

Meteorological Satellite Coverage of Florida Everglades Fires

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ABSTRACT

Several bog fires in the Florida Everglades in the spring of 1974 created a great deal of acrid smoke which was advected northward and reduced visibilities at many locations, including Patrick AFB. A subsidence inversion and low-level southwesterly flow combined on 1 May to send a plume of smoke into central Florida which reduced visibilities to 2 mi or less in areas south of Cape Canaveral. The 1430 GMT NOAA 3 satellite photo revealed the existence of the plume to the Cape Canaveral Forecast Facility (CCFF) forecasters. Later, satellite imagery taken between 1340 and 2110 GMT was received which showed movement of the plume offshore. These photographs gave evidence that timely use of meteorological satellite data can greatly aid in the forecasting of reduced visibilities due to smoke. In addition, high-resolution infrared and visual imagery from Defense Meteorological Satellite Program and NOAA satellites gave strong evidence that these data can be used to pinpoint and monitor brush and forest fires as well as provide local meteorological data vital to the fire fighting effort.

1. Introduction

The use of visual and infrared imagery for fire location and smoke forecasting is an added benefit to be derived from meteorological satellite imagery. Here we present polar orbiting (DMSP and NOAA 3) and

geostationary (ATS) satellite imagery to show the smoke generated by fires in the Everglades, which reduced visibilities in certain areas of the state of Florida on 1 May 1974. The forecast of impaired conditions was made easier by the use of the meteorological satellite pictures.

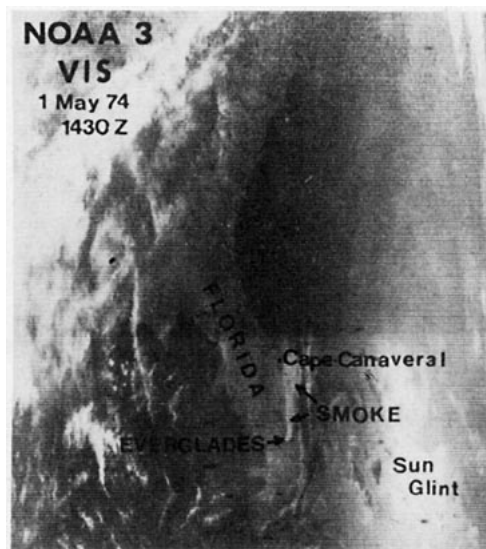


FIG. 1. NOAA 3 real-time visual scanning radiometer photograph, 1430 GMT 1 May 1974.

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2. Discussion

The southern and central portions of the Florida peninsula were exceptionally dry during the first months of 1974 as a direct result of below normal rainfall. In April, because of the near-drought conditions, many brush and woodland fires began to burn out of control. Most notable of these fires were several which began in the Florida Everglades, a region that is normally covered by a swamp-type terrain. After much effort, however, the fires were brought under control, but a "bog fire" situation still remained at the end of April. A bog fire develops when the fire on the surface is extinguished, but combustion continues beneath the surface. The bog fires produced a considerable amount of acrid smoke which eventually covered a large portion of southern Florida.

Prevailing light southwesterly winds in the lower levels and a strong subsidence inversion associated with a stagnant high pressure ridge combined to trap the smoke and steer it toward the central part of the state, some 100–150 mi from the source. By 1 May heavy smoke had moved as far north as central

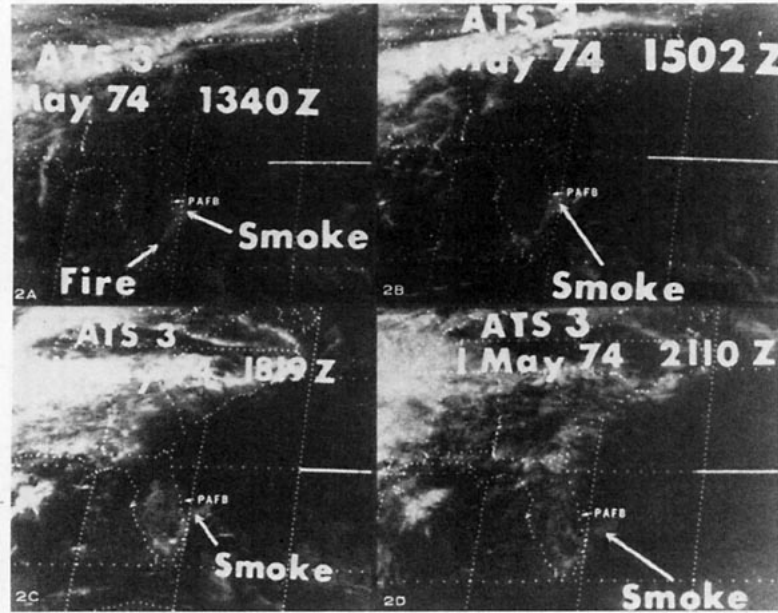


FIG. 2. ATS 3 geostationary satellite photographs, 1340–2110 GMT 1 May 1974.

Florida and reduced visibility in the Orlando and Daytona Beach areas.

On 1 May forecasters at the Cape Canaveral Forecast Facility, who also have responsibility for Patrick Air Force Base about 20 mi south of Cape Canaveral, had difficulties with the visibility forecast for Patrick AFB. It was obvious that the smoke was the cause of the restricted visibility, since it could be smelled, but the extent of the smoke coverage was not realized until the 1430 GMT NOAA 3 visual picture (Fig. 1) was received.

This picture shows a smoke plume extending from the Everglades, just to the south of Lake Okeechobee,

in a northeastward direction toward Cape Canaveral and Cocoa Beach. Visibilities from Cape Canaveral northward were generally 2 mi or better, while visibilities to the south were 2 mi or less.

Fig. 2, from the ATS 3 geostationary satellite, shows the movement of the smoke plume between 1340 and 2110 GMT. During that period, a slight veering of the low-level winds advected the plume more easterly, carrying the plume offshore and improving visibilities at stations in central Florida which had been affected earlier. At 1340 GMT the portion of the plume visible to the satellite extended to about 79°W. By 2110 GMT the plume reached 77°W, indicating a rate of movement of slightly more than

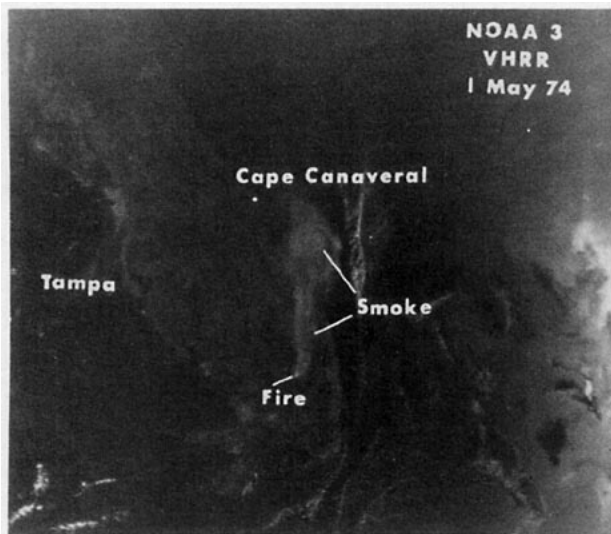


FIG. 3. NOAA 3 very high resolution radiometer (VHRP) photograph, 1430 GMT 1 May 1974 (received at Suitland, Md.)



FIG. 4. DMSP nighttime visual photograph, 0200 GMT 30 April 1974 (received at Howard AFB, Canal Zone).

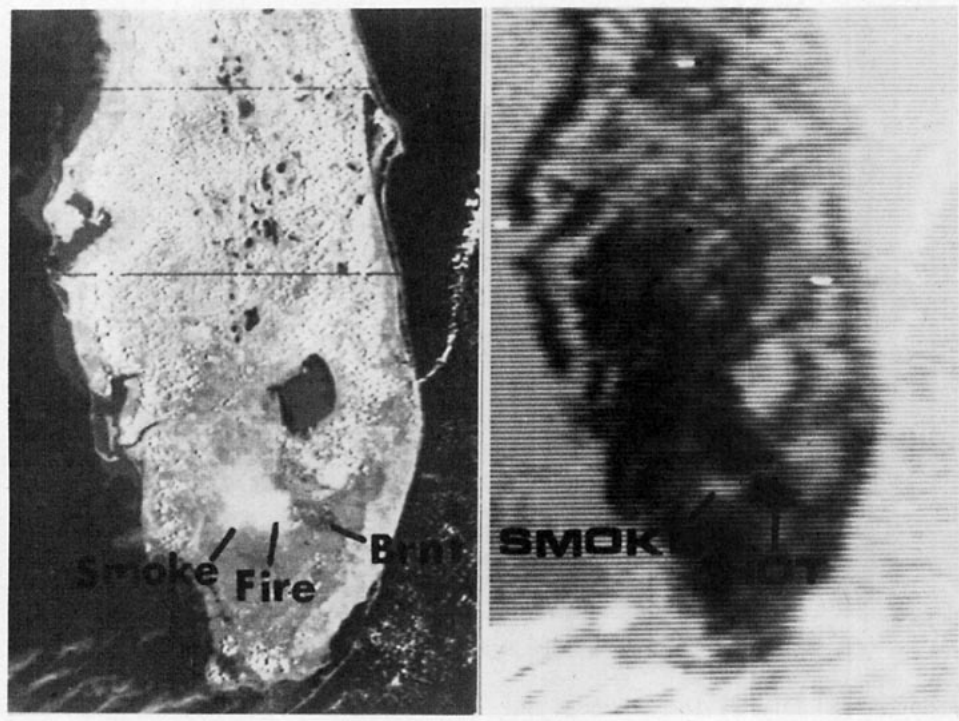


FIG. 5. Daytime DMSP visual and infrared photographs, 1700 GMT 30 April 1974 (received at Keesler AFB, Miss.).

15 kt. This was in reasonable agreement with the low-level wind direction and speed.

The NOAA 3 very high resolution radiometer (VHRR) picture (Fig. 3) received at the Suitland, Md., Satellite Field Service Station, is coincident with the NOAA 3 direct readout visual picture (Fig. 1) received at the Cape Canaveral Forecast Facility. This picture shows the plume in greater detail with little visible smoke in the Cape Canaveral area. The heaviest part of the plume is to the south of the Cape and this was confirmed by reported visibilities of 2 mi or less. Also, one of the major surface fires can be seen at the source of the plume. The location of the bright dot at the tip of the smoke has been verified by personnel of the Florida Division of Forestry as a major fire location on 1 May. This fire burned over 400 000 acres in the Everglades wildlife management area.

Data received from the DMSP satellite has added more information to the material just discussed. A nighttime visual picture (Fig. 4) received at Howard Air Force Base, Canal Zone, at 0200 GMT 30 April shows the bright spot directly associated with this

large surface fire. The city lights of Florida are also shown.

A daytime DMSP visual and infrared photo pair (Fig. 5) was received from Keesler AFB, Miss. The 0.62 km ($\frac{1}{3}$ n mi) resolution visual photo clearly shows the burned area and smoke plume. A high-pressure ridge line was directly over the Everglades that day and a weak east wind was evident from the orientation of the smoke. In addition, no rainshower activity can be seen that could bring relief to the area. The 3.2 km (2 n mi) resolution infrared imagery, which was set in 16 gray shades from 310 K (black) to 285 K (white), clearly depicts the burned area or smoldering fires under the ground.

3. Conclusion

It is evident that meteorological satellite data can be a valuable tool for forecasters when dealing with the difficult situation of reduced visibilities from widespread smoke. An important additional benefit from using these data is the ability to locate and monitor brush and forest fires, especially in sparsely populated areas where such a fire may otherwise go unnoticed for days.