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*CHASE SEASON: A DISASTER! **

I. COMMENTARY

Storms evaded the plains this year setting a record low in terms of the number of reported tornadoes. In April, no tornadoes were reported in Oklahoma. Not since 1948 has that occurred. What an incredible drought. I'm sure you feel frustrated at the near non- existent severe weather season. I too, have asked the question "All right mother nature, can we talk?"

So what did you do in your spare time? Some chasers decided not to head to the plains this year, end stayed home, saved their money, and possibly planned on taking that Caribbean vacation after all. Others braved the plains, and drove around for a few weeks improving their suntan. As for me, I decided not to chase this year unless the polar jet returns south from the Canadian/U.S. border.

What action there was swept the northern states in squall-line fashion. A few brief tornadoes were reported near Minneapolis on May 13th, and near Indianapolis the next day. The accompanying swift moving cold fronts did not allow isolated supercell development. So, it was probably better to go fishing on some of those pristine upland lakes than to play catch up with a squall-line.

Part of the reason for the quiet severe weather season was a large, persistent ridge over the central U.S. which kept the polar jet in Canada. Without a split flow in the jet stream, storms could not rely on the exhaust vent of strong winds which would take warm updraft parcels downstream. For weeks on end, upper winds over Oklahoma and Texas were light and variable. Although there was plenty of tropical surface moisture around, the unstable air heated by the sun, created "popcorn-type" thunderstorms during the mid-afternoon. Without the aid of upper air support, the storms collapsed within an hour.

Large amplitude troughs were around but in the wrong places. For several weeks, one trough was stationary in the eastern Pacific, about a thousand miles off the coast of California. Another trough was located in the western Pacific near China. Satellite loops of the Pacific showed monstrous cloud circulations over the ocean, and storms exploded defining the classic comma shape. If only I had a row boat!

The season finally got underway on May 18 when a tornado struck west of Emporia, KS in CHASE county. That's right. Fourteen homes were destroyed. Fortunately, people inside sought shelter escaping injury. Why have the storms left the plains till now? Have the best storms been hunted? Since tornadoes occur in Australia, Japan, and India, maybe it's time you convince your loved one to take an exciting trip overseas. Remember, to bring the camera.

*** EXCEPT FOR DAVE HOADLEY**

II. CHASER NEWS

It is now legal to drive 65 mph on rural interstate highways in Texas, Oklahoma, and in other states as posted. This will save chasers about an hour of driving time for each six hours on the road.

Rockford, Illinois was wiped out by a massive tornado. That was the scenario issued one day over the public wire service by the National Weather Service. According to Carolyn DeBona of the NWS, the trouble started when local offices were sent new computer disks designed to speed warnings when severe weather conditions occurred. When meteorologists tried the new disks, they were supposed to type "THIS IS JUST A TEST", but the phrase did not get transmitted. Similar problems were reported in Brownsville, TX, Long Island, NY, Washington, D.C., and Dodge City, KS.

The editor attended the 9th Annual National Hurricane Conference in Orlando, FL on April 1st through 3rd. About 1,000 people were in attendance. A wide range of programs were presented from Law Enforcement, Engineering, Meteorology, Recovery, Evacuation, Sheltering, Public Works, Media, Insurance, Resorts and Islands. Outgoing director of the National Hurricane Center, Dr. Neil Frank spoke at a luncheon. He said the administration and others have overwhelming confidence in our satellite and forecast system, so much so, that reconnaissance flights may be discontinued. Dr. Frank does not favor the cutback and showed evidence of excessive errors in forecast tracks and hurricane wind velocities using satellite alone.

III. LETTERS/PHONE CALLS TO THE EDITOR

Greg Story mentions: "The one and only tornado outbreak in Iowa this year was April 14th. A vertically stacked closed low pressure system was moving across Missouri. As per usual, the air aloft was cold, and the air over the region was unstable. Lifting of the air was accomplished as a warm frontal boundary moved in from south central Iowa to near Moline, Illinois. Temperatures in Northern Iowa were in the 50's while southeast Iowa climbed into the upper 70's. The warm advection, isentropic lift, and presence of the front was enough to focus local convergence under the cold air pool aloft. With the aid of afternoon sunshine heating, a few thunderstorms fired along the warm front. These storms went up real fast, and produced four small tornadoes in southeast Iowa on one in western Illinois. The Iowa tornadoes occurred southeast of Ottumwa between 2:30 and 3 pm CDT. Later, the same thunderstorm cell moved northwestward and produced a tornado at Keota, about 50 miles south-southeast of Cedar Rapids at 4:20 pm. This tornado tore a 30 foot sheet of tin roofing off the Keota post office."

Ken Nakamura saw a multiple-vortex dust devil on April 18th in Perris, CA. "I observed as many as four separate vortices. The vortices would form on the south side of the circulation and move around counterclockwise to the northwest side and dissipate." It is interesting how this also occurs in larger scale tornadic flows.

Dave Hoadley sent in an unsolicited comment: "I have greatly enjoyed your videotape of the Canadian, Texas tornadoes and have viewed it several times. The scenes from inside the speeding car, action interviews with Phil Sherman as he drives, and the controlled chaos of two photographers snapping pictures and exulting at the uncontrolled spectacle of the three tornadoes,

puts the viewer right there in the chase car and holds the attention until the last tornado fades from view. Congratulations on taking documentary chasing one step closer to a real art form." Editor: Thanks, Dave.

Richard Conn sent in his observations of Hurricane Elena: "It was midnight on September 2, 1985. I was driving west on I-10. All exits to the Gulf Coast were blocked by the National Guard. Hurricane Elena was gust south of Pensacola moving west-northwest at 20 mph. By 1 am, winds at my location were about 80 mph from the northeast. I kept driving toward Pascagoula. At 2 am, flashing blue, green, and purple lights vere all over the horizon as failing power lines created a symphony of electric lights. I parked along a seawall adjacent to a campground just west of Pascagoula Bay. Winds were now gusting to 120 mph. Large tree branches were falling on the road and over campground lanes behind me. I saw tree debris and smashed shelters blowing inland away from me through torrents of water. Winds were so strong, I thought my compact car was going to roll over. At 4:45 am, a pink sunrise reveals a thin cirrus overcast and winds decreased to near calm at 5:15 am. After being in the eye, I raced back to New Orleans to catch my plane back to Utah. The flight was cancelled."

Terry Kern from Boulder, CO likes the wind. "I was trying to sleep, but with the chinook shaking the house and making so much noise, my adrenaline was too pumped up to fall asleep. So at 1 am, I decided to drive around and listen to that beautiful wind. While at a stop light, a gust of wind blew a cloud of dust and rocks from a distant parking lot into my car. It sounded like driving through a wicked hailstorm. I realized something was wrong when I started getting pelted by gravel in the back of my head. After the wind let up, I turned around to see that the rear window had shattered and the back seat of the car was filled with rocks, dirt, and broken glass. I was quite unhappy at first, but realize that this is the type of adventurism I strive for."

Jack Corso got a sneak preview of the severe weather season. "On March 31, a slow moving cold front and low pressure system dragged across the eastern seaboard bringing high winds, heavy rains, and embedded thunderstorms. Three inch rains and winds to 60 mph lasted a long period causing local flooding and widespread power outages fram downed trees. I had to route Con Edison work crews to three emergency situations in my area to repair live wires in contact with the ground. While I did not experience any of the thunderstorms which did pass by, it sure looked like we were hit by one and gave me a good early season preparation for the weeks ahead."

On those dry days, C.L. Vlcek can remember how it was when storms were storms on the plains. "On April 15, 1972, Joe Golden, Bruce Morgan, and myself were intercepting a storm near Wichita Falls, TX which reportedly had a large VIP 6 core. We crossed in front of the storm and drove behind another cell which was spitting 1" diameter hail. Fortunately, the accelerator problem we had yesterday (which prevented the van from going mare than 20 mph) was fixed. Or so we thought it was fixed. With a solid brick wall closing in on us, the van faltered, and our hearts skipped a few beats. We headed southeast toward Nocona while the storm moved off to the northeast. Fist-size hail fell in St. Jo. We then spotted a large funnel against the precipitation which killed it before we could set up our cameras."

Editor's note: I appreciate the following chasers stopping by this spring: Richard Conn, Jason Blakeslee, and Greg Grabijas.

IV. ROSTER

The ST Roster lists names, addresses, and brief bibliographies of those persons interested in or willing to correspond with others about storms. Normally, only recent entries since the last issue are included.

Name	Address	Chase country-range
Greg Martin	1910 Sourwood Dr. Dalton, GA 30720	Oklahoma and beyond

Bibliography; "I'm 32 and unemployed. I took two years of meteorology at Texas A and M and was an active member of the Severe Storms Intercept Project there. I've always had a fascination for severe storms and tornadoes since I was eight years old. I have a 35 mm camera with normal, wide angle, and telephoto lenses along with binoculars, weather radio, and compact aneroid barometer. I prefer to drive with someone to Oklahoma and will help out with gas and expenses."

Mark Paran	84 Gainsborough St, #106 Boston, MA 02115	Midwest and Plains

Bibliography: "I'm 34, and grew up in Maple Heights, OH. Been fascinated with severe storms since I overcame a terrible fear of lightning and thunder when I was 4. Was a weather watcher for the NWS from age 7 to 18. I chased for two weeks in June, 1985 and last year I spent two weeks from Kansas to South Dakota, where the action was.

William Rutig	4411 Joliet Ave. Lyons, IL 60534	Illinois

Bibliography: "I found ST to be what I had been looking for- a source of contacts and useful information. I am a 38 year old Lieutenant on the LaGrange, IL Fire Department, and an avid tornado "buff". My actual involvement started some 30 years ago when I saw some funnel clouds form and dissipate over my home. Since that time, I have remained interested and involved in tornadoes. I have coordinated several seminars and started a cooperative spotters net among several companies in the western Chicago suburbs. I wrote a position paper for our Fire Department on Doppler Radar; coordinated a three-day severe weather seminar for public service personnel; developed and wrote the severe weather shelter and operations plans for our department; and am currently about a quarter of the way through writing a book on tornadoes for the fire service.

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Finally, a suggestion for those chasers who are new at forecasting and concerned about access to data while on the road. If you can borrow a small, portable television, you can watch the early morning PBS program "AM Weather" telecast Monday through Friday. It provides the best media weather-cast anywhere and is available nationally throughout the mid-west and plain states. Watch for the severe weather area during the last few minutes of the show and drive to the western third of that location. With a good antenna, you'll never leave your car except for gas, food, and nature breaks. Good Luck!"

- David Hoadley

STORM PHOTOS

This is a new section which will be featured as long as the supply of photographs are sent in. Subscribers are urged to send their photographs to ST for publication. Photographs will be returned if requested. The following photographs have been sent in by Mr. and Mrs. Grant Nelson from Mesa, Arizona. They were taken on May 10, 1985 near the town of Regan at 3:15 pm (state not specified). The tornado traveled north, then turned east.

The following photographs were sent in by an insurance adjuster from Marion, Illinois showing their tornado on May 29, 1982

Chasers: Please send in your chase accounts for this year. Your list should include what days you chased, where you went, and what you saw. A listing will be published in a future issue!

V. FEATURE #1 THE SWEETWATER, TEXAS TORNADO

by William Alexander
WSFO, Lubbock, TX

On the morning of April 19, 1986, a strong tornado ravaged the West Texas community of Sweetwater. The storm struck with what was apparently little or no warning to its residents and inflicted one fatality and caused approximately 15 million dollars in damage. The morning forecast alluded to a 40 percent chance of thunderstorms during the day, and there was no mention of the possibility of severe weather. Yet, at 7:15 am CST, a large, multi-vortex tornado touched down gust southwest of the city.

The following article addresses the lifecycle of the tornado, the synoptic setting that induced the formation of the parent supercell, and the plausibility of recognizing such a severe storm scenario. Could this have been a forecastable situation?

LIFECYCLE

A severe thunderstorm developed northeast of a surface low at the intersection of a dryline and a cold front to the southwest of Roscoe around 7:00 am. The Sweetwater tornado touched down approximately 1.5 miles southwest of the I-20 and Robert Lee Road intersection. The storm moved to the northeast, inflicting minor roof damage to a farm residence just east of the Santa Fe railway, a mile south of I-20. At this time, electric power lines were severed from transmission towers. Empty oil tanks were lifted and carried approximately 400 yards impacting and destroying a small house just south of I-20 at Robert Lee Road.

The funnel crossed the south-central section of town and intensified as it approached Highway 70. In this older part of town, many of the aged and weakly built structures, both residential and business, were unroofed or had exterior walls collapse. After the tornado crossed Highway 70, it strengthened further. Brick-veneer residences in the area sustained increasingly severe damage from the intersection of Arkansas and Lubbock Streets northeastward. An 86 year old man was killed in his residence by flying debris on Neff Street about one block north of Alabama.

From that point northeastward about a mile, many residences were unroofed with part or all of the exterior walls removed. A mobile home park about a quarter mile north of Alabama and Newman Streets sustained severe damage, with many homes totally destroyed and pieces thereof removed from the site several hundred yards. The damage track (FO) varied from 400 yards wide at Highway 70 to 700 yards wide in the area of most severe damage. The most intense damage was rated F3 near the site of the fatality. The tornado continued through Sweetwater and moved out into open country.

SYNOPSIS

At 500 AM CST, a surface cold front extended from western Arkansas through southeastern Oklahoma and northwest Texas to a low near Midland (Fig. 1). A strong dryline extended southward from the Midland low to just west of Sanderson, at the mouth of the Pecos River. The cold front curved from the Midland low northwest through eastern New Mexico. The airmass south of the

cold front and east of the dryline was very warm and moist, with temperatures from the 60's to the middle 70's and relative humidities between 90 and 100 percent. The airmass west of the dryline was mild and quite dry with dewpoints in the teens. North of the cold front, temperatures dropped 20 degrees in 200 miles. A light south to southeast wind prevailed in the moist air while a 10 knot northeast wind filtered in north of the front.

The 600 AM CST, intense warm, moist advection resulted from a 35 knot low level jet at 850mb (Fig. 2). Note the jet maximum to be situated just west of Sweetwater and just east of the front/dryline triple point. The wind field induced strong moisture convergence.

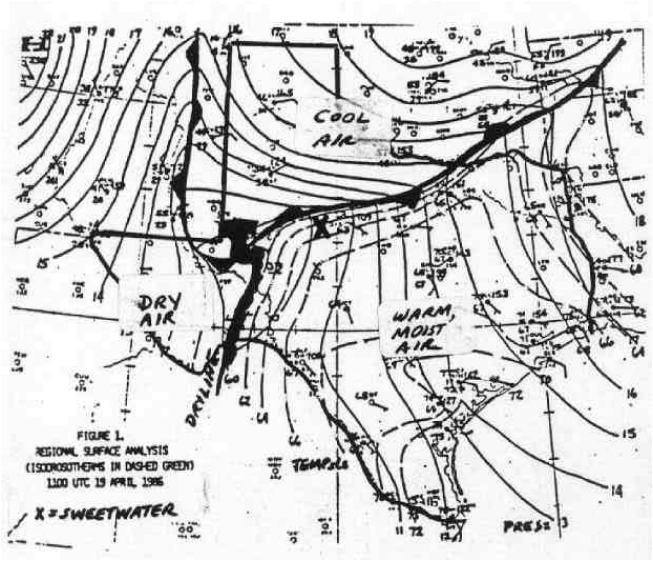


Figure 1

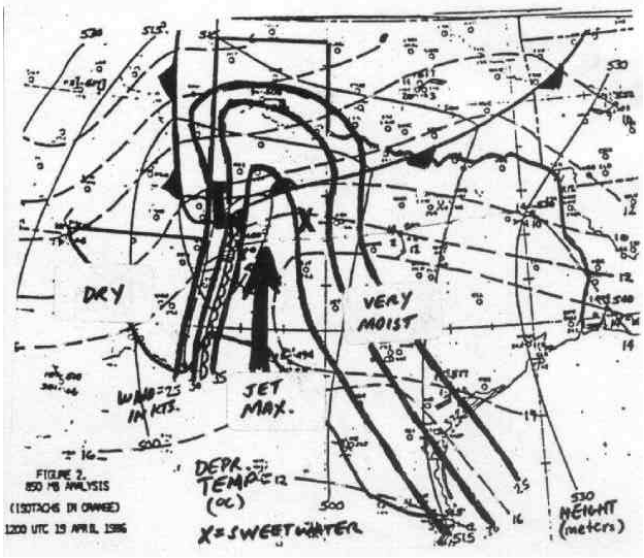


Figure 2

Wind veered some 60 degrees between 850 mb and 700 mb at Midland, but maintained a speed of around 30 knots throughout the layer. Cold advection was moving into western Texas, implying continued deepening of the 700 mb trough affecting eastern New Mexico and Trans-Pecos Texas. A negative tilt trough was more exaggerated at 500 mb (Fig. 3), where 30 meter height falls occurred west of Midland. Very cold (-17C) temperatures at 500 mb combined with the lower level tropical airmass to produce a steep lapse rate that rendered the airmass highly unstable.

At 300 mb (Fig. 4), the polar jet curved from northeastern Arizona through southern Mexico into the Texas Panhandle and northwestern Oklahoma. Upper wind speed analyses placed the eastern Permian Basin, including the Sweetwater area, in the right-rear quadrant of the jet maximum. This provided substantial speed diffluence across the area of developing thunderstorms.

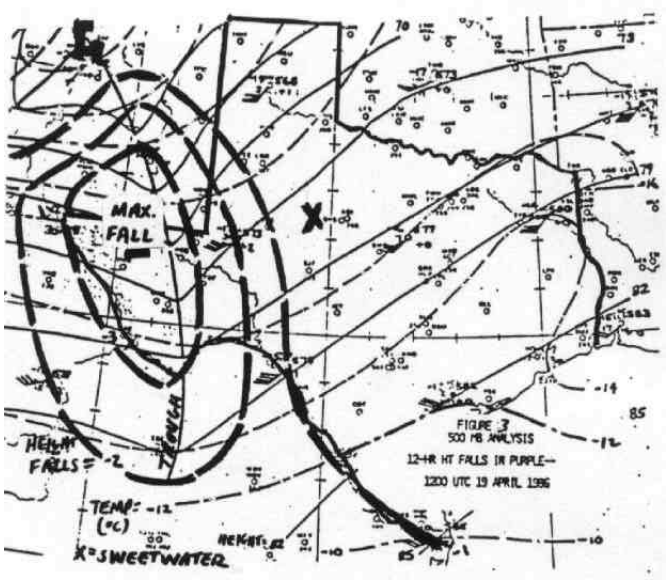


Figure 3

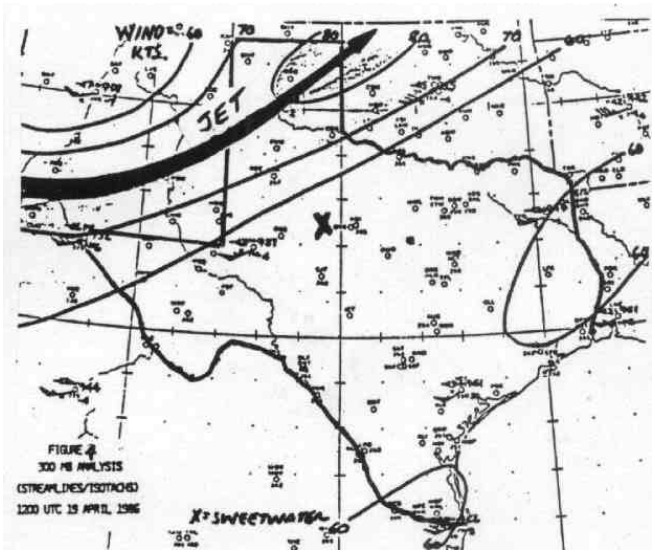


Figure 4

Both Midland and Del Rio soundings revealed a moist and explosively unstable environment over the southern part of western Texas. The combination of ambient lifted indices of between -6 to -8, vigorous sub-cloud veering of wind, strong low-level warm and moist advection, and upper level diffluence, created a classical tornadic situation. Unfortunately, by the time this sounding information and the 600 AM analyses were available, the Sweetwater tornado had already occurred.

SUMMARY OF EVENTS

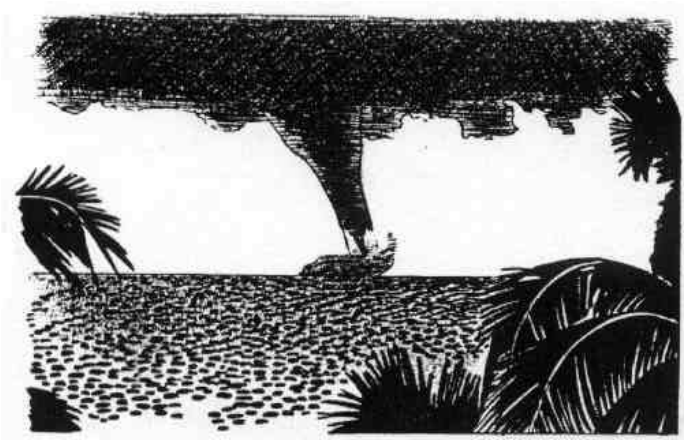
A Severe Thunderstorm Watch was issued at 5:52 AM CST by SELS, valid until noon. The watch included the town of Sweetwater. At 7:15 AM CST, golfball-sized hail began about 12 miles west of Sweetwater. Three minutes later, the hail report was received at the Abilene NWS. The office began immediately to prepare a Severe Thunderstorm Warning for Nolan County which includes Sweetwater. The warning was disseminated via NOAA Weather Radio at 7:24 AM. Only after 7:30 AM, was the information of a tornado having occurred relayed to the WSO. The Abilene Weather Service acted as quickly as possible in reacting to the situation.

It was learned during the post disaster survey that four telephone company power poles with phone lines were downed about 20 miles southwest of Sweetwater around 700 AM CST, 15 minutes prior to the Sweetwater tornado. The parent supercell evidently produced a tornado prior to the multi-vortex twister. Had this information been relayed to law enforcement or NWS personnel, a Tornado Warning could have been issued in time to prepare Sweetwater.

II. FEATURE #2 TORNADIC WATERSPOUTS OR "WATERNADOES"

By David Hoadley

Last November, I gave a slide/video talk show on severe weather at the David W. Taylor Naval ship Research and Development Center (Bethesda, MD). With their primary interest in coastal and ocean storms, I focused more on waterspouts and the comparatively rare "tornadic waterspout" (Morton, 1966). This is a tornado that originates over land and then passes over water. Like land based tornadoes, it differs from a waterspout in intensity, duration, and translational speed (1/Golden, 1974) -all the much higher values. In addition, although upper air dynamics are usually weak (2/Golden, 1973), there often is some synoptic forcing, although far less than for land tornadoes. Still, based on their size and destructive potential, I think it is misleading to refer to them as "tornadic waterspouts". This denigrates the danger and unique characteristics of such events and makes a mischievous linkage with their more anemic cousins. A better term may be "waternado" which emphasizes both the singularity and danger of this particular vortex. Hereafter, the term waternado is used.



There is ample evidence for this type of storm. Some of the more notable accounts: 1) Venice, Italy on September 4, 1970. Such a storm struck and lifted a 25 ton passenger boat, turned it around several times in the air, and sent it to the bottom of the harbor in 30 seconds killing 18 people (3/Golden, 1971), (2) At Kialua, Kona, Hawaii, on January 28, 1971, one came ashore and traced a destructive path some 2-1/2 miles inland (4/Zipser), and (3) Several waternadoes were reported in the Miami area during an unusually stormy summer in 1968, one lifted a five ton houseboat from the water, and the other sank six cabin cruisers in a marina.

Although rarely photographed, I did have two good slides of waternadoes for the slide show, both from the southeast Florida coast: (1) Howie Bluestein's great photo over Key Biscayne; and (2) Jim Leonard's memorable June 12, 1985 vortex, about 8-10 miles off-shore from West Palm Beach (illustrated in the March 31, 1986 issue of STORM TRACK). After only a few inquiries of the several leading researchers in the filed, I found there has been no single written study on waternadoes. What I was able to discover from other related studies is the following:

LOCAL ENVIRONMENT

1) On radar, "Rotating hook echoes could be directly associated with large waterspouts" and about 10% of waterspouts have hook echoes (1/Golden, 1974). Thus deductively, perhaps as many as one in ten are tornadic types.

2) Maximum rotational winds for "waterspouts" have been recorded "as high as ...190 knots" or about 220 mph (5/Golden, 1977).

3) Thirty percent of "waterspouts" have associated thunder and lightning (2/Golden, 1973).

4) Unlike waterspouts, if a rear flank downdraft is present, the waternado is usually unaffected (1/Golden, 1974).

5) Cloud tops are more like land tornadoes for the waternado variety with radar echoes between 30,000 and 50,000 feet (3/Golden, 1971). The waternado viewed by Jim Leonard had a cell top of 53,000 feet versus the normal 12,000 to 20,000 ft cell top for most waterspout cases.

6) Waternadoes may occur near and along the US coastline, probably within 15 miles, and from New Jersey to the southeast Florida coast.

DEEP ATMOSPHERIC ENVIRONMENT

7) Waternadoes have prevailing weak synoptic dynamics, as with waterspouts (2/Golden, 1973), but with some impetus from a cold front, some vertical shear, or a strong approaching upper wave. The Hawaiian tornado studied by Zipser resulted from interacting trade winds southwest of an elongated Northwest cold front, and a deep approaching 500 mb low.

8) In some cases, convection that produced waternadoes may be enhanced by alignment with the Gulf Stream, a land breeze with somewhat drier air, and comparatively warmer night-time temperatures from across the Gulf Stream flowing into a storm line parallel with the coast (i.e. Jim Leonard's midnight storm.)

VISUAL/AUDIBLE CLUES

9) Cone shaped or tapered vortex column for waternadoes. Waterspouts are typically cylindrical in appearance.

10) Waternadoes have higher translation speeds and longer durations than waterspouts.

11) Thunder and lightning are often present around waternadoes.

However, all of the proceeding information is largely deductive and based on aggregated waterspout data and analyses, with an apparent bias toward common (not exceptional) environments for standard waterspouts. Taking a fresh look at the existing data, here are just a few questions which should be addressed:

1) How can waternadoes be identified and measured? How many really occur? Is it as high as 1:10?

2) What synoptic patterns favor waternado formation? If a strong thermal cap is unlikely, what compensates for this? Does the "cap" extend several miles over the water? Are there any dry intrusions from land at low or mid-levels?

3) What different patterns, if any, conduce to form tornadoes over water as compared to those moving from land to water?

4) What is the diurnal, climatic, and geographic frequency of waternadoes? Do any occur over the deep ocean waters, or are they only a hazard to coastal harbors and shipping?

5) How can the casual observer tell the differences between the waterspout and waternado? Do storms which produce waternadoes have inflow bands, rain-free bases, wall or tail clouds?

6) How many mysterious small boat losses can be attributed to such storms, especially at night? What. special precautions should boaters take to secure boats, deck gear, etc., if one of these waternadoes approaches?
These are only some of the many questions regarding waternadoes. It's food for thought and ample material for several graduate theses.

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2/Golden, 1973; Weatherwise, June, 1973.
3/Golden, 1971; Monthly Weather Review, Vol. 99, No. 2.
4/Zipser, Randal; graduate study
5/Golden, 1977; Journal of Applied Meteorology, Vol 16, No. 3.

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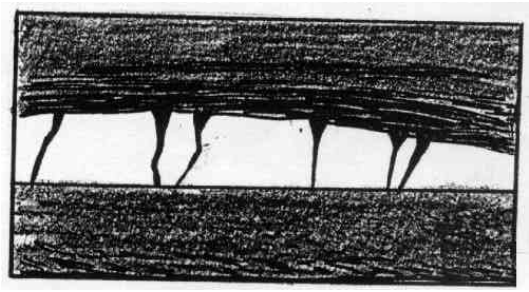
VII. FEATURE #3 NOTABLE WATERSPOUT ACCOUNTS

By Tim Marshall

Waterspouts have been described by many mariners over the years. Ship log reports have listed waterspouts in every ocean. From Japan to Australia, South America to India, North America to Russia, waterspouts have been observed. Here are a few notable ones:

In 1880, on the coast of France, a waterspout moved on-shore and destroyed the town of Saint-George-la-Riviere including the church. All the rooftops were carried away. Walls were crumbled and toppled. Trees were uprooted and broken. The damage path was 300 meters wide.

On September 5, 1935, a waterspout formed near the city of Norfolk, VA and moved northeast. First it destroyed a few buildings near the city, then it crossed the water again lifting a few boats and tossing them onto the bank. Part of a pier was broken. Coming onto land, the vortex destroyed two more houses, then crossed the bay, striking a rail station and derailed several freight cars. Arriving at the airport, the tornado flattened two hangers before continuing over the Chesapeake Bay where it dissipated.



Waterspouts, especially small ones, often form in groups. One of the most amazing photographs I've seen was taken during World War II off the coast of the Philippine Islands. Six waterspouts were aligned in a row across the sea. Sketched from Colton, 1943, National Geog.

VIII. FUNNEL FUNNIES: The Precise Forecast (Fiction)

With the evolution of the supercomputer, advanced research on tornadogenesis, and aid of the 65 mph speed limit, the sophisticated chaser will one day reach the day of:

THE PRECISE FORECAST