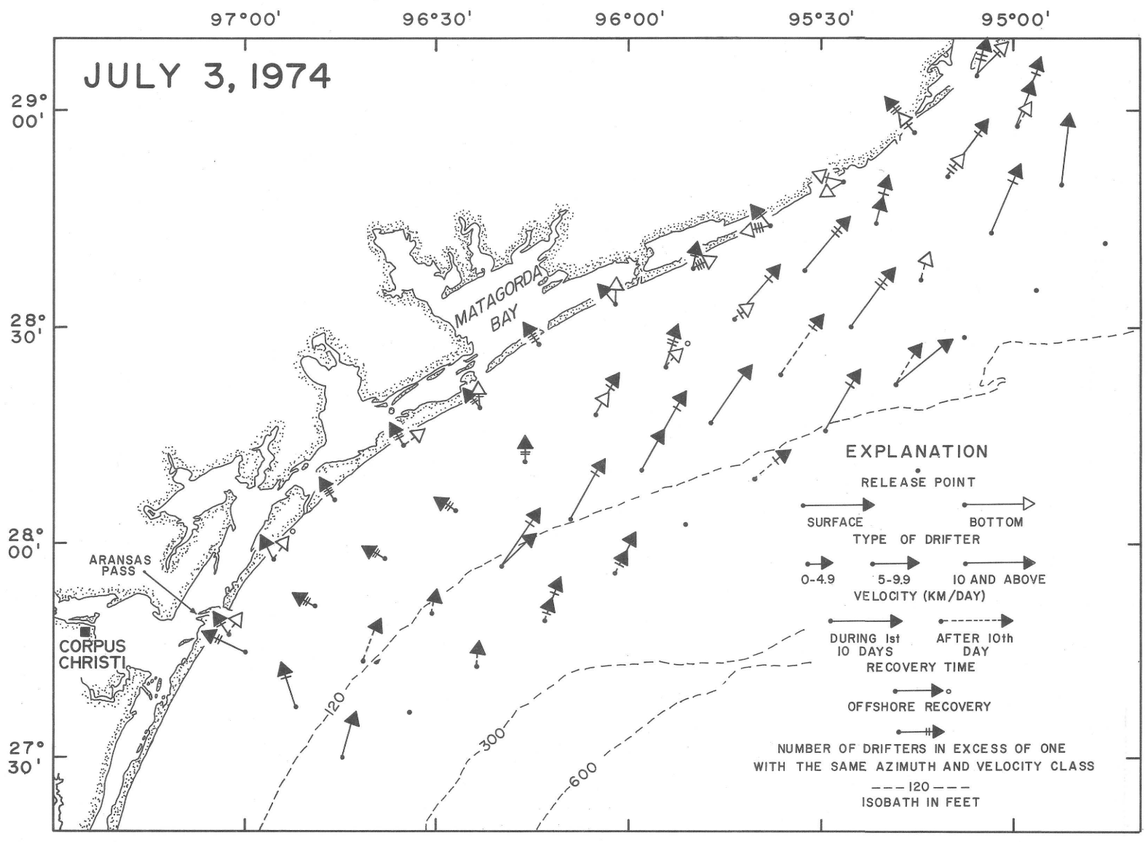
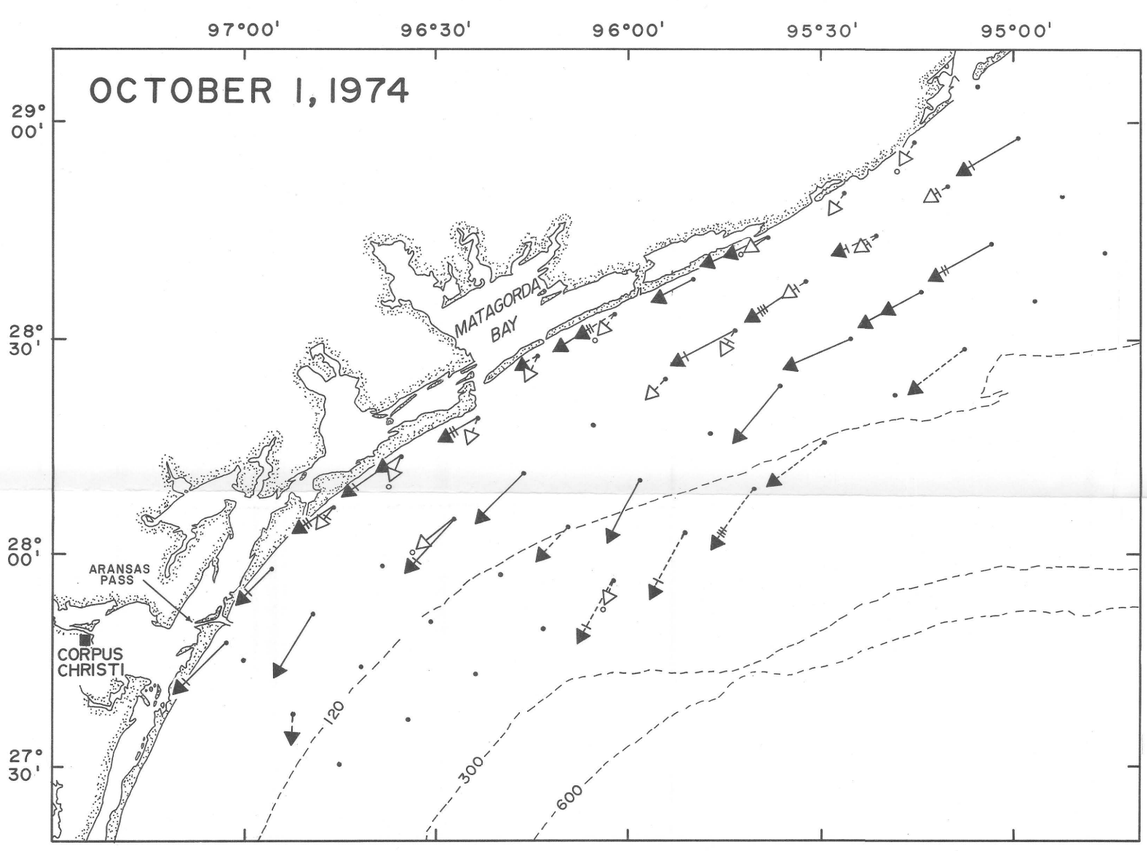
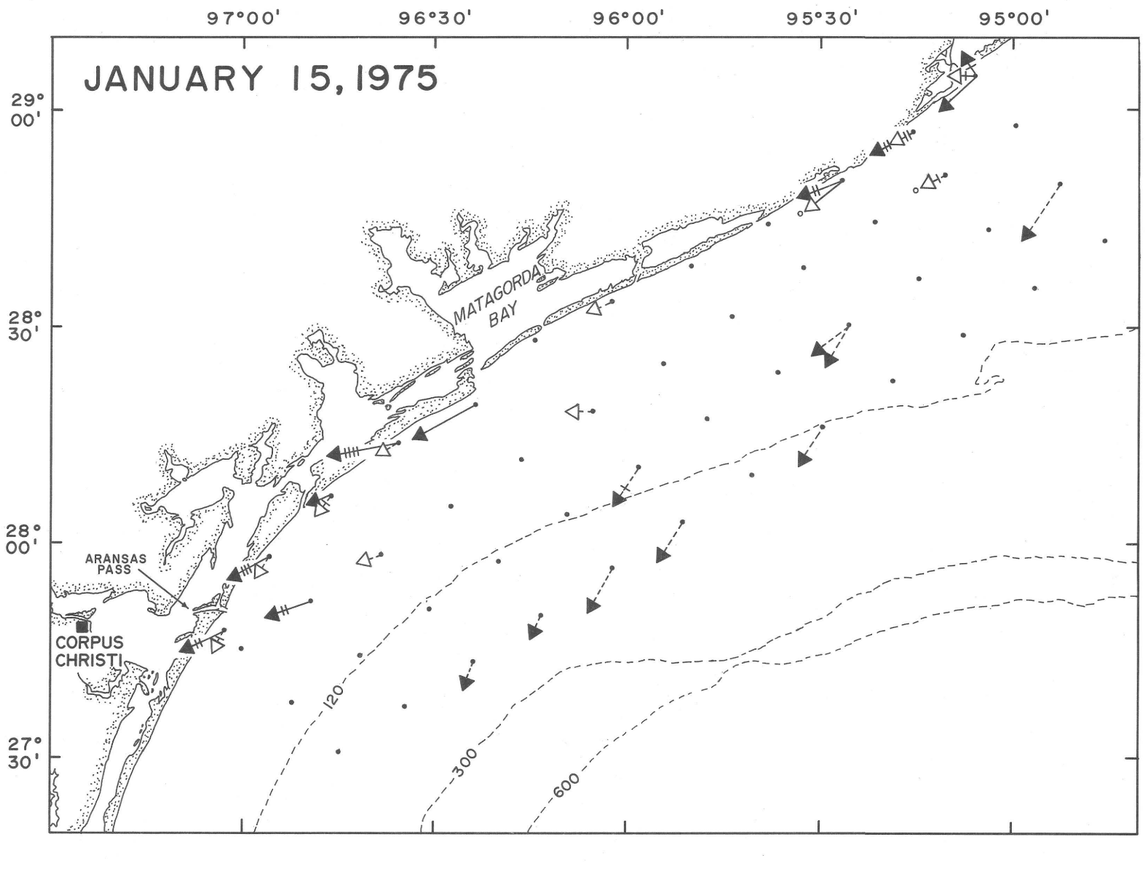
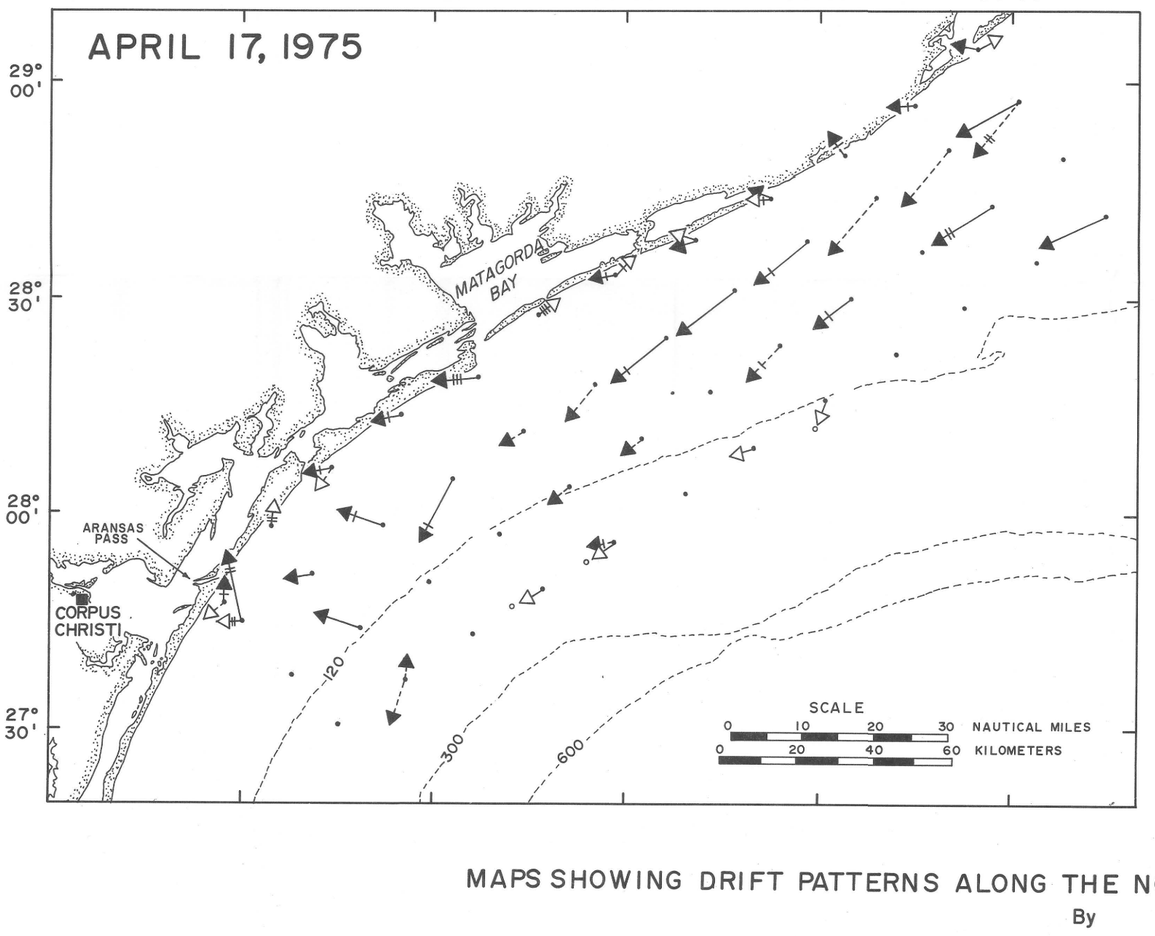
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY









MISCELLANEOUS FIELD STUDIES
MAP MF—839

HILL AND GARRISON: DRIFT PATTERNS, TEXAS COAST 74-75

INTRODUCTION

A multiyear program designed to study the rates and directions of coastal current drift in the northwestern Gulf of Mexico was initiated in January 1970 as part of a larger program to study depositional processes and sediment movement off the southern Texas coast. The drift study was divided into two phases. Phase one was conducted in the area off Texas south of the latitude of Corpus Christi (about 27°50'N.) and was reported on by Hunter, Hill, and Garrison (1974). Through the use of both surface and bottom drifters, the results of this study showed a yearly cycle of coastwise water movement that was controlled largely by seasonally changing winds and characterized by complex drift convergences and layered drift structure.

Phase two began in July 1973, when the study was shifted to the north-central Texas coast. The first-year results of this study reported by Hill, Garrison, and Hunter (1975) were generally consistent with the concept of a yearly cycle of seasonally changing coastal drift indicated in the south by phase one. Observed drift patterns were less complex off the north-central coast than off south Texas. The present report is the third of this series and presents the second year's results of the phase two drift study in the north-central area.

METHODS

Surface drift was measured by the net movement of ballasted drift bottles, and bottom-water drift was determined with Woodhead-type plastic seabed drifters. Five surface drifters and five bottom drifters were released at each of 48 stations on each release date by dropping them from an airplane whose location was fixed by Loran A or Racan. The release points were 12 nautical miles (22 km) apart along four lines roughly paralleling the coast between Galveston and Aransas Pass. As in phase one to the south, the lines were located 1, 10, 20, and 30 nautical miles (2, 19, 37, and 56 km) from the shoreline in water depths averaging about 30, 65, 95, and 155 feet (9, 20, 30, and 46 meters). Releases were made seasonally from July 1974 until April 1975.

Drifters recovered on open beaches by the public furnished most of the information for this report. Beaches not accessible to the general public were searched by project personnel on a weekly or semiweekly schedule for 6 to 8 weeks after each release.

RESULTS

The number of returned drifters varied with the season, the distance of release point from shore, and the type of drifter; 18 percent of all drifters released were recovered (table 1). Greater numbers of drifters were returned during the summer than during the winter, and drifters released nearshore were recovered in relatively greater numbers than those released offshore. Recoveries of drifters from the line nearest shore were generally made within 10 days of release, whereas most of those returned from outer lines were recovered within 60 days of the release date. Recoveries made more than 60 days after release were disregarded. The percentage of surface drifters recovered (26 percent) was much greater than that of bottom drifters (10 percent). Most drifters were found on the beaches between Galveston and Port Isabel, Texas although a few were returned from beaches to the north and south of these points, in the lagoons and bays, or by shrimp boats at sea.

Net-drift velocities were calculated from the straight-line distance and elapsed time between release and recovery and therefore are minimum velocities; they ranged from 0.10 to 34 km/day. Onshore - offshore components of drift are discussed relative to the local shoreline off which the drifters were released.

ACKNOWLEDGMENTS

We thank Dr. Joseph H. McGowen of the Texas Bureau of Economic Geology, and students from the University of Texas, who helped to search sectors of beaches not accessible to the general public. The United States Coast Guard and Miller Brewing Company continued their invaluable logistic support of these studies, for which we are grateful. We also express our gratitude to Lt. W. T. Newsome, USAF, for his cooperation in the search for drifters on the beaches of the Matagorda Air Force Base and to Mr. Perry Bass for allowing us to search for drifters on the beaches of his Matagorda Ranch.

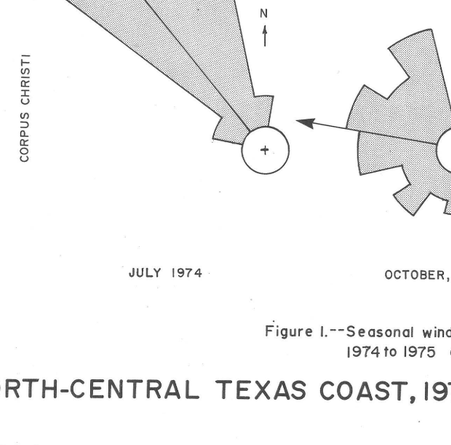
REFERENCES CITED

Hill, G. W., Garrison, L. E., and Hunter, R. E., 1975, Maps showing drift patterns along the north-central Texas coast, 1973-1974: U. S. Geol. Survey Misc. Field Studies Map MF-714.

Hunter, R. E., Hill, G. W., and Garrison, L. E., 1974, Maps showing drift patterns along the south Texas coast, 1970-1973: U.S. Geol. Survey Misc. Field Studies Map MF-623.

National Oceanic and Atmospheric Administration, 1974-1975a, Local climatological data-Corpus Christi, Texas: Environmental Data Service, 8 p.

National Oceanic and Atmospheric Administration, 1974-1975b, Local climatological data-Houston, Texas: Environmental Data Service, 8 p.



DISCUSSION

Drift pattern

Results of this study are consistent with the concept of a yearly cycle of seasonally changing coastal drift observed in the first year results of phase two (Hill, Garrison, and Hunter, 1975) and in phase one off the south Texas coast (Hunter, Hill, and Garrison, 1974). Seasonally changing winds to a large degree account for the observed seasonal drift patterns (fig. 1). An explanation of the rates and directions of drift relative to seasonal variation in wind direction, drift convergences, and onshore-offshore components of drift can be found in Hunter, Hill, and Garrison (1974).

Comparison with previously observed drift patterns along the Texas coast

Useful comparisons can be made between the 1974-75 observations and those previously reported by Hunter, Hill, and Garrison (1974) and by Hill, Garrison and Hunter (1975). Although the overall percentage of drifters recovered in the present study was somewhat lower, the general pattern of recoveries was similar (table 1). A decrease in the number of surface drifter returns from offshore stations accounts for the lower overall percentage of recoveries.

The seasonal changes in drift pattern observed in this study are similar to those described in previous studies. The striking change from northerly summer drift to southerly winter drift is consistend throughout the entire area and from year to year. However, a southerly drift during spring and fall is more pronounced off the north-central Texas coast than in the south, and in general, drift patterns in the north are much less complex than those in the south.

The general pattern of drift components directed normal to the shore is similar to that observed in the first year's study. Surface drift generally has a shoreward component in summer and a seaward component in winter; bottom drift has components in the opposite sense.

Drift patterns indicated by individual releases

July 3, 1974.--Surface drifters were recovered in significantly larger numbers than bottom drifters With the exception of three nearshore stations in the northern sector, bottom drift throughout the study area was uniformly to the north. Surface drift offshore was mainly to the northeast and slightly shoreward, except in the southwesternmost part of the study area where some northwest drift (directly onshore) occurred. In the nearshore, surface drift was generally directly shoreward. Drift rates were greater to the north and in the offshore region.

October 1, 1974.--Compared to July, fewer surface and bottom drifters were recovered from this release. Both bottom and surface drift were uniformly southwest in both the nearshore and offshore. Bottom drift in the nearshore had a slightly seaward-directed component, as did surface drift in some of the outer release lines; otherwise, drift was generally parallel to the coast throughout. Seaward drift of bottom drifters is supported by several recoveries at sea. Drift rates were fairly uniform throughout the study area.

January 15, 1975.--A substantially smaller number of surface drifters but about the same percentage of bottom drifters were recovered compared to previous releases. As in the October release, both bottom and surface drift were to the southwest, although bottom drift was directed shoreward instead of seaward as in October. Surface drift tended to be shoreward near the beach and seaward in the outer release lines. Seaward surface drift is also suggested by the reduced return of drifters from the outer lines. Drift rates were generally reduced in comparison to previous releases.

April 17, 1975.--Surface drifters were returned in much greater numbers than bottom drifters. No trend in the nearshore bottom drift is evident, but offshore bottom drift was southwestward as indicated by several recoveries offshore. The principal surface drift was also southwestward both in the nearshore and offshore regions, although some northerly drift occurred in the southern offshore sector. Surface drift tended to be shoreward near the beach and to the south in the outer sections. In the northern offshore, however, surface drift has a seaward-directed component.

Drift rates generally showed an increase over those observed in January, especially in the northern offshore lines.

Table 1.--Tabulated recovery data[1]

PERCENT RECOVERIES		DATE OF RELEASE: JULY 1974	OCT. 1974	JAN. 1975	APRIL 1975	AVERAGE OF ALL RELEASES[2]	AVERAGE OF ALL RELEASES[3]	AVERAGE OF ALL RELEASES[4]
SURFACE DRIFTERS	INNER RELEASE LINE	52	35	38	32	39	38	45
	OUTER THREE RELEASE LINES	38	19	7	19	21	29	25
	ALL FOUR LINES	42	23	15	23	26	31	30
BOTTOM DRIFTERS	INNER RELEASE LINE	45	15	22	27	27	33	29
	OUTER THREE RELEASE LINES	6 (1)	6 (1)	2 (1)	4 (2)	5 (1)	8 (2)	3 (1)
	ALL FOUR LINES	16	8	7	10	10	14	10
ALL DRIFTERS ALL LINES		29	16	11	16	18	23	20

[1] PERCENTAGES IN PARENTHESES ARE OFFSHORE RECOVERIES
[2] THIS STUDY
[3] DATA FROM, HILL AND OTHERS (1975)
[4] DATA FROM HUNTER AND OTHERS (1974)

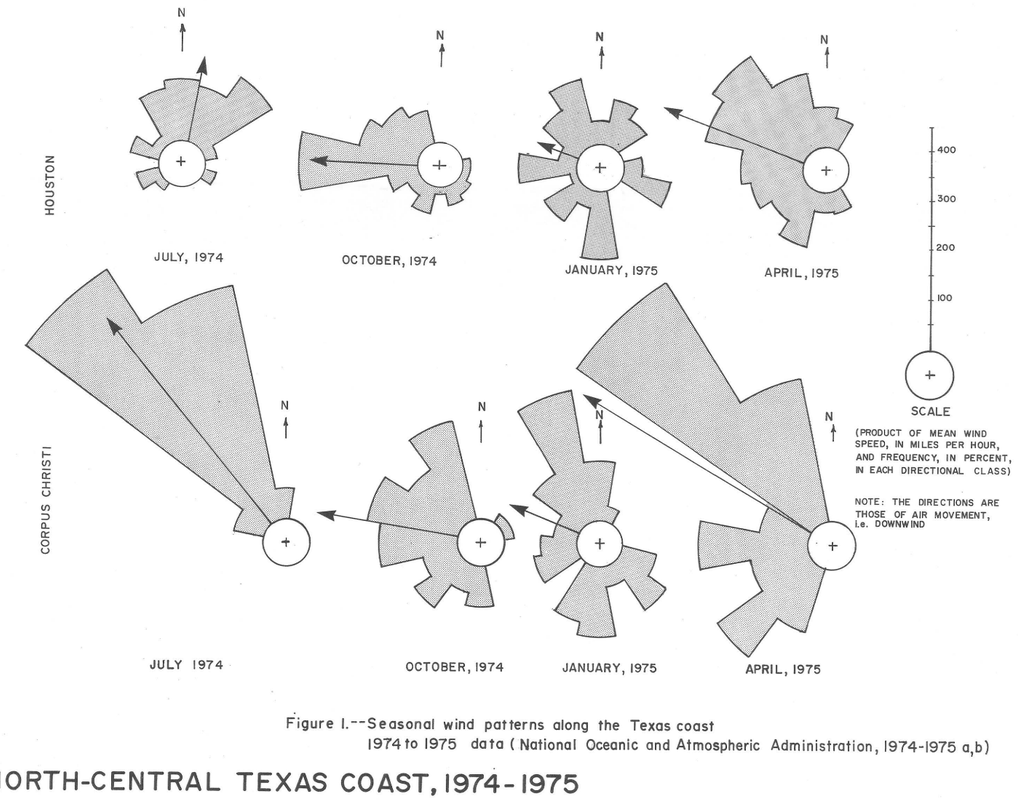


Figure 1.--Seasonal wind patterns along the Texas coast 1974 to 1975 data (National Oceanic and Atmospheric Administration, 1974-1975 a,b)

MAPS SHOWING DRIFT PATTERNS ALONG THE NORTH-CENTRAL TEXAS COAST, 1974-1975

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