REMOVAL OF LIGHTNING ACTIVITY LEVEL & HAINES INDEX

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

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Much of this presentation based on content presented to Incident Meteorologists in 2024
by National Wildfire Coordinating Group Fire Weather Chair Darren Clabo, PhD & Vice Chair Jim Wallman (Former NWS IMET)

Removing the Haines Index and LAL from Fire Weather Forecasts

Darren Clabo, PhD

South Dakota State Fire Meteorologist

Chair, NWCG Fire Weather Subcommittee

Jim Wallmann

NICC Predictive Services Meteorologist

Vice Chair, NWCG Fire Weather Subcommittee

IMRR - 3/6/2024

IMET CEE - 3/15/2024

NATIONAL WILDFIRE COORDINATING GROUP

NICC
National Interagency Coordination Center

SOUTH DAKOTA MINES
An engineering, science and technology university

NWCG
National Wildfire Coordinating Group

National Wildfire Coordinating Group Timeline

- **Beyond 10 years ago, even since inception:** Haines Index (HI) recognized as inadequate.
- **Past 5-10 years:** Monthly to annual discussions on the issues with both HI and Lightning Activity Level (LAL) within the NWCG Fire Weather Subcommittee
- **Past 5 or so years:**
  - Focused effort by Fire Weather Subcommittee on addressing the issues with HI/LAL
  - Documentation of **why these products need to be removed**
    - Thorough review of the state-of-the-science
    - Integrated work within USFS, NWS, and University Subject Matter Experts

BACKGROUND: “BYE” to HI, and “LOL” to LAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

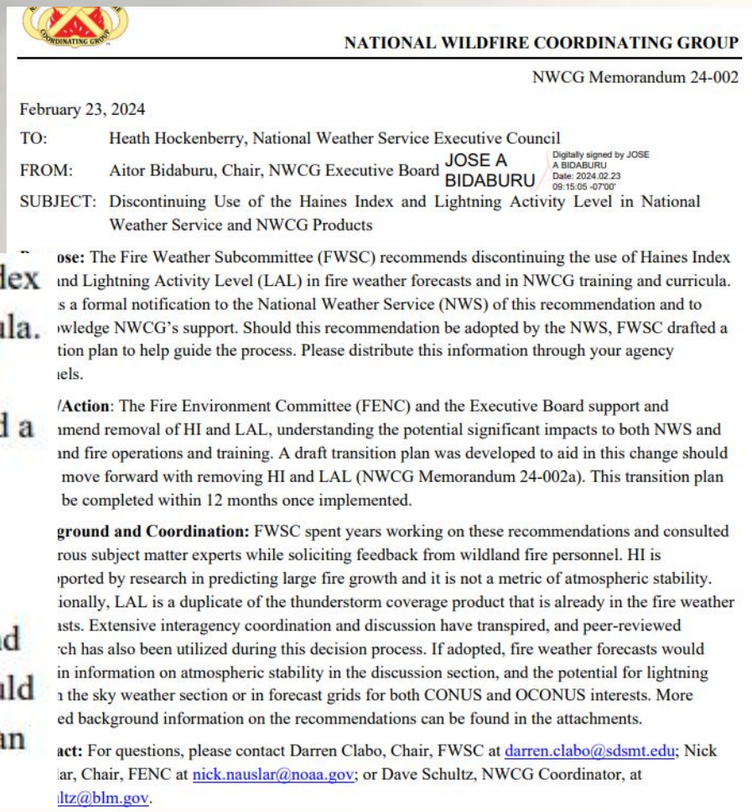
NWCG
National Wildfire Coordinating Group

National Wildfire Coordinating Group Timeline

- **Last Year: NWCG Memorandum issued**

Purpose: The Fire Weather Subcommittee (FWSC) recommends discontinuing the use of Haines Index (HI) and Lightning Activity Level (LAL) in fire weather forecasts and in NWCG training and curricula. This is a formal notification to the National Weather Service (NWS) of this recommendation and to acknowledge NWCG’s support. Should this recommendation be adopted by the NWS, FWSC drafted a transition plan to help guide the process. Please distribute this information through your agency channels.

Issue/Action: The Fire Environment Committee (FENC) and the Executive Board support and recommend removal of HI and LAL, understanding the potential significant impacts to both NWS and wildland fire operations and training. A draft transition plan was developed to aid in this change should NWS move forward with removing HI and LAL (NWCG Memorandum 24-002a). This transition plan could be completed within 12 months once implemented.



NATIONAL WILDFIRE COORDINATING GROUP

NWCG Memorandum 24-002

February 23, 2024

TO: Heath Hockenberry, National Weather Service Executive Council

FROM: Aitor Bidaburu, Chair, NWCG Executive Board JOSE A BIDABURU Digitally signed by JOSE A BIDABURU Date: 2024.02.23 09:15:05 -07'00'

SUBJECT: Discontinuing Use of the Haines Index and Lightning Activity Level in National Weather Service and NWCG Products

ose: The Fire Weather Subcommittee (FWSC) recommends discontinuing the use of Haines Index nd Lightning Activity Level (LAL) in fire weather forecasts and in NWCG training and curricula. s a formal notification to the National Weather Service (NWS) of this recommendation and to wledge NWCG’s support. Should this recommendation be adopted by the NWS, FWSC drafted a tion plan to help guide the process. Please distribute this information through your agency els.

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ground and Coordination: FWSC spent years working on these recommendations and consulted rous subject matter experts while soliciting feedback from wildland fire personnel. HI is ported by research in predicting large fire growth and it is not a metric of atmospheric stability. ionally, LAL is a duplicate of the thunderstorm coverage product that is already in the fire weather asts. Extensive interagency coordination and discussion have transpired, and peer-reviewed ch has also been utilized during this decision process. If adopted, fire weather forecasts would in information on atmospheric stability in the discussion section, and the potential for lightning the sky weather section or in forecast grids for both CONUS and OCONUS interests. More ed background information on the recommendations can be found in the attachments.

act: For questions, please contact Darren Clabo, Chair, FWSC at darren.clabo@sdsmt.edu; Nick ar, Chair, FENC at nick.nauslar@noaa.gov; or Dave Schultz, NWCG Coordinator, at ltz@blm.gov.

BACKGROUND: “BYE” to HI, and “LOL” to LAL

NWCG
National Wildfire Coordinating Group

National Wildfire Coordinating Group Timeline

- **This Year: Haines Index and Lightning Activity Level are no longer in NWS Fire Weather products.**

BACKGROUND ON HAINES INDEX REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

Most of these Haines Index slides based on content presented to Incident Meteorologists in 2024 by National Wildfire Coordinating Group Fire Weather Chair Darren Clabo, PhD and Vice Chair Jim Wallmann (former IMET)

Removing the Haines Index and LAL from Fire Weather Forecasts

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BACKGROUND ON HAINES INDEX REMOVAL

March 3, 2025

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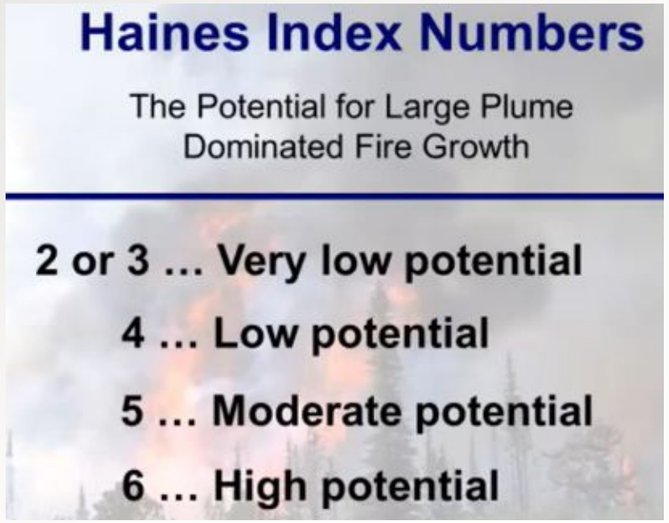
HAINES INDEX (originally known as the Lower Atmospheric Severity Index) was developed by USFS Meteorologist Don Haines in 1988.

- Combines knowledge of the temperature lapse rate and atmospheric dryness to produce a number related to the potential for large fire growth.
- 1, 2, or 3 for lapse rate + 1, 2, or 3 for atmospheric dryness. Add the two terms together for a Haines "score" of 2 to 6.
- The problem: We have known for over 20 years that **Haines Index does not adequately represent conditions conducive to large fire growth - and whether or not it could be plume-dominated.**

From S-290



BACKGROUND ON HAINES INDEX REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

HAINES INDEX ISSUES

- **Don Haines himself said it was incomplete/shouldn't be used operationally!**
- **Does not include wind.** Haines identified this as a huge drawback that would need to be addressed (perhaps added as a third term). It never was. Wind is a MAJOR factor for whether large fire growth occurs.
- **Not actually a measure of instability** - at best, it oversimplifies instability, using two specific pressure levels instead of whole picture/atmospheric column. Which levels used, itself is arbitrary and problematic. Remember, it was called the Lower Atmosphere Severity Index, not Stability Index!
- Oddly enough, even the threshold used to reach "3 out of 3" for the lapse rate in the Haines Index is still inherently stable! The ranges used were arbitrary. Not scientific.

BACKGROUND ON HAINES INDEX REMOVAL

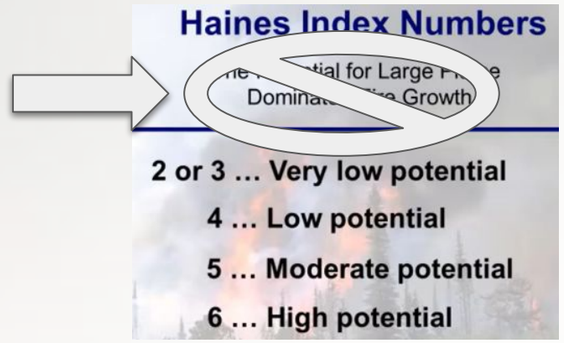
March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

HAINES INDEX ISSUES

- It was **based upon biased data** (i.e. focused on closest radiosonde/weather balloon soundings from late day/00Z, corresponded it to fire activity that day, AND the data that was collected by Don Haines was via USFS personnel who happened to respond for their most active fire days; regionally biased and not-at-all random). **Not predictive.**

- Also, Haines himself **never related it to "plume dominated" fires.** Despite that, Haines Index has been a forecast element for many years now, and implied as a tool for assessing whether fires may become plume-dominated.

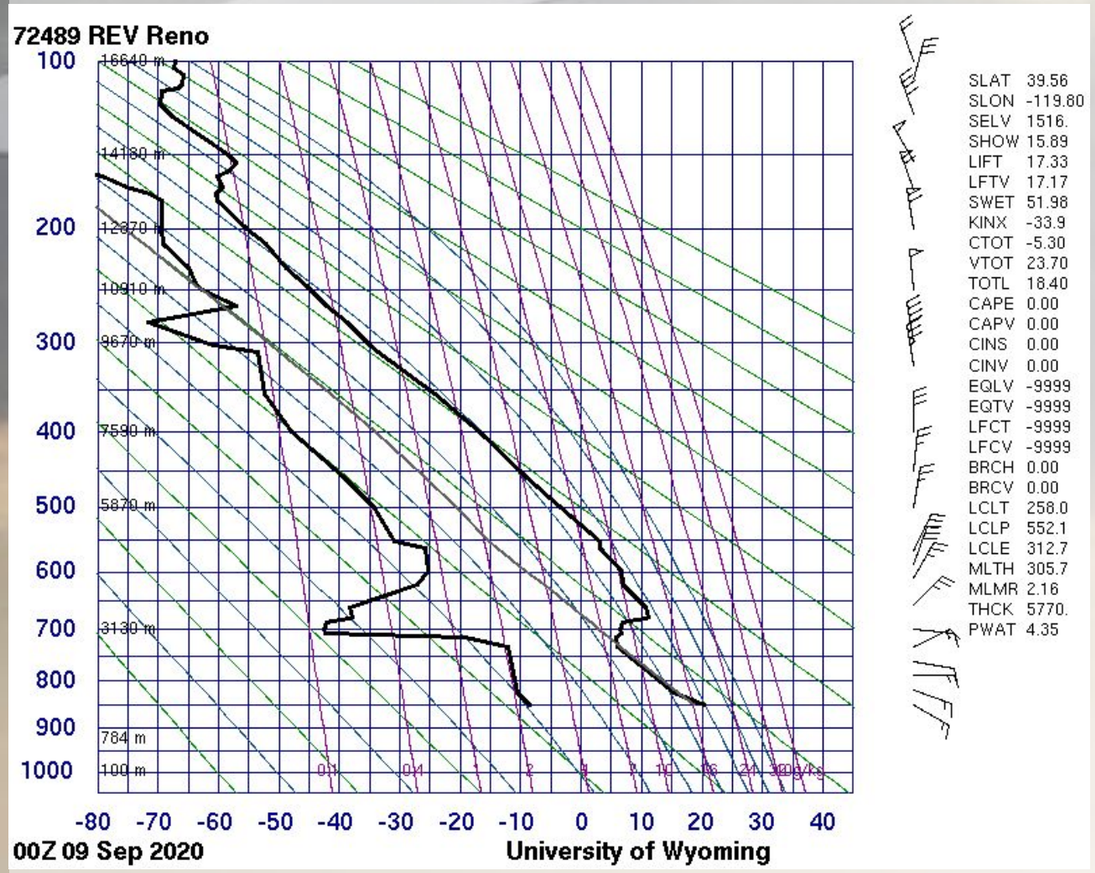


BACKGROUND ON HAINES INDEX REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

Example: Bear Fire (North Complex 2020), California



North Complex Incident General Weather Outlook

For Planning Purposes Only, see the IAP for the Official Forecast

Made Mon, Sep 7th, 2020 - IMET [redacted] For Elevation 5,500 feet

	Mon	Tue	Wed	Thu	Fri	Sat
	7-Sep	*8-Sep*	*9-Sep*	*10-Sep*	*11-Sep*	*12-Sep*
Clouds @ 1600 (%)	0	0	0	0	0	0
5500FT Max Temp (F)	92	80	85	87	88	91
Min Humidity (%)	13	11	10	13	16	14
RH Recovery (%)	35	30	25	45	45	45
Peak Wind Direction	W	NE	E	SW	SW	SW
Ridge Wind (mph)	13	20G35	10	10	10	10
Mixing Height (kft)	14	8	11	12	12	12
LAL	1	1	1	1	1	1
Haines Index	4	4	4	4	5	5
Air Quality (Quincy)	Unhealthy	Good	Good	USG	USG	USG

KEY:	Moderate Burning Conditions	se Caution: Near Critical	Critical Burning Conditions
Clouds @ 1600L	> 31 %	15 to 30 %	< 15 %
4500ft Max Temp	< 75 F	75 to 80 F	> 81 F
Min Humidity	> 25 %	20 to 25 %	< 20 %
RH Recovery	>50%	30 to 50%	<30%
Peak Wind Direction	E, NE	NW, N	SE, S, SW, W
Sustained Ridge Wind	< 13 mph	13-17 mph	> 18 mph
Mixing Height	< 10 kft AGL	10kft to 15kft AGL	>15 kft
LAL	< 2	2	> 2

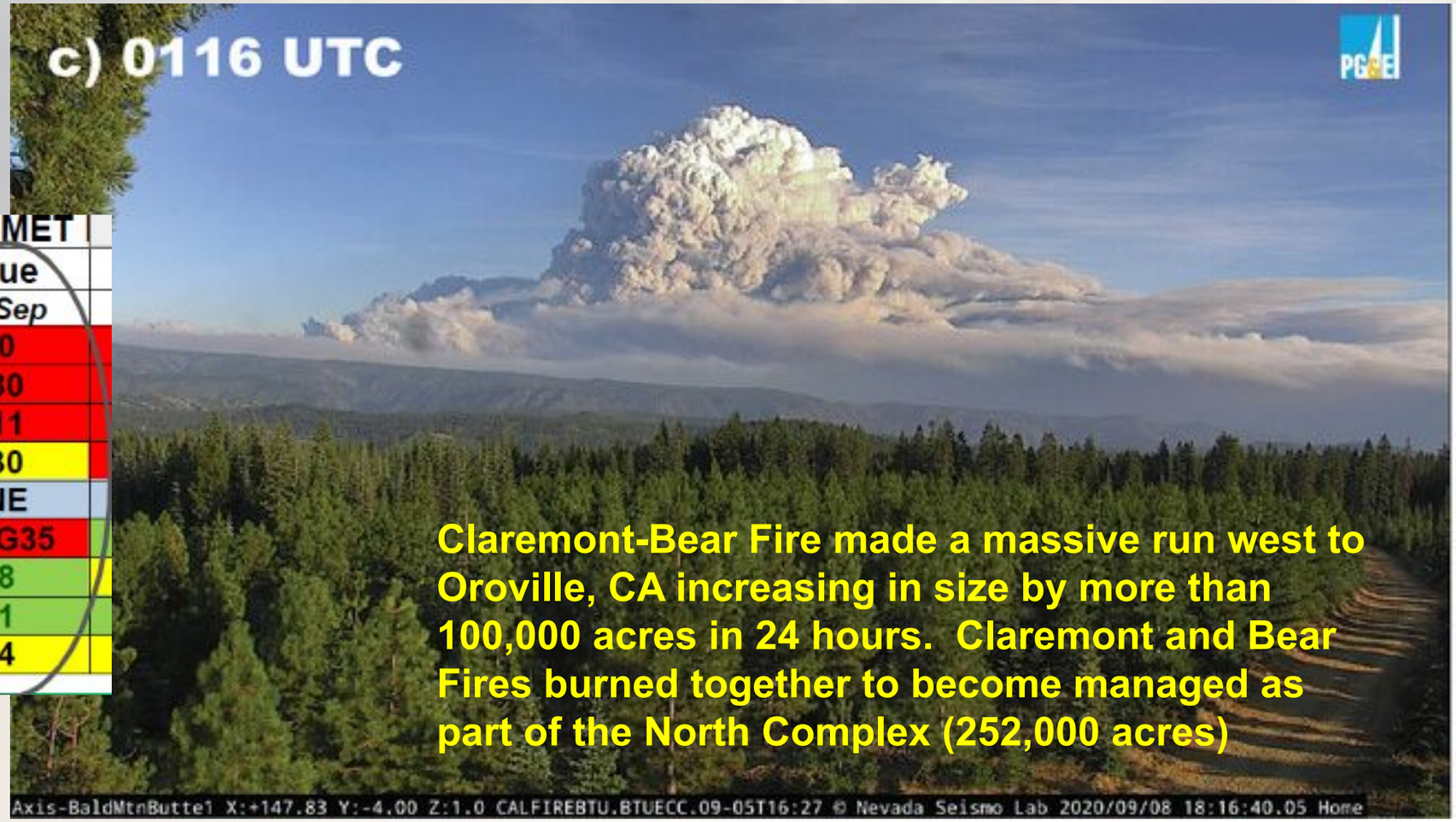
5 or more EXTREME blocks in a day equals the potential for a Critical Weather Day

BACKGROUND ON HAINES INDEX REMOVAL

2025 NY FIRE WEATHER PARTNERS MEETING

Example: Bear Fire (North Complex 2020), California

Made Mon, Sep 7th, 2020 - IMET		
	Mon	Tue
	7-Sep	*8-Sep*
Clouds @ 1600 (%)	0	0
5500FT Max Temp (F)	92	80
Min Humidity (%)	13	11
RH Recovery (%)	35	30
Peak Wind Direction	W	NE
Ridge Wind (mph)	13	20G35
Mixing Height (kft)	14	8
LAL	1	1
Haines Index	4	4



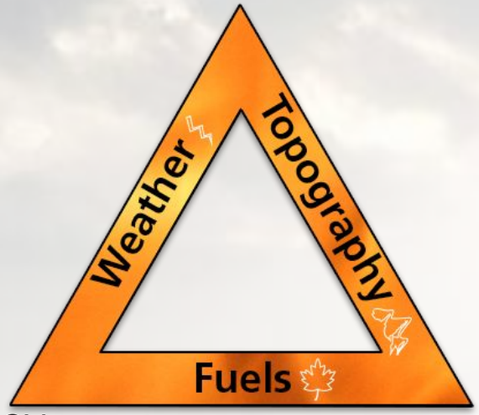
BACKGROUND ON HAINES INDEX REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

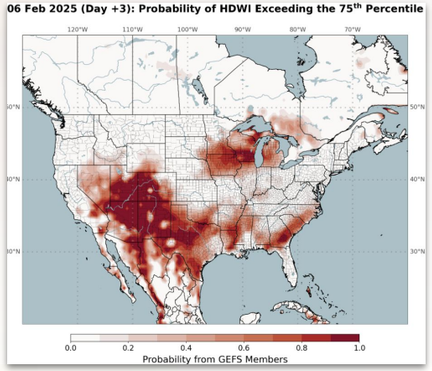
WHAT TO USE INSTEAD?

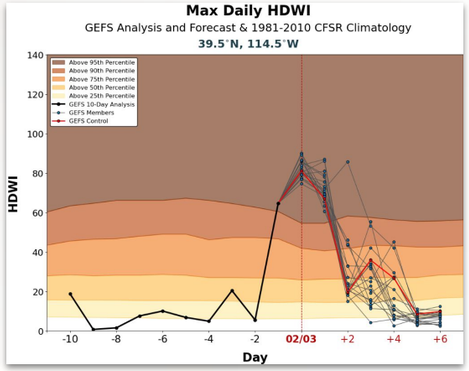
- **Back to the basics of Fire Triangle and Fire Weather**!
  (Wind + RH + Temp) + Fuels + Slope
  WIND especially! Both surface and transport winds.



NPS.GOV

- If you want a single index for situational awareness and some predictive value, **Hot-Dry-Windy Index (HDWI)** combines a lot of these weather parameters (but not fuels/topography). It does a good job of very simply expressing evaporation and drying of fuels. It's not a NWS product, but uses weather modeling and climatology amongst other things. https://hdwindex.fs2c.usda.gov/





BACKGROUND ON HAINES INDEX REMOVAL

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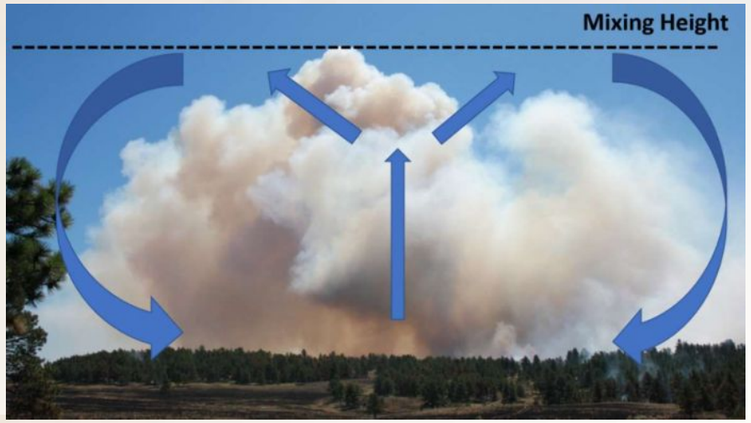
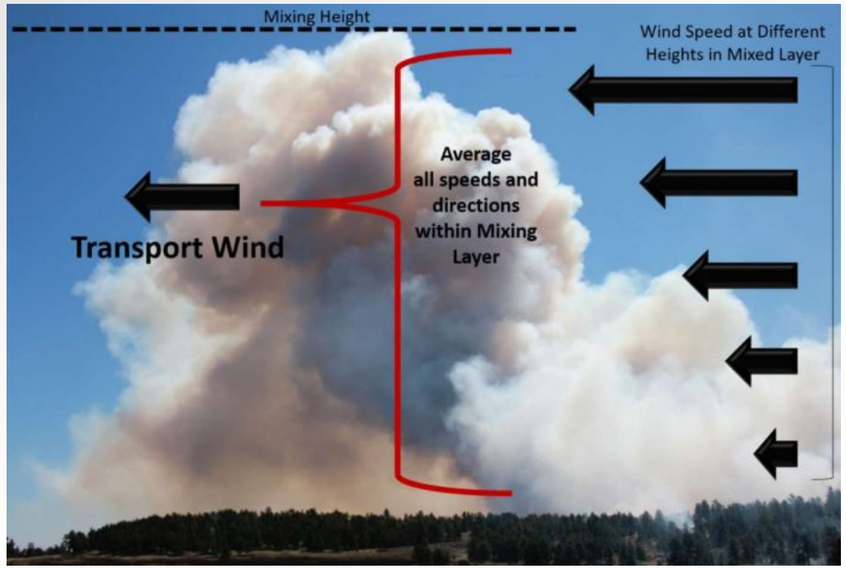
2025 NY FIRE WEATHER PARTNERS MEETING

WHAT TO USE INSTEAD?

- For Plume-dominated: That's NOT driven by temperatures/dryness ALOFT (i.e. Haines)! To get an UNSTABLE COLUMN/PLUME, you need a lot of heat from below. The basics - like fuel, like **Energy Release Component (ERC)** - determine that; ventilation as well.

- **Mixing Height** can be used to infer less stable conditions
  - Higher mixing heights associated with plume-dominated fires
  - Mixing height as stability metric currently under study
  - Also: Higher mixing heights usually increase transport winds





BACKGROUND ON LIGHTNING ACTIVITY LEVEL REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

LIGHTNING ACTIVITY LEVEL (LAL)

- A number, related to the precipitation & number of lightning strikes from thunderstorms
  - Originally was an **observation** for an input into National Fire Danger Rating System (NFDRS), but it is not used now
  - Was not designed to be a **“forecast”** but like Haines, it became a forecast element
  - Little skill exists in lightning forecasting (as in, number of strikes within X miles)

BACKGROUND ON LIGHTNING ACTIVITY LEVEL REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

LIGHTNING ACTIVITY LEVEL (LAL)

LALs (L)ightning (A)ctivity (L)evels numbered 1 through 6

LAL 1 - No thunderstorms.

LAL 2 - Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a 5 minute period.

LAL 3 - Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5 minute period.

LAL 4 - Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strinkstrikes minute period.

LAL 5 - Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5 minute period.

LAL 6 - Dry lightning (same as LAL 3 but without the rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with Red Flag Warning.

6 to 10 cloud-to-ground strikes? Within how many miles, or just visual? Wait, can we actually predict this?

BACKGROUND ON LIGHTNING ACTIVITY LEVEL REMOVAL

March 3, 2025

2025 NY FIRE WEATHER PARTNERS MEETING

WHAT TO USE INSTEAD

- Ultimately, Lightning Activity Level (LAL) is duplicate information
- Simply infer lightning risk via thunderstorm probability already produced by the NWS. That is, the chance and coverage of thunderstorms:
  - Example of Chance: Thunderstorms likely (70%)
  - Example of Coverage: Scattered thunderstorms (There will be hit-or-miss thunderstorms)

Thanks!

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