Wind Shear Parameters

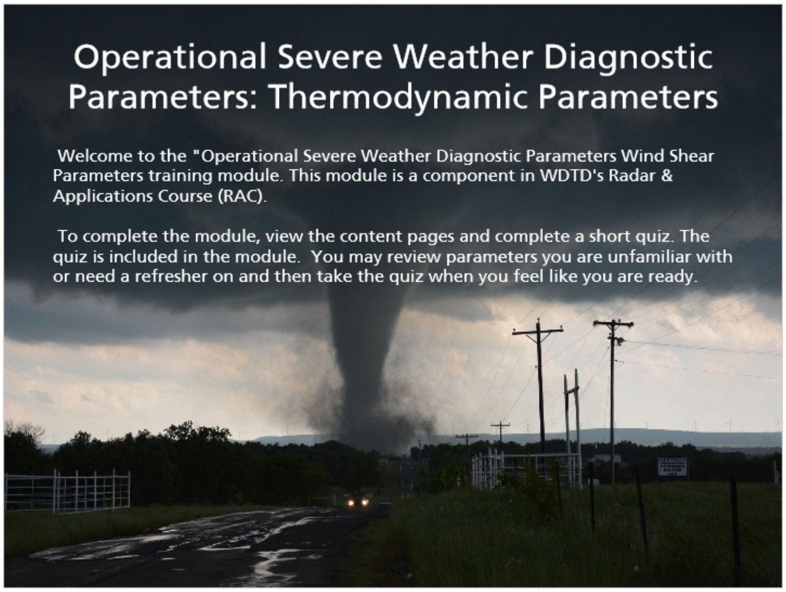
1. Wind Shear Parameters

1.1 Operational Severe Weather Diagnostic Parameters:

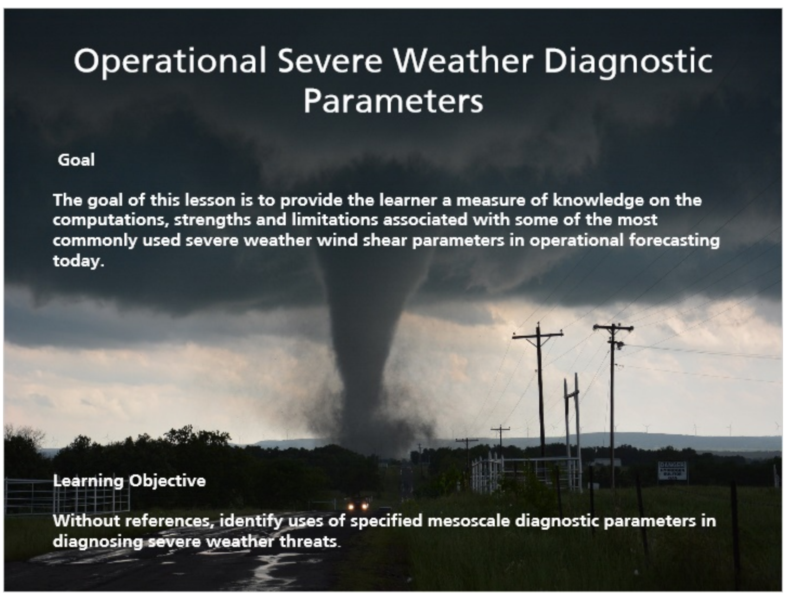
Wind Shear Parameters

Notes:

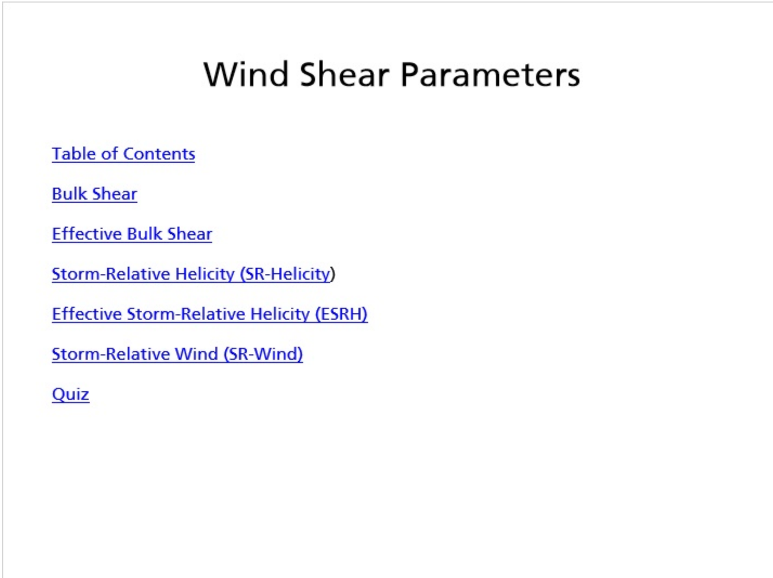
1.2 Operational Severe Weather Diagnostic Parameters: Thermodynamic Parameters



1.3 Operational Severe Weather Diagnostic Parameters

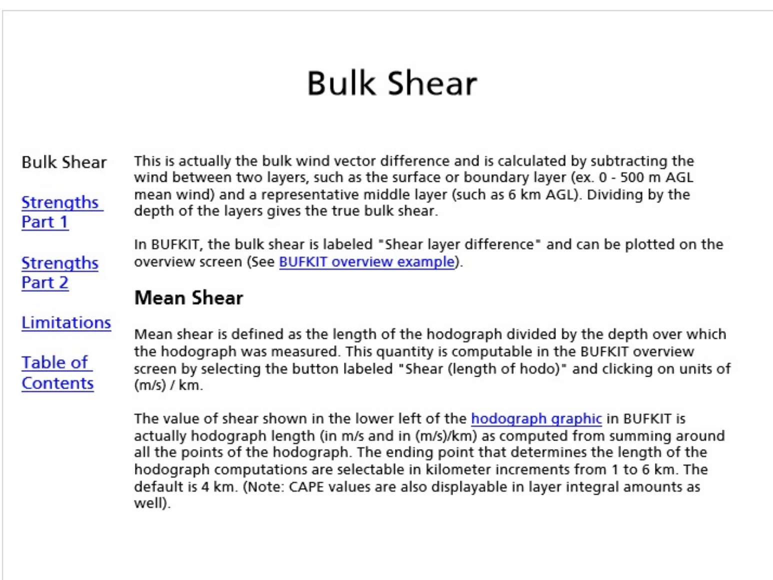


1.4 Wind Shear Parameters

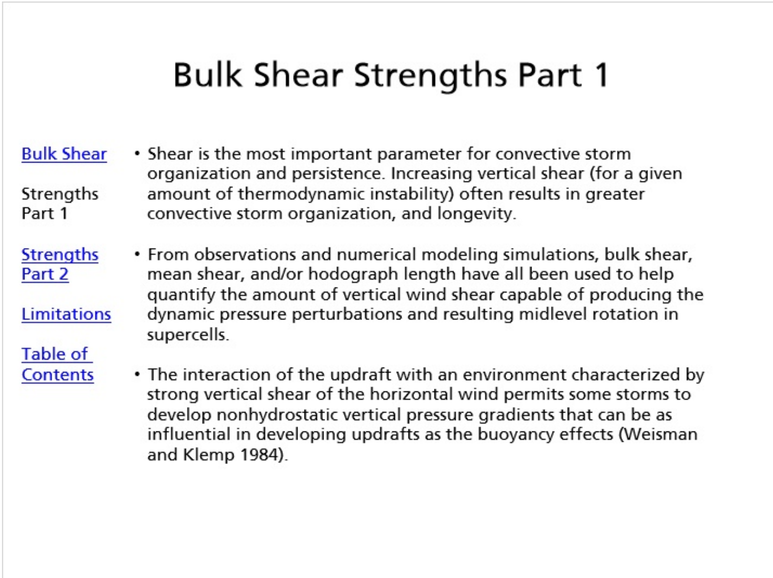


Notes:

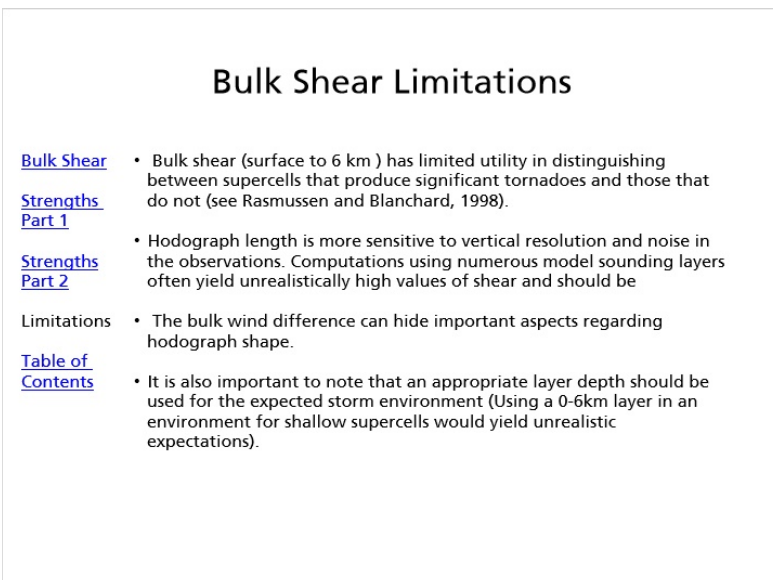
1.5 Bulk Shear



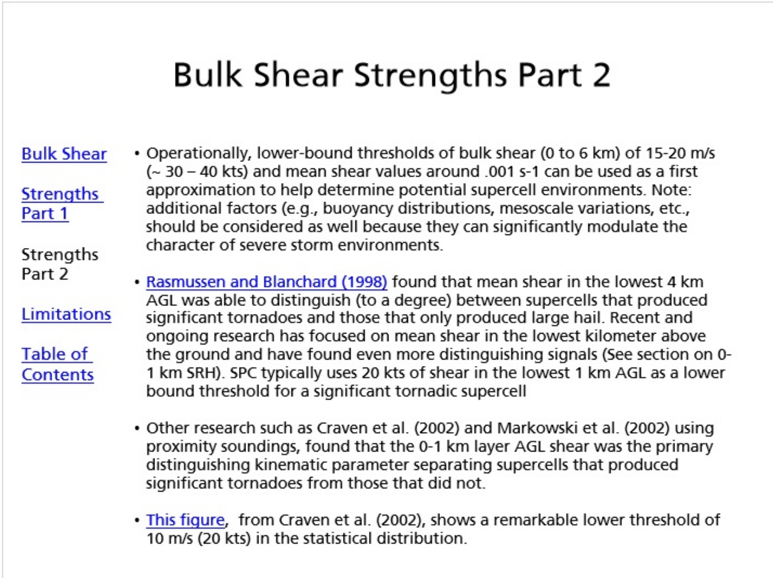
1.6 Bulk Shear Strengths Part 1



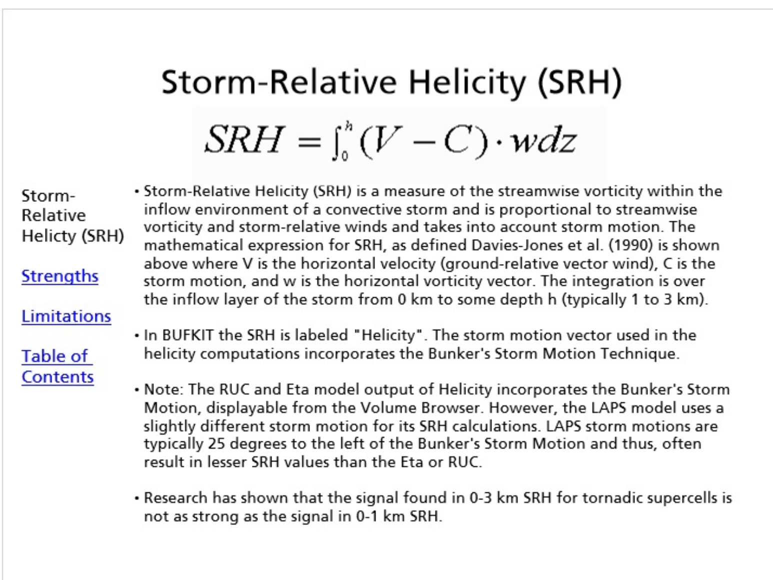
1.7 Bulk Shear Limitations



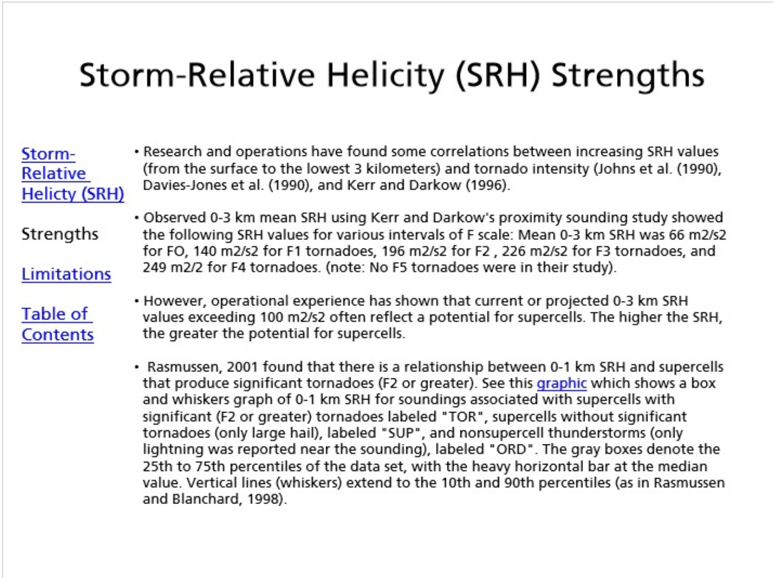
1.8 Bulk Shear Strengths Part 2



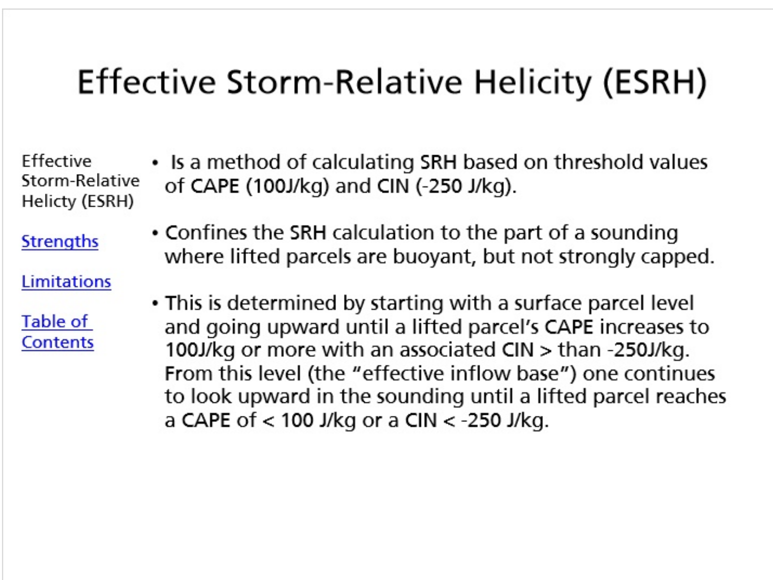
1.9 Storm-Relative Helicity (SRH)



1.10 Storm-Relative Helicity (SRH) Strengths



1.11 Effective Storm-Relative Helicity (ESRH)



1.12 Effective Storm-Relative Helicity (ESRH) Strengths

Effective Storm-Relative Helicity (ESRH) Strengths

Effective Storm-Relative Helicty (ESRH)

Strengths

Limitations

Table of Contents

- Provides a more reasonable estimate of SRH in elevated supercell environments.
- More clearly discriminates between tornadic and non-tornadic storms than the standard, fixed layer versions of SRH. (see this figure)

1.13 Effective Storm-Relative Helicity (ESRH) Limitations

Effective Storm-Relative Helicity (ESRH) Limitations

Effective Storm-Relative Helicty (ESRH)

Strengths

Limitations

Table of Contents

- The ESRH can be missing from a sounding due to:
  1. Insufficient buoyancy
  2. Excessive CIN
  3. The effective inflow layer is a single level within a sounding
- Not a good distinguisher between supercells and non-supercells.

1.14 Storm-Relative Wind (SR-Wind)

Storm-Relative Wind (SR-Wind)

Storm-Relative Wind (SR-Wind)

Strengths

Limitations

Table of Contents

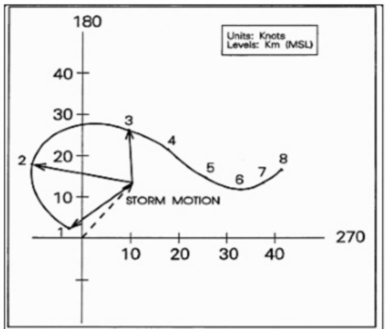


Figure 2. A hodograph showing storm relative wind "inflow" vectors and storm motion. (from NWSTC RTM-230).

- SR-wind is determined by subtracting the parent storm motion vector from the environmental wind vector. Vectors on a hodograph represent wind flow that the storm experiences at various levels as the storm moves through the environment (see figure at left).
- SR-wind affects the precipitation distribution of a storm with respect to the main updraft.
- Higher values of of mid and upper-level SR-wind carry precipitation away from the updraft summits of well-organized storms (such as supercells) thereby diminishing the potential for significant water-loading (OTB, 1993).

1.15 Storm-Relative Wind (SR-Wind) Strengths

Storm-Relative Wind (SR-Wind) Strengths

Storm-Relative Wind (SR-Wind)

Strengths

Limitations

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- SR-wind is more physically significant in producing a particular storm structure than ground relative winds. Strong SR-wind at midlevels mitigates precipitation loading in updrafts, while strong low-level SR-wind is often associated with strong storm-relative helicity and low-level mesocyclones. One can qualitatively assess the amount of SRH by looking at the amount of area swept out on hodograph by the storm-relative wind vectors.
- Thompson (1998) found that supercells were more likely to produce tornadoes when midlevel (~ 500 mb) storm-relative winds were greater than 8-10 m s-1.
- Evans and Doswell (2001) found 0-2 km system-relative winds stronger in derecho events than in non-derecho events. This was likely due to faster forward speed and low-level convergence in derecho events.
- Near-ground (0-1 km) storm-relative wind (speed) may also be crucial to tornadogenesis (Markowski et al. 2002).
- SR-wind significantly influences hail growth because it determines hail trajectories across the updraft.

1.16 Storm-Relative Wind (SR-Wind) Limitations

Storm-Relative Wind (SR-Wind) Limitations

Storm-Relative Wind (SR-Wind)

Strengths

Limitations

Table of Contents

- Storm-relative wind requires an estimate of storm motion, which is often difficult to determine from observations and especially, in forecasts. It can be difficult to determine the appropriate layer in which SR-wind effects are greatest in a storm.
- Multiple storm motions can occur simultaneously with storm systems making storm-relative flow estimates difficult with multicell systems.
- Most of the differences in storm-relative wind between tornadic storm and non-tornadic storms reside in the lowest kilometer or so above the ground, where observations of environmental winds on a sub-mesobeta time and space scale are sparse.
- Storm-relative wind was not a statistically significant tornado discriminator when RUC proximity soundings were analyzed (see Markowski et al. 2002).

1.17 Storm-Relative Helicity (SRH) Limitations

Storm-Relative Helicity (SRH) Limitations

Storm-Relative Helicty (SRH)

Strengths

Limitations

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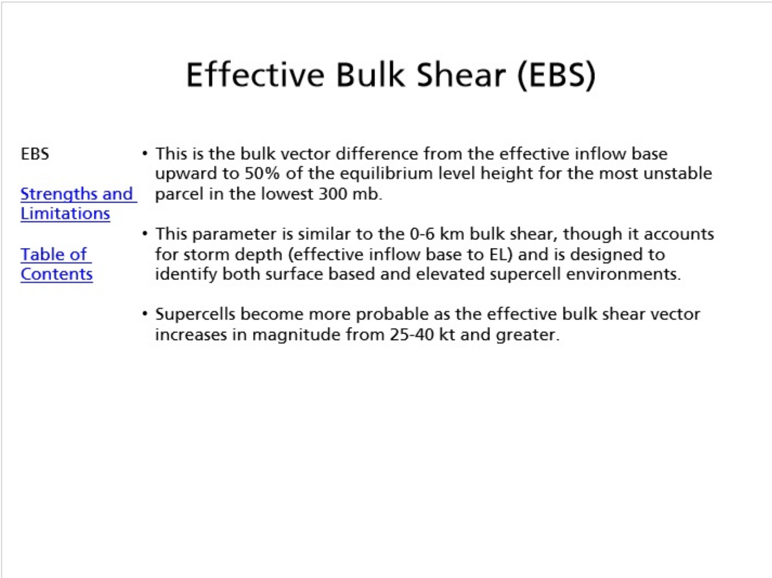
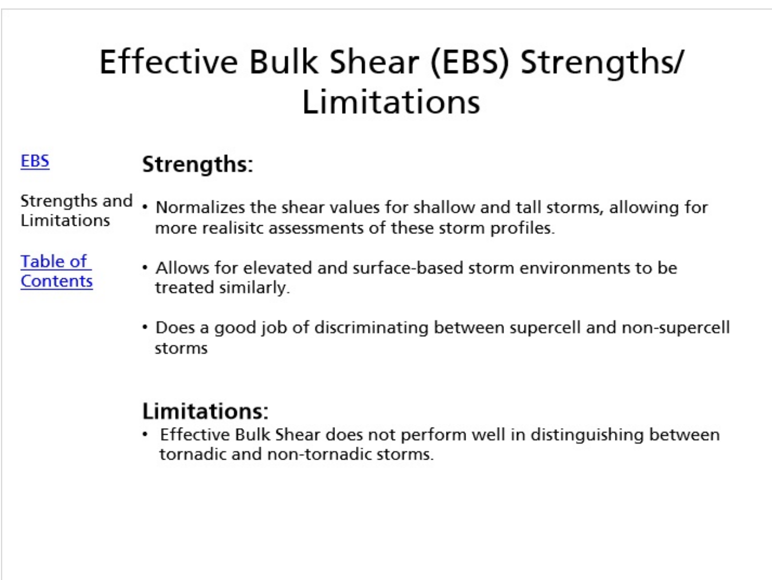
- SRH is very sensitive to changes in the horizontal wind vector and storm motion and thus, to use it effectively in mesoscale analysis, the parameter inputs must be updated frequently by METARS, profilers, VAD winds, ACARS, or other data sources.
- Many studies such as Johns et al. (1993) and Edwards and Thompson (2000) indicate a wide spectrum of SRH values associated with any single tornadic event. (This graphic from Edwards and Thompson's study is an example of the data scatter associated with CAPE and 0-3 km SRH.)
- In AWIPS model calculations of 0-1 km shear (or SRH), there are typically insufficient model layers in the vertical to adequately sample the layer. In BUFKIT, the native resolution of the model is retained.
- Due to differences in storm motion calculations, model derived SRH can vary.

1.18 Effective Bulk Shear (EBS)



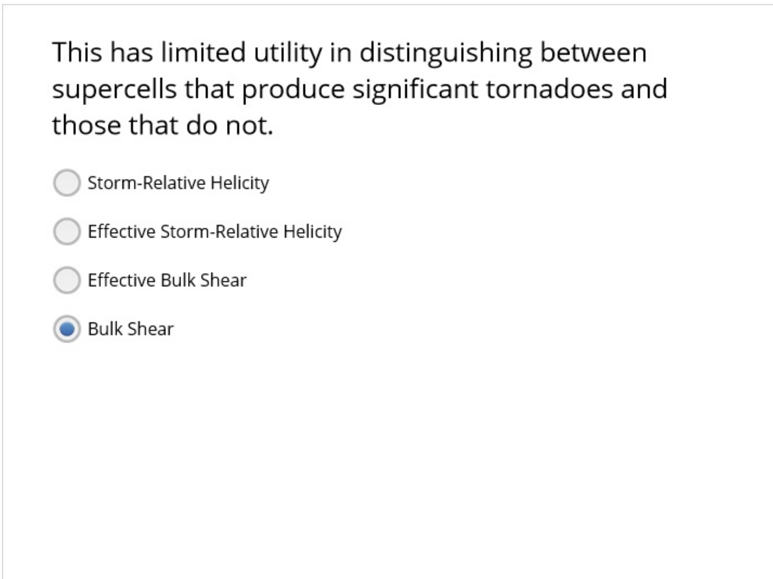
1.19 Effective Bulk Shear (EBS) Strengths/Limitations



2. Wind Shear Parameters Quiz

2.1 This has limited utility in distinguishing between supercells that produce significant tornadoes and those that do not.

(Multiple Choice, 10 points, 1 attempt permitted)



Correct	Choice
	Storm-Relative Helicity
	Effective Storm-Relative Helicity
	Effective Bulk Shear
X	Bulk Shear

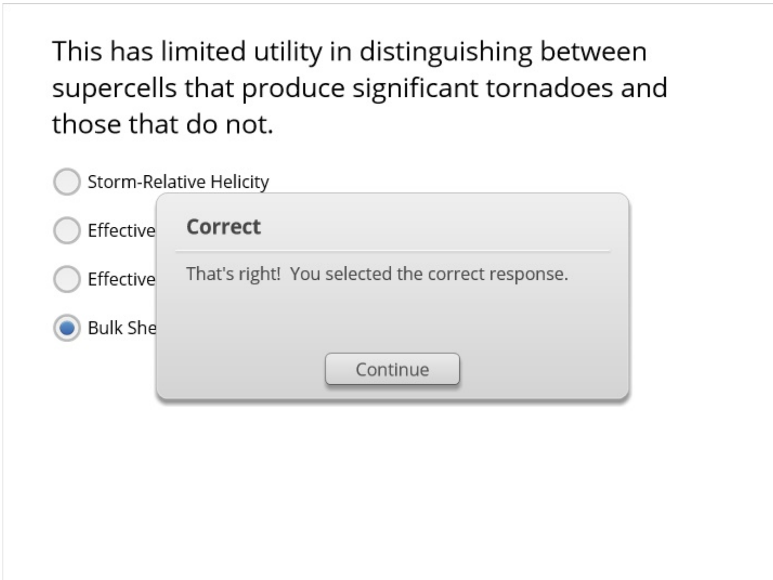
Feedback when correct:

That's right! You selected the correct response.

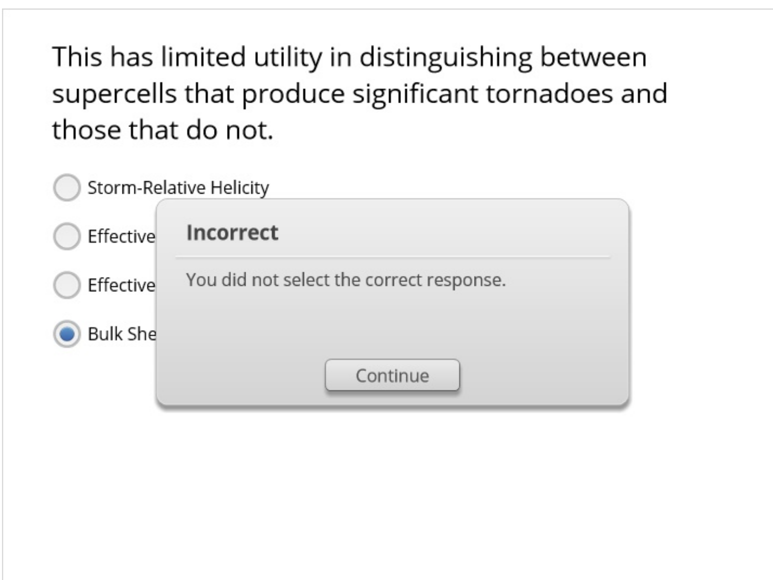
Feedback when incorrect:

You did not select the correct response.

Correct (Slide Layer)

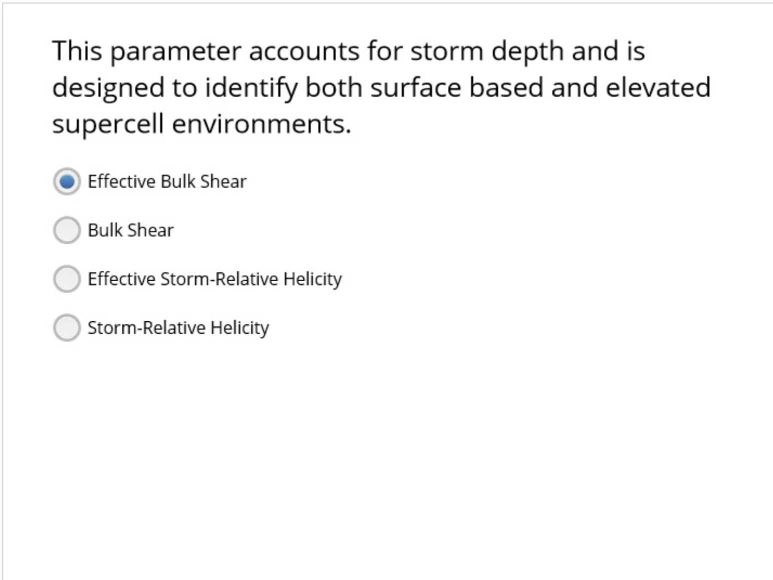


Incorrect (Slide Layer)



2.2 This parameter accounts for storm depth and is designed to identify both surface based and elevated supercell environments.

(Multiple Choice, 10 points, 1 attempt permitted)



Correct	Choice
X	Effective Bulk Shear
	Bulk Shear
	Effective Storm-Relative Helicity
	Storm-Relative Helicity

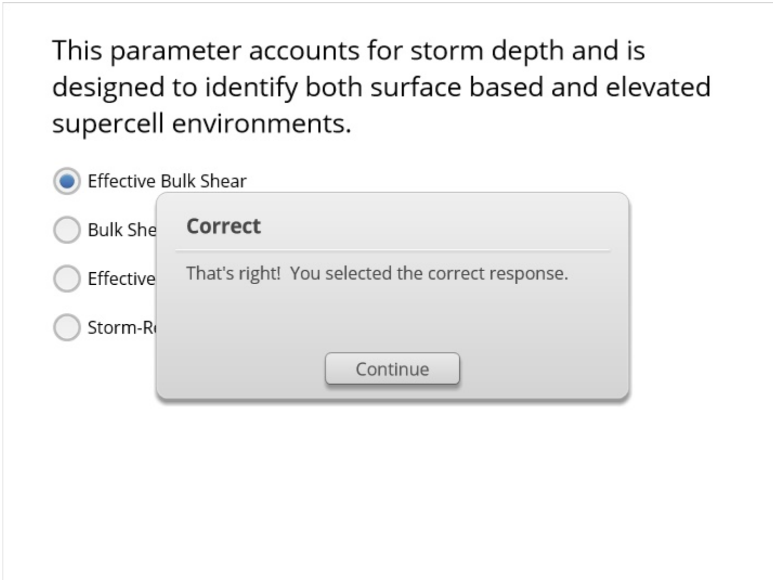
Feedback when correct:

That's right! You selected the correct response.

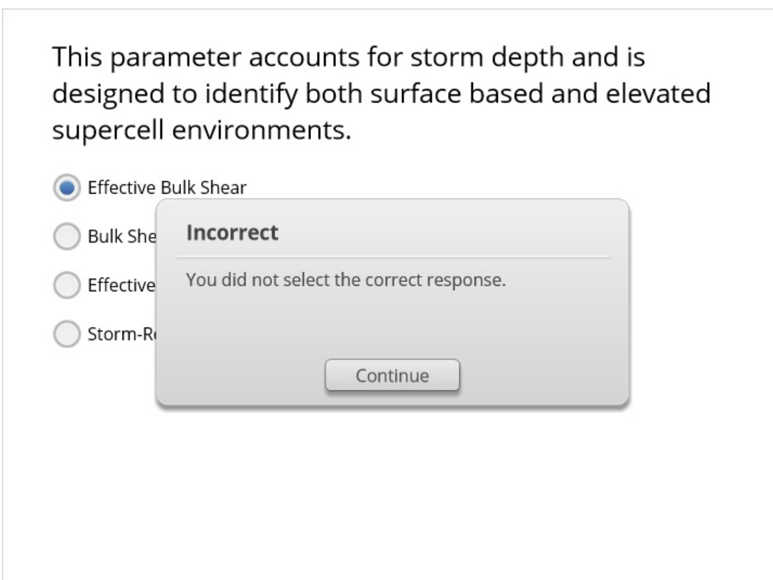
Feedback when incorrect:

You did not select the correct response.

Correct (Slide Layer)

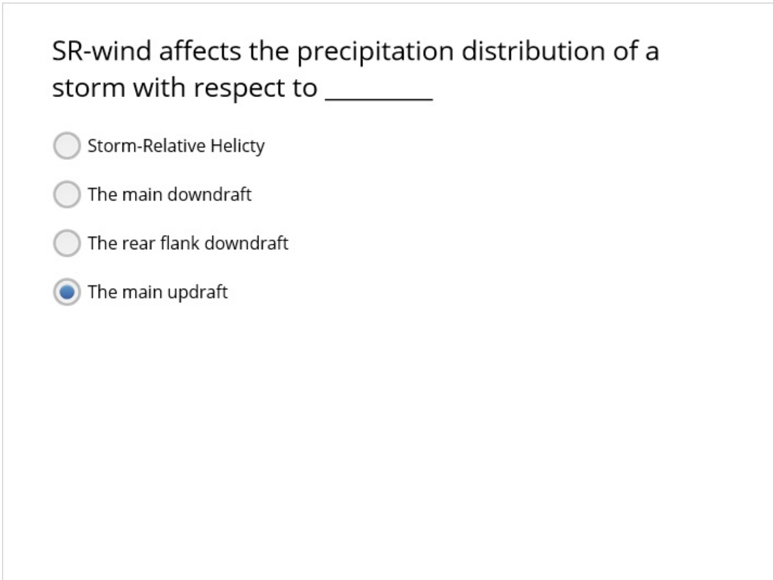


Incorrect (Slide Layer)



2.3 SR-wind affects the precipitation distribution of a storm with respect to __________

(Multiple Choice, 10 points, 1 attempt permitted)



Correct	Choice
	Storm-Relative Helicty
	The main downdraft
	The rear flank downdraft
X	The main updraft

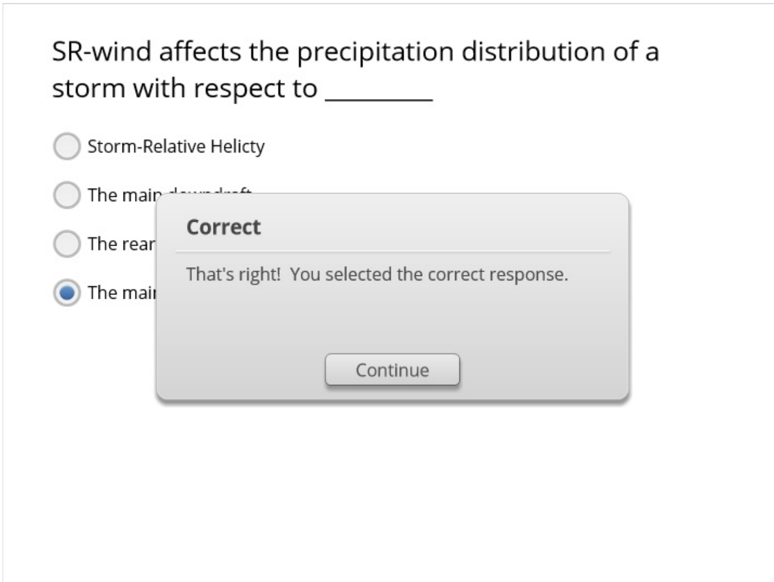
Feedback when correct:

That's right! You selected the correct response.

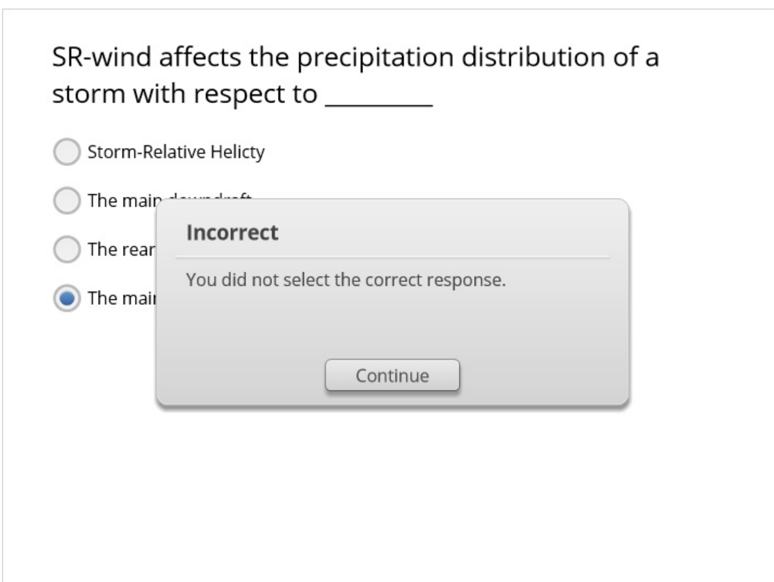
Feedback when incorrect:

You did not select the correct response.

Correct (Slide Layer)

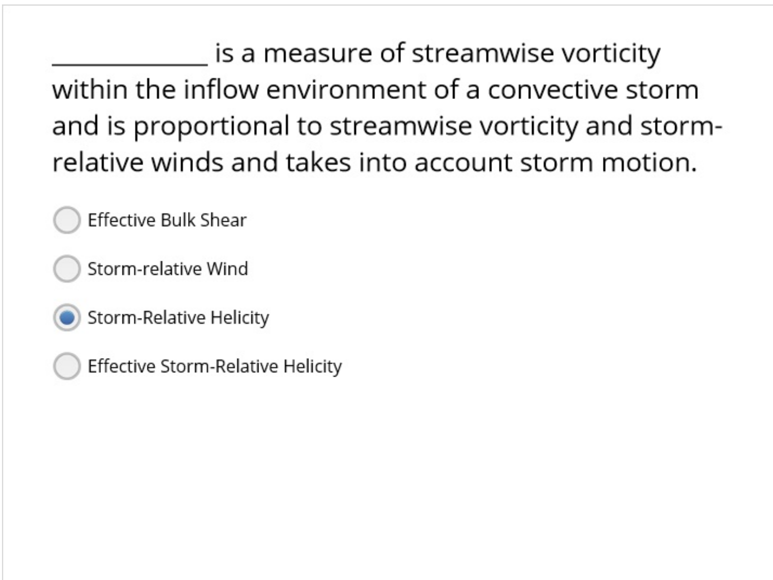


Incorrect (Slide Layer)



2.4 _____________ is a measure of streamwise vorticity within the inflow environment of a convective storm and is proportional to streamwise vorticity and storm-relative winds and takes into account storm motion.

(Multiple Choice, 10 points, 1 attempt permitted)



Correct	Choice
	Effective Bulk Shear
	Storm-relative Wind
X	Storm-Relative Helicity
	Effective Storm-Relative Helicity

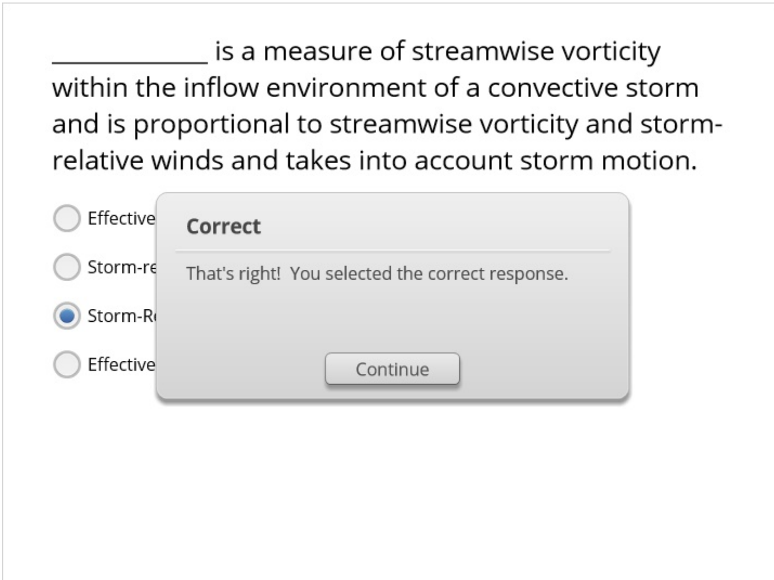
Feedback when correct:

That's right! You selected the correct response.

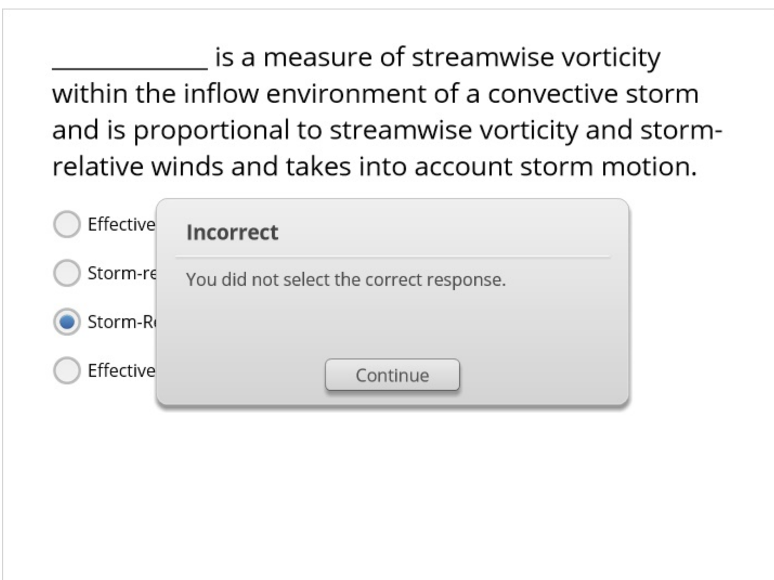
Feedback when incorrect:

You did not select the correct response.

Correct (Slide Layer)

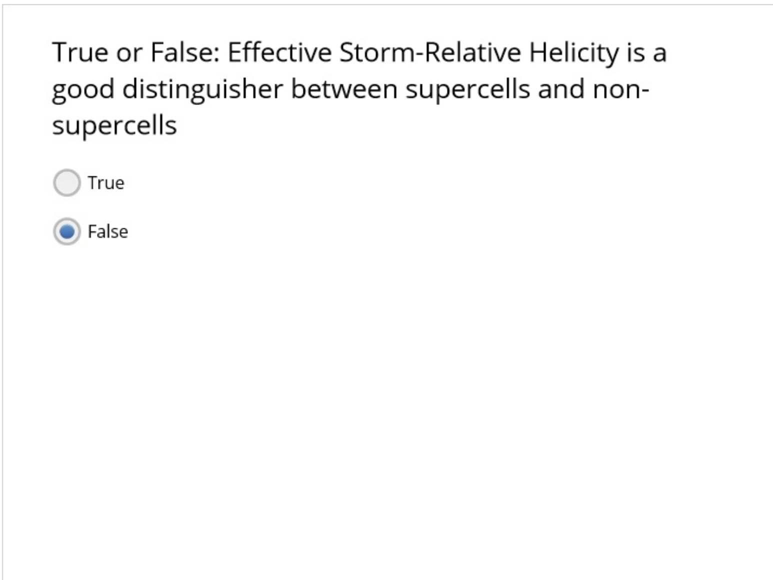


Incorrect (Slide Layer)



2.5 True or False: Effective Storm-Relative Helicity is a good distinguisher between supercells and non-supercells

(True/False, 10 points, 1 attempt permitted)



Correct	Choice
	True
X	False

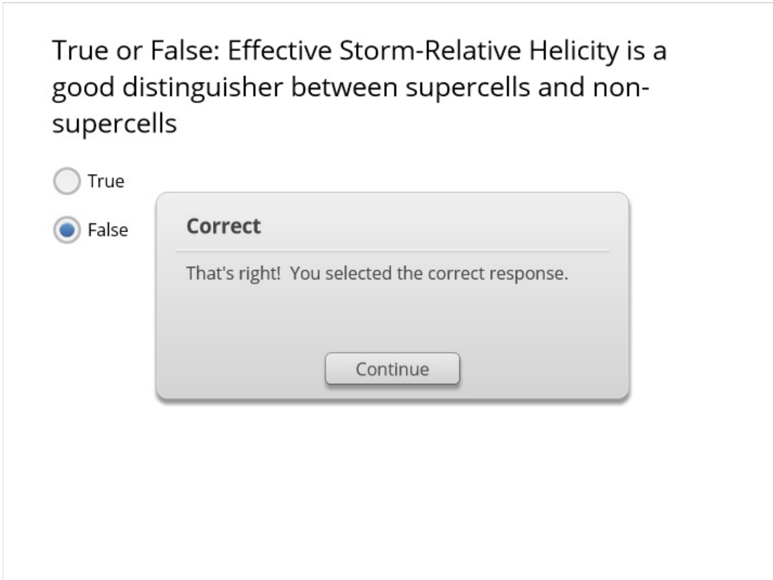
Feedback when correct:

That's right! You selected the correct response.

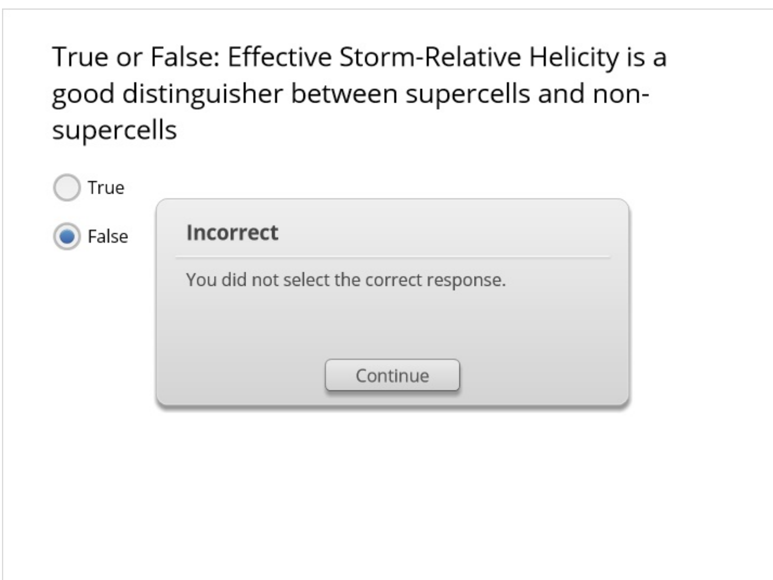
Feedback when incorrect:

You did not select the correct response.

Correct (Slide Layer)



Incorrect (Slide Layer)



2.6 Results Slide

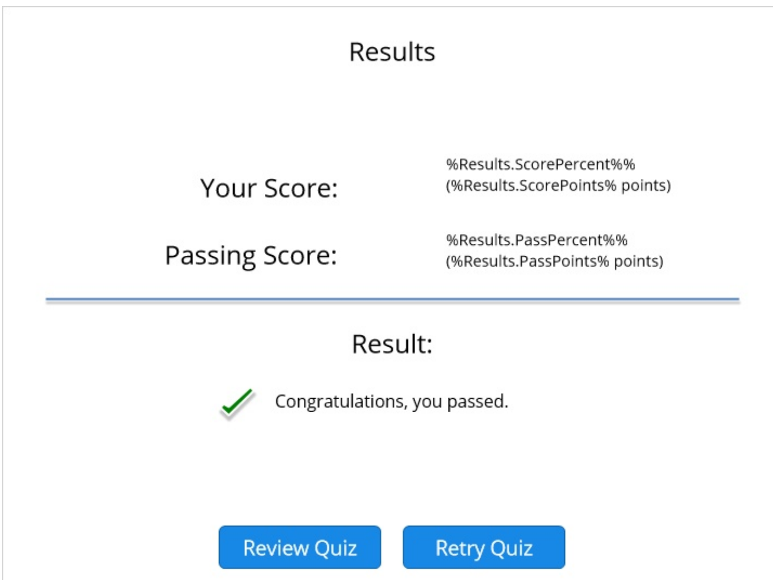
(Results Slide, 0 points, 1 attempt permitted)

Results for
2.1 This has limited utility in distinguishing between supercells that produce significant tornadoes and those that do not.
2.2 This parameter accounts for storm depth and is designed to identify both surface based and elevated supercell environments.
2.3 SR-wind affects the precipitation distribution of a storm with respect to __________
2.4 _______________ is a measure of streamwise vorticity within the inflow environment of a convective storm and is proportional to streamwise vorticity and storm-relative winds and takes into account storm motion.
2.5 True or False: Effective Storm-Relative Helicity is a good distinguisher between supercells and non-supercells

Result slide properties

Passing Score	80%

Success (Slide Layer)



Failure (Slide Layer)