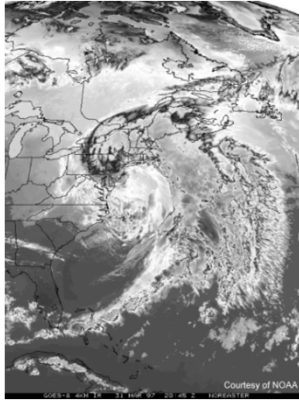


## Chapter 11: Cyclones: Along the East and Gulf Coasts



- East Coast Cyclones
- Gulf Coast Cyclones

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## Extratropical Cyclones in North America

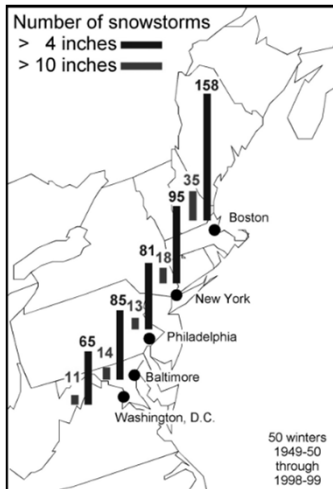


Cyclones preferentially form in five locations in North America:

- (1) East of the Rocky Mountains
- (2) East of Canadian Rockies
- (3) Gulf Coast of the US
- (4) East Coast of the US
- (5) Bering Sea & Gulf of Alaska

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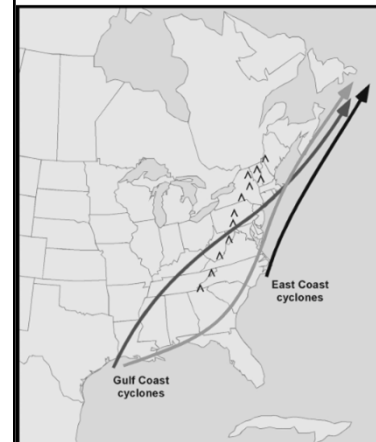
## How Often are the Coastal Cyclones?



- Coastal cyclones have the greatest economic impact of any storm type on the northeast United States and Canada, even more than hurricanes.
- Extratropical cyclones form along the East and Gulf Coasts of North America several times each year during late fall, winter, and early spring.

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## Origins of the Coastal Cyclones

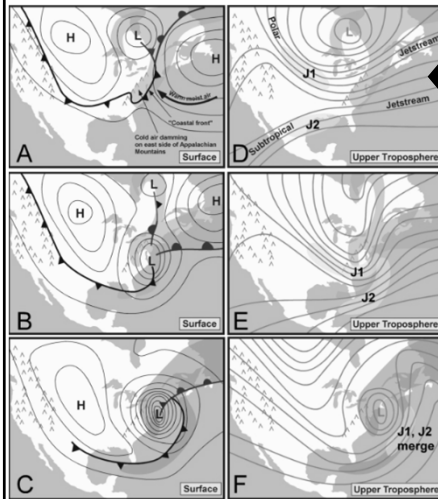


- Coastal cyclones form in two regions: (1) off the central East Coast and (2) off the Gulf Coast.
- Cyclones form along the East and Gulf Coasts of the US are often more intense than their Rocky Mountain counterparts, because of:
  - ✓ Costal cyclones form over warm water → more latent heat to cyclones
  - ✓ More sensible heat from ocean to cyclone
  - ✓ Stronger thermal contrast btw land and ocean
  - ✓ Exist both the polar and subtropical jetstreams
  - ✓ Cyclones over water experience less friction.

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## East Coast Cyclone: Prior to Development

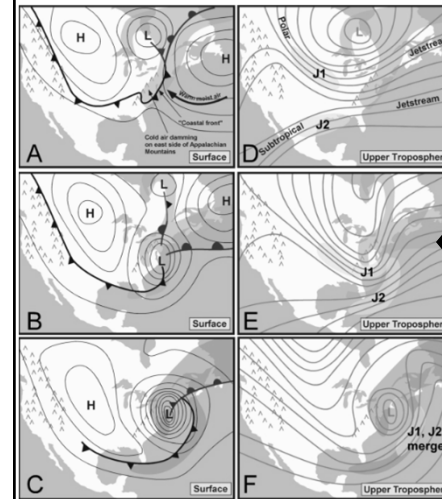


- East coast cyclones typically develop after an earlier cyclone originates east of the Rockies and progresses across the continent, which brings cold air to the East Coast.
- The cold air damming between the coast and the Appalachian Mountain leads to the formation of a coastal front.
- Prior to the cyclone development, subtropical jetstream moves northward to merge with the polar jetstream.

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## East Coast Cyclone: Initial Development



- The jetstreams in the polar and subtropical jetstreams move eastward and are on top of the surface coastal front.
- The upper-level divergence associated with the jetstreams induced upper-level divergence which then begin the development of a low pressure center on the surface.
- Latent and sensible heat releases from the ocean help the development.
- The pressure can drop as much as 30mb in 24 hours.
- Strong winds and heavy snows lead to blizzard conditions.
- East Coast cyclones are called "**Nor'easter**".

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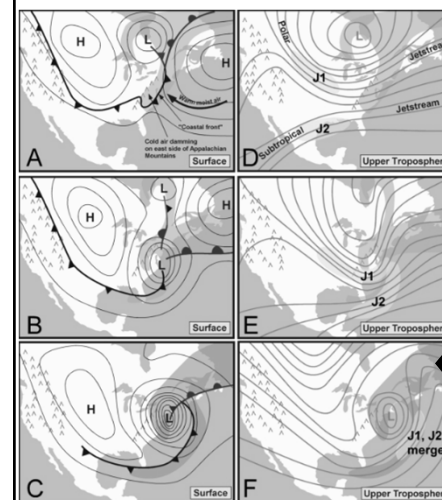
## Explosive Cyclogenesis → Bomb

- Meteorologists use "explosive cyclogenesis" to describe the rapid deepening of a low-pressure center during cyclone formation.
- If the central pressure drops 24 mb in 24 hours, the cyclone is called a "bomb cyclone".

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## East Coast Cyclone: Mature Phase



- East Coast cyclones track northeast along the coast and typically reach their maximum intensity 24-48 hours after the initial development.
- During this phase of the cyclone evolution, the polar and subtropical jetstreams typically merge and propagate northeastward along the east side of the storm.
- The upper-level trough continues to deepen and is eventually filled with cold air transported southward from west of the surface low.
- A cutoff low is formed and eventually filled by the convergence due to surface friction.
- The filling is slower over ocean than over land.

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## Gulf Coast Cyclones

Figure 11.4

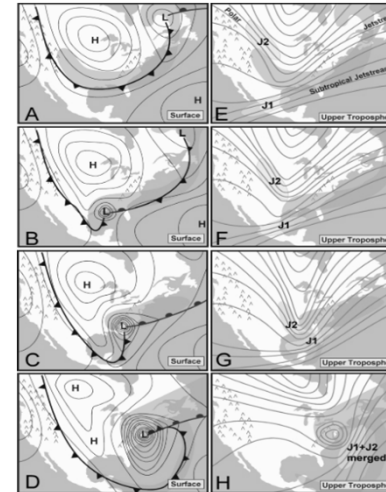


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- Gulf Coast cyclones develop most frequently during years when the subtropical jetstream is a persistent feature in the upper troposphere over northern Mexico and the Gulf of Mexico.
- Subtropical jetstreams tend to be strong in El Niño years, therefore, Gulf Coast cyclones are more common during El Niño years.
- Gulf Coast cyclones follow two tracks: (1) along the Gulf Coast and then northeast along the Atlantic Seaboard and (2) inland along the Mississippi and Ohio River Valleys.

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## Gulf Coast Cyclone: Prior to Development

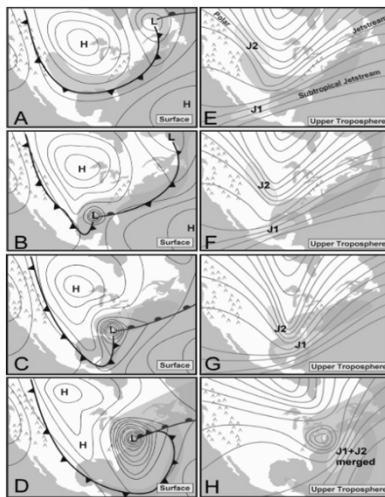


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- Gulf Coast cyclones typically develop after a cold front or an arctic front move across the US and arrives at the Gulf Coast.
- Aloft, a large trough is often present over the entire eastern US, which typically develops in association with an earlier Rocky Mountain cyclone.
- A subtropical jetstream flows from the tropical Pacific Ocean, across Mexico and over the Gulf Coast.

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## East Coast Storm Track

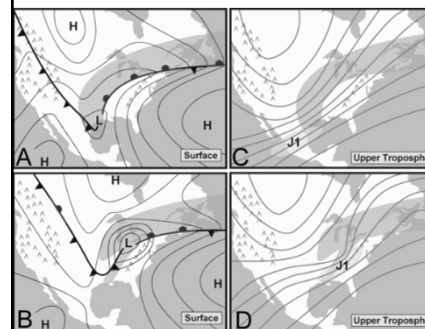


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- A jetstreak in the subtropical jetstream usually triggers the storm formation.
- Upper-level divergence of the jetstream begins to develop a low-pressure center on the cold front.
- As the low-pressure center forms and intensify along the cold front, cold air begin to move out over the warm Gulf waters west of the low center.
- Part of the cold front becomes a warm front.

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## Mississippi-Ohio River Valley Storm Track



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- Gulf Coast cyclones are more likely to track northward along the Mississippi Valley when the upper-level trough is farther west over the central US prior to their formation and the airflow across the eastern third of the US is southerly.
- The subtropical jetstream merges into the polar jetstream east of the trough axis.
- Cyclones forming in this environment is usually weaker in intensity than their coastal counterparts.
- The cyclone first develops along the cold front.
- As the cyclone tracks northward, freezing rain and heavy snow occur north of the advancing warm front and in the northwest of the low-pressure center.
- Floods may occur in the southeast sectors of the low due to moist air.

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