

Temporal Indications of Atmospheric Stability Affecting Off-Target Drift in the Mid- South U.S.

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Atmospheric Stability

- ▶ What is it and why do we care?
 - Simply and indication of how air is mixing and moving
 - Air that is more stable does not mix and will tend to remain still
 - Air that is unstable mixes well and moves quickly
 - Inversions are cases where air is very stable and does not mix vertically within the atmosphere

Finding a balance

- ▶ When making an application, you are trying to find a balance.
 - Too stable and spray does not disperse, stays suspended, and may move off-site in a concentrated volume.
 - Too unstable and spray does not reach the target and may be blown far beyond its intended position.

Why

- ▶ The goal of this work is to provide guidance on when these different conditions occur along with some basic rules of thumb for identifying them.

Diurnal Evolution of the Atmospheric Temperature Profile

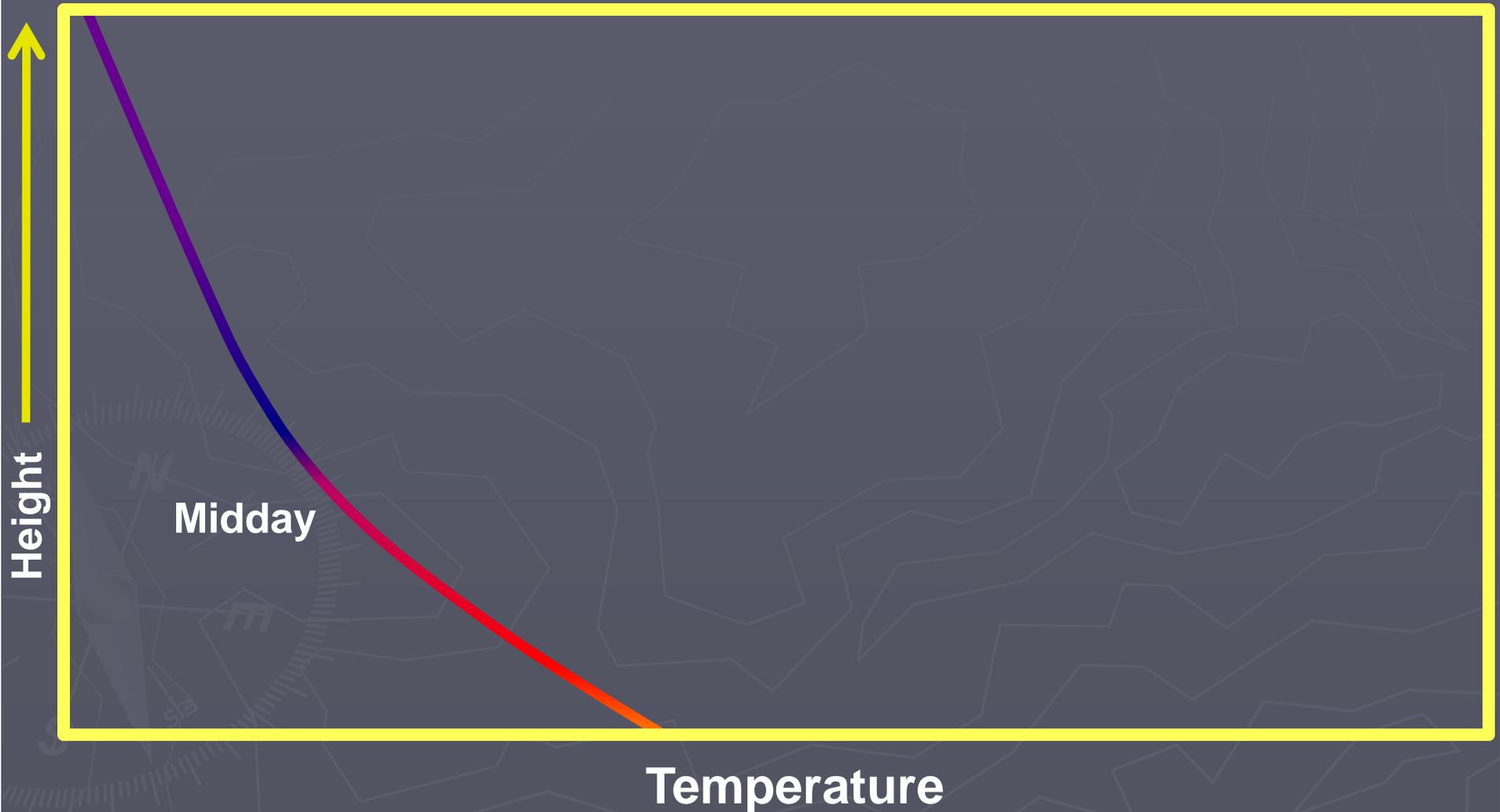


Figure adapted from: Bache, D.H. and Johnstone, D.R. 1992. Microclimate and Spray Dispersion. Ellis Horwood Limited, Chichester, England.

Diurnal Evolution of the Atmospheric Temperature Profile

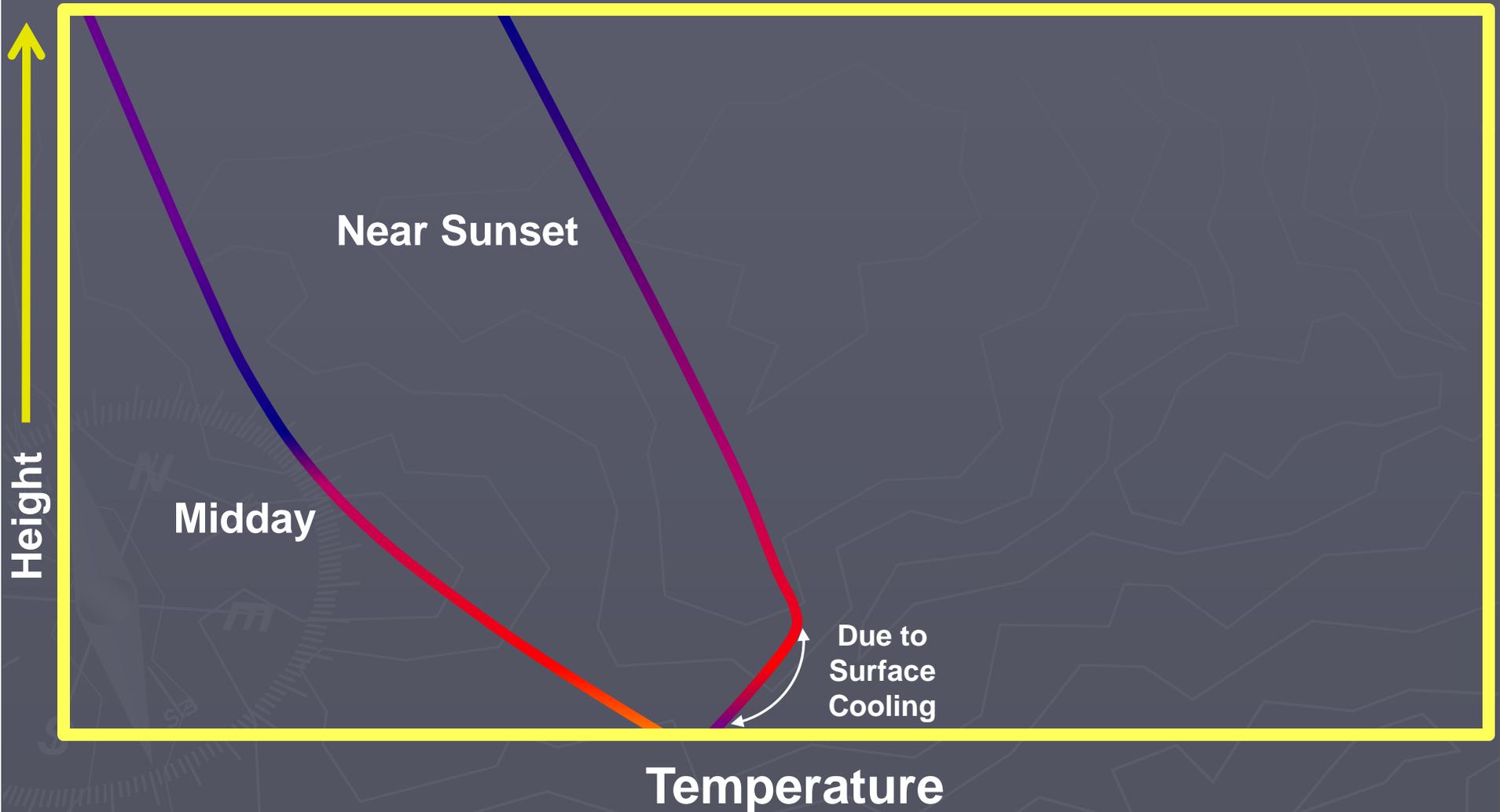


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Diurnal Evolution of the Atmospheric Temperature Profile

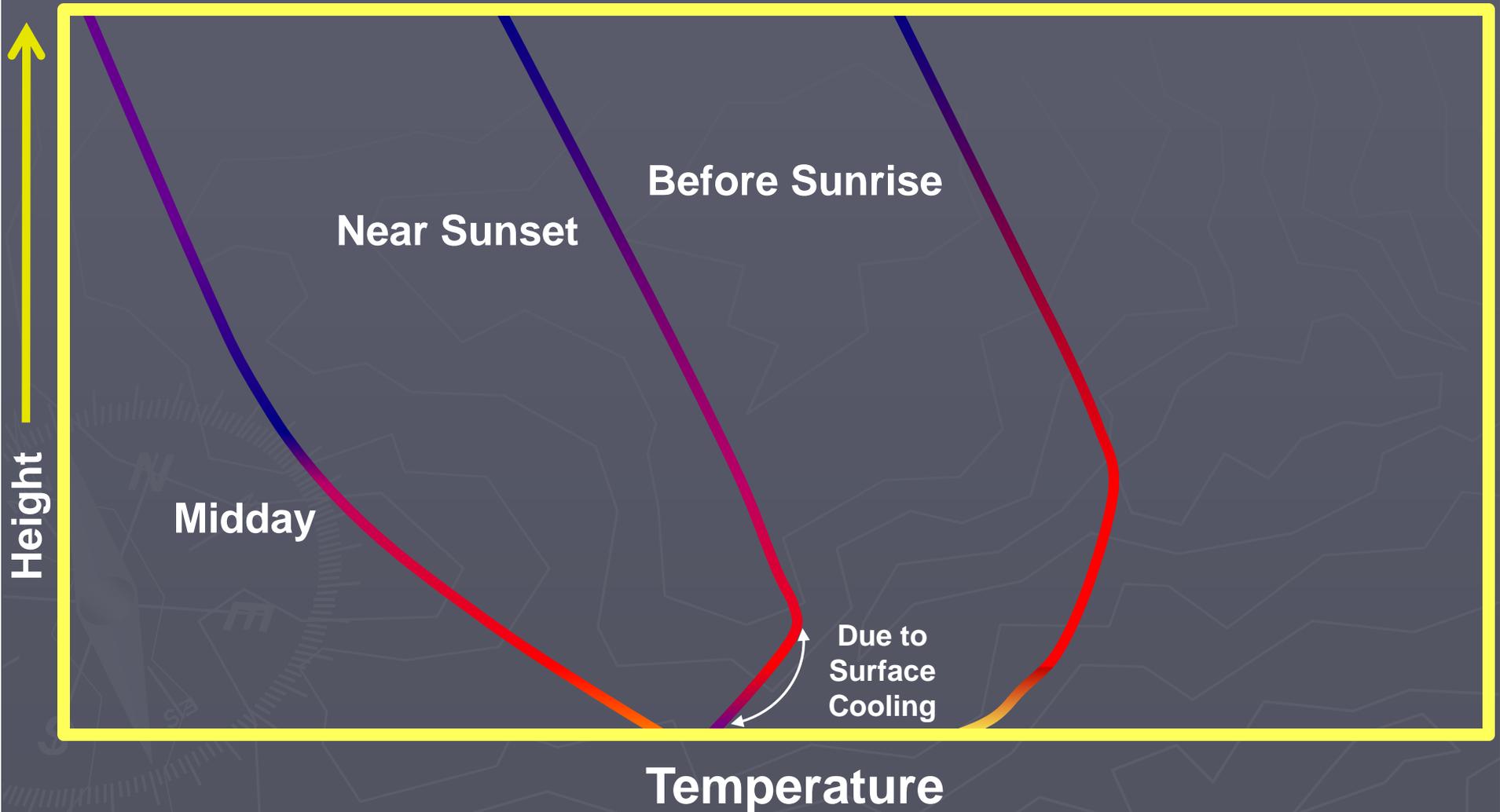


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Diurnal Evolution of the Atmospheric Temperature Profile

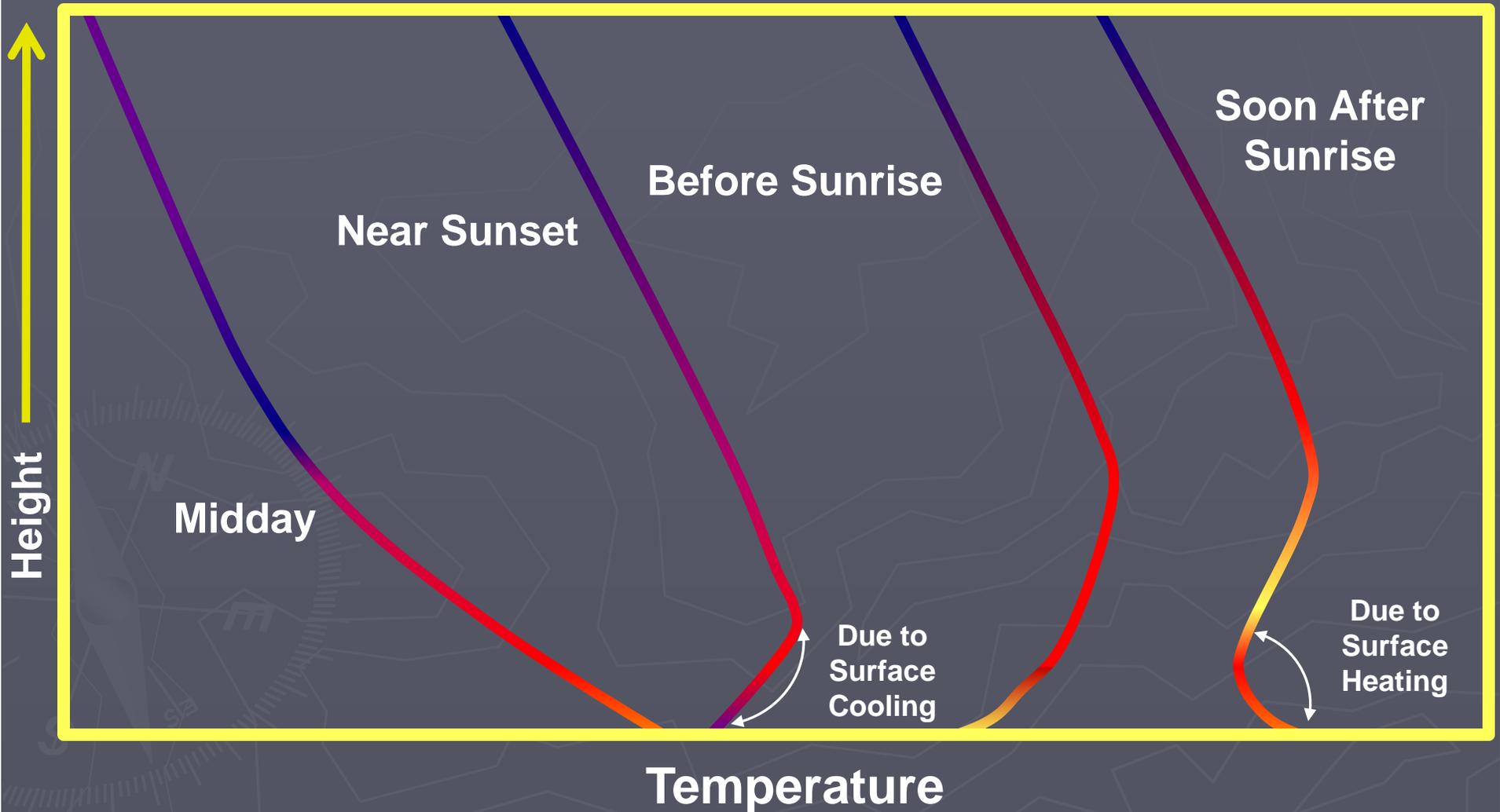
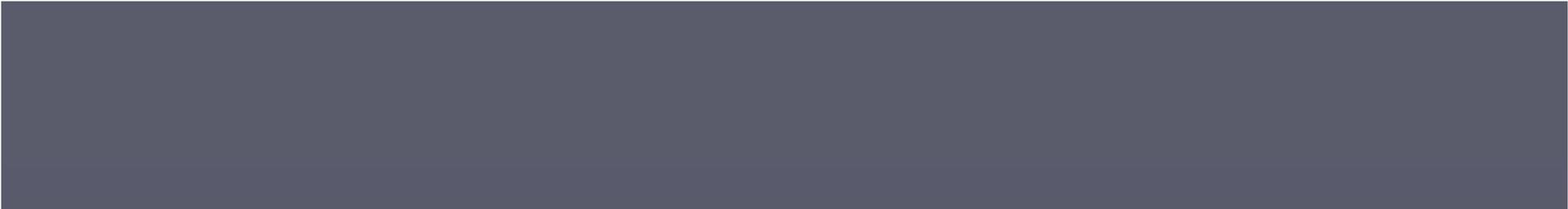


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105 foot temperature monitoring tower

← 105' 38° F

← 64' 40° F

← 32' 40° F

← 16' 41° F

← 8' 41° F

Cloud of 5-25 u oil droplets generated under unstable conditions

OK to SPRAY!

AM 9:15:42

Source: Ramsey (2001)

<http://www.cdpr.ca.gov/docs/enforce/drftinit/conf/2001/ramsey.ppt>

Temperature Profile

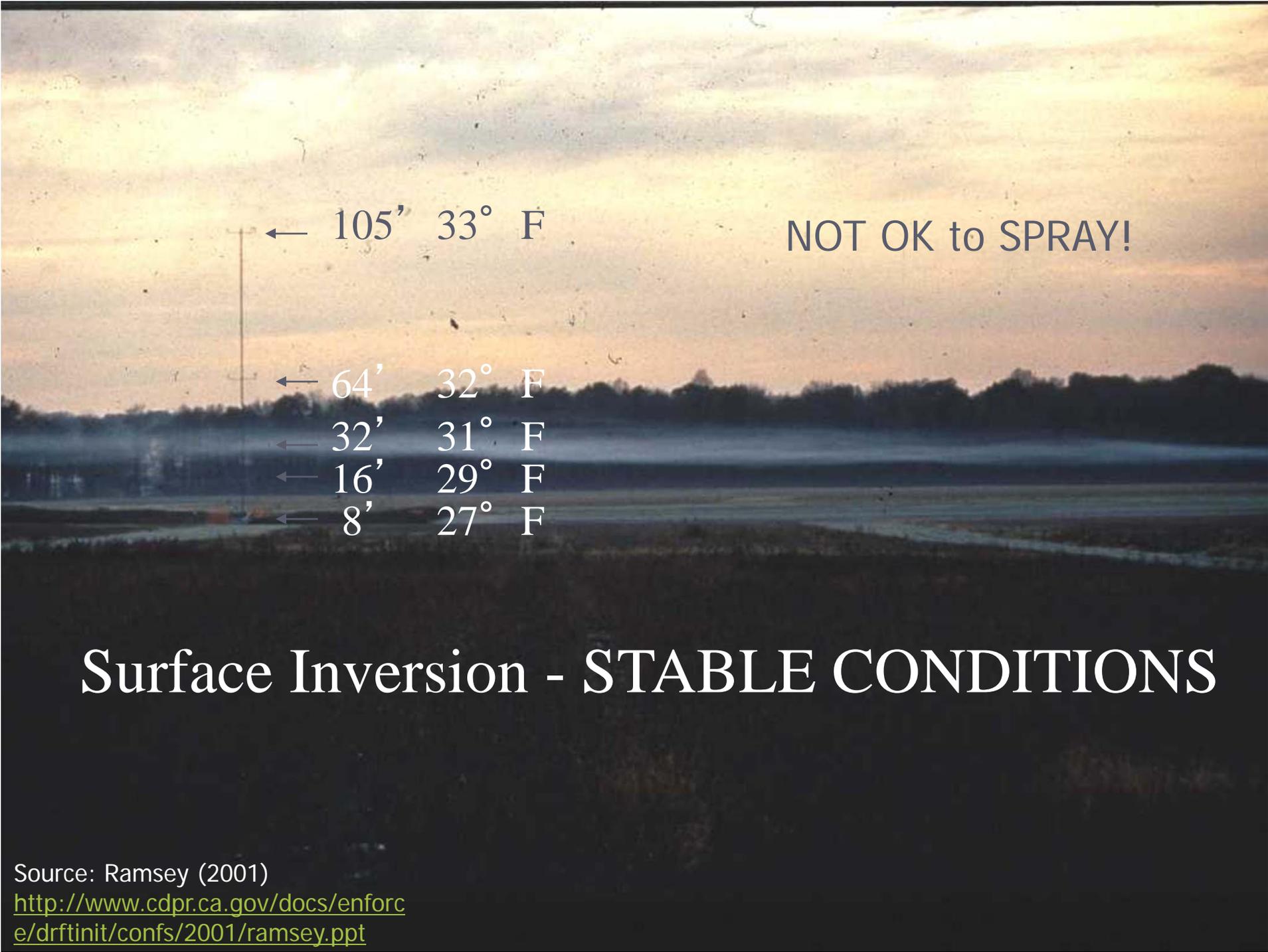
105'	35°	F
64'	30°	F
32'	29°	F
16'	28°	F
8'	26°	F

Surface Inversion - STABLE CONDITIONS

AM 6:57:44

Source: Ramsey (2001)

<http://www.cdpr.ca.gov/docs/enforce/drftinit/confs/2001/ramsey.ppt>



← 105' 33° F

NOT OK to SPRAY!

← 64' 32° F

← 32' 31° F

← 16' 29° F

← 8' 27° F

Surface Inversion - STABLE CONDITIONS

Source: Ramsey (2001)

<http://www.cdpr.ca.gov/docs/enforce/drftinit/confs/2001/ramsey.ppt>

Monitoring Temperature Profile



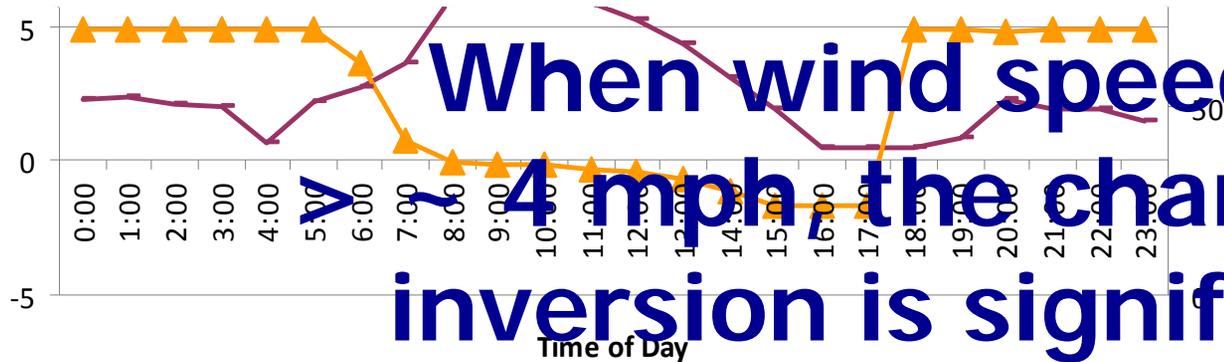
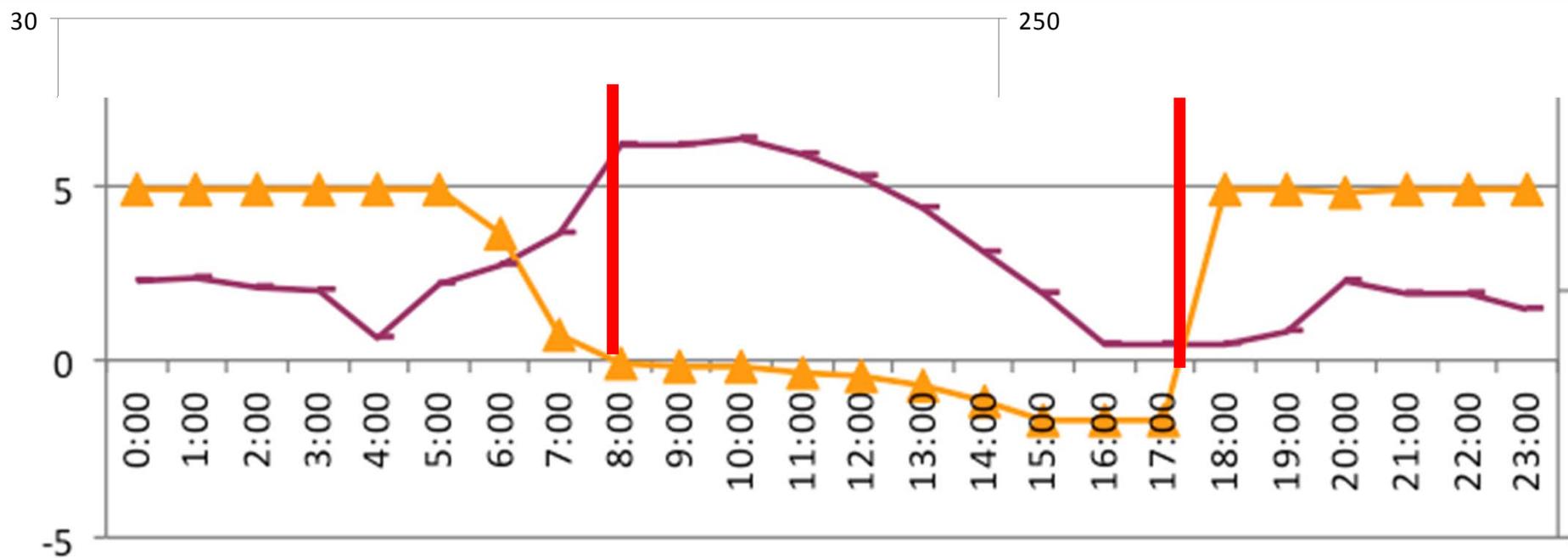
Procedures

- ▶ Data were analyzed to determine when inversions typically occurred and what wind speeds were present when they did.

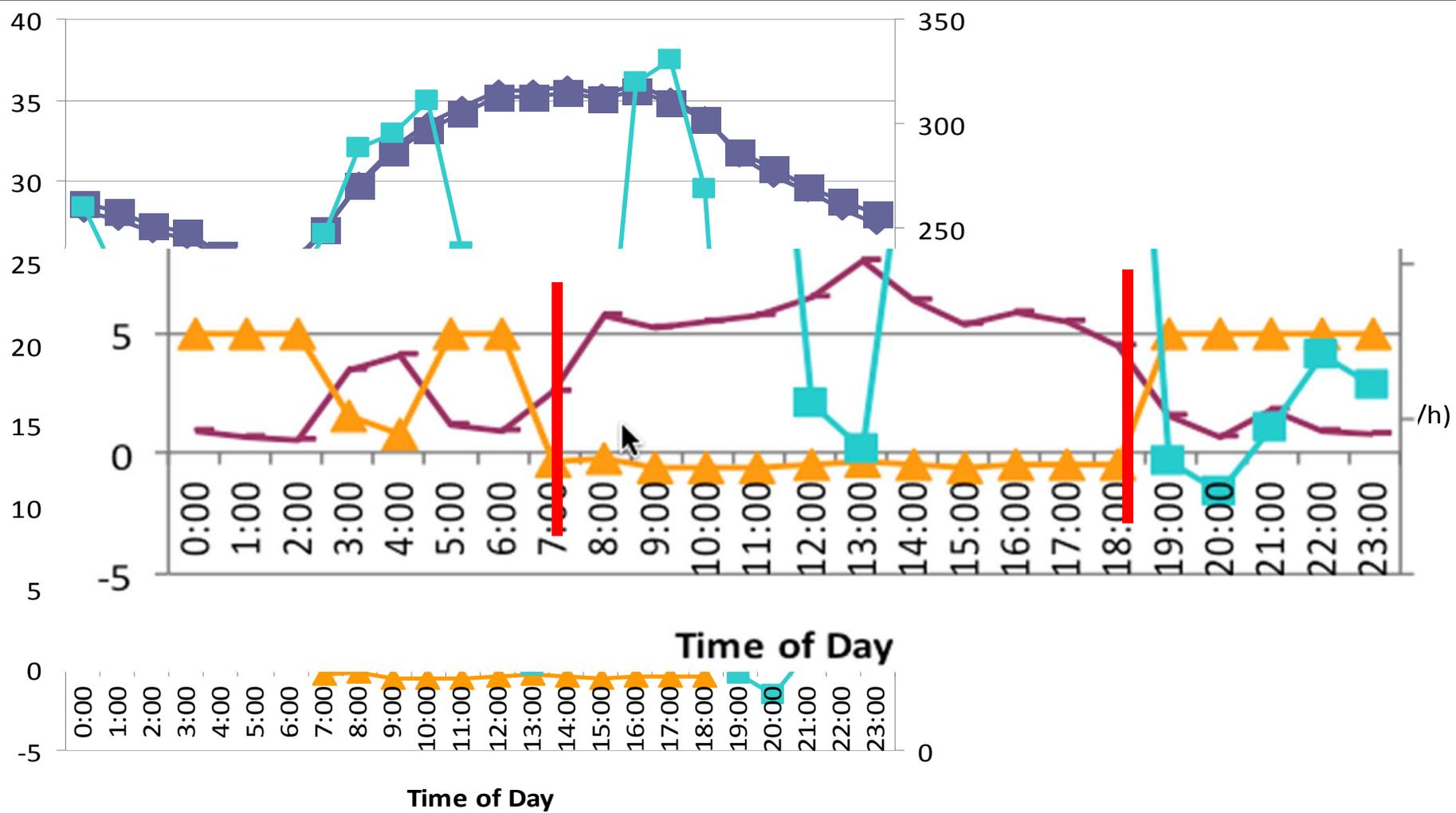
Results

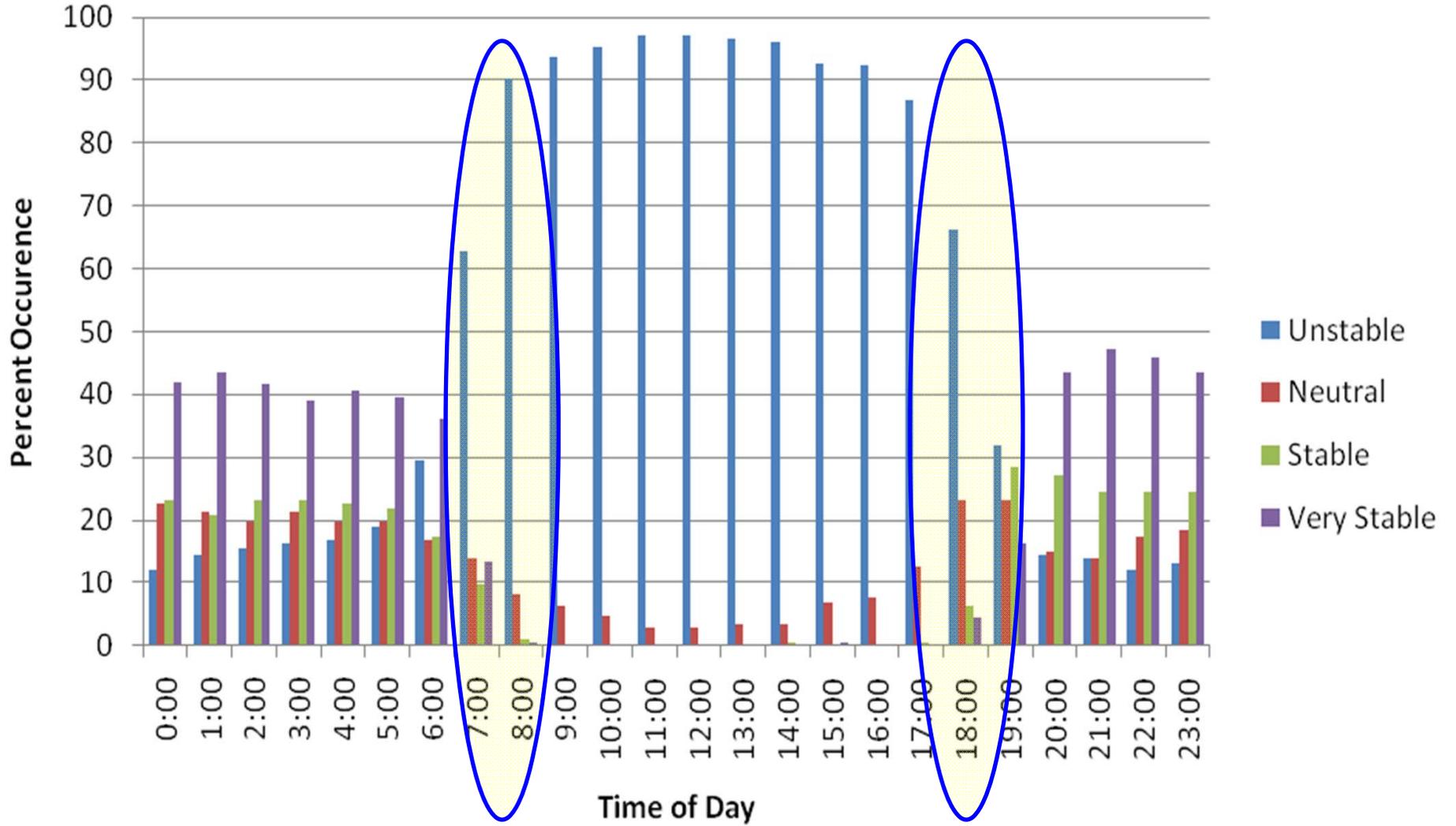
1/11/2011

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When wind speeds are ≥ 4 mph, the chance of an inversion is significantly decreased.





Wind Speed

- ▶ “Rules of Thumb” for early mornings and late afternoons
 - Wind speeds above 5-6 mph generally indicate neutral or unstable conditions.
 - Wind speeds below 3-4 mph generally indicate very stable conditions.
- ▶ The inversions that occur in the late afternoon are of most concern as they will tend to persist longer.

Acknowledgements

- ▶ Dr. Lowrey A. Smith (retired) for beginning this work in 2003

Thank You!

► Contact: Steve.thomson@ars.usda.gov