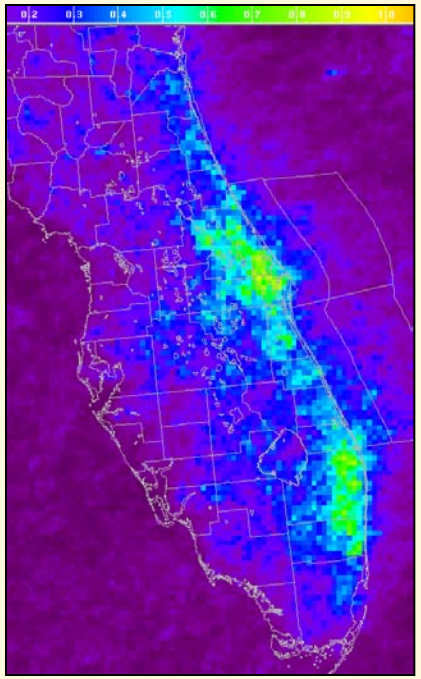




Probability # Strikes

Ridge North of JAX (E – SE flow)





Probability # Strikes

Ridge South of MIA (W – SW flow)

Future Work and Summary

- Future work (AMU tasking meeting 6 March):
  - Use offset time intervals (e.g. 1500–0300 UTC)
  - Consider strength of flow
  - Stratify by month as more data are collected over time
- Created gridded climatologies of CG probabilities and number of strikes stratified by
  - Large scale flow regime
  - 24- and 6-hour time intervals
- Used to create a first-guess lightning threat index map

Lightning Threat Map: http://www.srh.noaa.gov/mlb/ghwo/lightning.shtml

AMU Website: http://science.ksc.nasa.gov/amu