Final Exam Clicker Questions ATOC 1050 Spring 2011

Chapter 16: Mountain Snowstorms

- True or false: Mean annual snowfall in the western United States always increases from south to north.
  A. True
  B. False

- Total precipitation amounts are often _____ on the windward side of a mountain compared to along a front.
  A. Less
  B. About the same
  C. Greater

- The leeward side of a mountain is the _____ side of a mountain.
  A. Upwind
  B. Downwind
  C. Both (a) and (b)
  D. None of the above
- The elevation of the Coast Range is _____ than the Sierra Nevada, yielding more precipitation in the form of _____ over the Sierra Nevada.
  A. Higher, snow
  B. Higher, rain
  C. Lower, snow
  D. Lower, rain
- A snow water equivalent of 12 inches of snow per 1 inch of water would be considered _____.
  A. Low
  B. High
  C. Typical
- Upslope flow in Boulder, CO occurs if there is high pressure _____ of Colorado and/or low pressure _____ of Colorado.
  A. South, south
  B. South, north
  C. North, north
  D. North, south
- For a surface high pressure center north of Colorado you would expect the air that arrives at the Front Range to be _____ resulting in _____ in the winter.
  A. cold and dry, heavy snow
  B. cold and dry, light snow
  C. mild and moist, heavy snow
  D. mild and moist, light snow

Chapter 17: Mountain Windstorms

- You would expect air to _____ on the windward side of a mountain range resulting in _____ skies.
    A. Rise, mostly sunny
    B. rise, mostly cloudy
    C. Sink, mostly sunny
    D. sink, mostly cloudy
- For west winds across the Rocky Mountains you would expect lee waves to form on the _____ side of the Rocky Mountains.
    A. east
    B. south
    C. west
    D. north
- A hydraulic jump may form downstream of a mountain range if the winds are _____ upstream of the mountain and an inversion layer is present _____ the top of the mountains.
    A. weak, above
    B. strong, above
    C. weak, below
    D. strong, below
- Which of the following is a cold downslope wind?
    A. Foehn
    B. Chinook
    C. Katabatic
    D. Santa Ana

- You would expect the warmest downslope winds in Boulder, CO if the air originated over _____ and a _____ amount of latent heat was released on the windward side of the mountains.
    A. Canada, large
    B. Canada, small
    C. the Pacific Ocean, large
    D. the Pacific Ocean, small

- For west winds across the Rocky Mountains Boulder would be located on the _____ side of the mountains and you would expect _____ skies in Boulder.
    A. windward, mostly sunny
    B. leeward, mostly sunny
    C. windward, mostly cloudy
    D. leeward, mostly cloudy

- Santa Ana winds will occur when there is strong _____ pressure over the Great Basin and a _____ north-south pressure gradient over Southern California.
    A. high, strong
    B. high, weak
    C. low, strong
    D. low, weak
- Santa Ana winds are most likely to occur in _____.
    A. Spring
    B. Summer
    C. Fall
    D. Winter
    E. Both c and d

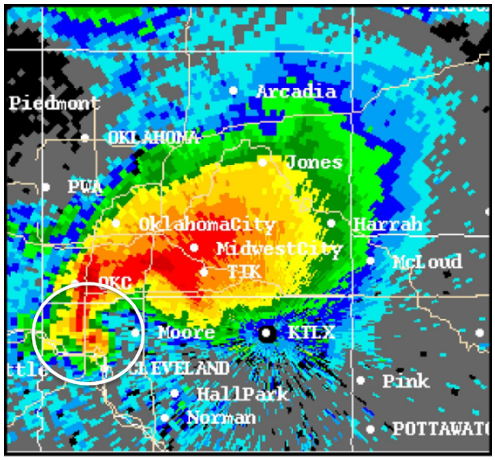
Chapter 18: Thunderstorms

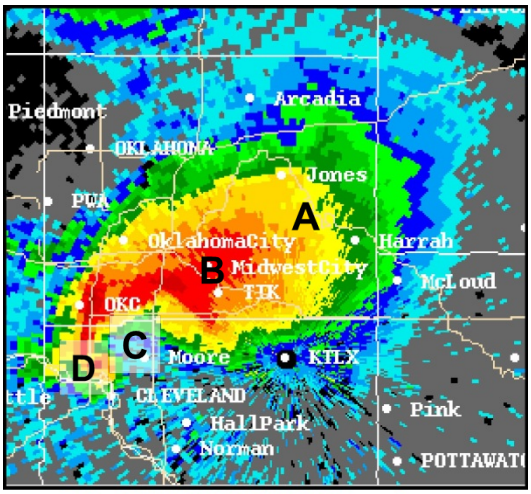
- True or false: A thunderstorm that is producing hail with diameters of ½ inch and winds of 60 kts is a severe thunderstorm.
    A. True
    B. False
- At which stage of development is an airmass thunderstorm if it has both an updraft and downdraft that coexist?
    A. Growth
    B. Cumulus
    C. Mature
    D. Dissipation
- What thunderstorm feature is found near the surface and created by rain-cooled air in the downdraft?
    A. Anvil
    B. Mammatus clouds
    C. Cold pool
    D. Updraft
- True or false: An MCS can form from an initially disorganized cluster of thunderstorms.
    A. True
    B. False

- In what order would you expect the following features to develop in a mesoscale convective system?
    A. squall line, disorganized cluster of thunderstorms, trailing stratiform region, bow echo
    B. bow echo, trailing stratiform region, squall line, disorganized cluster of thunderstorms
    C. trailing stratiform region, bow echo, disorganized cluser of thunderstorms, squall line
    D. disorganized cluster of thunderstorms, squall line, bow echo, trailing stratiform region

- The leading edge of evaporatively cooled air in a thunderstorm is known as _____.
    A. A derecho
    B. A gust front
    C. A bow echo
    D. A trailing stratiform region
- A radar fine line indicates the position of _____ that forms along a thunderstorm _____.
    A. a shelf cloud, gust front
    B. mammatus clouds, updraft
    C. a shelf cloud, updraft
    D. mammatus clouds, gust front
- A squall line is _____.
    A. an individual thunderstorm cell
    B. a long line of thunderstorms in which heavy precipitation falls in a long continuous line
    C. a rotating thunderstorm
    D. all of the above
- A frontal squall line is most likely to form _____.
    A. in the interior of an airmass away from fronts
    B. along a cold front
    C. along a dry line
    D. along an upper level front
    E. b), c), and d) are all likely places for a squall line to form
- What environmental condition does a supercell require that distinguishes it from an air mass thunderstorm?
    A. Moisture source
    B. Conditional instability
    C. Vertical wind shear
    D. Triggering mechanism for the updraft
- If a sounding in Norman, Oklahoma shows 2500 J/kg of CAPE in the atmosphere, while at Dodge City, Kansas the CAPE is 1000 J/kg. Which location, if any, is likely to get the strongest, most severe thunderstorms?
    A. Norman would have the strongest storms
    B. Dodge City would have the strongest storms
    C. Both would get thunderstorms of equal intensity
    D. Neither would get thunderstorms
- A strong updraft in a supercell thunderstorm can be as strong as _____.
    A. 1 mph
    B. 10 mph
    C. 100 mph
    D. 1000 mph

- The rain free base in a supercell occurs _____.
  A. below the forward flank downdraft
  B. below the updraft
  C. below the rear flank downdraft
  D. both a) and c)
- The bounded weak echo region of a supercell is an area of _____ reflectivity on a radar image.
  A. No
  B. Low
  C. High
- The most likely place for a supercell to initially form is _____.
  A. along a cold front
  B. along a dryline
  C. along an upper level front
  D. where airmass boundaries intersect
- What feature of a supercell is contained in the highlighted area? (see above to the right)
  A. BWER
  B. Anvil
  C. Forward flank
  D. Hook echo
- You would infer the updraft is located at which point in this radar image of a supercell?
  A. A
  B. B
  C. C
  D. D





Chapter 19: Tornadoes

- Rotation in a supercell occurs when _____.
  A. the shear associated with the low-level jet creates rotation about a vertical axis
  B. the rear flank downdraft forms
  C. the forward flank downdraft forms
  D. the rotation created by the shear associated with the low-level jet is tilted into the vertical direction by the updraft
- What is the typical size of a supercell mesocyclone compared to a tornado?
  A. Mesocyclones are typically 1 mile wide and tornadoes 3 miles wide
  B. Mesocyclones are typically 3 miles wide and tornadoes 0.5 mile wide
  C. Mesocyclones are typically 10 miles wide and tornadoes 3 miles wide
  D. Mesocyclones are typically 0.5 mile wide and tornadoes 1 mile wide

- When the rear flank downdraft gust front catches up to the forward flank downdraft gust front this is referred to as the _____ and leads to _____.
    - A. mesocyclone occlusion, vortex stretching
    - B. occlusion downdraft, vortex stretching
    - C. mesocylone occlusion, the formation of hail
    - D. occlusion downdraft, the formation of hail
- Vortex stretching _____ the rotation in a supercell.
    - A. weakens
    - B. does not change
    - C. strengthens
- When the rear flank downdraft completely wraps around the tornadic circulation, what would you expect to happen?
    - A. Vortex stretching
    - B. Tilting of horizontal rotation into the vertical
    - C. Tornadogenesis
    - D. Tornado dissipation
- A tornado family refers to multiple tornadoes that form _____.
    - A. on the same day
    - B. from the same supercell
    - C. in a squall line
    - D. in multicell thunderstorm complex
- Landspout tornadoes form in _____ thunderstorms as a result of _____.
    - A. supercell, vortex stretching followed by vortex breakdown
    - B. non-supercell, vortex stretching by vortex breakdown
    - C. supercell, stretching of small vortices that form due to shear across a front
    - D. non-supercell, stretching of small vortices that form due to shear across a front
- A gustnado forms in a manner similar to a _____, but is associated with shear _____.
    - A. supercell tornado, across a gust front
    - B. landspout, across a gust front
    - C. supercell tornado, in an occlusion downdraft
    - D. landspout, in an occlusion downdraft
- True or false: Tornadoes only occur in the United States.
    - A. True
    - B. False
- What intensity tornadoes occur most frequently in the United States?
    - A. EF0
    - B. EF1
    - C. EF2
    - D. EF4
    - E. EF5

- A hook echo would be visible on a _____.
    A. infrared satellite image
    B. visible satellite image
    C. Doppler radar reflectivity image
    D. Doppler radar radial velocity image
- On a Doppler radar radial velocity image a small area where radial winds rapidly switch from outbound to inbound is a _____.
    A. hook echo
    B. mesocyclone signature
    C. tornado vortex signature
    D. gust front
- The Storm Prediction Center would issue a _____ when conditions are favorable for the development of thunderstorms that contain strong winds, hail, frequent lightning, heavy rain, and possible tornadoes.
    A. severe thunderstorm watch
    B. tornado watch
    C. severe thunderstorm warning
    D. tornado warning

Chapter 21: Lightning

- True or false: Most lightning occurs over land than compared to oceans.
    A. True
    B. False
- _____ is a negatively charged particle.
    A. A proton
    B. An electron
    C. An ion
    D. all of the above
    E. none of the above
- For the fair weather electric field the atmosphere has a _____ charge and the earth's surface has a _____ charge.
    A. positive, positive
    B. negative, negative
    C. positive, negative
    D. negative, positive
- Through the process of interface (non-inductive) charging hail will acquire a _____ charge and ice crystals will acquire a _____ charge in a thunderstorm.
    A. positive, positive
    B. positive, negative
    C. negative, negative
    D. negative, positive

- The top of a thunderstorm would have a _____ charge due to the presence of _____.
    A. positive, hail
    B. positive, ice crystals
    C. negative, hail
    D. negative, ice crystals
- Which of the following statements about induction charging in a thunderstorm is true?
    A. Induction charging occurs due to differences in the arrangement of electrons on the surface of hail and ice crystals.
    B. Induction charging occurs due to sublimation of ice crystals.
    C. Induction charging can only occur in the presence of an electric field.
    D. All of the above.
- A visible flash of lightning occurs in the _____ stage of a lightning stroke.
    A. stepped leader
    B. return stroke
    C. dart leader
    D. second return stroke
    E. both b and d
- Thunder is caused when air in the path of a lightning stroke is rapidly _____ causing the air to _____.
    A. cooled, expand explosively
    B. heated, expand explosively
    C. cooled, contract violently
    D. heated, contract violently

Chapter 24: Tropical Cyclones

- A cluster of thunderstorms in the tropics with a wind speed of 50 knots would be classified as a _____.
    A. tropical disturbance
    B. tropical depression
    C. tropical storm
    D. hurricane
- In the Atlantic Ocean tropical storms are _____ and tropical depressions are _____.
    A. given names, given names
    B. assigned numbers, given names
    C. assigned numbers, assigned numbers
    D. given names, assigned numbers

- A Saffir-Simpson rating of _____ is given to the weakest hurricanes and a rating of _____ is given to the strongest hurricanes.
    A. 0; 10
    B. 1; 5
    C. 10; 0
    D. 5; 1
- The nearly cloud free area at the center of a hurricane is the _____.
    A. Eye
    B. Eyewall
    C. Spiral rainband
    D. Storm surge
- You would expect air to be flowing _____ near the surface and to be flowing _____ at upper levels in a hurricane.
    A. Inward, outward
    B. Outward, inward
    C. Inward, inward
    D. Outward, outward
- You would expect air to be _____ in the eyewall of a hurricane and to be _____ in the eye.
    A. Sinking, sinking
    B. Sinking, rising
    C. Rising, rising
    D. Rising, sinking
- The sea level pressure _____ as you move from the edge to the center of a hurricane.
    A. Decreases
    B. Remains constant
    C. Increases
- The strongest winds occur in the _____ on the _____ side of the hurricane when looking in the direction the hurricane is moving.
    A. eye, right
    B. eye, left
    C. eyewall, right
    D. eyewall left
- _____ is where easterly trade winds from the Northern and Southern hemisphere meet.
    A. The ITCZ
    B. The subtropical jetstream
    C. An easterly wave
    D. A mid-latitude front

- Rotation in a hurricane is due to _____.
    A. the pressure gradient force
    B. the gravitational force
    C. the Coriolis force
    D. the frictional force
- A tropical cyclone can survive as long as _____.
    A. 1 day
    B. 5 days
    C. 10 days
    D. over 20 days
- A tropical cyclone will weaken when it encounters _____.
    A. SST < 27 deg C
    B. decreased vertical wind shear
    C. movement over land
    D. all of the above
    E. both a) and c)
- A storm surge can be enhanced by _____.
    A. Tides
    B. wave height
    C. the shape of the coastline
    D. all of the above can enhance a storm surge
    E. none of the above can enhance a storm surge

Clicker Quizzes

Quiz #7

- Mountain snowstorms are important because they _____.
    A. are an important source of water for the western US.
    B. can cause transportation problems
    C. can result in avalanches
    D. all of the above
    E. none of the above
- True or false: The main factor that controls snowfall in the western United States is elevation.
    A. True
    B. False
- On the Great Plains of the United States mean annual snowfall _____ as you move from south to north due to _____.
    A. Increases, increased precipitation
    B. increases, decreased temperature
    C. decreases, increased precipitation
    D. decreases, decreased temperature

- Precipitation on the windward side of a mountain is often _____ than along a front, due to _____.
    A. Less; the localized nature of the precipitation against the stationary mountain
    B. Less; the localized nature of the precipitation along the moving front
    C. Greater; the localized nature of the precipitation against the stationary mountain
    D. Greater; the localized nature of the precipitation along the moving front
- Orographic lifting refers to _____.
    A. air rising over a cold front
    B. air rising over a warm front
    C. air rising in a trowal
    D. air rising over a mountain
- You would expect _____ precipitation totals on the windward side of a mountain compared to the leeward side of a mountain.
    A. Smaller
    B. About the same
    C. Larger
- In general _____ snow falls in the Rocky Mountains compared to the Sierra Nevada.
    A. More
    B. Less
    C. About the same amount of
- A snow water equivalent of 30 inches of snow per 1 inch of water would occur when the density of the snowflakes is _____.
    A. Low
    B. High
    C. Typical
- The National Weather Service in Boulder, CO is forecasting a winter storm for the Front Range of Colorado with southeasterly surface winds. You would expect the heaviest precipitation to fall in _____.
    A. Fort Collins
    B. Boulder
    C. southwestern Denver
    D. Grand Junction

Quiz #8

- Which of the following is a warm downslope wind?
    A. Bora
    B. Chinook
    C. Katabatic
    D. both a) and b)

- Santa Ana winds are strong _____ winds in southern California.
    A. Southerly
    B. Westerly
    C. Northerly
    D. Easterly
- As air descends dry adiabatically from 3,000 m near the crest of the Rocky Mountains to 1,500 m near Boulder, CO you would expect the air to warm approximately _____ degrees C.
    A. 1.5
    B. 10
    C. 15
    D. 20
- Katabatic winds are most likely to occur _____.
    A. over the world's large, hot deserts
    B. over the ocean
    C. in the central United States
    D. over Antarctica
- According to the National Weather Service a severe thunderstorm must _____.
    A. have hail with a diameter of 3/4 inch or larger
    B. cause wind damage or have wind gusts greater than 50 kts
    C. cause a tornado
    D. any of the above will result in a thunderstorm being classified as a severe thunderstorm
- True or false: A thunderstorm that produces lightning is always considered a severe thunderstorm by the National Weather Service.
    A. True
    B. False
- Which of the following is not required for a thunderstorm to form?
    A. a source of moisture
    B. a stable atmosphere
    C. a mechanism to trigger the thunderstorm updraft
    D. all of the above are required for a thunderstorm to form
- True or false: You would expect raindrops to be present during the cumulus stage of an airmass thunderstorm's life cycle.
    A. True
    B. False
- A downdraft forms in a thunderstorm due to _____.
    A. the drag from falling precipitation
    B. the presence of warm, moist air
    C. evaporative cooling as precipitation and cloud particles evaporate
    D. all of the above
    E. both a) and c)

Quiz #9

- A frontal squall line often forms the _____ of a mid-latitude cyclone comma cloud as viewed from a satellite.
    A. Head
    B. Tail
    C. both a) and b)
    D. none of the above
- The wall cloud in a supercell thunderstorm is located _____.
    A. Near the updraft
    B. near the forward flank downdraft
    C. near the rear flank downdraft
    D. both b) and c)
- The updraft in a typical supercell _____.
    A. Is vertical and rotating
    B. is vertical and not rotating
    C. is tilted and rotating
    D. is tilted and not rotating
- The lifetime of a frontal squall line is usually _____ the lifetime of an airmass thunderstorm.
    A. Shorter than
    B. About the same
    C. Longer than
- An area of less intense precipitation on the rear side of a squall line in a mesoscale convective system is known as _____.
    A. an airmass thunderstorm
    B. a gust front
    C. a bow echo
    D. a trailing stratiform region
- The wind shear associated with a low-level jet creates _____.
    A. an updraft
    B. a downdraft
    C. rotation about a horizontal axis parallel to the ground
    D. rotation about a vertical axis
- The mesocyclone in a supercell occurs when _____.
    A. the shear associated with the low-level jet creates rotation about a vertical axis
    B. the horizontal rotation created by the shear associated with the low-level jet is tilted into the vertical direction by the updraft
    C. the rear flank downdraft forms
    D. the forward flank downdraft forms
- True or false: Meteorologists understand how all tornadoes form.
    A. True
    B. False

- A key process in tornado formation that concentrates the rotation within the mesocyclone is called _____.
    A. Shear
    B. Tilting
    C. Stretching
    D. The forward flank downdraft

Quiz #10

- What type of particles are responsible for the negative charge near the bottom of a thunderstorm?
    A. ice crystals
    B. rain
    C. hail
    D. none of the above
- Which of the following statements about interface charging in a thunderstorm is true?
    A. Interface charging occurs due to differences in the arrangement of electrons on the surface of hail and ice crystals.
    B. Interface charging occurs due to sublimation of ice crystals.
    C. Interface charging can only occur in the presence of an electric field.
    D. All of the above.
- If you see a flash of lightning and then count 10 seconds until you hear the rumble of thunder you would estimate that the lightning stroke was approximately _____ away from you.
    A. 1 mile
    B. 2 miles
    C. 5 miles
    D. 10 miles
- The Fujita scale is used to measure the intensity of _____.
    A. Hurricanes
    B. Tornadoes
    C. Thunderstorms
    D. Blizzards
- The term hurricane is used in the _____ Ocean, while the term typhoon is used in the _____ Ocean to refer to the strongest tropical weather systems.
    A. Atlantic, eastern Pacific
    B. western Pacific, eastern Pacific
    C. Indian, Atlantic
    D. Atlantic, western Pacific
- An organized cluster of thunderstorms in the tropics with a wind speed of 80 knots would be classified as a _____.
    A. tropical disturbance
    B. tropical depression
    C. tropical storm
    D. hurricane

- A band of heavier rainfall that extends outward from the eyewall of a hurricane is called _____.
    A. an eye
    B. an eyewall
    C. a spiral rainband
    D. a storm surge
- The strongest winds in a hurricane are located in the _____.
    A. Eye
    B. Eyewall
    C. spiral rainbands
- Heavy rainfall occurs in the _____ of a hurricane, but the heaviest rainfall occurs in the _____ of a hurricane.
    A. spiral rainbands, eye
    B. eye, eyewall
    C. spiral rainbands, eyewall
    D. eyewall, eye