Storm Chasing with Safety, Courtesy, and Responsibility

by

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*The content of this essay is purely the opinions of Charles A. Doswell III; no endorsement by the National Severe Storms Laboratory, ERL, NOAA, or the Department of Commerce is implied. Moreover, my current affiliation is now the Cooperative Institute for Mesoscale Meteorological Studies, also in Norman, OK.

Also see my Chasing FAQ list. If you want to comment or discuss anything on this page, send e-mail to me at either: cdoswell@hoth.gcn.ou.edu or cdoswell@earthlink.net

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Storm chasing is a hobby of considerable interest to those of us who are deeply interested in tornadoes and severe storms. There is a whole world of storm chasing enthusiasts now and chasing's growth as a hobby has exceeded my expectations. That growth means that more and more people are doing this than ever before, and some of the people currently storm chasing are not necessarily doing so in a safe, courteous, and responsible way. This essay is an attempt to articulate what I think are "rules" of storm chasing that everyone should heed, and some of the reasons behind those rules.

I realize that we live in a free country and you are quite free to behave in any manner you wish, irrespective of any rules and recommendations I might want to impose on you. If you choose to behave stupidly, there is nothing I can do about it. The highways are as open to you as they are to me. However, if you do something really dumb and that action in some way jeopardizes my opportunities to chase storms, then I reserve the right to be upset with your behavior and to create as many obstacles to your continued stupid behavior as I can think of and get implemented.

For the record ... I do not claim to be *perfect* ... there are times when I bend some of the "rules" I have listed here. The key to any set of safety rules is to know when they can be bent and still be within the bounds of reasonable safety.

Chasing Safety Rules

Basically, storm chasing is not really all that dangerous, **if** you know what you are doing. "If" is a mighty big

word, in this context. When I started chasing in 1972, there were no rules and we had precious little knowledge to guide us. What chasers there were (e.g., Dave Hoadley) were unknown to us and whatever they might have learned was unavailable. We did a lot of dumb things and yet, like many teenagers who do dumb things, we survived without killing or even maiming ourselves. Not because we were so smart, but because we were lucky and tried to learn from our mistakes. What lessons we learned continue to be relevant today. Basically, there are three primary threats to your life and welfare during a storm chase:

The Number 1 Threat: Being on the Highways

There can be no doubt that simply being on the highways is a dangerous thing. Literally thousands of people are killed this way every year and there is no reason to believe that we storm chasers are exempt. In fact, we do several things that put us at risk: we often drive with less than 100% of our attention on the very important task of driving, we are prone to exceed the posted speed limits, we hurtle down rain- and possibly hail-covered highways, we are prone to sudden stops and starts without much warning. The immediate storm environment is a hostile place to drive, with limited visibilities due to rain and blowing dust, wet roads, strong winds that can change speed and direction rapidly. We may end up congregated in groups of anywhere from 2-20 vehicles (or more!), all seemingly in Brownian motion or parked in mobs virtually anywhere, including on the roadway itself. To a regular citizen (or a police officer), we can look like a mob of crazies! A few years ago, a University of Oklahoma student was killed in a single-vehicle auto accident during a storm chase.

There are some simple things to consider for safety purposes that will make your prospects for a long storm chasing life a whole lot better (the order is not important):

1. **Avoid chasing alone** . It helps to have a driver who isn't particularly excited about storms, who will pay strict attention to the full-time job of driving. Lacking that, make good and sure that the driver will stick to the driving business. Besides, navigation is tough to do when driving, because tough decisions need information. Looking at a map while driving is a good way to get in serious trouble. There are good reasons to have chase partners aside from sharing costs.

2. **Be *very* alert to standing water on the roads!** Hydroplaning is no joke, is very scary, and can get you dead or hurt or wreck your vehicle pretty fast. When roads are wet, the water tends to collect along the tire paths, so it is wise to avoid those puddles that are more or less parallel to your path. If you are hearing water splashing under the car from the spray of your passage, then you are on the verge of hydroplaning, if you are not doing so already. Certainly, it makes no sense to chase with worn-out tires, either. The threat of hydroplaning is in fact a major threat during storm chasing ... please take it seriously!

3. **Avoid chasing in cities if at all possible**. Your angst levels will skyrocket if you chase storms within a city, especially large metropolitan areas, prompting you to take unneeded risks. Ordinary traffic signals and normal traffic levels will have you pulling your hair out; heaven forbid you get caught in rush hour traffic. Be prepared to obey the reduced speed limits in school zones, and in small towns (see the next item).

4. I know this is probably a waste of time, since I admit that I have violated this recommendation, but **if you have to exceed the posted speed limits to get to the storm, then you should consider resigning yourself to missing some of the action and slow down**. Speeding creates a whole host of dangers I don't really need to repeat, here; speeding is especially foolhardy on wet roads and/or in poor visibility. Few chasers have ever followed the speed limits religiously (including me!), but if you feel you *must* exceed the speed limit, at least use some common sense.

Don't speed in places and situations where you place anyone other than *yourself* at risk ... especially in towns and on crowded roads!

5. **When you park on the side of the road, be sure that you are fully off the right-of-way and that parking is, in fact, legal where you are doing so**. Be careful when you open vehicle doors ... it's best if you can pull far enough off the roadway that opening your doors will not swing the doors onto the roadway. As unbelievable as it sounds, I suppose I have to tell you to get off the road in the first place; thoughtless chasers have been known to use the highway as a place to set up their tripods! See the essay by Roger Edwards and myself. You also should think carefully about the condition of the shoulders as you begin to pull over ... you might find them to be a quagmire, with deep ditches hidden by tall grass and weeds. Also, see Item #11, below.

Most of you know that parking is allowed for emergencies only on Interstates ... you might have a tough time convincing a police officer that your chance to see and photograph the event of a lifetime constitutes a true emergency (I've tried, and it doesn't work!). I usually try to avoid Interstates except as a means to make time; they have limited access on and off, making them a poor choice during the active phase of chasing. At best, chasing on an Interstate is only acceptable when no alternative exists ... only in rare cases does chasing on an Interstate make sense, although *repositioning* via Interstates (not an *active* chase trip) is obviously fine.

6. **Use your turn signals!** Sudden stops and starts, pulling onto and off of roads, etc. is likely to create problems for you if you have not made other drivers aware of your intentions. You need to be very alert about road obstacles (construction, animals jumping in your path, pedestrians, stopped vehicles, etc.) as they will cause you to react instinctively (and sometimes stupidly). Sudden, instinctual driving actions are quite dangerous at the best of times.

7. **When chasing in heavy rain or blowing dust, slow down!** If you can't see, then you may not be happy with what you encounter (see previous discussion about sudden, instinctual moves).

8. **Be thinking about the availability of fuel**. Refill your fuel tank before it gets really low. You may not get the chance when small towns "roll up the sidewalks" in the evening and it may be 50-200 miles to the closest big city with an open fuel stop. Storms have been known to knock out power ... if the power is out, you won't get fuel even if the town is still "open." And running out of fuel *could* put you in danger from the weather if it happened at a bad time.

9. **Avoid unpaved roads!** Even if you have a 4x4, wet dirt roads can sink you up to your axles; when you're high-centered, even a 4x4 is useless. Moreover, having a 4x4 tends to lead the driver into overconfidence about driving under adverse conditions. Remember that a 4wd doesn't *stop* you any faster than a 2wd! If the mud on a dirt road isn't a quagmire, be aware that a thin layer of mud on hard-packed dirt can be *very* slippery.

10. **Be thinking about your vehicle's visibility to other vehicles**. This means put on your headlights when it's raining or the air is filled with dust. Use your parking lights when you pull off the side of the road. Your flashing "hazard" lights are an option for roadside parking, but may draw unwanted attention with the implication you're having a problem. Flashing light bars added to your chase vehicle (similar to those used by law enforcement) may be illegal in some places and their use to imply some sort of official status to your chasing is probably going to get you in trouble someday.

The Number 2 Threat: Lightning

Severe thunderstorms are, obviously, accompanied by lightning. Lightning kills many scores of people every year, and is second only to flash floods in that regard, on the average. So what are we chasers doing? We hang around thunderstorms a lot. We clamber to high spots with unobstructed views, often near fences and power/phone lines, and stand next to metal tripods while we record our images. It doesn't take a PhD in plasma physics to figure out that we are putting ourselves at risk from lightning strikes. I am amazed that we have not had someone killed by lightning during a storm chase; there have been some close calls, with chasers being affected by nearby lightning strikes but not being hit directly. However, the fact that such a death has not occurred cannot be from the wisdom and foresight of chasers - it's pure, unadulterated dumb luck. There's no reason to assume that it will continue forever. In case you feel pretty much unworried about lighting, consider the information contained here, provided by Dr. William Hark and that here, provided by Dr. Mary Ann Cooper. Some of these effects may not kill you but will be with survivors for a very long time.

Being inside a vehicle is apparently a safe place ... there is at least one video that has gotten considerable media attention of chasers whose car was struck by lightning ... they survived. Being in your vehicle is certainly safer than not taking shelter at all. However, there is reason to believe that if someone in the vehicle happens to be tuning the radio when the radio antenna gets hit by a CG flash, they may be in danger. Same for working the cellular phone, or using the CB or amateur radio rig, or whatever. The following are some basic recommendations for lightning safety. You can take whatever risks you like, of course.

1. **If cloud-to-ground (CG) lightning strikes less than one mile away, move immediately to some place of shelter (inside your vehicle, for instance).** Depending on the circumstances, you might need to move to shelter *sooner* than that. In fact, strictly speaking there is no specific distance from a storm that is always "safe" ... you can be struck by lightning when a storm is miles away. Keep in mind that you may not have any preliminaries at all ... the *first* CG strike in your vicinity may be right through you!

2. The first CG lightning strikes often come near developing rain shafts, so **if rain has not been approaching, but a few drops begin to fall around you, you may be in imminent danger.** I have seen lightning stabbing the ground ahead of moving rain shafts, as well.

And once the rain begins, of course, CG lightning can occur within the precipitation, too.

3. **CG lightning strikes can occur well away from the main precipitation area, either in the downstream anvil (where precipitation can be light or even absent), or even well upstream from the main updraft towers and the precipitation area**.

[Image ©1976 A. Moller, used by permission]

Such strikes can be miles from any rain. Therefore, even if you seem to be well away from a storm's "action area" it is not clear that you can count on not being struck; hence, you should follow some basic safety precautions:

a. Avoid being the tallest object around, and avoid being too close to any tall objects like trees and power/phone poles and lines.

b. Don't stand close to fences and power/phone lines that lead into areas where CG lightning is active. The wire can carry the strike to you. I know of chasers who have had unpleasant encounters in just this way; to date, none of them have been fatal.

c. If you decide you're in danger and, for some reason, you can't move to a place of safety quickly, sit down on something nonconducting to reduce your chances of being struck or being affected by a nearby strike to ground. Wet ground can carry the strike to you, so you need to be isolated from the ground, if possible. Getting low is a good idea, but don't spread out prone; kneel, squat, or sit.

d. Don't assume that you'll have unlimited time to decide whether or not it's safe at your location. As noted already, the *first* CG flash from a storm may be the one that gets you, and you'll not hear it coming. I daresay you won't hear a flash that gets you at all! Not all CG flashes "signal" their intentions by causing such effects as making your hair stand on end. If lightning strikes close enough to you that you don't hear thunder ... only a sort of "zapping" sound ... and you may feel some induced electricity in your body ... you should get to safety, immediately! You're very lucky not to be dead ... don't push it. This has happened to me and I don't like it! And I didn't wait to bail out of there!

e. Make sure that your chase team includes at least one person who knows CPR, and pray that he or she isn't hit at the same time you are! CPR can mean the difference between life and death, since lightning often stops the victim's breathing and/or heart. Doing CPR would save many such individuals ... if someone on your team is struck, initiate CPR immediately.

f. For photographers, such measures as using a non-metallic tripod, or wearing insulated shoes don't reduce the lightning threat in any substantial way.

The Number 3 Threat: The Storm

Of the primary threats, the *least* likely to get you is the storm you are chasing. I like to think of it as the difference between going out bear hunting and having a bear come into your tent: the danger you have in front of you is much less likely to be a threat than a danger that comes on you as a surprise. Having said that, I must remind you that the severe thunderstorm/tornado environment is not very much akin to your everyday world. In that everyday world, things don't change as fast and the potential danger in a severe thunderstorm is nothing to take as routine. There are very nasty goings-on with these beasts and they can become unbelievably fierce so fast that you may not have time to respond intelligently. Folks unfamiliar with severe storms simply may not be able to comprehend their danger until it is too late ... smart chasers never take stupid risks near severe storms.

I shudder to think of what a "feeding frenzy" the media will have on the day when a chaser gets killed by a severe storm. I am certain it will happen eventually, if enough folks put themselves in harm's way. The thrill seekers among you, the adrenaline junkies (e,g, many of those who do bungee jumping, extreme skiing, freebase parachute jumps, solo unroped rock climbing, etc.) have to accept the fact that people die taking risks. That seems to be the thrill for some of you out there, and you hasten the day when the first storm-eaten chaser hits the headlines. When it happens, there may be talk of banning the "sport" or regulating it or whatever. I hope that I don't live to see the day.

Even though the risks of a storm getting you are relatively low, there are some simple things you can do to minimize those risks.

1. **Avoid "core punching" storms!** For the uninitiated, a "core punch" means going through the heavy precipitation core of the storm in order to get into a better position. Having to do this is the result of being out of position; core punching is a *loser's* last resort to avoid missing a tornado. There are several bad things that can happen:

a. You can drive into very large hail and seriously damage your vehicle (including losing a windshield).

b. You can drive out of the rain and hail right into the tornado (see the figure).

c. In the core, you can have serious problems with rain: slick roads, zero visibility, etc. (see Threat No. 1).

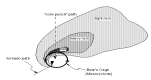

Figure illustrating a classic supercell, with the shading indicating roughly the radar reflectivity and associated precipitation. The storm is moving from southwest to northeast. In the southwest corner of the storm is the "hook" which is the result of the mesocyclone wrapping precipitation around itself. In this figure, a stupid core punch has put the chasers right in the path of the tornado as they emerge from the rain and hail.

Of course, you *might* luck out and nothing bad would happen. Speaking for myself, I almost *never* core punch, anymore. If I have to drive into precipitation and I don't know for sure what's on the other side, I am on a hair-trigger to stop and go back the way I came if I see hail larger than pea-sized, or have any hint of something nasty embedded within the rain. Driving into dark cores with lots of lightning is just not a smart policy and I personally have missed several tornadic events because I would have had to take the risk of a core punch to get to the action. If you are driving in rain and you encounter hail that increases in size, stop, back up, and get out of there! You may be driving into a core without even knowing it.

2. **Avoid driving under (or even very close to) rotating wall clouds**! While this seems rather obvious, chasers sometimes figure they can beat the storm to a key intersection or whatever. At the very least, large hail is likely to be present between the wall cloud and the visible precipitation shaft.

3. **It is generally unwise to put yourself in the path of a rotating wall cloud**, and it's even more stupid to put yourself in the path of a tornado. How can you tell if you're in the path? If the tornado is not evidently moving to your right or left, but is simply getting larger and closer, then you're in the path. This is not a good place to be. Of course, even seeing a tornado is not like going out for a Sunday afternoon picnic and it is even harder to find oneself in the path, but if you should do so, then do us all a favor and get out of there, ASAP!

4. When stopped to view a nearby storm, **keep your head on a swivel**. Look overhead occasionally, as well as all around. Don't get trapped into looking fixedly at one part of the scene in front of you. Tornadoes can form in many places besides under a rotating wall cloud; along flanking lines of convection attached to a main storm is a likely place for tornadoes. These will be seen as flat updraft bases ... if you *don't* recognize an updraft base when you see it, you shouldn't be that close! (see the next item)

5. If you're new to chasing, **chase with someone experienced** and sensible for a while, if you can. You can learn a lot in a few chases if you find the right chase "mentor" to start with and this knowledge can keep you out of trouble.

6. It's a good idea to keep your engine running when you park your vehicle to view a potentially dangerous storm. Having a storm from Hell about to engulf you is a bad time to find our your voltage regulator bought the farm and your battery is dead.

7. **Tornadoes are not the *only* threat from a severe storm**! Winds of 100 mph, especially when combined with, say, baseball hail and/or flying sheet metal could do you serious harm, with nary a tornado in sight. HP supercells often take on very nasty proportions, even when they are *not* tornadic. LP supercells can produce hail from what appears to be precipitation-free air (the stones do not produce much visual light attenuation, but they can "attenuate" you and your vehicle).

8. Rotating curtains of rain within the mesocyclone often precede tornado development, so if you find yourself entering rotating rain curtains (the **bear's cage** ... see the figure above), it is not a safe place to be. Unless you are pretty certain of what you are doing, your best bet is to get out ASAP! Sure, on a good day you get to eat the bear, but on a bad day ... well, the bear eats you!

9. Know when you've put yourself in a dangerous situation and have the courage and wisdom to **back off**! The "macho" trip some folks get into is really dumb. Taking calculated risks can always turn out fine, of course ... avoiding *all* risks is not consistent with chasing storms in the first place. But it only takes *once* to create a disaster and getting yourself killed or seriously hurt by being stupid is going to hurt chasing for all of us. There's a big difference between calculated risks and being foolhardy. Some recent events have suggested to me that there is some "competition" to get the wildest possible video, by means of risk-taking that most reasonable chasers would consider foolhardy. If the only person you endanger in the process is yourself, that's one thing ... but by taking extreme risks (e.g., driving under tornadic wall clouds, or racing a tornado to an intersection, or putting oneself in the path of a tornado and staying there to the point where debris is about you, or driving right up to the edges of a tornadic debris cloud) and literally profiting from them (as in selling high-risk video to TV), you are reinforcing the image of chasing as the domain of "thrillseekers" ... an image that the media seem to want to pin on *all* storm chasers. Personally, I resent being labelled a "thrillseeker" but some chasers (including some veterans and media types, sad to say, who should know better) are working very hard to fit that "Yahoo" stereotype. I can't prevent anyone from taking whatever risks they want, but *they should recognize that by taking high-end risks, they are implicitly encouraging others to do the same*. Thus, the danger is *not* just to them; their bad examples put others in danger. Chasing, in my view, is definitely *not* for thrill-seekers, who want to experience enough danger to get their adrenalin levels up ... but a few bad apples seem to be trying to spoil the situation for the rest of us.

10. **Never drive into rising waters**, especially if you don't know to a high degree of certainty how deep they are! It would be a really stupid way to die, in a flash flood. Some severe storms, especially HP supercells, can produce torrential rainfall leading to flash floods. On level terrain, such prodigious rainfall can lead to "flash ponding" and at the least you could be stranded with a waterlogged vehicle, possibly miles from anywhere. You might even be struck by another chaser going down the same road and equally heedless of the danger! Please avoid "macho" foolishness ... if you have *any* doubts about your ability to make it through water on the road, don't even attempt it!

11. A key element in staying out of danger from a storm is **having a clear idea of its structure**, how it may be changing, and especially its *movement* . Severe storms often change their direction of movement, turning to the right (typically, in the Northern Hemisphere) of their original

movement direction. Be prepared for this. Not all storms move from southwest to northeast, so be prepared to adjust your expectations accordingly: the "action area" may not always be in the southwestern quadrant of the storm. If you don't understand storm structure and how it relates to severe weather, stick to chasing with someone who *does* know for awhile, until you learn enough to be competent.

12. **A prudent chaser has planned escape routes** when navigating near severe convection. It is unpleasant to find yourself on a road without a feasible escape route as a tornado bears down on you. Ask the veteran chasers (e.g., me, Gene Moore, Erik Rasmussen) who in spite of years of experience can find themselves in trouble! Unlike in the movies, if you were to get caught by a tornado, you probably would at least be seriously injured, if not killed. It pays to have thought about what you might do if you somehow end up trapped, anyway. Note that roads and storms can create situations that you don't expect. Maps aren't always accurate, and events can arise for which you didn't plan. It is easy to find yourself with route problems as a storm bears down on you, so please do your best to plan ahead. Note that rivers and international borders (see "Some thoughts from 2001", below) can limit your options.

If you get caught in your car and can't get away by driving, you should abandon your vehicle and move well away from it. If your vehicle starts tumbling, it could tumble over you. Although vehicles are usually good protection against lightning, they are *death traps* in tornadoes. Get as low as you can if you can't find something substantial to shelter you from flying debris, and try to find something you can hang onto. A culvert is a reasonable place; Interstate overpasses are not (see #11 in the Highway threats section). Injuries and fatalities in tornadoes are mostly due to flying debris, so you want shelter, especially for your head. But your best bet is not to be put in this situation in the first place; generally, getting trapped by a tornado is the result of not thinking, bad map information, or inadequate planning!

13. Contrary to popular opinion, **in rural areas it can be quite feasible to escape a tornado in a vehicle** ... provided the roads offer an escape route (see #12, above), and that traffic permits you to do pretty much whatever you need to do. The old rule about moving at right angles to the tornado's movement makes sense, if possible. Most tornadoes travel at speeds less than 60 mph, so most of them don't move fast enough to overtake you on an open road [ignoring the malevolence of fictional tornadoes in the movies, or those chasing camera crews], especially on Interstates ... but it makes most sense to try outrunning them only until you can find a *road that takes you out of the tornado's path*. In urban areas, it is likely that traffic and other things that slow down movement in a city (intersections, shopping malls, etc.) would prevent a hasty escape, so abandoning a vehicle to seek more appropriate shelter in urban areas makes sense. It's quite likely that appropriate shelter can be found in cities (this is not the place for a review of tornado safety rules). Of course, in the "TWISTER" era, chasers might create their own congestion even in lonely rural areas ... . If you do find yourself trapped, at the moment, many people believe that the main instruction is to abandon your car and head for a ditch. Taking **shelter in a ditch should be considered only as the last, desperate alternative**. It's better to avoid such a desperate situation in the first place.

14. **Don't park under Interstate overpasses** to avoid hail and tornadoes. I am by now seriously exercised by the (in)famous "overpass" tornado video from the 26 April 1991 outbreak in Kansas, where crouching under the overpass is implied to be proper shelter. Parking under overpasses is getting grossly out of control ... drivers are turning them into parking lots during storms, with people literally parking *on the roadway*. This is going to cause a fatal crash someday, when some idiot continuing to drive at high speed in the rain runs into one of these "gatherings" beneath an overpass. Don't participate in this egregious practice! Moreover, it is not at all clear that they are safe places to be in the event of a tornado; in the "overpass" video, the tornado was not a violent one (being unable to pick up a mini-van) and did not hit the overpass directly, so the apparent

safety of the location was really untested. Since the 3 May tornado event, we have had our first fatalities (3) among those who have sought shelter under overpasses. I hope these will signal the *end* of this egregious practice ... **being under an overpass is simply not an acceptable way to seek shelter**! A detailed discussion of this topic can be found here.

Chasing Courtesy

Being courteous is a matter of choice. Some people choose never to exhibit courtesy, others do it without even thinking about it, most of us have to be reminded now and then about the Golden Rule (not *Joe* Golden's!).

1. If you stop in a National Weather Service Office for information, please remember that the folks working there have a tough job to do. There are some simple rules to keep in mind so you don't find yourself unwelcome:

   a. **Don't ask them to make your forecast for you.** If you don't know enough to use the weather information they provide to make your own forecast, stay out of their office until you do!

   b. **Unless you are familiar with the equipment in their office (because you yourself work with the NWS, for instance), keep your hands off their equipment! Even if you *do* know how to use it, *ask for permission* first.** If you crash one of their systems, please tell them right away. In fact, everyone should ask permission even to be in their office and if they say you can't come in, don't go away moaning about their rudeness. Keep reminding yourself, "It's their office, they have a job to do, and I am a guest only if invited!" Many bad experiences with chasers have resulted in NWS offices being much less friendly now than they were when I started in this business.

   c. **When a lot of chasers arrive at an NWS office, it is not appropriate for everyone to congregate in the work area and have a loud bull session.** At most one person per vehicle is needed to obtain information in such situations. It is not at all uncommon these days to find 3-10 vehicles at an NWS office. Keep the conversations at a low sound level unless you are clearly separated from their work area. The new offices typically have a conference room in which chasers can congregate without disturbing the forecasters in the work area.

   d. **Keep your opinions about their forecasts to yourself.**

2. Remember that law enforcement folks have their hands full on a chase day. If they have a roadblock up because of severe storms, and you can't convince them to let you through, then back off and let it go.

3. Do not trespass in order to storm chase! Unbelievable as it seems, I have seen chasers driving their vehicles down private roads and even into fields in order to view a storm. This sort of behavior is detestable and gives chasers a bad name.

Responsible Chasing

Acting responsibly is a good way to ensure that chasing isn't associated with yahoos, wackos, and thrill-seekers. Apart from ensuring that safety is a constant consideration and courtesy is an automatic action, what do I mean by *responsible* storm chasing?

1. **Keeping our enthusiasm for violent weather in the proper place**. If you've had your home and perhaps loved ones taken from you by a tornado, then you are probably not going to react favorably to a bunch of folks whooping it up enthusiastically over a tornado. When I first drove into the damage path of the Union City tornado, shortly after it left town, I realized that the tornadoes that I *wanted* to happen could wreak havoc on people's lives. After some reflection, I realized that what I wanted didn't really change the weather (good thing, too!), and that by happening in front of trained observers, what we learned could be used to mitigate the impact of such storms in the future. But I still feel uncomfortable dealing with tornado victims. Talking about death and destruction as a good thing in front of the wrong people, even as a joke, can create an awful impression of storm chasers. Virtually all storm chasers would be delighted to have tornadoes happen only in open country where not even crops would be damaged.

2. **Chasers can be of tremendous help to science and to the public if they will take a few moments to *report* what they have seen**. Call or visit the appropriate NWS office and give the report of what was seen, including the location of the event(s) and the time(s) of occurrence. I personally do not believe it is necessary to break off a storm chase to call in a report, unless you have some electronic communication aboard your chase vehicle so that you can make a report without terminating the chase. However, as soon as possible afterward, you should report the event(s). If you feel that the storm is about to strike without any warning and you have the opportunity to do something to warn people, then by all means do what you are able to do.

3. **Responsible chasers don't endanger themselves or others**. Keep in mind that your actions might be used to portray storm chasing as a whole. If you behave recklessly, without regard for your safety and, especially, the safety and well-being of others, then you invite people to make the unfair comparison. I don't want the job of having to answer for *your* irresponsible actions!

4. **Effective chasing is a constant learning process, and responsible chasers need to be aware of what is going on in severe thunderstorm and tornado science**. It behooves all of us to be informed about the latest scientific findings, even if the only rationale is to make us better chasers. Participate in the process and don't be selfish with it. If you have seen something noteworthy, you can be responsible for preventing future disasters through sharing what you have seen. Knowing what is noteworthy requires you to be knowledgeable about the science of severe storms, so it is a two-way street that works most effectively when everyone shares what they know for scientific and educational purposes freely.

5. **Chasing can become a dangerous obsession**. Student chasers who let their studies go to follow the convection run the risk of sacrificing their careers. Chasers who neglect their family responsibilities to chase are not folks I admire, no matter how much they "succeed" in chasing. Letting chasing get in the way of any work responsibilities is also a problem, in my view. Some folks wear their obsession about chasing as some sort of badge of honor, but I say "Get a life!" Everyone has to decide on an individual basis what is their operational definition of "responsible" chasing from this personal point of view. All I know is that building a life totally around storm chasing, in my opinion, is not a very responsible life.

6. **Stay out of tornado damage areas if possible**. During a chase, this seems fairly obvious. Damage paths are full of hazards that no one would enjoy if it is possible to avoid them; downed

power lines, jagged pieces of sheet metal, boken boards, etc. When the chase is over, some chasers may want to do their own damage survey ... in general this is a bad idea! Stay out of such places unless you have been **invited** to participate as part of an organized storm damage survey or a cleanup crew. You are likely to be in the way of cleanup and folks who have been hit by a tornado tend to be suspicious of strangers in their midst. Gawkers are not appreciated and being taken for a potential looter is not likely to make you welcome!

Choosing Chase Partner(s)

I've talked about having at least one chase partner with you on your team. This can reduce overall costs by sharing the expenses, and it also makes the chase safer and more fun, at least partly for reasons I've already mentioned. But if you are going to be on a chase "vacation" with someone other than a family member, be aware that picking a chase partner is not unlike picking a *spouse*! You're going to be very close to this person for an extended period and you'd better be pretty certain you're compatible. Some items to consider when choosing a chase partner:

1. You'd better agree on how you are going to make chase-related decisions. There's no faster way to ruin a chase than arguing about decisions and finger-pointing exercises when the choices made don't pan out. Unless you expect to be right 100 percent of the time, it's not a good idea to blame your partner(s) when things go wrong. Remember that no one is right *all* the time. Don't have unreasonable expectations about how often you are going to see a tornado and accept the reality that no one ever sees them all.

2. Another point you'd better work out is how you're going to spend your "down" time. Every chase has some down time; this is when there is no reachable event worth chasing. Of course, deciding on down time is an important decision, but assuming that you all agree about a down period, it's useful if you can use that time in some mutually agreeable, satisfactory way.

3. Plan on spending a lot of time shooting the bull on the road. If you have some repertoire of mutual interests besides storms, this helps pass the time and the conversation doesn't go stale.

4. If you're going to be sharing motel rooms, know the personal habits of your chase partner(s) and be certain you can tolerate them. As I said, this can be like having a temporary spouse!

Storm chasing, for those who have not done it, is mostly frustration and failure. Although the ratio varies from person to person and year to year, a fair expectation is one tornado day (i.e., a day when you actually see one or more tornadoes) for every 5-20 chase days (not quite what was portrayed in "Twister"!). In the course of a tornado day, the number of tornado minutes (a minute spent actually viewing a tornado) probably averages about 20. If you chase for 3 weeks, you might be reasonably lucky and have 3 tornado days, or about 1 hour's worth of "tornado time." in that 3-week chase (504 hours). That's a pretty good year, and you spent 0.2% of that time actually seeing tornadoes in action. In a wildly successful year, you might get up to 1% of your time viewing tornadoes ... but in some years, the tornado time is *zero*! Out of a three week chase vacation, not every day actually includes a storm chase ... the atmosphere just isn't doing it anywhere close to where you are. If all that interests you is tornado time and you can't deal with that amount of failure (remember, even mediocre batters in baseball get hits 20% of the time), then don't bother chasing in the first place.

There are many important decisions to make and, on any given chase day, it is likely that a critical decision will be made incorrectly and the chase will not be a complete success. I find the whole experience more satisfying if seeing a major tornado is not my *only* criterion for a successful chase. I can get a great deal of

enjoyment from seeing an interesting non-tornadic storm. Don't get me wrong, though! I still chase tornadoes as a primary goal and a chase season without a tornado is like having a great piece of pie without that scoop of ice cream: it's O.K. but if I have the choice, I'll take them together. This has happened to me more than once; it's not so discouraging that I'm going to quit chasing, but it is always disappointing.

Clearly, a lot of time is spent on the road. Most of the time, like time in the Army during a war, is spent doing nothing very exciting, but it can be punctuated by all-too-brief periods of sheer exhilaration and excitement. In the heat of a chase, it is not uncommon to travel many hours without stopping. This means that eating, drinking, and toilet stops can be a serious liability. If your chase partner (or you) can't miss a regular meal time, can't regulate bowel movements, can't go without that cup of coffee or a coke on a regular basis ... well, you may miss some storms because of that. The choice is yours. Drinking a lot of fluids leads to frequent pit stops, so draw your own conclusions about hydration. Your main concerns in the heat of an active storm chase (one involving a good storm) are: navigation, access to good roads, and keeping fuel in your vehicle. My kids often have asked to go with me and I have always refused. Perhaps I'm selfish, but I don't want to be hearing "I'm bored!" or ""I'm hungry" or "I've got to go to the bathroom!" while I'm homing in on a classical supercell. You certainly don't want team members who can't handle the boredom and special pressures of a storm chase.

Some thoughts from 2001:

There were several days with major "chaser convergence", including long caravans of chasers following the DoWs or tthe Mobile Mesonets like a column of caterpillars. We saw several occasions where chasers failed to pull completely off the road,. (See #5 under Highway safety, above) Some teams, even though the vehicle's tires were marginally off the road, the driver was hanging out the open driver's side doors, such that the open door and the driver were overlapping the roadway. I observed this several times with college-sponsored chase teams driving vans. One time, a friend of ours had to screech to an emergency stop to avoid T-boning an idiot within a chase parade who decided to do a U-turn just over a hill on the road!

Many of my worst fears about chasing have been realized. It's now come to the point that the chaser convergences are hindering scientific observations by their sheer numbers (long "convoys" of vehicles inhibit the freedom of research teams to conduct their observations). Also, some chasers with more money than sense have equipped their vehicles with marine radars, the beams of which can interfere with the mobile research radars. Chaser convergence used to be something I enjoyed ... seeing respected friends, almost all of whom were behaving responsibly. Now, it's become a phenomenon I usually loathe and will avoid in the future if possible, even at the cost of seeing a tornado, if need be.

I observe of late that many wannabe chasers have festooned their vehicles with anemometer propellers, "Mobile Mesonet"-style sewerpipes, amber flashing lights, self-promoting prominent labels ("The International Storm Research Team" or whatever), Skywarn decals, garish paint jobs, and the like. Frankly, I doubt that much useful information is gained from these gadgets (if they even work at all!), and such attempts to draw public attention to oneself as a chaser seem to me to be pathetic or even imbecilic. If TV stations want to do such things, that's one thing (the media are perpetually committed in self-promotion) ... *private* chasers who do this are not necessarily irresponsible, but it sure looks pretty foolish to me. It seems that for many chasers these days, it's not about the clouds, it's about *themselves* (as Gene Moore has so wisely described it).

I was appalled to see the behavior of a few famous, experienced "professional" storm chasers,

one team of whose drove wildly around us (we were parked on a farm road just off the main roadway), careeening *through* a farmer's field in the process ... on 29 May.

Important Note: Although there are many possible roads to use for crossing the Canadian border *during the day*, only a small fraction of the border sites are staffed at night. In effect, an international border is very much like a river ... especially at night ... with only a few places to get across, so this needs to be accounted for in your navigation. It behooves chasers crossing the border into Canada to (a) get back across the border before the stations close (generally, at 10 p.m.), or (b) *know* which stations stay open 24 h per day and use *them*! Don't use a road with a border site that closes at night as an "escape route" from the storm, if at all possible! If you feel you *must* cross the border *illegally*, as we did once in 2001 (i.e., after the border at a particular station has closed) because of imminent danger from storms, then go back to that station as soon as possible after it re-opens next morning and be prepared to explain why you did it. Illegal border crossing is a serious Federal crime and carries with it the possibility of vehicle impoundment, a $5000 fine, and jail time!! No chaser should take this lightly ... repeated occurrences surely will result in the Border Patrol viewing storm chasers in a bad light.