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New Advances in Lightning Forecasting from WFO Grand Junction

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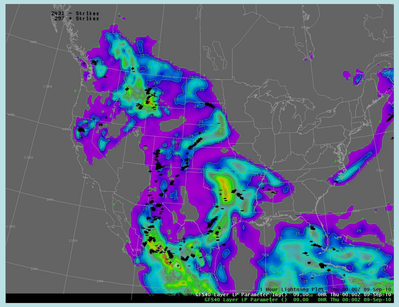
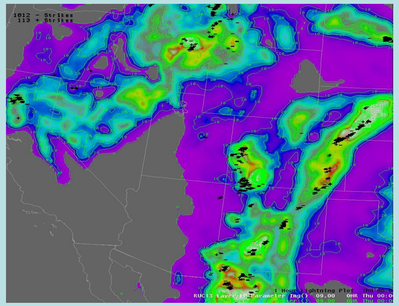
Improved Lightning Forecasts
Why is it Needed?

- Leading Weather Related Killer in Colorado
  - Casualties due to seemingly benign isolated short-lived thunderstorms over mountain tops (Hodanish, et al., 2004)
  - Lightning strike survivors may experience lifelong debilitating injuries
- Planning for Outdoor Activities
  - Recreation (hiking, skiing, boating, golfing, etc.)
  - Impacts on business (e.g. white-water rafting, ski industry)
  - Outdoor work
- Wildland Fires – Allocation of resources with respect to lightning
- Aviation – Economic costs related to thunderstorm delays

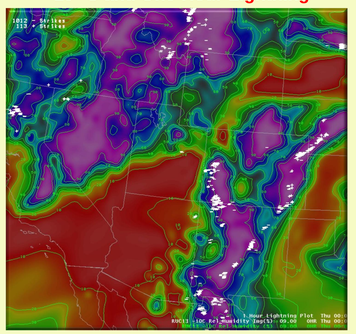


GFS40 – Methodology works for the CONUS

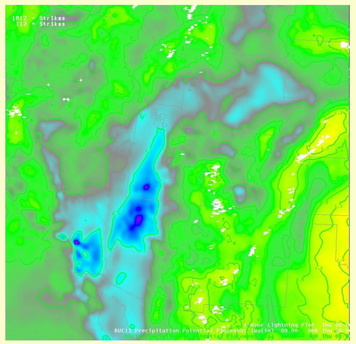


RUC13 – Works well; although not perfect (e.g. NE Nevada, North Central Colorado)

RUC13 Analysis: Relative Humidity at -10° C and One-Hour Lightning



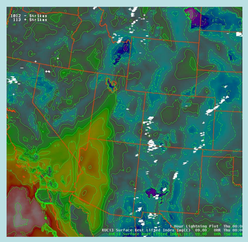
Dominant effect on charge transfer and RH: Ice crystal growth is greatest at -15° C ± 3° C
- Berdeklis and List, 2001



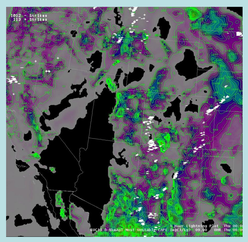
For Thunderstorms: Forecasters focus on lower-level moisture

RUC 13 Analysis of Precipitation Potential Placement (the product of 0-3 km relative humidity and precipitable water) and One-Hour Lightning (white hash marks)

Best Lifted Index



Most Unstable CAPE

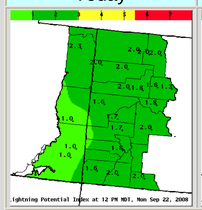
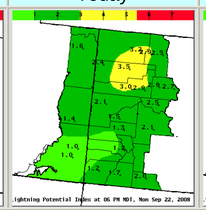
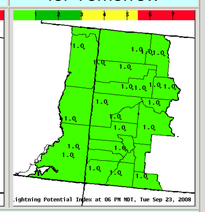


No strong correlation between lightning and instability parameters

Example from the LPI web page:
weather.gov/gjt?n=lightningpotentialindex

Lightning Potential Index

The **Lightning Potential Index** (LPI) provides graphical guidance on the potential of lightning for a 48 hour period beginning at 9 AM on the first day. The 48 hour period is broken down into three periods and are defined as follows: The first chart is for the 9 AM to 3 PM period; the second chart is for the 3 PM to 9 PM period, and the third chart will contain an outlook for the next day and is expected to be used for general planning purposes during the afternoon hours. These charts are generated once a day, normally around 12 AM.

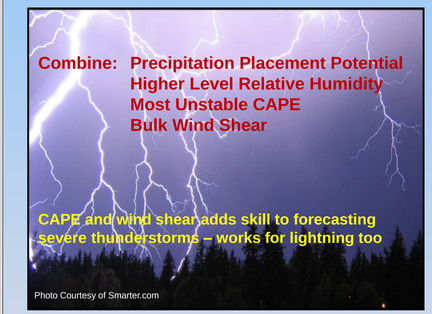
9 AM to 3 PM	3 PM to 9 PM	Outlook
Today	Today	for Tomorrow
		

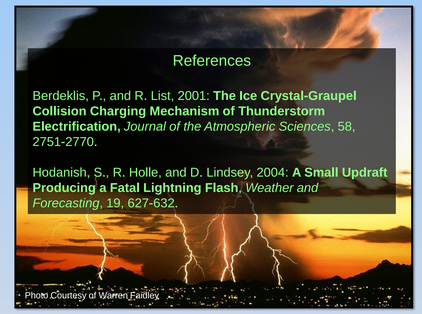
Please Click on the Images for a larger view

Link to website

Color Key and Explanation

Low Risk	The lightning threat may either be negligible or low. Isolated thunderstorms may occur, but the probability of thunderstorms is low.
Moderate Risk	The lightning threat is considered moderate. Isolated thunderstorms are expected within the green area.
High Risk	The lightning threat is considered high. Expect scattered thunderstorms within the yellow area. Plan accordingly, as there is a high probability of lightning in the yellow area. Be aware of lightning safety guidelines.
Extreme Risk	Lightning in the red area will occur. Practice lightning safety, as the threat of lightning is imminent.





TALKING POINTS

- Moisture is the most important element in thunderstorm forecasting, with higher level relative humidity given added weight
- If moisture is present, all that is needed is instability
- The magnitude of any instability parameter (e.g. lifted index) is a poor lightning predictor

FUTURE WORK

- Defining the area of instability (e.g. elevated instability, etc.)
- Evaluate lightning risk categories (Low, Moderate, High, Extreme) for societal impacts