SATELLITE

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SOUTH FLORIDA HEAVY RAIN EVENT OF OCTOBER 19, 1986

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ABSTRACT

Subtle, warm cloud tops that produce localized heavy rain and flash flooding are not easily discernable from satellite imagery alone. Many times, by knowing the synoptic conditions along with satellite techniques, the identification and estimation of heavy rain is made easier. This was the case in a warm-top, heavy rain event that occurred over southern Florida.

1. INTRODUCTION

On the morning of October 19, 1986, a warm cloud top, heavy rain event occurred near the Broward-Dade county border of south Florida. This subtle, warm cloud top, heavy rain event was typical of other similar events that have occurred along coastal areas in Texas and the southeastern United States during the past few years.

The Synoptic Analysis Branch (SAB) of the National Environmental Satellite Data and Information Service (NESDIS) has a program for sending rainfall estimates on AFOS to the National Weather Service whenever heavy rainfall is occurring over the continental United States (Clark, Borneman, 2). Subtle, warm cloud top events are occasionally missed by the precipitation meteorologists of the Synoptic Analysis Branch. However, this was a case in which the operational precipitation meteorologist recognized the subtle event with the NESDIS warm cloud top enhancement curves and estimated heavy rain over south Florida that morning.

2. SYNOPTIC CONSIDERATIONS

The synoptic pattern for this heavy rain event was typical of other similar events along the coasts of Texas and the southeastern United States (see Fig. 1, a–f). Surface conditions showed a rather tight northeast gradient across southern Florida with a long fetch over the western Atlantic Ocean. The 850-mb level was moist with a strong northeast confluent flow. A weak 500-mb trough was moving into the area during the morning of October 19. The 300-mb level showed significant diffluence and a jet axis in the vicinity of South Florida, resulting in tremendous shear between the 850-mb and 300-mb levels. Also, moisture in the 1000- to 500-mb layer was abundant, as confirmed by the precipitable water values of 1.5 and the relative humidity of at least 80%.

3. SATELLITE CLOUD CONSIDERATIONS

An east-west band of clouds developed near the Broward-Dade county border of south Florida and extended into the Atlantic about 50 mi (see Fig. 2, a–b). Cloud tops showed little or no enhancement (MB curve) along the coast and just inland, indicating that temperatures were warmer than −32°C. Over the water, cloud tops showed slightly more enhancement (temperatures in the −32°C to −40°C range). This was probably the result of strong vertical shear and helps explain why heavy rain was not falling underneath the coldest cloud tops. The visible imagery (Fig. 2b) pinpointed the heavy rain by showing lumpiness and even some overshooting tops that extended inland (where cloud tops were warmer than −2°C). This pattern strongly indicated that heavy rain was falling between MIA (Miami International Airport) and FLL (Ft. Lauderdale-Hollywood International Airport).

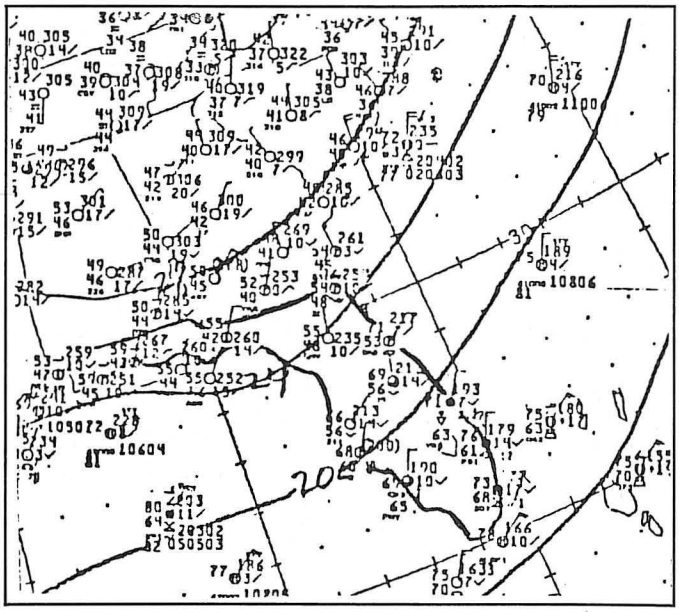
4. RESULTS

Estimates of warm cloud top rainfall over South Florida were begun around 1200 GMT on October 19 by the SAB precipitation meteorologist. Rainfall estimates over south Florida were based on the warm-top modification of the Scofield-Oliver Convective Storm Technique (Scofield, Oliver, Spayd, 3) (Spayd, Scofield, 4) (Scofield, 5).

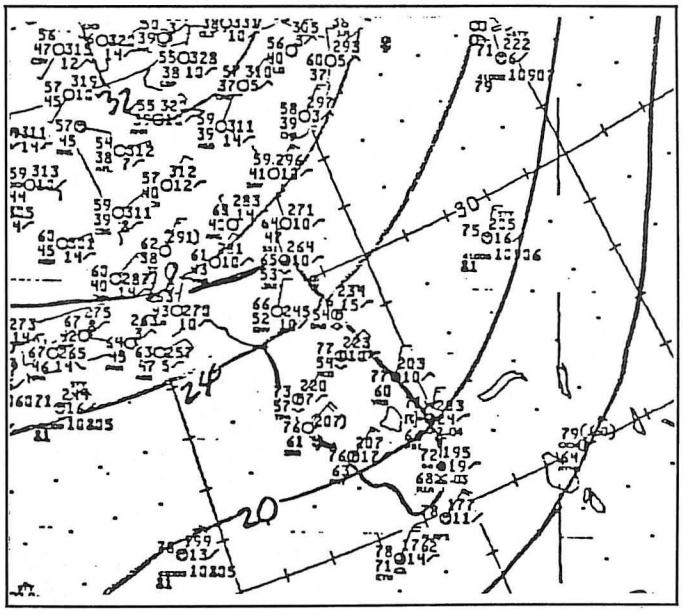
Satellite precipitation estimate messages were sent to the Miami, FL, office of the National Weather Service via AFOS during the morning, with the last message (Fig. 3) sent at 1528 GMT and advising (in the remarks section) that the heavy rain could end by 1700 GMT as some drying to the northwest was pushing toward South Florida (this later verified well). Satellite precipitation estimates reached as high as 3.7 in. along the Dade-Broward county border for the period 1200 GMT to 1600 GMT (as seen by looking at Fig. 4), with a very sharp gradient between coastal central Broward and extreme northeastern Dade counties on the north, and coastal central Dade and extreme northeastern Dade county on the south. This was confirmed by observed rainfall rates in the south Florida area (Fig. 5), with FLL and northeastern Dade county reports in the 3- to 4-in range and an unofficial report of 6- to 7-in. in the Dania (southern Broward county) area.

5. CONCLUSION

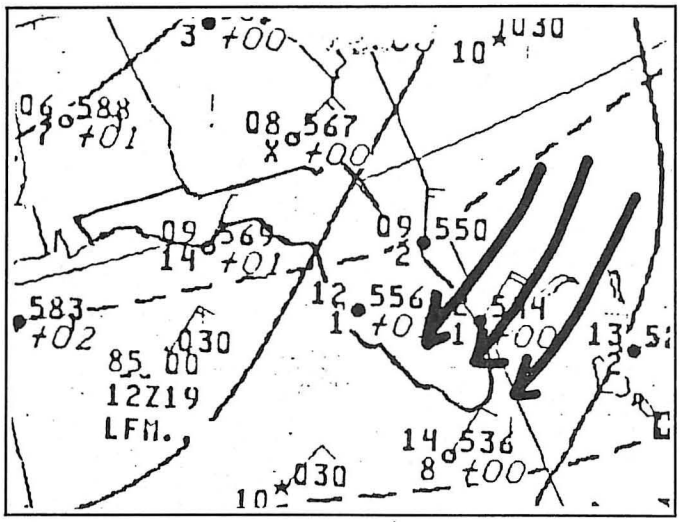
The south Florida heavy rain event of October 19, 1986, was a case in which the important meteorological parameters (abundant low-level moisture, strong vertical wind shear, approaching 500-mb trough) that were recognized early led to a more detailed and thorough examination of the subtle, warm-top cloud features that existed on the satellite imagery. Special NESDIS warm-top enhancement curves and estimation techniques helped in identifying and quantifying the heavy rain event, and the information gathered was sent to the forecaster at the local National Weather Service office in a timely manner. Although these types of subtle, warm-top heavy rain events often occur more frequently along the Gulf of Mexico and southeastern United States coasts, they are certainly not confined to just these areas. It is hoped that better knowledge of existing meteorological parameters, along



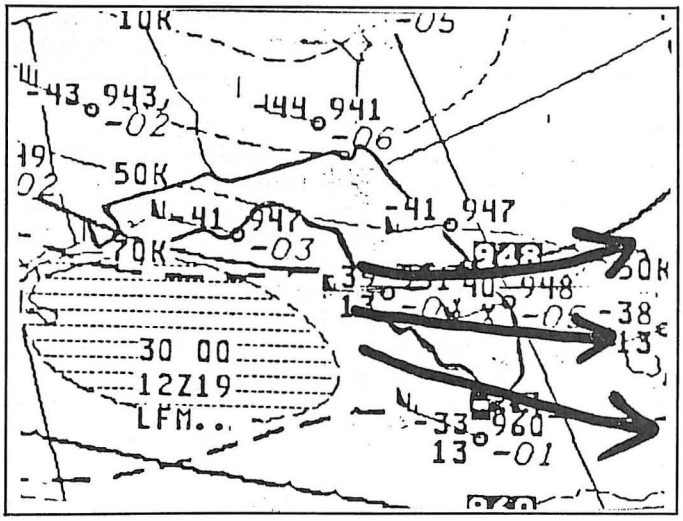
(a). 1200 GMT October 19, 1986 surface.



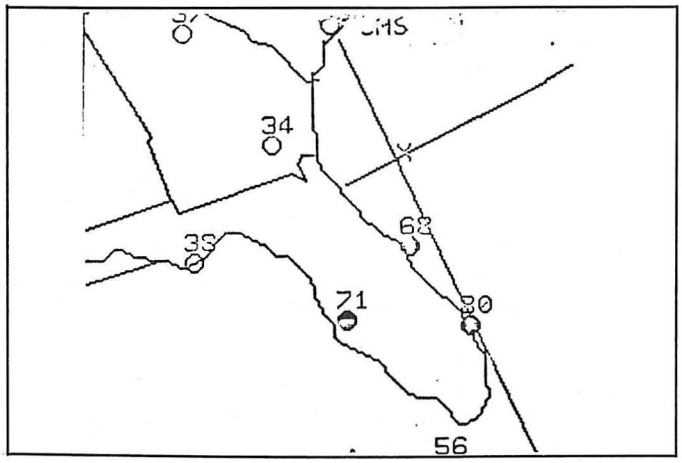
(b). 1500 GMT October 19, 1986 surface.



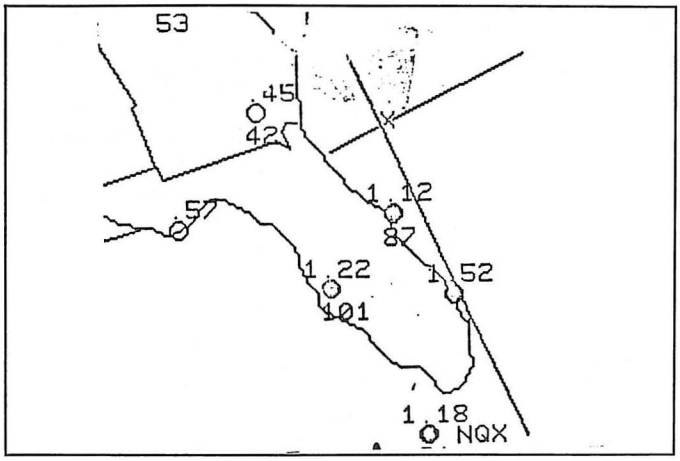
(c). 1200 GMT October 19, 1986 850 mb.



(d). 1200 GMT October 19, 1986 300 mb.



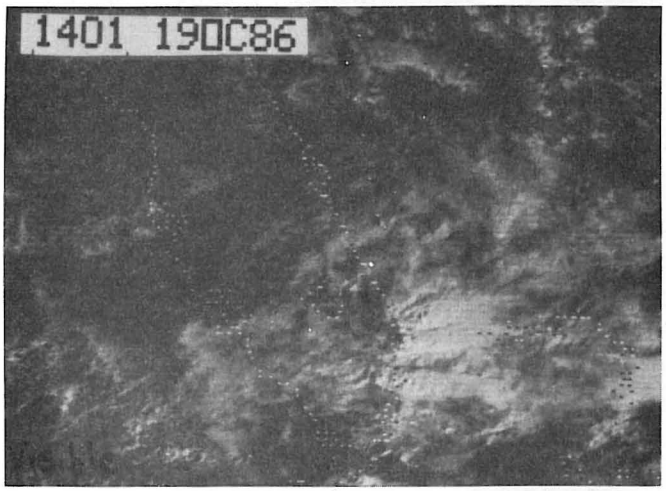
(e). 1200 GMT October 19, 1986 relative humidity 1000–500 mb.



(f). 1200 GMT October 19, 1986 precipitable water 1000–500 mb.

Fig 1. a–f. Synoptic weather features on the morning of October 19, 1986.

(a). Infrared MB Enhanced Satellite Picture



(b). Visible Satellite Picture

Fig. 2. Satellite imagery over Florida at 1400 GMT October 19, 1986.

Satellite Precipitation Estimates . . . Date/Time 10/19/86 1528Z CORR Prepared by the Synoptic Analysis Branch/NESDIS Tel. 763-8444 Quantitative values reflect maximum or significant estimates. Orographic effects not accounted for. Please compare with radar to check accuracy of locations. Latest satellite data used: 191500Z SJK

Location	Hrly Rt	Totals	Time	Remarks
S Fl Counties . . .	1.4″	2.5 –3.0″	12–15Z	Most persistent warm top band continues to line itself E–W across ext SE Broward and ext NE Dade FM FLL area to OPA LOCKA-N Miami Beach Area . . . DCRG low clds to NW across Okeechobee area may help hvy rain end over this area by 17Z . . .
Ext SE Broward	1.2″	2.2″–2.8″	″	
Ext NE Dade (NE of MIA)				
MSGS sent OCNLY				

Fig. 3. Satellite precipitation message sent during the morning of Oct. 19, 1986.

with an understanding of satellite cloud signatures that result in heavy rain, will make it easier to identify these types of events on the imagery in the future.

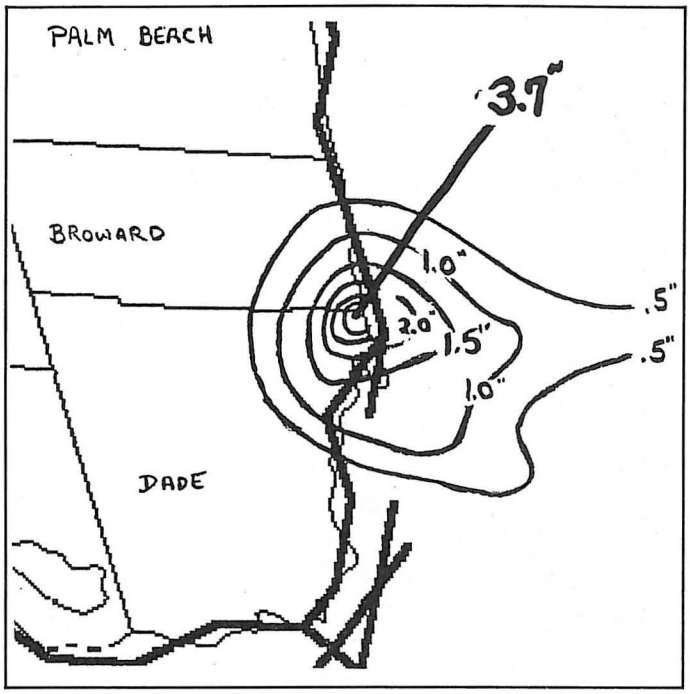


Fig. 4. SAB precipitation estimates from the NESDIS interactive computer 1200 GMT–1600 GMT October 19, 1986

Station	Hi	Lo	24 Hr Precip	Station	Hi	Lo	24 Hr Precip
Apalachicola	75	50		Miami Beach	79	70	.02
Clewiston	82	68		North Dade County	82	64	3.73
Crestview	72	37		Orlando	81	61	
Daytona Beach	79	57		Pensacola	72	50	
Conch Key/Mid Keys	78	71	1.15	Ruskin	82	57	
Ft Lauderdale Beach	82	69	.95	Sarasota/Braden-ton	85	62	
Fort Myers	83	64		Tallahassee	73	35	
Gainesville	72	49		Tamiami Airport	MM	MM	
Homestead	79	60	.02	Tampa	82	60	
Jacksonville	69	48		Tavernier	79	70	.11
Key West	80	74	.06	Vero Beach	81	73	.01
Lakeland	80	56		West Palm Beach	82	69	2.43
Miami	81	68	.64				

Fig. 5. Observed rainfall for the 24-hr period ending 1200 GMT October 20, 1986.

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NOTES AND REFERENCES

1. Sheldon J. Kusselson served as a summer meteorological intern in 1975 with the Washington, D.C. Satellite Field Service Station. He was a forecaster for Accu-Weather, Inc., State College, Pennsylvania, from 1976 to 1979. From 1979 to the present he has worked as a meteorologist with the Synoptic Analysis Branch of NESDIS/NOAA in Camp Springs, Maryland. He is a 1975 graduate of The Pennsylvania State University.

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Folklore

FICKLE—FACED APRIL

Sue Mroz

Depending on the geography and topography of certain locations, weather extremes can often be found. Just as important as location is the time of the year, since some months are generally more fickle than others. In the mid-latitudes, April is often many-faced. Accordingly, Luther wrote, "Trust not a day ere the birth of May."

April is known for the warmth that causes trees to bud prematurely, only to be ripped by a killing frost or buried by a snow storm. By mid May, warm weather is more constant and is more to be trusted by farmers.