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I. COMMENTARY

A new year begins. How many times past has each of us paused on this occasion, wondering at what the spring will bear. For those who mark the calendar only as a passage to or from the great storms, we note the passing of the winter solstice, lengthening of days and rising temperature. The snow will go to sleet, and then to rain. The river goes from ice to flood to sea. And chasers, patient, listen to an unseen stirring -- tugging at bare limbs, curling scraps of paper 'cross a driveway, to the street, to the highway . . .

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Storm Track pauses to note that the author of our recent series, History of Thunderstorm Forecasting, is not the only talented member of the Weaver family. John's wife, Freda, is an accomplished artist who produces exquisite miniature water color paintings on "First Day Cover" envelopes. These are mailing envelopes on which are placed new postage issues, and which are then sent in to be canceled on the first day of issue (A design is often placed on the left side of the envelope to coincide with the theme of the stamp).

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A special note to the Southern Region NWS offices, which received the last issue of ST. I failed to mention it in your copies, but you now have an annual subscription through next November 30, courtesy of the Regional Office. Thus, the subscription renewal notice in that issue did not apply to you. Sorry if this caused some confusion.

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Also, a correction to the last ST which should have read Volume 6, No. 1 (another penalty of the late night preparation of these newsletters, when the Editor isn't always awake). [Corrected]

II. ROSTER

This entry reflects an address change for a previous listing.

Name	Address	Chase country - range
Dr. Charles A. Doswell III	1328 Emery Street Longmont, Colorado 80501 (Biography: Age 36, married/one 7 year old son; Employer - NOAA/ERL/OWRM. Began chasing in Oklahoma and Texas in 1972.)	Texas to Colorado, Colorado to Missouri

III. LETTERS TO THE EDITOR   IV. BULLETIN BOARD/COMMERCIAL MARKET -$- FOR PICTURES

One of ST's subscribers, Douglas W, Beadle, Consulting Meteorologist with Weather Communications Services, Inc. in Marion, Iowa, wrote about securing some storm photos. "Would it be possible to invite readers interested in a 'photography exchange' to submit their names and addresses for publication? I am sure there are many weather nuts, such as myself, with limited resources, who would be very interested in expanding their photo files. The exchange could consist of trades or purchases (hopefully at the cost of duplication) from others who had submitted their names. I envision the printing of names as a once only project. 'Storm Track' would serve only as a vehicle for putting photographers in touch with each other. Correspondence would take place only between interested parties." What do you think about this?

FUNNEL FUNNIES: "Some Kind A Nut. Take Him Away!"

V. CAMERA TIPS

VI. TRAVEL TIPS

VIII. FEATURE I

Highlights of Storm Chase '82
By David Hoadley

The ST Editor's 1982 storm chase report has been delayed by other more dramatic accounts (Leonard, Marshall, Moller), but can now finally be told. My chase covered May 23 to June 11 not a very active storm period last year, despite something over 12,000 miles of driving (just two weeks earlier, more tornadoes were recorded at that time and in that part of the country than at any other time in history). Vacation was originally scheduled two weeks earlier, but a last minute requirement for emergency leave fram one of the staff precluded my absence at that, time. Hopefully, this year will turn out differently, as I plan -again- to be in tornado country during mid-May (specifically May 8-28). However, I made the most of the time last, year, filming four small tornadoes and nine funnels in the Texas triangle bounded by Mineral Wells, Plainview and Midland. Three of these storms were unique in my experience and bear recounting here.

On May 27, 1982, I started from Wichita Falls, Texas at 11:00 AM with my own forecast calling for severe weather from there to Sweetwater to Floydada, and then to Erick, Oklahoma. Subsequently, Kansas City (the NWS National Severe Storms Forecast Center) issued a tornado box 80 miles either side of a line from 30 miles WSW of Hobbs to 10 miles NE of Childress. There being nothing in my forecast area, overlapping but at the east end of theirs, I assumed that later activity would move in from the west and headed west to intercept it. I entered Lubbock 45 minutes after the watch began (in the middle of the box) but was depressed to see a sky full of anvils as early as 1:30 PM (all times are CDT). The atmosphere was too primed for severe weather, and the storms started too soon, before maximum heating could occur. They lined out early, before becoming well organized, and one of the first big cells formed a ponderous shelf cloud 20-25 miles W to SW of Lubbock. The precip overcast was so heavy that an area beneath the shelf was almost a purple-black (2:30 PM). Proceeding southwest out of Lubbock, I followed US 82 to Farm Road (FR) 179 and turned south to FM 211. The shelf cloud was lining out now in a N-S orientation, curving back to the NE at the northern end. Strong surface to cloud outflow dust was boiling up ahead of it. I began driving east, on FM 211, passing a string of 10-15 farm trucks with concerned families, moving away from the storm.

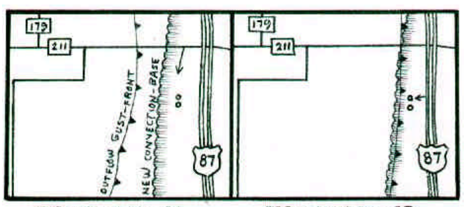


Illustration 1A Illustration 1B

Enroute, I stopped twice (8.0 and 9.6 miles east of the FM 179/211 intersection 2:42 and 2:45 CDT respectively) to record ground dust swirls of suspicious nature. These were occurring well ahead of the swiftly advancing dust, wall (Illustration 1A). The second of these stops drew my attention to the SSW at two swirls beneath new convection ahead of the outflow lip (Illustrations 1A and 2).

The new, small (N-S) convective line seemed detached (at lower levels) from the main storm to the N and NW and was building into the pervasive anvil overhead, from the old cell to the west. I charged on to US 87, and then south about 3-4 miles. At this point, my record keeping on picture locations/times failed completely under the pressure of "close in work," as the two swirls reappeared, in almost the same location as before. In swift succession, each rotation gave evidence of tornadic structure: First the northern one, with a narrow tube connecting the tight, small conical ground swirl to the turbulent cloud base; and then the southern one, with a laminar structure 5-10 seconds later (Illustration 3B). Both lasted 25-30 seconds, with the outflow dust wall still within 1/2 mile to the west of the rotation, but rapidly approaching. It subsequently overtook the new convection and swept on east.

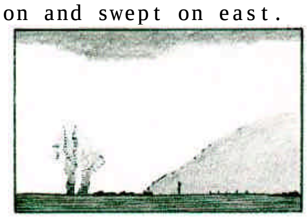


Illustration 2

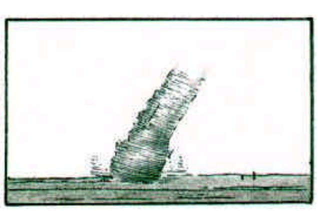


Illustration 3B

Illustration 3A

Illustration 4 shows a possible explanation for the final "gustnadoes" in #3A/B by Tim Marshall. However, this doesn't explain the initial paired-rotation, well ahead of the gust front. In such a case, Dr. Charles A. Doswell III believes that, strong updraft can occasionally form tornadoes (and not necessarily just small ones) without a coincident "rear flank downdraft." Undoubtedly, the new convection was enhanced, through some interaction, by the gust front to the west.

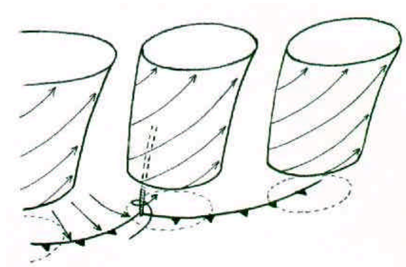


Illustration 4

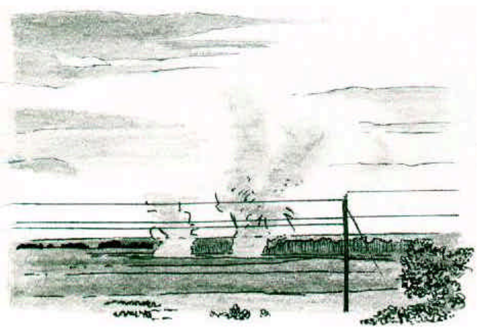


Illustration 5

At this point, I submit that the term "gustnado" needs to be redefined into tornadic (TGO) and nontornadic (NTGO) gustnadoes. I have no specific citation on use of the term "gust'- nado" in the literature but suspect that such applications have been more general than specific. I submit that a TGO is identifiable by (1) proximity to a gust front, (2) proximity to updraft convection, and (3) laminar structure. An NTGO develops directly at the interface between outdraft and inflow, or between outdraft and normal environmental winds, but without (2) or (3) above. The latter rotation is characteristically disorganised, fitful and translates with the moving outflow boundary. Tim Marshall and I spotted an example of a pair of these on June 11, near Snyder, Texas (Illustration 5). They lasted 10-15 seconds and were poorly organized, moving rapidly to the SE along the leading edge of the gust front.

The only other gustnado examples from my early chase years (which also tend to confirm this TGO/NTGO dichotomy) were from 1964 and 1971 storms in Kansas and New Mexico. On May 29, 1971 (5:32 PM), a TGO occurred 2-3 miles east of Tucumcari, New Mexico (Illustration 6A). The ground tube was laminar for about 5-10 seconds along an outflow boundary and was immediately adjacent to strong updraft convection. The storm had only begun outflowing a minute or so earlier from a very turbulent, fractus charged base (tops to 44,000'). Another example of a possible NTGO (although not as easy to "call" as the others) is from a July, 1964 Kansas storm north of Junction City (Illustration 6B). This rotation developed right, on the outflow boundary, with a strongly defined SW wind spinning off the back side and lighter, northerly inflow in front (see inset). This rotation never became completely laminar, beneath a high level convective base (maybe 7-8,000'), but was strong and potentially damaging. This suggests that an NTGO could do severe, localized damage and -yet- be nontornadic (i.e. not be linked to convective rotation at or above cloud base). What do you think? Write Storm Track and share your experiences.

Illustration 6A

Illustration 6B

<u>On June 3, 1982</u>, I left Norman, Oklahoma at noon toward my forecast area for NW Texas, from about Childress to Fort Worth to Abilene. A severe storm developed at the eastern end of my area, just west of Springtown, and several small funnels were photographed between 7:56 and 8:00 PM. I then proceeded south of Springtown at 8:48 PM on State Road 51. At 9:00 PM and 3.3 miles south of town, I observed a remarkably rapid convective development to the SW -- near Peaster (Illustration 7). A small cumulus materialized quickly about 1-2,000' above ground, beneath a rain free base and just ahead of a southward moving rain curtain (suggesting a "rear flank downdraft").

I watched it build up at a rate of at least 100 ft per second (probably more) until it joined the rainfree base overhead. It then drew in its original base and became almost perfectly conical. The last picture in Illustration 7 was taken a few seconds afterward, still showing the general conical shape. The picture before that is reproduced from memory. I presumed that this was a funnel but had never before seen a formation grow like that. This small cumulus was the only one like it in the area, there being almost no fractus below cloud base anywhere nearby. Unfortunately, frequent lightning at the time prevented any radio reports on local warnings or possible damage from this event.

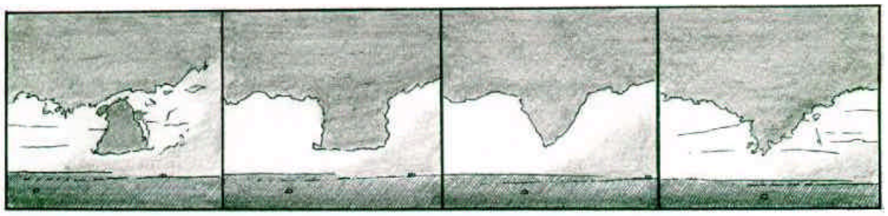


Illustration 7

On June 7, 1982, I started from Wichita. Kansas at 10:00 AM, under northerly winds, overcast skies and temperatures in the 60s (how depressing). With my forecast for the southern Texas panhandle and SW Oklahoma (roughly from Lubbock to Plainview to Shamrock to Lawton), I drove down I-35 and broke through the NE-SW front south of Oklahoma City. The radio reported that Wichita Falls was baking slowly in 100 deg. At this, I turned west to Hobart, where the NWS had left a tornado watch, blocking most of the two panhandles. I drove to the SE corner of their box, where it overlapped my forecast, and photographed two small tornadoes including the F1 at Happy Union. The remarkable thing about this storm was that the vortex developed (1) not only a mile or more south of the turbulent wall but (2) did so from one of the smoothest cell bases I have ever seen. The vortex, never clearly seen from my vantage, appeared as a rising dust column, from ground to cloud base (Illustration 8). Tim Marshall was surrounded by dust in Happy Union but did see a small tube from the cloud. Shortly afterwards, I encountered a local chaser on Farm Road 1914 near Happy Union, who was routing traffic around a downed "60,000 volt" power line pole. He confirmed hearing the roar and spotting three separate rotating dust swirls. Lubbock radar reported a hook on radar, but I am unsure if it was looking at, Happy Union or the wall cloud to its north. One interesting visual reference to the Happy Union tornadic cell: Along with the unnaturally smooth base was a narrow band of cumulus "teeth" (downdraft?) along the western edge.

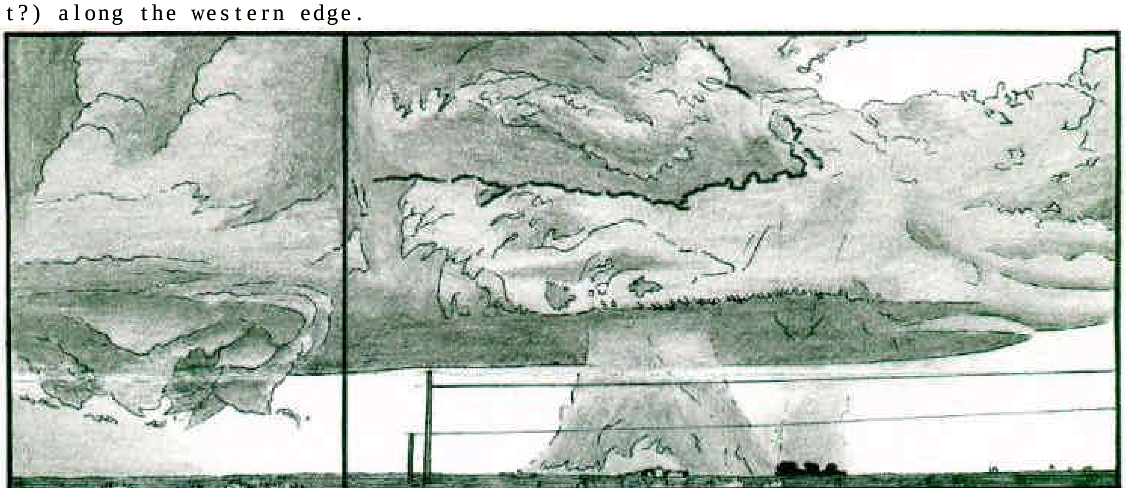


Illustration 8

(Editor's note: I am willing to use, and welcome the receipt of, high contrast prints from readers to accompany ST articles. However, lacking these and reluctant to pay the high cost of printing just for this purpose, I prefer to copy-illustrate storm pictures from slides or low contrast prints. Photo-copying will lose many details, which I can otherwise highlight.)

VII. FEATURE II

Modeling the May 19 Pampa Tornado
By David Hoadley with the assistance of Tim Marshall

Tim Marshall's documentation on the May 19, 1982 Pampa, Texas supercell, which produced six tornadoes, is extremely interesting regarding storm structure. This cell did not exhibit the classical "rear flank downdraft" as modeled by Leslie R. Lemon and Charles A. Doswell III in the Monthly Weather Review, Vol. 107, No. 9, September, 1979.

Actually, Doswell allows that there are some variations and subtleties to the 1979 model (Illustration 9A), which were known then but not addressed, in order to present a cleaner example of the most cocoon structure. Tim Marshall's account seems to present one of these variations.

(To clarify the following discussion, the Editor has made a creative distinction (his own) between the traditional "tornadic wall cloud" and a "meso-low wall cloud." The banded cloud base around some supercells exhibits a circular organization, with well defined (sculpted) edges and covering 3-5 miles in diameter (Tim describes it from the Pampa storm, and I have seen it in the supercells at 'WaKeeney and Ellis, Kansas on June 5, 1974 and at Garden City, Kansas on May 30, 1978). By contrast, the traditional tornadic wall cloud is only about 1 to 1 1/2 miles wide and is characterized by a condensation lowering below cloud base. The WaKeeney-Ellis storm exhibited both at the same time, with a lowering wall beneath the nominal cloud base and a banded cloud "wall" above, shaped like the bottom of a cereal bowl. Tim refers to driving in and out, beneath the 'wall', where surface inflow winds changed dramatically and abruptly from about 20 to 60 knots (higher when outside the wall). Other meteorologists have also referred to such a banded base as a wall cloud. However, I am convinced that it is a formation distinct from the traditional wall, shelf, roll or other cloud descriptors. Therefore, for the purpose of this discussion, I will distinguish between a meso-low and tornadic wall cloud.)

The unique characteristics of the Pampa supercell included:

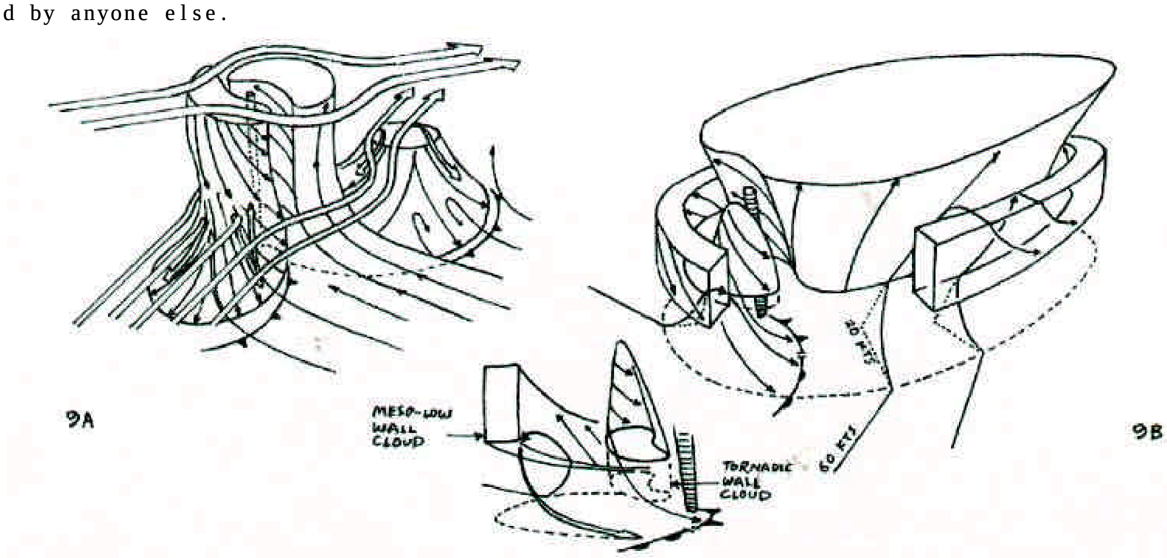
(1) Absence of a single dominating outflow/gust front after inception of tornadic activity;

(2) Presence of at least one warm outflow/gust front (perhaps more than one occurred, but location of the chase team only allowed one to be measured);

(3) Failure of any outflow to clear out or open up the cloud deck, as would normally be expected to the west or southwest of the vortex (however, several apparent rear flank downdrafts were indicated by rain wrapping, close in, around the tornadoes); and

(4) Sharp demarcation of surface inflow winds as they passed beneath the outer edge of the meso-low wall cloud (dropping almost instantly from 60 to 20 knots).

In addition to these anomalies, examination of one of Jim Leonard's prints, taken in Pampa and looking east at tornado #3, suggests a downward component to the meso-low, well above cloud base. The preceding seems to indicate a model something like Illustration 9B. Tim has reviewed one that is similar to it and takes no exception. Other than this, it is purely the Editor's own speculation, not endorsed by anyone else.



Basically, it shows a core with a dominant updraft, while a lower, outer ring, or meso-low wall, surrounds it. Some of the updraft is drawn up around the lower pressure core, but so much air is lifted that the anvil can't ventilate it all, and some centrifuges out to the lower ring. Here, with higher pressure, a weak downdraft moves around to cloud base, only to be curled back up (not reaching the ground) by the stronger inflow wind. When a localized rear flank downdraft develops, it is smaller at the top than the Doswell-Lemon model and doesn't ventilate a large enough anvil area to overwhelm the surface inflow. Whatever cooler air enters the downdraft remains close to the vortex and wraps around it, but also, fails to overcome the strong inflow. The inflow rises along both the updraft core and inner side of the meso-low wall.

However, it turns downward from the meso-low when adjacent to the rear flank downdraft, and returns, uncooled, to the surface as warm outflow. The short gust front lasts only until the rear flank downdraft is eroded by the pervasive circulation in the meso-low wall, permitting the supercell to continue in its steady state. How, otherwise, would you explain this storm in a conceptual model?

VII. FEATURE III

Storm Classification Scheme

By by Eric Rasmussen

Many ST readers are familiar with the fact that I am frequently trying to improve forecasting techniques by applying what we learn chasing storms. Recently, I have acquired the capability to use an interactive computer to develop forecasting tools. One of these is the wind hodograph (this shows how the wind speed and direction varies up through the atmosphere), which is computed and plotted on a screen. It appears that the morning wind structure in the lowest 6,000 to 9,000 feet, combined with the "buoyant energy" available to a growing storm, may largely determine the type of storm that could occur on any given day.

To facilitate this research, it is necessary to classify storms, based largely upon the observation of chasers, according to a few easily observable qualities. This is the latest version of the classification scheme:

I. Outflow Dominates (Chasers curse and swear)
A. One rather short-lived storm, no regeneration along the gust front. Example- "air mass" storms of the SE U.S. in the summer.
B. Regeneration along the gust front well away from the original storm.

II. Rough Balance Between Inflow and Outflow (Multicell storms) Most type II storms are maintained by incorporating discrete updrafts from the flank or stone periphery.
A. Multicells undercut by outflow. Often have repeated generation of mesocyclones with wall clouds frequently undermined by outflow; not "cyclic." Gust fronts stay close to updrafts.
B. Steady squall line.
C. "Steady hook mode." Does this multicell storm even exist? This would have a persistent wall cloud or tornado, yet be a multicell.
D. Cyclic tornadogenesis. New wall clouds/tornadoes form rapidly as the gust front surges around and ahead of an ongoing tornado. Examples: May 28, 1980 Tulia, TX storm; May 17, 1981 Tecumseh, OK storm, and May 19, 1982 Pampa, TX storm. Perhaps a fairly common storm type.

III. Inflow Dominates (True supercells, chasers in ecstasy) These are maintained by continuous propagation of one strongly dominant, steady updraft. Little or (typically) no flanking line.
A. Weak rear flank downdraft, little or no gust front. Can produce tornadoes but does so with apparent difficulty. Example: Borger storm photographed by Al Moller, ST, Nov 82.
B. No discernible rear flank downdraft. Possibly can't produce tornadoes. Bluestein’s "bell-shaped" storms probably fit here.

It must be pointed out that storms can and do evolve from one form to another. For example, the Pampa storm appeared to evolve from type II-D to III-A. I have been classifying storms mainly according to that character which is exhibited through most of the storm's life.

I have some guesses as to what combinations of wind structure and instability produce which type of storms. Oddly enough, type II-B (squall lines) can occur with just about any combination, so evidently some other factors must be involved. Since squall lines are very common over some parts of the country, it will be important to determine what additional factors play strong roles in determining their structure.

With the addition of more "cases," I hope to be able to tell if storm types truly are easily predictable, and I'll share the results with ST readers when they are available. Until then, I would appreciate input from the readers about the classification scheme and ways to improve it without complicating it.

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Next issue of Storm Track will feature results of the tornado sound study, some cautionary advice about using vinyl slide pages (sheets) that contain polyvinylchloride (PVC) (in other words, DON'T), and other interesting articles.