MAR 110 LECTURE #18
Ocean Storms

Figure 18.1 Blizzard of 1978
The blizzard of 1978 was associated with an unusually strong storm that developed explosively off of North Carolina over the Gulf Stream and then tracked up the coast closing down Rhode Island and Massachusetts for days. (PJ)

Figure 18.2 Ocean-ravaged Scituate Mass. (??)
Figure 18.2b Ocean-ravaged Scituate Mass. (??)

Figure 18.3 Gridlock (above) Providence (below) I-195 in Massachusetts Closed (PJ)
The Generation of a Winter “Bomb’ Stage 1

Figure 18.4 Satellite IR image of the explosive generation of a strong northeastern coastal storm.

Figure 18.5a A meteorologist’s view of the explosive generation of a strong northeastern coastal storm.

Figure 18.5b A idealized view of the explosive generation of a strong northeastern coastal storm.
Figure 18.6 Origins of the Storms
An unstable polar front generates storm systems in the subtropics that have the net effect of moving heat poleward. (?)

Figure 18.7 Genesis of a Cyclone – Stages 1 & 2
The polar front (above) is inherently unstable, (below) so it does not take much of a disturbance to plant the seeds of a future storm. (?)
Anatomy of a Cyclone – Stage 3

A Developing Cyclone with a Distinct Warm Front & Cold Front

Anatomy of a Cyclone – Stage 4

A Maturing Cyclone with Distinct Fronts & a Developing Occlusion

Figure 18.8 Genesis of a Cyclone – Stages 3 & 4

(above) The disturbance winds move (a) warm air masses over cold air masses defined by a Warm Front (red semicircles); (b) cold air masses under warm air masses defined by a Cold Front (blue triangles). (below) Maturing cyclone developing an occlusion. (??)
Anatomy of a Cyclone – Stage 5

Figure 18.8 A Cyclone is Born–Stage 5
The low pressure center pulls back from the fronts as the full-blown cyclone develops. (??)

Figure 18.9 Warm and Cold Front Structures
(above) Advancing cold air lifts warm air creating cloudiness and precipitation and also generates strong winds along the front. (below) Advancing warm air rides up over the cold air producing cloudiness and precipitation. (??)
Figure 18.10 The Gulf Stream
The Gulf Stream transports warm tropical water northwards into cooler regions. The heat from the water can strengthen storms and provide energy for changes in the weather. (??)

Figure 18.11 The Annual-Averaged Earth Heat Budget.
Incoming solar energy is absorbed primarily by the oceans (covering 72% of the Earth). The atmosphere is heated by the ocean (and land) via (1) infrared radiation (absorbed by clouds, water vapor, and other greenhouse gases; and reradiated back to Earth); (2) sensible heat flux; and (3) latent heat flux via evaporation. Over the ocean, latent heat flux is most important in fueling the storms. (??)
Figure 18.12 Storm Winds Promote Oceanic Heat Extraction
Over the ocean, latent heat flux is most important in fueling the storms. It takes 2425 kilojoules of heat energy – “Latent Heat of Evaporation” - from the ocean to convert 1 kg kilogram of ocean water to atmospheric water vapor. As the water vapor-laden air rises away from the ocean surface, the air is cooled, becomes saturated with water vapor, at which point water condenses. The latent heat energy is released in this process warms the air. (??)

Figure 18.13 The Polar Jet Stream (JS) Controls the Weather Systems
(below) The high and low pressure weather systems are formed in harmony with the Jet Stream above. (above) The position of the JS loops determines the ground tracks of the low pressure storm systems in the troposphere below. (??)
Figure 18.14 “Winter Bomb” Generation –Stage 1
Low pressure system develops in the vicinity of the Gulf Stream off of North Carolina (??)

Figure 18.15 “Winter Bomb” Propagation –Stage 2
The storm system (a double L) tracks up the east coast from the Mid-Atlantic (??)

Figure 18.10 “Winter Bomb” Exit –Stage 3
Low pressure system tracks northeastward out of the northeast toward Canada (??)