



FIRESTORM:

The Anatomy of a Southern Great Plains Wildfire Outbreak



"The wind hit and the prairie exploded in fire...an unnatural wind that blew shrapnel-like debris on the windows. I didn't think it was that close when actually, it was everywhere"
Linda Roy ~ Matador, Texas ~ 27 February 2011

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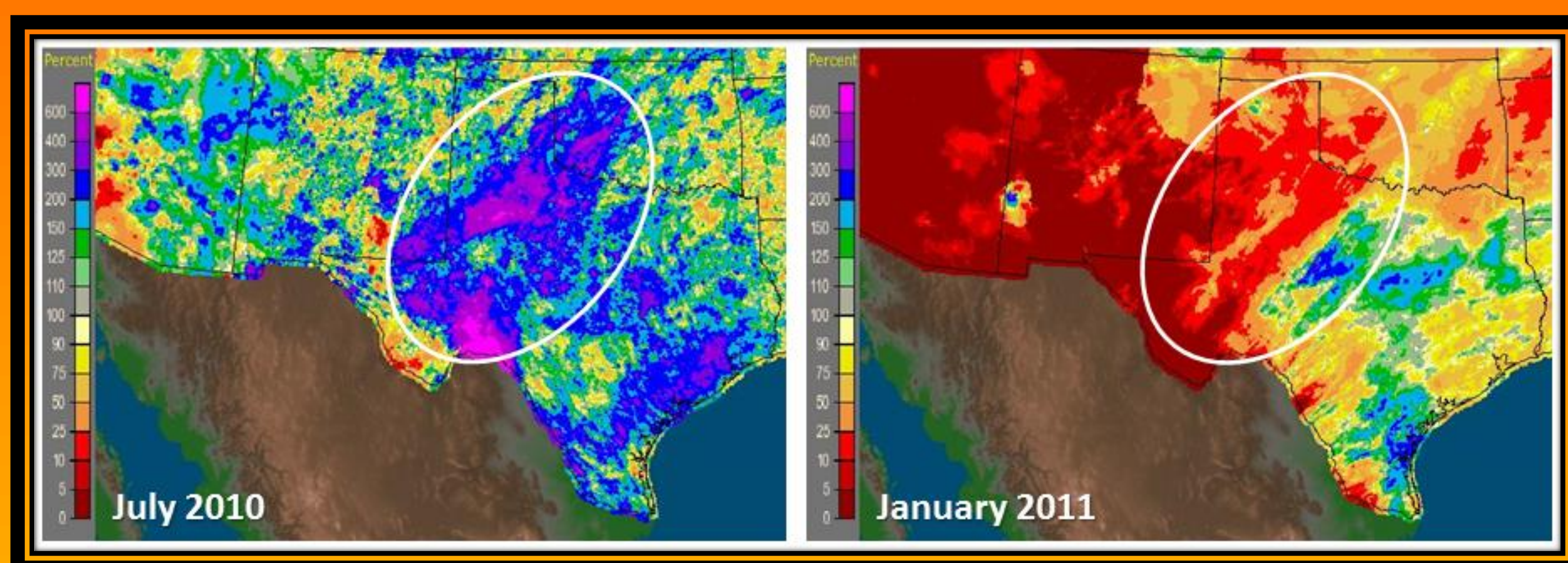
Bradley R. Smith

Texas A&M Forest Service – Longview, Texas

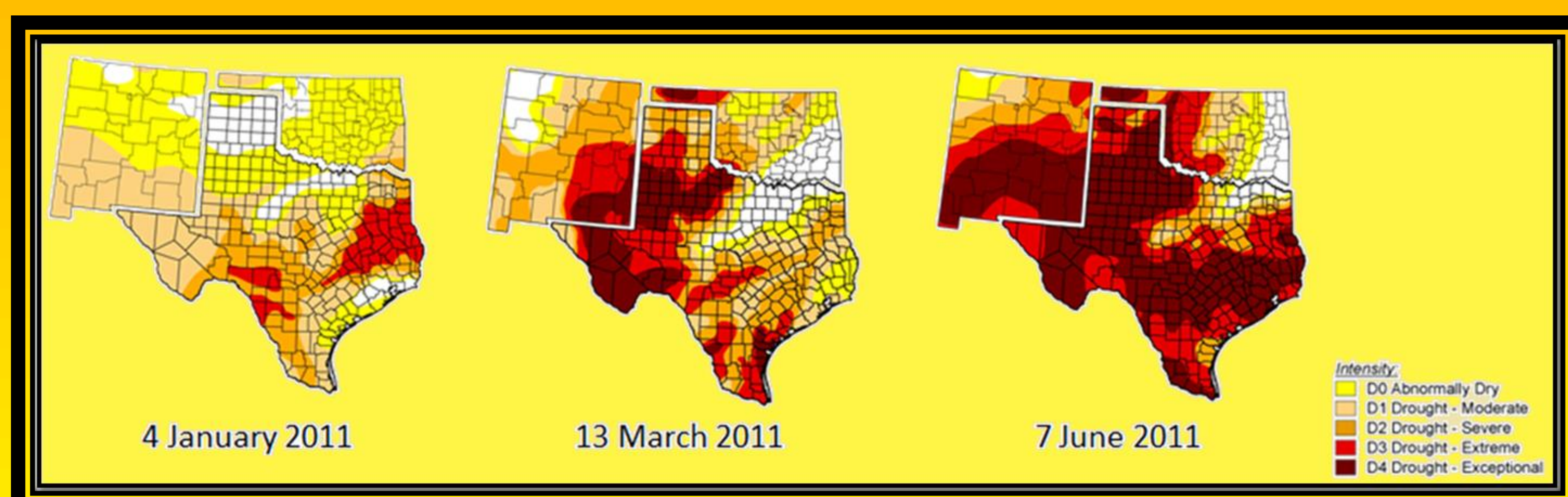
INTRODUCTION

- The grasslands of the southern Great Plains are vulnerable to widespread outbreaks of destructive wind-driven wildfires.
- Since 2005, a total of 18 southern Great Plains wildfire outbreaks (SGPWOs) have cumulatively burned 3.9 million acres (1.6 million ha), killed 27 people and injured more than 200.
- The Texas A&M Forest Service has referred to these outbreaks as “a force of nature” and “a perfect storm for extreme fire”, and has termed the most violent outbreaks “firestorms”.
- This study utilizes the seasonal climatic variability and its associated response within the southern Great Plains grass-dominated fuel regime observed prior to the historic 2011 Texas fire season and meteorological analyses of the 27 February 2011 “firestorm” to dissect the biophysical and atmospheric anatomy of a SGPWO.

SEASONAL VARIABILITY

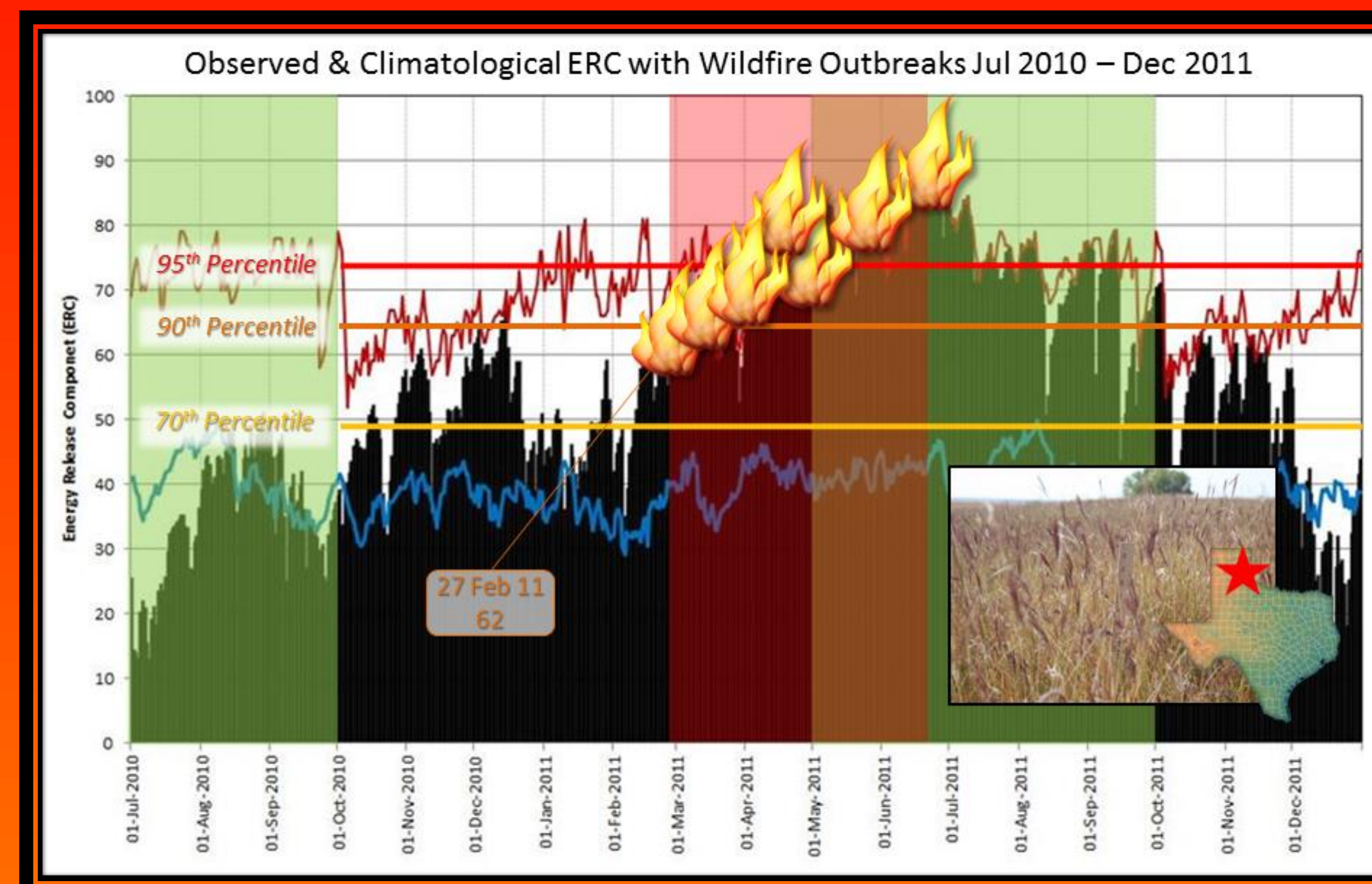


July 2010 precipitation totals were 200-400% of normal over the Great Plains of southeastern New Mexico, west Texas, and western Oklahoma, but the same areas received <25% of normal precipitation in January 2011.



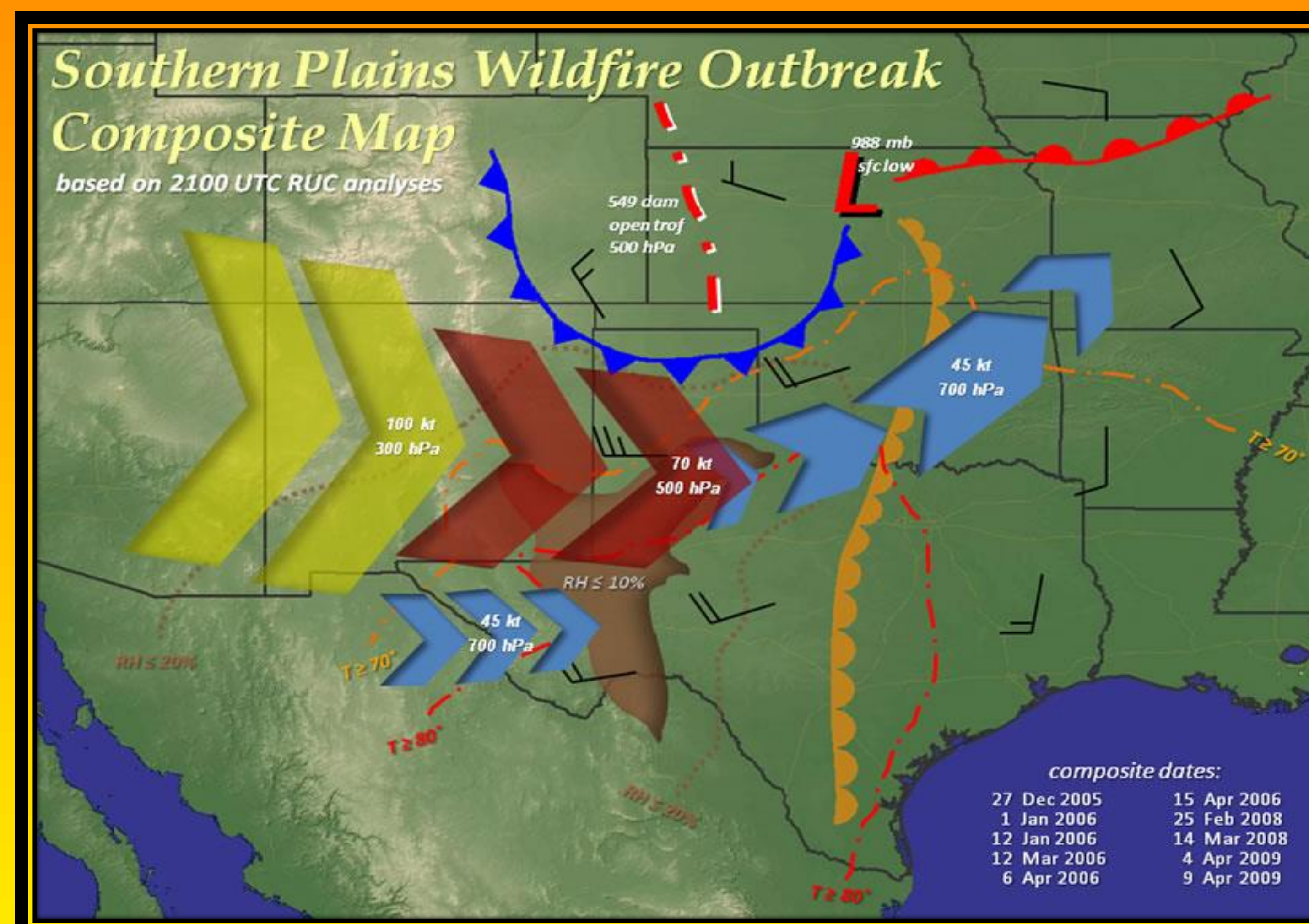
The progression of southern Great Plains drought during the winter and spring of 2011.

RESPONSE IN VEGETATIVE FUELS



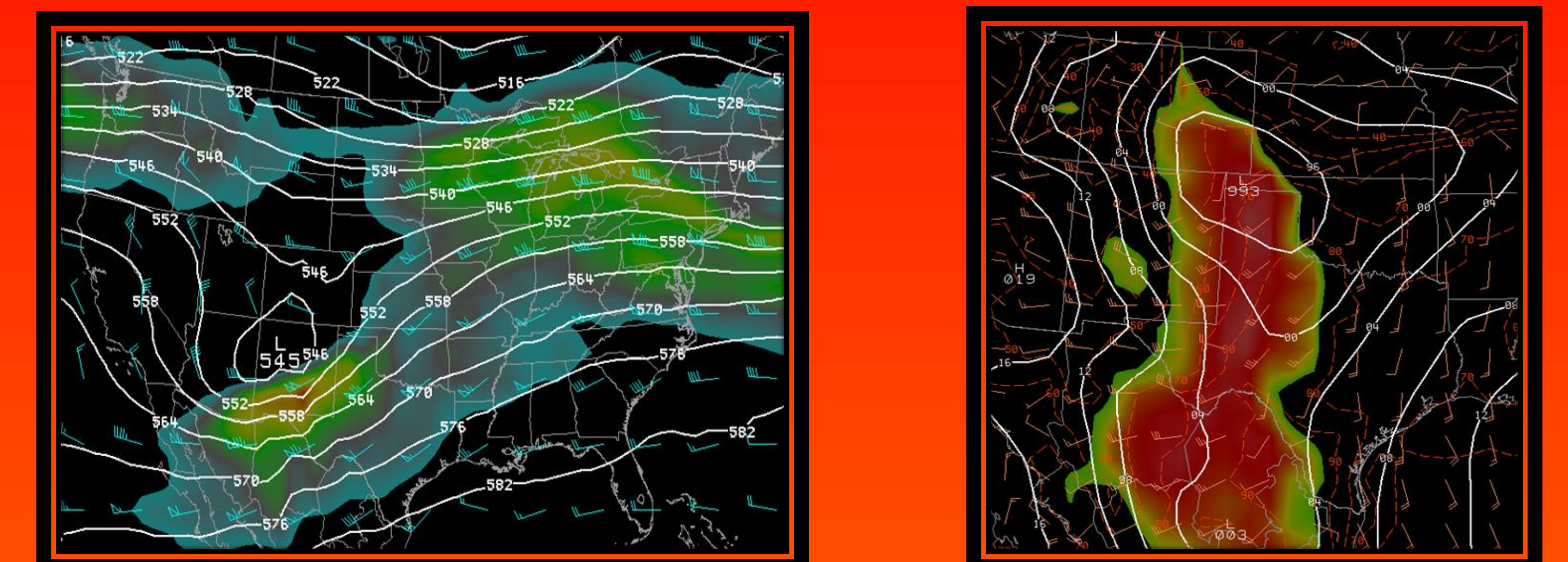
Daily Energy Release Component (ERC) in west Texas July 2010-December 2011 with climatological daily mean (blue) and maximum (red) values, and 20-y 75th percentile, 90th percentile, and 95th percentile rankings. The typical growing season (green shade) and range of 2011 SGPWOs (red shade) is shown. Individual SGPWO occurrences are indicated (fire icons) with the 27 February 2011 “firestorm” detailed. Insert shows typical fuel loads on the southern Great Plains of Texas in October 2010.

OUTBREAK CONCEPTUAL MODEL

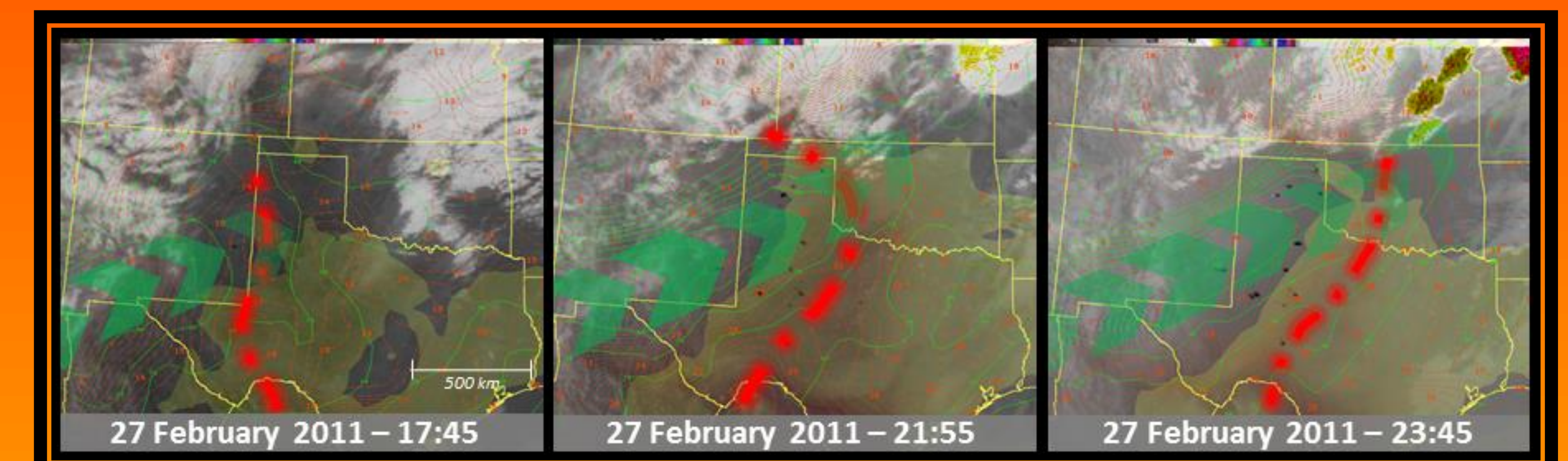


Meteorological composite based on the 2100 UTC peak burn period of ten SGPWOs which occurred between 2005 and 2009.

METEOROLOGICAL ANALYSIS



2100 UTC 27 February 2011 analyses of 500 hPa geopotential heights and winds (left) and surface mslp, winds, and relative humidity $\leq 30\%$ (right) consistent with the imminent passage of an intense mid latitude cyclone and associated wind maximum and accompanying surface low over the southern Great Plains.



Evolution of the 27 February 2011 “firestorm” as depicted per infrared satellite imagery, 850 hPa isotherms (red dash contours) and 500 hPa isotachs (green contours) showing that wildfire activity (black spotted “hot spots”) peaked as an incoming mid-level wind maximum overspread a low-level thermal ridge.

CONCLUSIONS

- Seasonal variability on the southern Great Plains prior to the 2011 “firestorms” was characterized by 200-400% of normal precipitation in July, followed by <25% of normal precipitation by January.
- The resultant enhanced vegetative growth cured as drought deepened. ERCs reached sustained values in excess of 70th to 90th percentile rankings by late February and persisted through spring.
- On 27 February 2011 a violent “firestorm” accompanied the passage of a mid latitude cyclone. Wildfires burned along a sharp low-level thermal ridge beneath an overspreading wind maximum aloft. The 27 February 2011 “firestorms” was the first of eight SGPWOs which occurred during the historic 2011 fire season.
- The fire events of 2011 were consistent with pre-existing conceptual models and serve as the ideal example of a dangerous wildland fire environment on the southern Great Plains.

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