A WELL-ORGANIZED THUNDERSTORM OUTFLOW IN FLORIDA

Ronald L. Holle

National Severe Storms Laboratory, NOAA
Norman, Oklahoma

Andrew I. Watson[1]

National Severe Storms Laboratory, NOAA
Norman, Oklahoma

Dan Purcell

WSR-88D Operational Support Facility
National Weather Service, NOAA
Norman, Oklahoma

Gust fronts can be sources of new convection as well as significant wind events, and are discussed in detail in training materials for WSR-88D radar operators. The radar course includes a time-lapse photographic view of a spectacular Florida gust front that will be described briefly in this note. Numerous studies describing the importance of such outflow boundaries include Purdom (1976), Holle and Maier (1980), Weaver and Nelson (1982), Wilson and Schreiber (1986), Droegemeier and Wilhelmson (1987), Intrieri et al. (1990), and Kingsmill (1995).

A network of surface wind stations, radars, and time-lapse cameras was deployed south of Lake Okeechobee (Figs. 1, 2) during the Florida Area Cumulus Experiment in south Florida (Sax et al. 1975). On one of the experiment's days, a particularly strong and well-organized thunderstorm outflow is photographed as it moved across this region. Time lapse photography of this case is used in the training videotape "Basic Convection" produced by the WSR-88D Operational Support Facility (OSF), Operations Training Branch[2]. The training material is designed for WSR-88D operators in the National Weather Service and the US Air Force.

In the late afternoon of 12 August 1975, a thunderstorm to the north of Lake Okeechobee formed a gust front that moved southward (Fig. 2) at an average speed of 21 knots (11 m s^{-1}). The maximum recorded gust in the mesonetwork was 43 knots (22 m s^{-1}) from the north-northwest. Winds averaged 23 to 33 knots (12–17 m s^{-1}) during the first 5 minutes after passage of the leading edge at stations throughout the mesonet. Temperatures dropped by 7°F (4°C) in the northern portion of the mesonetwork near Lake Okeechobee during the first 10 to 20 minutes after gust-front passage, while the drop was 17°F (9.4°C) at a station about 20 miles (32 km) southeast of the Field Observation Site (FOS) located in Fig. 1.

As the outflow moved south, it encountered dry ground over a recently-drained and plowed sugar cane field. The dry ground provided a better visible manifestation of the gust front, and allowed the clear view of the gust front to the northeast from FOS in Fig. 3. Not only is the gust front visible, but also apparent are the effects of frictional retardation at the surface and a secondary wave slightly ahead of the main cold air boundary.

As the boundary continued to the south, a photo was taken perpendicular to its movement (Fig. 4) across Lake Okeechobee toward the west from Pahokee. It shows a possible gravity or buoyancy wave associated with the gust front lifting a mid-level cloud layer above the shelf cloud. A new thunderstorm developed to a height of 12 km as the gust front passed south of the lake. The shelf cloud is the low-level accessory cloud in a wedge shape that is attached to the thunderstorm base along the gust front, as defined in NOAA's Severe Storms Spotters' Guide. This photograph was taken from the same location as the time-lapse view that is included in the WSR-88D training videotape.

References

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[1]Current affiliation: National Weather Service, NOAA, Tallahassee, Florida.

[2]The videotape is available from the WSR-88D Operational Support Facility, Operations Training Branch, 3200 Marshall Avenue, Norman, OK 73072.

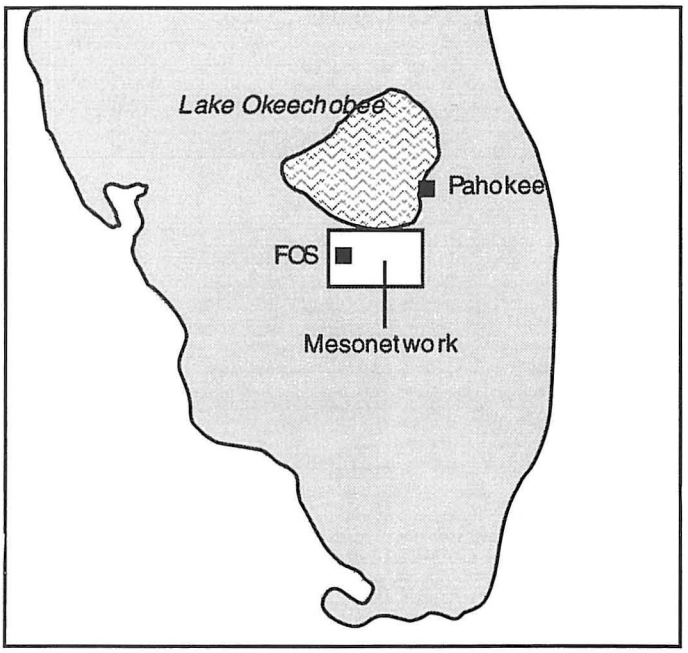

Fig. 1. Map showing region of south Florida where photos were taken of gust front on 12 August 1975.

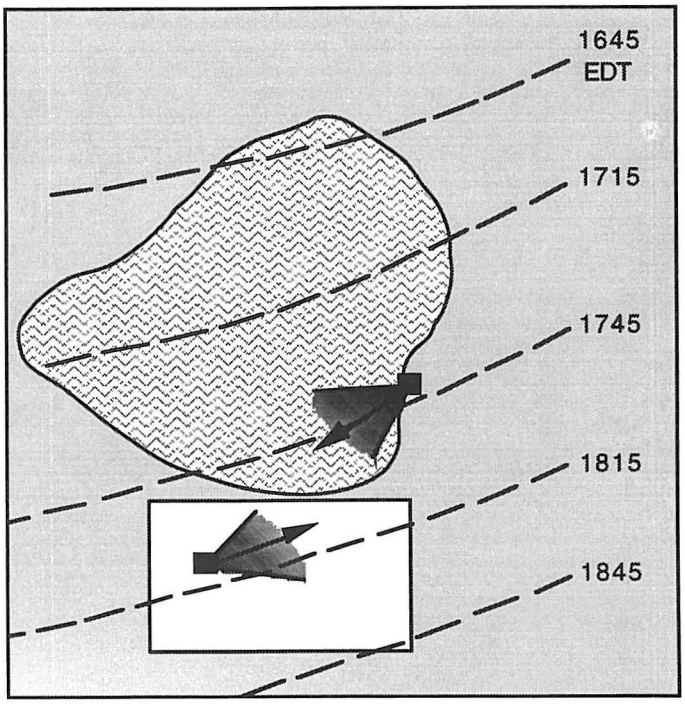

Fig. 2. Map showing Lake Okeechobee, mesonetwork, Pahokee and FOS camera sites, and locations of gust front over a two-hour period as it passed through area on 12 August 1975.

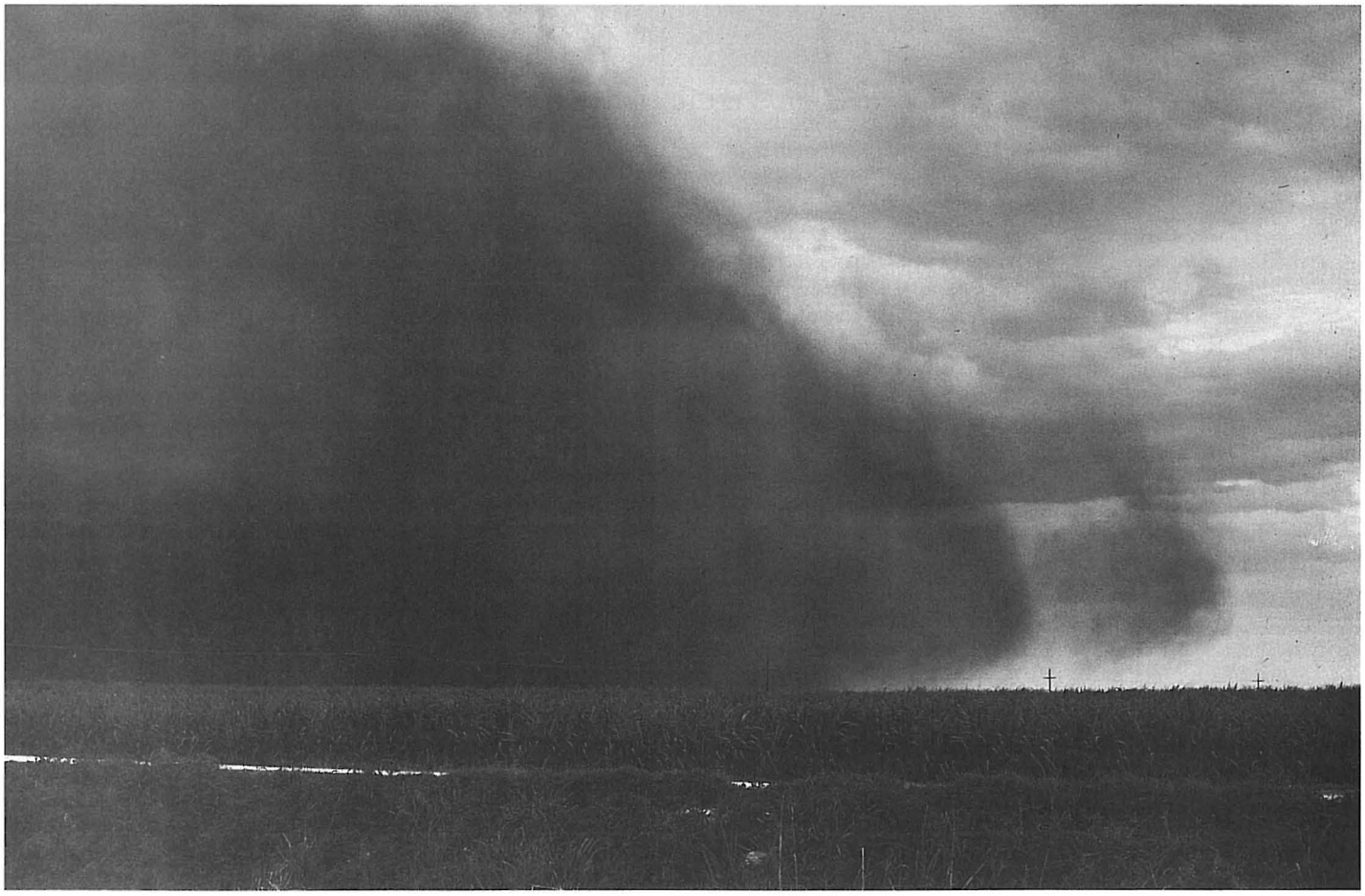

Fig. 3. Photograph to the northeast from FOS at 1807 EDT/2207 UTC 12 August 1975.

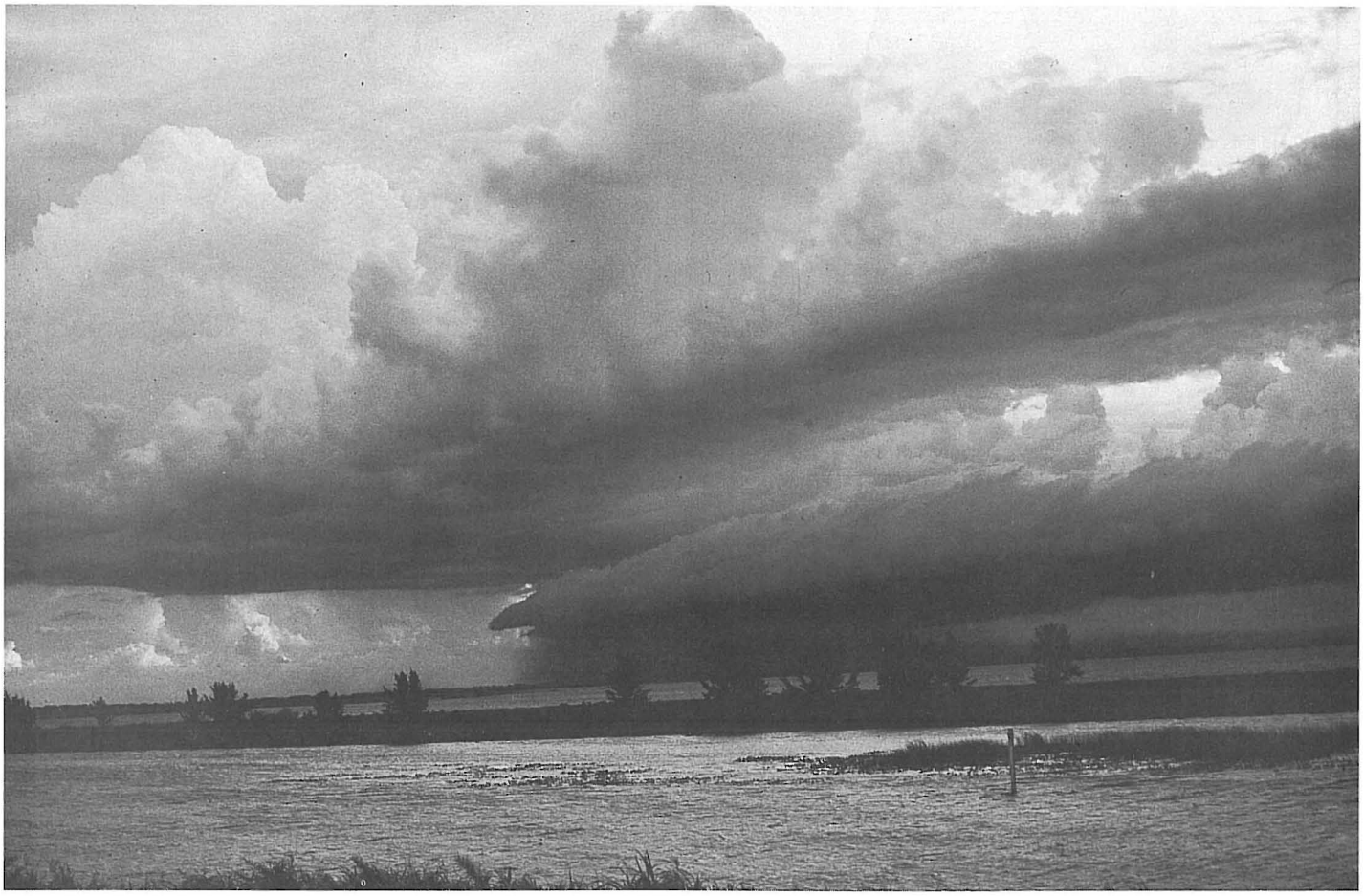

Fig. 4. Photograph to the west from Pahokee at 1813 EDT/2213 UTC 12 August 1975.