PICTURE OF THE MONTH

A Narrow Clear Zone Over Florida and the Atlantic Ocean

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ABSTRACT

A narrow cloud-free zone of large longitudinal extent was observed in visible and infrared satellite imagery on 21 September 1978. An attempt to explain the zone in terms of subsidence induced by a transverse frontal circulation is presented.

An interesting meteorological feature was observed in satellite imagery on the morning of 21 September 1978. A clear zone or narrow, cloud-free band was seen in both visible and infrared wavelengths across central Florida, extending westward into the Gulf of Mexico and eastward into the

Fig. 1. GOES-1 visible data (4 km resolution) 1530 GMT 21 September 1978. Data have been enhanced to emphasize contrast. Arrows indicate the location of the clear zone. Photograph is from screen of CSU's ADVISAR.
Atlantic Ocean. Figs. 1 and 2 are, respectively, the visible and infrared images at 1530 GMT (1030 EST) as displayed on Colorado State University's ADVISAR (All Digital Video Imaging System for Atmospheric Research). The infrared image has been enhanced to highlight temperatures in the region of interest, while the visible imagery has been enhanced to emphasize contrast. In Fig. 2, the white area across the Florida peninsula represents blackbody temperatures \( T_{BB} \) in the range 26.8–31.8°C, while the adjacent, elongated gray area represents \( T_{BB} \) from 24.3 to 26.3°C. The feature is most clearly discernable across the peninsula in a band 75 km wide, but also extends at least 1000 km eastward and several hundred kilometers westward over the water.

Parmenter (1977) noted a similar feature in central Florida when afternoon convection was inhibited by a morning haze layer. In the 1978 case, however, all reported haze conditions were confined to stations well north of the clear zone. In addition, the advection of particulate material would not explain the clear zone's small ratio of width to length. This feature appears to be a result of a dynamically induced subsidence mechanism manifested in a narrow region along a lower tropospheric boundary.

The synoptic situation over the region was characterized by a warm-core high-pressure system centered near the North Carolina coast which maintained a weak closed circulation both at the surface and aloft. Fig. 3 shows the North American surface analysis at 1500 GMT. Easterly flow at the surface prevailed over Florida in response to the high while winds aloft over Florida also were easterly and less than 15 m s\(^{-1}\). A stationary front extended eastward from the coast of Florida into the Atlantic Ocean. Although the exact location of the frontal system is difficult to determine because of the paucity of oceanic data, an attendant area of convective cloudiness to the north of the clear zone can be seen on the 2 km resolution visible image at 1530 GMT (Fig. 4). The convection, though seemingly not intense, is organized in narrow, rope-like arcs along the zone's northern boundary and closely parallels the orientation of the satellite-viewed clear zone.

Eliassen's (1962) analysis of idealized frontal zones using a semi-geostrophic approach indicates that transverse vertical circulations form along frontal zones as a result of differential advection within a horizontal deformation field and by cold

![Enhanced IR Image](Image)

**Fig. 2.** As in Fig. 1 except for enhanced infrared imagery.
Fig. 3. North American surface analysis at 1500 GMT 21 September 1978.
Shaded area is location of satellite-viewed clear zone.

air advection by the thermal wind within the frontal zone. The transverse circulations are direct with rising motions immediately along the front and sinking motion on either side. It is postulated that the clear zone is a result of a transverse circulation around the frontal layer, with subsidence and hence clearing occurring on the southern (descending) branch. The existence of the predicted northern (descending) branch of the circulation is apparently evident to the north of the convection (Fig. 4) as a broad clear area extending northeastward from South Carolina to eastern Virginia and then eastward over the ocean.

Four hours later at 1930 GMT the clear zone is somewhat more diffuse but still discernable over the peninsula (Fig. 5). The suppression of the sea breeze front off the west coast of Florida is quite apparent (cf. Figs. 4 and 5). The location and spatial dimensions of the swath do not suggest the presence of a sea breeze circulation or the advection of particulate material. The causative mechanism is proposed to be dynamically induced subsidence but
the extent and resolution of the data preclude a verification of this hypothesis.

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REFERENCES
