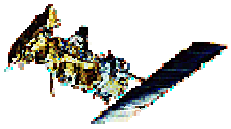
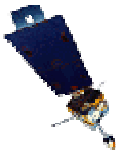
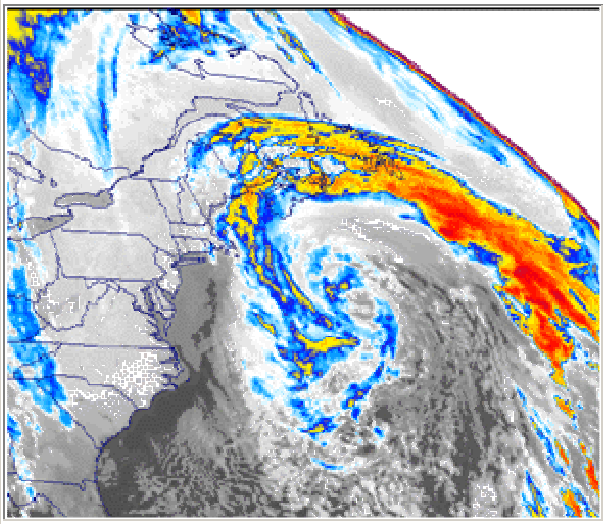


The Perfect Storm
October 1991



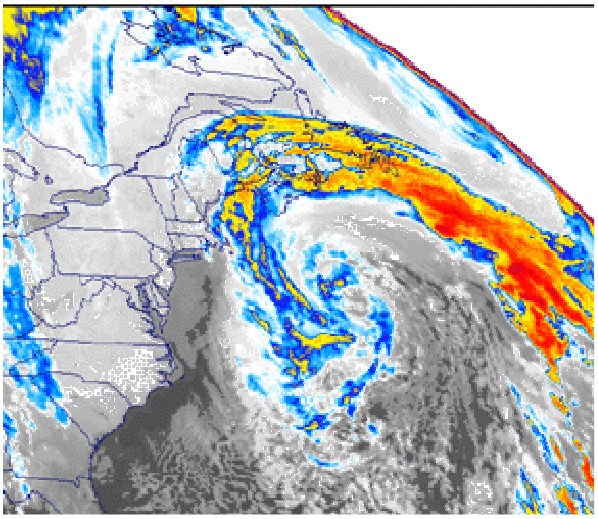


Enlarged Image
Image Information
Event Discussion
Bizarre Ending

An enormous extratropical low is creating havoc along the entire Eastern Atlantic Seaboard in this infrared image at 1200 UTC (0700 EST) on October 30, 1991. Labelled the "perfect storm" by the National Weather Service, the storm sank the swordfishing boat Andrea Gail, whose story became the basis for the currently best-selling novel "The Perfect Storm" by Sebastian Junger. A little-known and bizarre ending came to this monster, which came to be known as the Halloween Storm. To tell this incredible story in its entirety, the Satellite's Eye Art Gallery spans two subject headings (Extratropical Cyclones and Hurricanes)!

Image Information			
Satellite System		**Image Specifics**	
Satellite Name	GOES 7	Channel Band	No. 4 (Infrared)
Date	October 30, 1991	Resolution	4-km
Julian Date	303	Orbit No./Dir	NA
Time	1201 UTC 0701 EST	Entity ID	NA

Instrument System	VAS: VISSR	Area	Western Atlantic
Data Type	Sector		



The Perfect Storm

Conditions at the Time of the Image

The color-enhanced infrared image of 1200 UTC October 30, 1991 depicts a monster storm off the Eastern Seaboard, which was described by the National Weather Service as the "perfect storm." In this image, the storm was at its peak intensity. The storm became subtropical thirty hours later, just before the inner core of the storm developed into a topical storm and later an unnamed hurricane.

History of the Storm

Late October and November are months with weather in rapid transition in the eastern U.S. To the west, large fresh cold air masses from Canada begin to envelope the Midwest on a regular basis. To the east, the Atlantic Ocean is slower to lose its stored summer heat than the continent, and hurricanes sometimes form over the warm waters. The contrast between two very dissimilar air masses often results in massive storms just offshore of North America. These tempests, called "Nor'easters" in the Atlantic states, have sunk many ocean vessels, and this storm lived up to the reputation of being severe.

On October 28, 1991, a extratropical cyclone developed along a cold front which had moved off the Northeast coast of the U.S. By 1800 UTC, this low was located a few hundred miles east of the coast of Nova Scotia. With strong upper air support, the low rapidly deepened and became the dominant weather feature in the Western Atlantic. Hurricane Grace, which had formed on October 27 from a pre-existing subtropical storm and was initially moving northwestward, made a hairpin turn to the east in response to the strong, westerly deep-layer mean flow on the southern flank of the developing extratropical low. Grace was a

large system and it was already generating large swells ranging in size from about 15 feet offshore of North Carolina to about 10 feet near the Florida coastline.

As the low pressure continued to deepen on October 29, Grace became only a secondary contributor to the phenomenal sea conditions which developed over the Western Atlantic during the next few days. At 1800 UTC on the 29th, the vigorous cold front from the extratropical low undercut and quickly destroyed Grace's low level circulation east of Bermuda (Note the red and yellow area east of Charleston, SC in Figure 1). The remnant mid- and upper-level moisture from Grace became caught up in the outer part of the extratropical storm center's circulation, far from the storm's center. By the next day these remnants had become indistinguishable. The center of the extratropical low drifted southeastward and then southwestward, deepening all the time. It reached peak intensity of 972 mb and maximum sustained winds of 60 knots at 1200 UTC on October 30, when it was located about 340 n mi south of Halifax, Nova Scotia (See Event Discussion image above). After reaching peak intensity on October 30, the low retrograded southwestward on October 31 (Note swirl off Delmarva Peninsula in Figure 2), and then southward as the central pressure rose to about 998 mb by 0000 UTC on November 1.

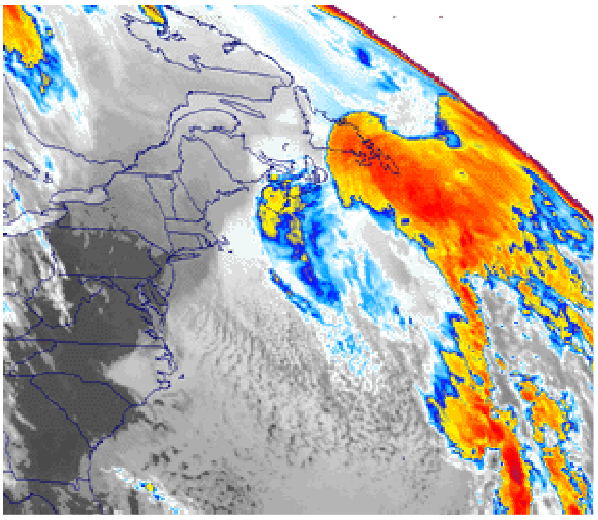


Figure 1
Hurricane Grace Being Absorbed
IR: 18 UTC October 29

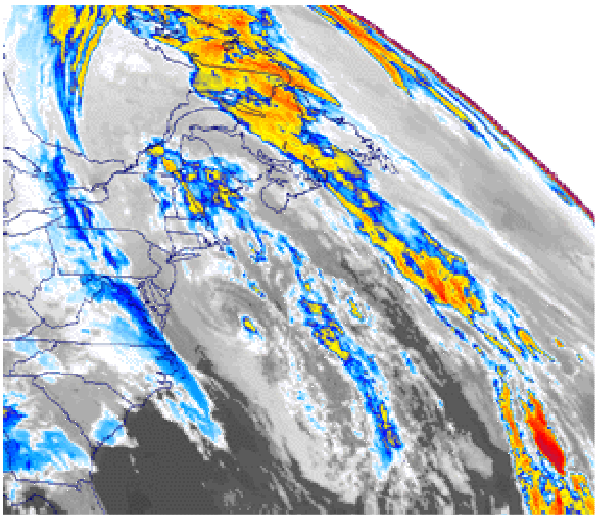


Figure 2
Weakening Halloween Storm
IR: 12 UTC October 31

65 Knot Winds/ 39 Foot Wave Heights

During the early phase of the storm's history, a strong high pressure center extended from the Gulf of Mexico northeastward along the Appalachians into Greenland. Strong winds were generated from the tight pressure gradient between a strong high pressure center in eastern Canada (1043 mb) and the surface low. Phenomenal seas and strong winds and waves along the eastern U.S. coastline occurred at this time. Several vessels passed close to the extratropical storm center on October 30 and reported winds of 50-60 knots. NOAA buoy 44011 located at 41.1 degrees N, 66.6 degrees W reported maximum sustained winds of 49 kt with gusts to 65 kt and a significant wave height of 39 feet near 1500 UTC. Buoy

44008 located at 40.5 degrees N, 69.5 degrees W reported maximum sustained winds of 53 kt with gusts to 63kt and a significant wave height of 31 feet near 0000 UTC on October 31. Other unsubstantiated observations reported winds and waves considerably higher.

North Carolina's coast was lashed with occasional winds of 35 to 45 mph for five consecutive days. In New England on October 30-31, wind gusts of above hurricane force pounded the Massachusetts coastline. Representative peak gusts included: 78 mph at Chatham NWS, 74 mph at Thatcher Island, 68 mph at Marblehead, 64 mph at Blue Hill Observatory (all in Massachusetts) and 63 mph at Newport, RI. Even more damaging were the heavy surf and coastal flooding caused by the tremendous seas and high tides caused by the long overwater fetch length and duration of the storm. Waves 10 to 30 feet high were common from North Carolina to Nova Scotia. High tides pushed to from three to seven feet above normal. In New Jersey, the greatest tidal departures of winter storms of record occurred during this event, with tide heights exceeded only by the Great Atlantic Hurricane of 1944. In Delaware, Maryland, and Virginia, the highest water levels were comparable to those of the nor'easter of March, 1962. A record high tide of 7.8 feet occurred at Ocean City, MD on the 30th, which eclipsed the old record of 7.5 feet recorded during the March 1962 storm. In Massachusetts, 25-foot waves reached the shoreline atop high tides already 4 feet above normal. At Boston, the tide reached 14.1 feet above mean low water or about 1 foot less than the tides associated with the "Blizzard of 1978." Elsewhere treacherous swells, surf, and associated coastal flooding occurred along portions of the Atlantic shoreline extending from Puerto Rico and the Dominican Republic, to the Bahamas, along the U.S. and Canada and in Bermuda.

Search and Rescue Satellite-Aided Tracking System (SARSAT)

According to "The Perfect Storm" book, The Andrea Gail is presumed to have sunk sometime after midnight on October 28 when the storm was still intensifying. The vessel was equipped with a 406 MHz EPIRB (Emergency Position-Indicating Radio Beacon) which is used to notify search and rescue authorities of a distress situation. However, the EPIRB was found with the switch turned off. Such is not the case with many vessels where activation of the 406-Megahertz EPIRB has been detected by NOAA's weather observing satellites, and has led to swift rescue when they have been in trouble. The Search and Rescue Satellite-Aided Tracking system (SARSAT), was developed in a joint effort by the United States, Canada, and France. In the United States, the system was developed by NASA and its operation was turned over to NOAA where it remains today. Today there are more than 63,000 EPIRBS in the NOAA 406 MHz Registration Database. These EPRIBS, which are reserved for use in maritime operations, and similar Emergency Locator Transmitters (ELTs), used for the location of downed aircraft, have dramatically reduced the time to reach accident victims. In an odd twist of fate, the 406-Megahertz EPIRB identified as belonging to The Andrea Gail was found washed ashore on Sable Island on November 5.

Widespread Extensive Damage

A state by state damage summary reveals the widespread and extensive damage caused by the storm and accompanying seas. Beach erosion and coastal flooding was severe and widespread, even causing damage to lighthouses. Hundreds of homes and businesses were either knocked from their foundations or simply disappeared. Sea walls, boardwalks, bulkheads, and piers were reduced to rubble over a wide area. Numerous small boats were sunk at their berths and thousands of lobster traps were destroyed. Flooding was extensive invading homes and closing roads and airports. Former President Bush's home in Kennebunkport, ME suffered damage as windows were blown out, water flooded the building, and some structural damage also occurred. Even inland areas suffered major damage. The Hudson, Hackensack, and Passaic Rivers all experienced tidal flooding, and high winds brought down utility poles, lines, tree limbs, and signs in several states.

The most extensive damage occurred in New England where federal disaster areas were declared for seven counties in Massachusetts, five in Maine, and one in New Hampshire. Off Staten Island, two men were drowned when their boat capsized. Other fatalities occurred when a man fishing from a bridge was either blown or swept off in New York and a fisherman was swept off the rocks at Narrangansett, RI by heavy surf. Offshore, six lives were lost when the Andrea Gail, a swordfishing boat, sank. Total damage in the Halloween Storm, as it came to be known because of its date, was in the hundreds of millions of dollars.

Bizarre End to the Halloween Storm

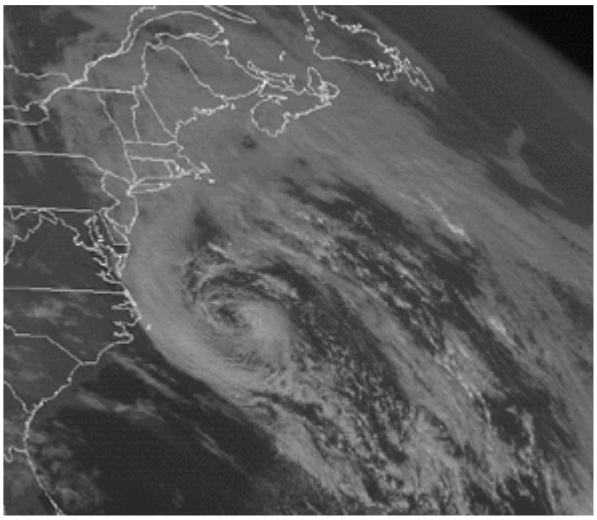


Figure 3
Subtropical Storm
Vis: 18 UTC October 31

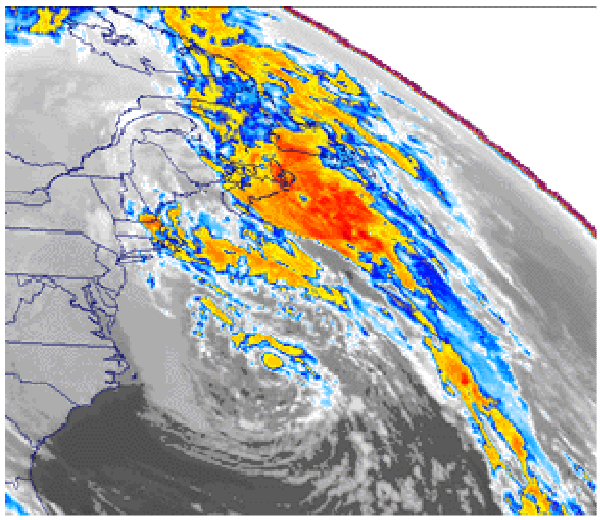


Figure 4
Tropical Storm Formation
IR: 06 UTC November 1

The southward motion of the cyclone on October 31 had brought the storm over a section of the Gulfstream with sea surface temperatures near 26 degrees C (80 degrees F).

Convection began increasing in bands near the center and it is estimated that subtropical characteristics were acquired at 1800 UTC on October 31, setting the stage for a bizarre ending to this storm (See Figure 3).

By 0600 UT on November 1, central convection had increased to the point where a tropical cyclone (estimated to be of tropical storm intensity) could be identified within the central area of the low (See Figure 4). Later it became a true hurricane in every sense of the word. Images of the hurricane phase and a discussion as to why this storm will be remembered in history as the "Unnamed Hurricane" can be found in the Hurricane Gallery of the Satellite's Eye Art Gallery.

---

http://www.ncdc.noaa.gov/oa/satellite/satelliteseye/cyclones/pfctstorm91/pfctstorm.html

Downloaded Tuesday, 20-Sep-2011 20:03:46 EDT

Last Updated Wednesday, 20-Aug-2008 12:41:27 EDT by Alvin.L.Mcgahee@noaa.gov

Please see the NCDC Contact Page if you have questions or comments.