Mission Summary

TS Dennis
IFEX/TCSP Research Mission Summary
050706I Aircraft: N43RF

Scientific Crew:

Lead Project Scientist	Michael Black
Radar Scientist	Peter Dodge
Workstation Scientist	Shirley Murillo
Cloud Physics	Paul Willis
TCSP Scientist	Robbie Hood
Observers	3 graduate students participating in NASA TCSP

Aircraft Crew:

Pilots	Randall TeBeest, Mark Nelson
Flight Engineers	Dewie Floyd
Navigators	Devin Brakob
Flight Director	Marty Mayeaux, Tom Shepherd,
Engineers	Terry Lynch, Jim Barr, Damon San Souci

Mission Brief:
This mission was a follow on to the flight on the day before. Here, we wished to examine the structural changes associated with the transition of Dennis from a TS to a hurricane. The NOAA P3 would once again coordinate with the NASA ER2 on a modified figure 4 or butterfly pattern with 75 nmi leg lengths at an altitude of 14,000 ft. We also had hoped to execute a microphysical module in a stratiform region. Takeoff for the P3 was scheduled for 1800 UTC for N43 and 1900 UTC for the ER2. Ferry time was estimated at 2 h, 45 min, allowing for about 3 hours in the in storm pattern, 2 h for the radial leg portion and about 1 h for the microphysics module. We planned to drop 20 regularly spaced GPS sondes and 4 AXBTs during the butterfly pattern.

Mission Synopsis:

Unfortunately the takeoff from the P3 was delayed by 4 hours due to crewing issues and a delay on the taxiway due to air traffic. The ER2 could not delay its takeoff because of concerns of limited visibility forecast for a later landing at San Jose. The mission plan was redesigned before takeoff and once again in-flight to accommodate the limited amount of time for a coordinated portion of the mission with the P3 and the ER2. Takeoff from San Jose was at 2156 UTC and NOAA43 headed NE for the Initial Point (IP) 75 nmi west of the projected center of Dennis. Here, we planned a south-north pass through the eye of Dennis. The IP was reached at 0041 UTC (07/07) after a descent from the ferry

altitude to 14,000 ft. The AOC navigator communicated directly with the ER2 to coordinate the pass from south to north across the center of Dennis. The radar signature of Dennis during the approach to Dennis was well-defined and we adjusted our track based on the center that was estimated from the LF radar display. The ER2 adjusted its track as well.

During the northward leg into the eye, the P3 executed a slow climb to18,000 ft followed by a slow descent back to 14,000 ft. The ascent/descent occurred while crossing an extensive region of stratiform rainbands and rain shield with occasional areas of modest convection. The ER2 was well coordinated above the P3 during this maneuver. The eye was reached at 0100 UTC where a sonde measured a surface pressure of 980 mb. Maximum flight-level winds were about 55 kt on the south side at a radius of about 15 nmi from the center. The eye and developing eyewall was more clearly-defined that on the flight the day before, but Dennis was clearly still in its organizational phase during this early phase of the flight. On this first pass into the eye, the eyewall was just now forming, appearing as a large rainbands that spiraled into the center from the south to east (see Fig. 1)

The NOAA P3 exited the eye on a northward track with the ER2 aligned vertically above. We once again performed an ascent/descent through the melting layer into the ice region between 14 k ft and 18 k ft. Regions of weak stratiform rainbands populated the north side of the storm, some areas were nearly rain-free, and a small area contained only isolated areas of moderate convective cells. Flight-level winds reached about 70 kt about 14 miles north of the eye associated with the end of the spiral band that was becoming the northern eyewall. Another wind maximum of about 55 kt was in a rainband about 50 nmi north of the center where we dropped an AXBT.

At 0117 UTC the aircraft reached the north point at 75 nmi radius, where we had hoped to track upwind to a point 75 nmi NE of the center to perform a NE-SW pass with the ER2. The ER2 pilot informed us that he did not have enough time on station to accomplish that so we instead mad a north-south reciprocal track to the eye. Another ascent/descent through and above the melting level was executed during this leg. Flight-level winds were 70-75 kt about 16 nmi north of the center which the aircraft reached at 0138 UTC. The pressure had dropped to 979 mb 38 minutes after the first eye pass.

The NOAA P3 continued on the southbound track to a point 75 nmi south of the center at 0157 UTC. The final ascent/descent was performed during this leg, but this time we climbed up to 19 kft where the temperature was -3° C. Maximum flight-level winds were about 60 kt at 10 nmi radius in the developing southern eyewall.

The ER2 was headed back to base by this time and N43 proceeded to a point 75 nmi SW of the center to begin a SW-NE pass though the center. The pass started at 0212 UTC and N43 was in the eye at 0228 UTC. Maximum flight-level winds were about 67 kt in the SW eyewall. We missed the wind center in the eye and executed an interesting maneuver back through the southern eyewall before turning back around to reach the center a second time at 0241 UTC. An eye sounding revealed that the central pressure had

stopped falling temporarily and remained at 979-980 mb. The eye and eyewall continued to organize though with the eye clearing somewhat and the eyewall becoming detached from the original spiral band (see Fig. 2).

The P3 then tracked NE out of the eye and ended the 75 nmi leg at 0254 UTC. Maximum flight-level winds in the NE eyewall were 78kt at 12nmi radius. We had planned a downwind leg to a point NW of the center but fuel and time constraints would not allow us to perform the downwind leg and complimentary pass from NW to SE. Instead we tracked west to a point 65 nmi north of the center at 0312 UTC, tracked south to the center at 0324 UTC before heading outbound to the west where we ended our final leg at 0343 UTC, 75 nmi west of Dennis's eye.

Dennis began intensifying once again as a sonde in the eye measured a surface pressure of 976 mb, a drop of 4mb in less than an hour. Maximum flight-level winds were about 75 kt in the northern eyewall and 65 kt in the western eyewall. The eye and eyewall were rapidly evolving as they took on a polygonal structure during the final pass through the center (Fig. 3)

The ferry back took about 2.3 h and the P3 landed at 0600 UTC after passing through another fog bank at the end of the runway. Although the mission could not be executed as planned, valuable Doppler radar and cloud physics measurements were made in a rapidly evolving and organizing hurricane. The combination of this data combined with the concurrent remotely-sensed instruments on the ER2, especially on the ascent/descent areas will provide valuable information that addresses both IFEX and TCSP goals. The flight was performed without any major equipment failures. The coordination between the NOAA P3 and the NASA ER2 was again excellent.

A total of 20 dropsondes were deployed during the flight and all of those were transmitted from the aircraft. Four AXBTs were also released as planned. The radar systems and cloud physics probes worked exceptionally well.

A satellite overview from the SSMI 85 GHz channel is shown in Fig. 4 and one from the GOEs-12 visible channel is in Fig. 5.

Problems:
The HRD workstation was not operable at the beginning of the flight. The AOC technical crew was able to remove the workstation from the rack and perform repairs on it so that it was operating normally during the in-storm portion of the flight.

Michael Black
7/8/05

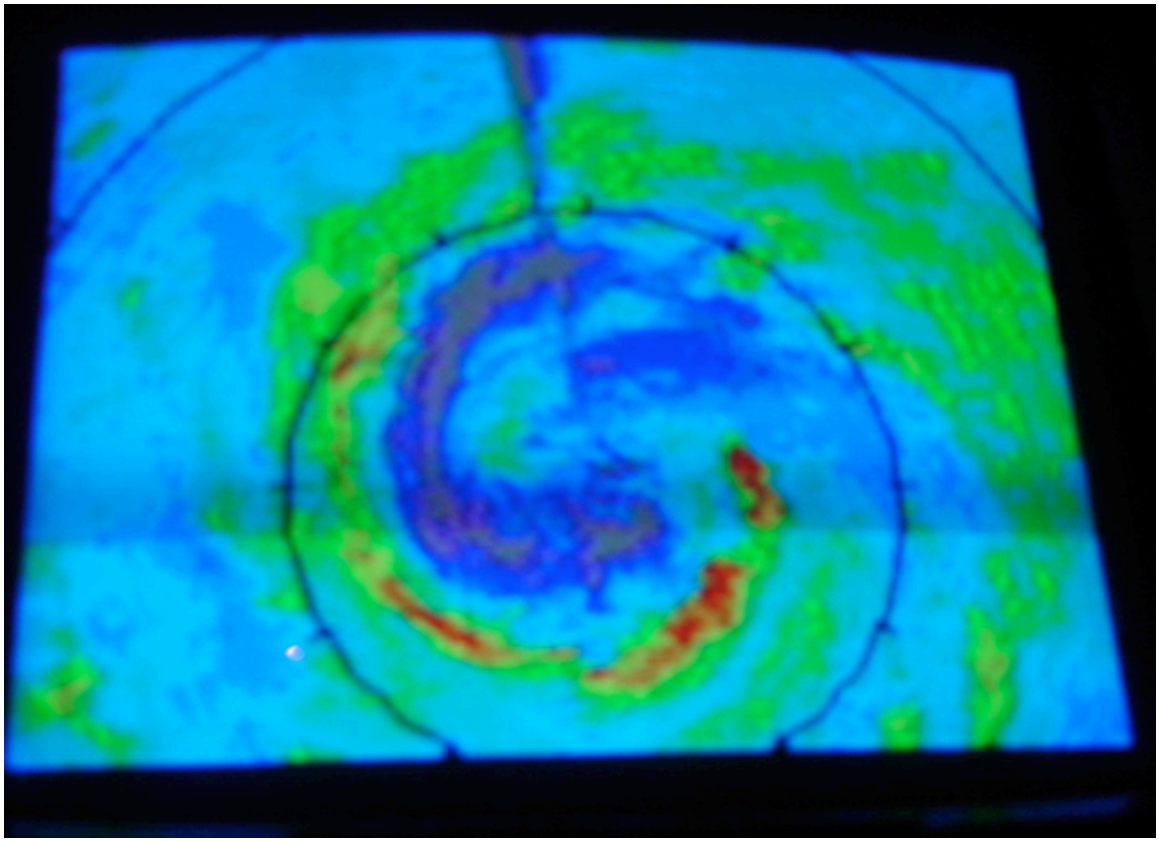

Fig. 1: A photo of the LF radar display screen at 0058 UTC showing the initial formation stage of the eyewall of Hurricane Dennis.

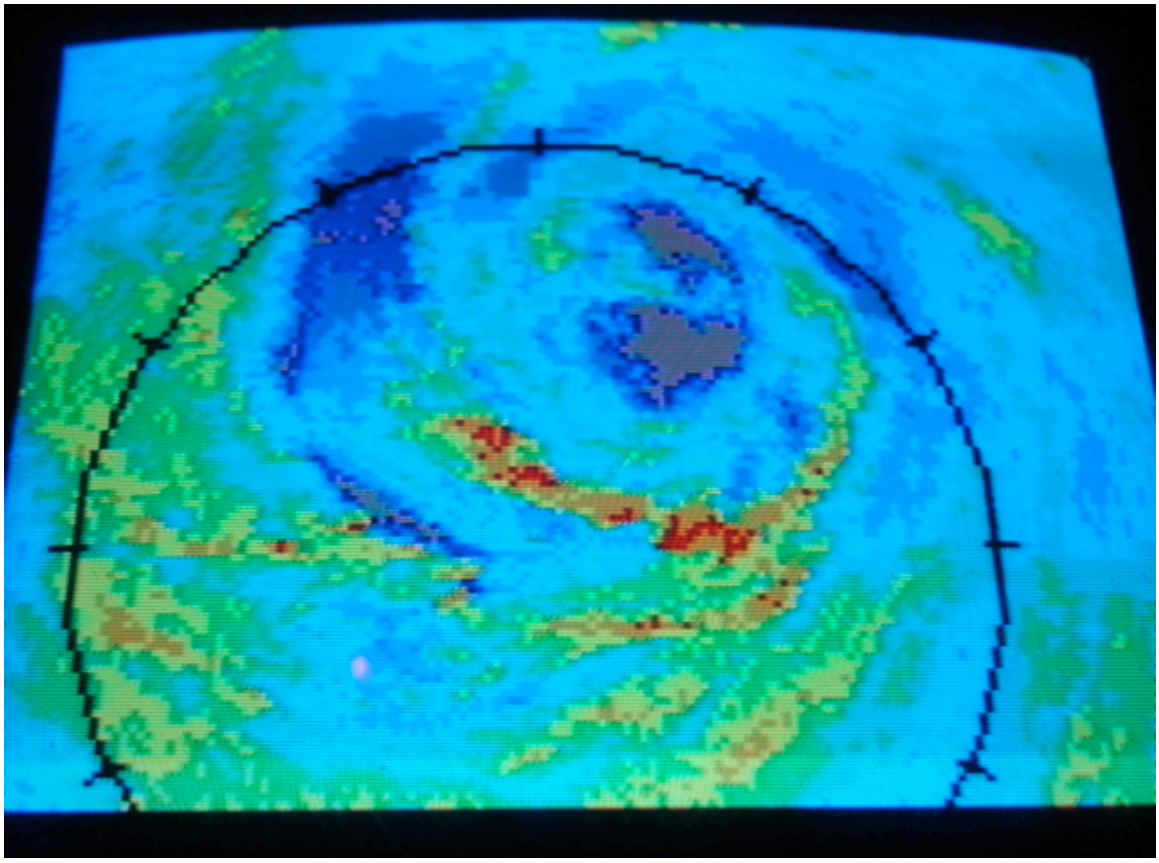

Fig. 2: A photo of the LF radar display screen at 0222 UTC showing the evolution of the eyewall as it detached from the spiral rainband.

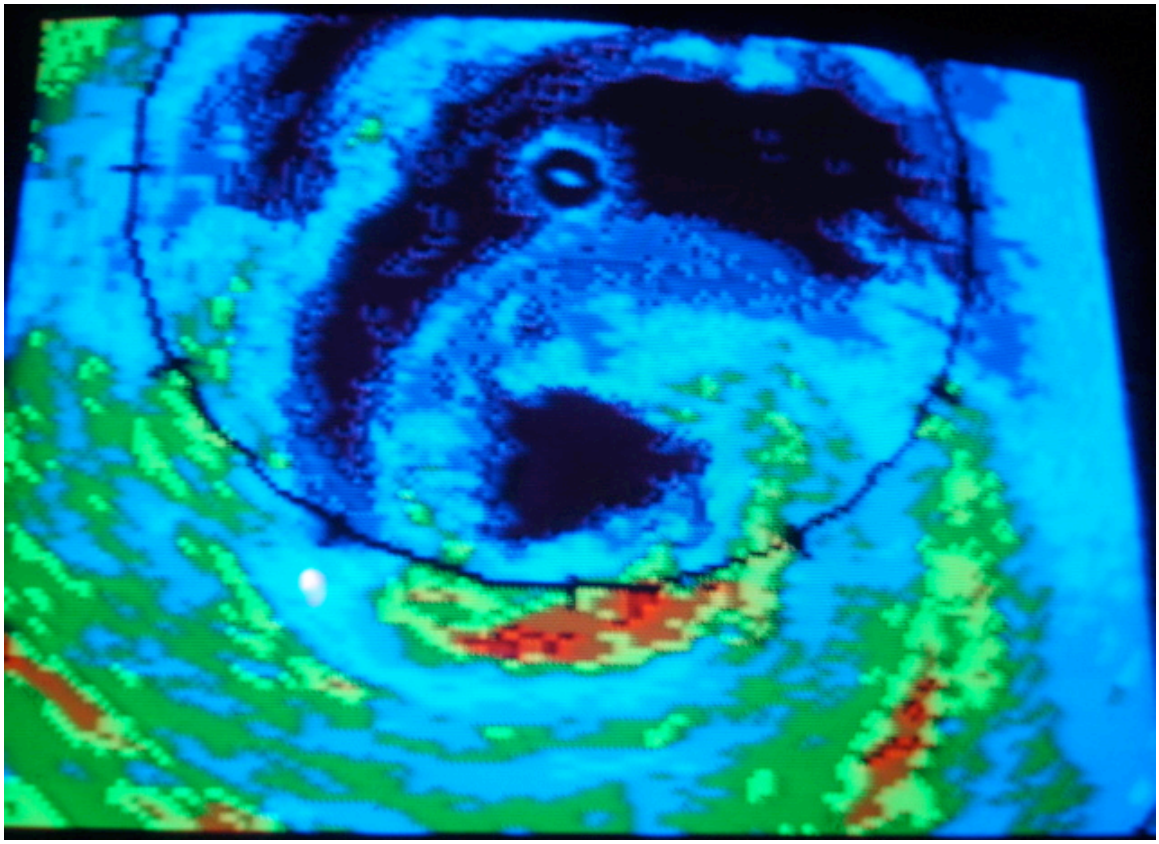

Fig. 3: A photo of the LF radar display screen at 0318 UTC showing the continued evolution of the eye/eyewall as it takes on a polygonal structure.

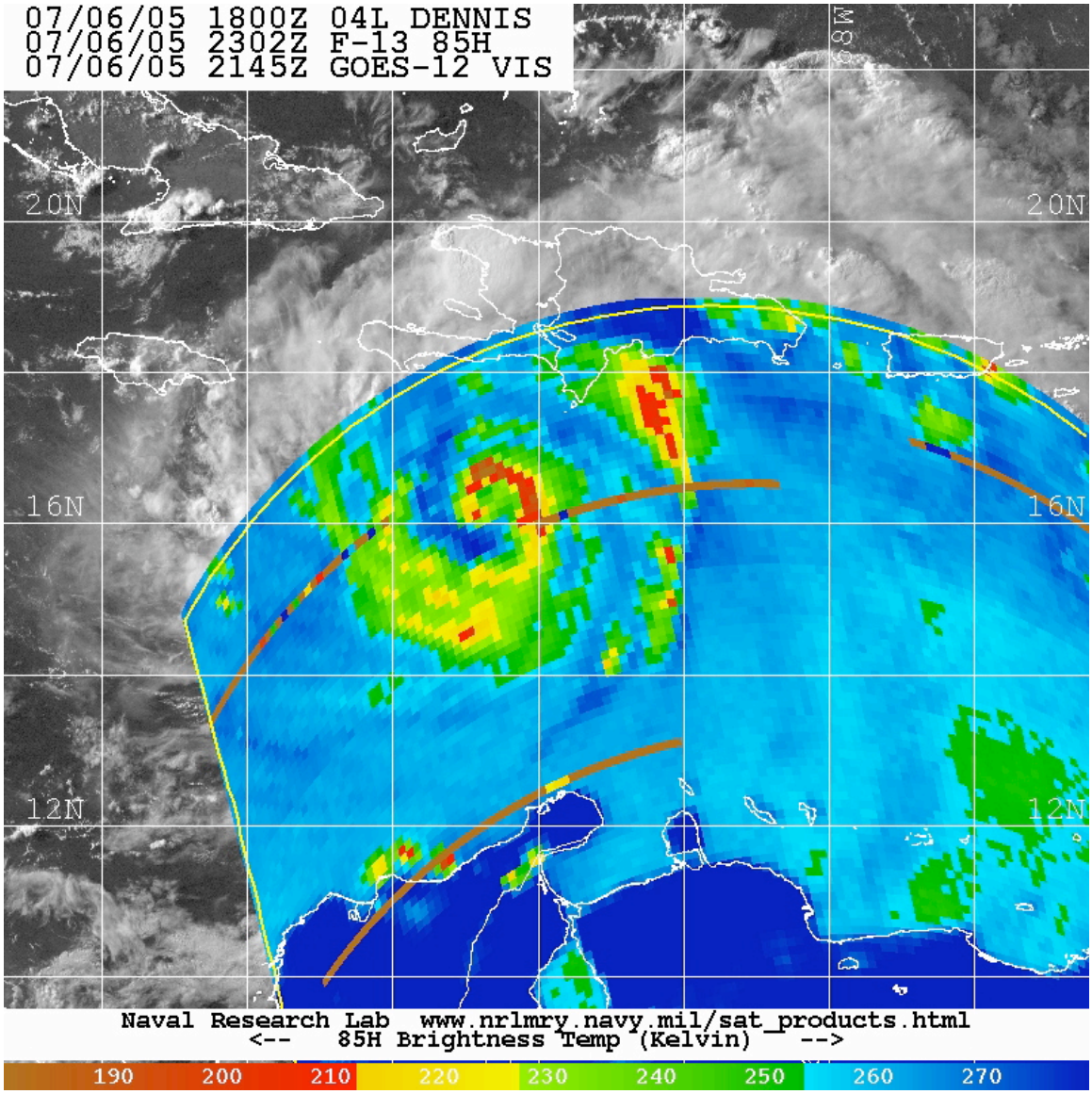

Fig. 4: SSMI 85 GHz satellite imagery of Hurricane Dennis at 2302 UTC 6 July.

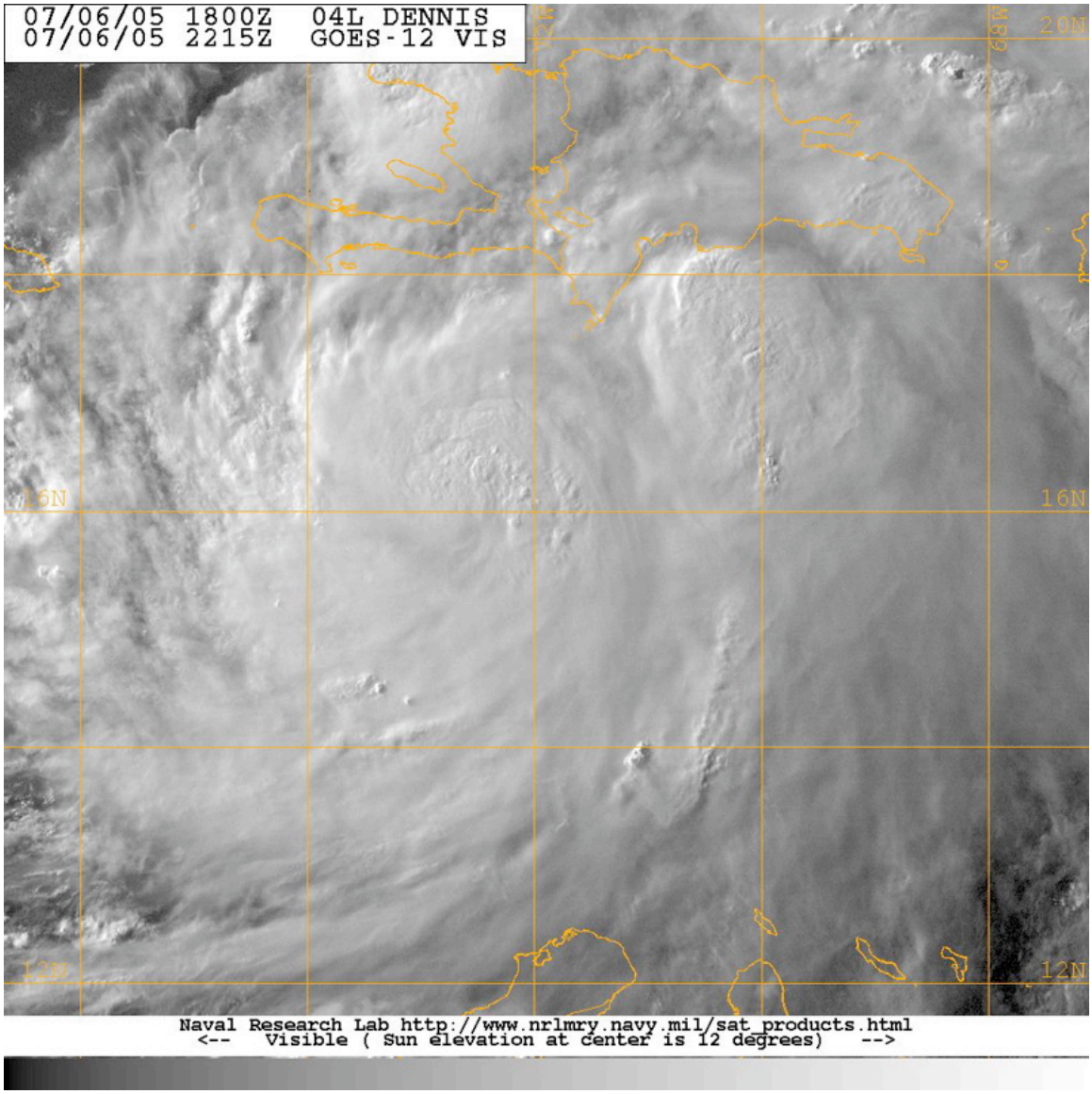

Fig. 5: Goes 12 high-resolution satellite imagery of Hurricane Dennis at 2215 UTC 6 July.