

# Forecast Tools and the Basics of My Approach to Choosing When/Where to Fly (HG) (S.Ford Jun 10)

- The goal of this is to introduce you to some tools that I use as well as things that I keep in mind when evaluating forecast information. Much of it has been learned from others including the newer guys 'cause they ask questions of me that force me to think!
- There are some repeating themes – they exist 'cause of the importance that I feel they merit from my experiences as well as those of others.
- I hope that the information will stimulate your interest in exploring/learning more about things that help you pick days/places/times to fly and reward you with many happy flying days over many years.
- The main topic areas in this presentation are:
  - Basic forecast resources that I use and how I use them
  - Things to consider when evaluating forecast information
  - Forecast update resources available to you at a flying site and weather developments to watch for at a flying site

## Basic Forecasting Tools (S.Ford Jun 10)

- I start by reading the Colorado Forecast Discussion  
<http://www.weather.gov/view/prodsByState.php?state=co&prodtype=discussion>
  - You'll have to work on understanding some of the forecasters terms and shorthand, but you'll begin to get a feel for it with a bit of work.
  - There is a handy glossary of terms at <http://www.nws.noaa.gov/glossary/>
    - Example: CAPE = Convective Available Potential Energy. A measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather. Observed values in thunderstorm environments often may exceed 1000 joules per kilogram (J/kg), and in extreme cases may exceed 5000 J/kg.  
  
However, as with other indices or indicators, there are no threshold values above which severe weather becomes imminent. CAPE is represented on an upper air sounding by the area enclosed between the environmental temperature profile and the path of a rising air parcel, over the layer within which the latter is warmer than the former. (This area often is called positive area.) See also CIN.
  - I'll read all three of the discussions (DEN/BOU; GJT; PUB) if I'm really free to go anywhere, or to keep track of the trends for locations that I am considering in the days prior to my flying day.

# Forecast Tools cont'd (S.Ford 10)

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AREA FORECAST DISCUSSION  
NATIONAL WEATHER SERVICE DENVER CO  
303 AM MDT WED JUN 16 2010

.SHORT TERM...QUIET WEATHER DAY IN STORE FOR THE AREA AS AN UPPER LEVEL RIDGE PASSES OVER THE STATE. THIS WILL USHER IN WARMER AND DRIER AIR TO NORTHEAST COLORADO. HIGHS WILL BE 10 TO 15 DEGREES WARMER THAN MONDAY WITH MOST LOCATIONS ALONG THE FRONT RANGE NEAR 80 DEGREES. BIGGEST QUESTION IS...**WILL THERE BE ANY CONVECTION TODAY? THERE WILL BE SOME CAPE TODAY...UP TO 500 J/KG.** FEEL THE MODELS DRY OUT THE LOWER LEVELS TOO MUCH TODAY BECAUSE OF THE WET SOILS FROM THE RECENT RAINFALL. THE HRRR MODEL DOES SHOW SOME CONVECTION DEVELOPING OVER THE MOUNTAINS THIS AFTERNOON. THEREFORE WILL KEEP THE 10 POPS IN THE FORECAST. IF ANY STORMS FORM THEY ARE EXPECTED TO BE WEAK.

**LOW LEVEL JET KICKS IN OVER THE EASTERN PLAINS TONIGHT. THIS WILL TRANSPORT MOISTURE BACK INTO THE AREA.** MODELS NOT SHOWING ANY PRECIPITATION ASSOCIATED WITH THIS BUT WILL HANG ON TO THE 10 POPS AFTER MIDNIGHT OVER THE EXTREME NORTHEAST CORNER OF THE STATE.

**.LONG TERM...AN INCREASING SOUTHWESTERLY FLOW ALOFT WILL BE OVER COLORADO ON WEDNESDAY AND THURSDAY. A RIDGE OF HIGH PRESSURE WILL BE CENTERED OVER THE SOUTHEASTERN U.S. WHILE AN UPPER LEVEL TROF WILL BE MOVING THROUGH THE NRN ROCKIES.** THE MDLS DO NOT INDICATE MUCH IN THE WAY OF QPF OVER THE NERN PLAINS IN WEDNESDAY AFTN/EVNG. BEST POTENTIAL WILL BE OVER ZONES 48>51 SO WL GO WITH ISOLD POPS THERE BUT NIL ELSEWHERE. THE UPPER TROF IS EXPECTED TO PASS NORTH OF COLORADO ON THURSDAY WITH THE CWA UNDER THE DRY AND WINDY SIDE. SWLY WINDS MAY BE ESPECIALLY STG OVER ZNES 33>37 BUT ALL THE MSTR WE RECEIVED OVER THE LAST FEW DAYS SHUD MINIMIZE THE FIRE WEATHER

THREAT...IN SPITE OF THE WARMER TEMPERATURES. BEST TSTM POTENTIAL WILL BE ALONG THE NRN BORDER THURSDAY AFTN/EVNG SO LEFT ISOLD POPS THERE BUT DROPPED THEM ELSEWHERE. **RIDGING REDEVELOPS OVER CO ON FRIDAY AS THE TROF LIFTS TO THE NORTHEAST. IF THIS PANS OUT THEN TSTMS CHC WL DROP TO ZERO FOR MUCH OF THE CWFA FOR FRIDAY AS WELL.** FOR NOW WL HANG ON TO THE ISOLD POPS PRESENTLY IN THE GRIDS. **OVERALL THE WEEKEND LOOKS DRY TOO. THERE MAY BE ENOUGH LOW LEVEL MSTR OVER THE NERN PLAINS FOR A FEW TSTMS DURING THE LATE AFTN/EVNG PERIODS. WL HOLD OFF MAKING ANY CHANGES AT THIS TIME AS SLGT CHC POPS ALREADY IN THE GRIDS WILL SUFFICE.**

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.AVIATION...SKIES WILL BE MOSTLY CLEAR FOR THE NEXT 24 HOURS AS AN UPPER LEVEL RIDGE PASSES OVER THE REGION. A STRAY THUNDERSTORM CAN'T BE RULED OUT BUT IS VERY UNLIKELY TODAY. SOUTHERLY DIURNAL WINDS WILL SHIFT TO THE SOUTHEAST OR EAST DURING THE AFTERNOON HOURS.

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.HYDROLOGY...HIGH FLOWS WILL CONTINUE ON SOUTH BOULDER CREEK NEAR ELDORADO SPRINGS. OTHER STREAMS IN THE FOOTHILLS ARE EXPECTED TO CONTINUE SLOWLY DECREASING. FLOODING CONTINUED ON THE CACHE LA POUDE AND SOUTH PLATTE RIVERS IN WELD COUNTY. OVERBANK FLOWS AND LOW LAND FLOODING WERE OBSERVED AND FORECAST DOWNSTREAM ON THE SOUTH PLATTE RIVER FROM MASTERS TO STERLING.

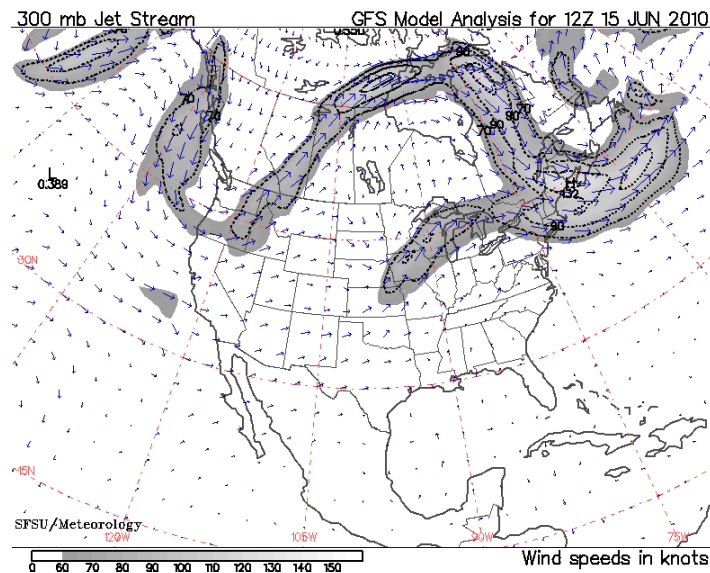
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.BOU WATCHES/WARNINGS/ADVISORIES...  
...FLOOD WARNING WEST CENTRAL WELD COUNTY UNTIL 315 AM WEDNESDAY...  
...FLOOD WARNING AT SOUTH PLATTE AT KERSEY UNTIL 8AM TUESDAY...  
...FLOOD WARNING AT THE CACHE LA POUDE RIVER NEAR GREELEY UNTIL 6 AM TUESDAY...  
...FLOOD ADVISORIES FOR THE SOUTH PLATTE RIVER IN MORGAN...LOGAN AND WASHINGTON COUNTIES...SOUTH BOULDER CREEK IN BOULDER COUNTY AND THE NORTH PLATTE RIVER IN JACKSON COUNTY.

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## Forecast Tools cont'd (S.Ford 10)

- Jet Stream Forecast is a great way to check on upper level movements that indicate troughing and ridging as well as zonal flow and areas of jet max
  - <http://squall.sfsu.edu/crws/jetstream.html>
  - Generally I use North America, Forecasts, Animated Loop, big images and follow the instructions that pop up.



## Forecast Tools cont'd (S.Ford 10)

- I like to look at Launch Code <http://www.usairnet.com/cgi-bin/launch/code.cgi> for one indication of surface winds and other WX features. I believe that the AVN model is the data source.
  - For Lookout I look at Broomfield.
  - For Williams I look at Eagle and Copper Mtn.
  - For Steamboat I look at Craig
  - For Aspen: Aspen and Eagle
  - For Villa: Alamosa and La Veta Mtn.
  - Etc

Like I say, this is one source of many and the graphical presentation is handy for me because it gives clues on how I might dig deeper for info on winds, thunderstorm potential, clouds, etc.

## Forecast Tools cont'd (S.Ford 10)

- I like to look at **winds aloft forecasts**  
<http://aviationweather.gov/products/nws/winds/>
- I try to look at the trends from morning to afternoon and beyond because that can be indicative of the approaching weather or change in conditions.
- I try to use several stations surrounding the area that I'm interested in flying.
- The upwind stations typically give indications of weather coming my way.
- Downwind stations typically give indications of any tendency for the wind to accelerate from upwind stations as they pass over my area towards the downwind ('can indicate significant direction changes too)
  - For Steamboat, Williams, Wolcott, Aspen, etc: I use RKS and GJT for upwind; MBW and DEN for downwind.
  - Kenosha, Badger, and others: ALS and GJT "upwind", PUB and DEN "downwind"
  - Villa, Whale, Princeton...etc: I like to look at FMN, GJT, ALS, PUB and DEN

## Forecast Tools cont'd (S.Ford 10)

- Winds aloft forecasts are particularly important for:
- Direction change – and potential shear – with altitude change.
- Velocity Change – and potential shear – with altitude change
  - A shear aloft – particularly between 12 and 18K for us in CO – can create instability that will break a mid/high level cap (inversion) which can then lead to overdevelopment when other indications are that the chances of OD are not great..... Watch for these clues in the forecast data.
- How to read the text data:
  - A. Columns are altitude. Note that models use altitudes of equal pressure so the actual geographical measurement relative to Sea Level will vary according to highs/lows/temps/etc
  - B. The first 4 digits for a location under a column are compass rose wind direction (from direction) and speed (knots)
  - C. Example 1: 2010 = 200 degrees at 10 knots
  - D. Key point: 9900 = light and variable (we often like to see this at 9K or higher as a transition from low level upslope to westerly's at Lookout (DEN)) (It's also not a bad thing to see when planning to fly the really high mtn launches (Whale, Princeton, etc) for winds at 9 and even 12K MS.... in fact I like less than 10 knots thru 18K for the high launches and moderate to strong high pressure)
  - E. The next symbol and digits represent temp and I don't pay attention to them. They might be useful, but I haven't figured I need them with the soaring forecasts that are available.

## Forecast Tools cont'd (S.Ford 10)

- I like to use the Unisys site <http://weather.unisys.com/index.html> to look at forecast model trends for winds and other things.
  - For Lookout, I look at 850mb and 700mb predictions from both models.
  - For the mountain sites I look at 700mb for sure and maybe 500mb if there were indications of increasing winds aloft so that I can see how the models agree as well as how they predict timing of changes
- During the late Spring/ early Summer months into early Fall I really like to use the Relative Humidity/Lifted Index Loop 'cause I think it gives a pretty good idea where the greatest potential for OD is based on available moisture and instability.
  - I have found it to be a great tool in determining if I can fly Williams, Wolcott, Steamboat, etc during our monsoon season!
  - Sunday June 6, it was useful in ruling out Williams 'cause it showed a moisture push into the Williams area and our experience indicated that the wind profile coupled with that moisture & instability would likely lead to OD over and E-NE of the Gore range. Williams is in that area..... Our observations from Wolcott that afternoon confirmed our suspicions.

# Forecast Tools cont'd (S.Ford 10)

- 'lots of stuff available at the next source: <http://www.crh.noaa.gov/den/> (substitute /PUB/ or /GJT/ for /DEN/ to switch forecast offices in CO.)
- Major uses:
  - Point forecasts are based on Zone Forecasts
  - Zone forecasts are useful – be sure to also look at zones adjacent to the area that you want to fly, particularly those “upwind”
  - Satellite views; high/low/front location maps; etc
  - Soaring forecasts. You have to switch to each forecast office to get the one for that area.
    - Useful to spot trends/timing. I have noticed that Williams often has 1<sup>st</sup> thermals about 1 hour before DEN unless it is really HP west of the Divide.
    - The model is looking at Thermal Soaring! So, the DEN soaring forecast \*will not\* predict good soaring when we are looking for a lee side surface cold front (upslope) to push into Lookout 'cause that is not captured in the computer model.
    - **Look at the K-index! If the value is approaching 20 or greater, the potential for OD is pretty high, particularly when the lifted index is less than -1 and the RH/Lifted index loop at the Unisys website has shown you that the “dry line” is forecast to influence your desired area. (-2 is “less” than -1 ....)**
  - Fire weather forecasts
    - I like these a bunch, particularly with some of the changes introduced.
    - Note that the forecasters error on the conservative side with regard to winds..... However, these forecast winds are useful for estimating “gust differential” during times of strong convection
    - Fire WX for the entire state available through DEN forecast office link.

## Forecast Tools cont'd (S.Ford 10)

- Fire weather forecasts, cont'd
- 2010 additions to the DEN forecast office Fire WX that I like:
  - Mixing Height: This seems to be a good indication of where the morning lower level inversion exists and when it might mix out as well as where a mid/upper level cap (inversion) might set-up later in the day
  - Transport winds: another indication of winds and lower level inversion mix-out.
  - Smoke Dispersal: yet another indication of lower level inversion mix-out with regard to timing.
  - Compare the indications in these forecast items to the soaring forecast – there is often some really cool agreement.

- SOUTH AND SOUTHEAST GRAND/WEST CENTRAL AND SOUTHWEST BOULDER/
- GILPIN/CLEAR CREEK/SUMMIT/NORTH AND WEST PARK COUNTIES ABOVE 9000
- FEET-
- INCLUDING BERTHOUD PASS...BRECKENRIDGE...EAST SLOPES MOSQUITO RANGE...EAST SLOPES SOUTHERN GORE RANGE...EISENHOWER TUNNEL...
- INDIAN PEAKS...KENOSHA MOUNTAINS...MOUNT EVANS...PUMA HILLS...
- TARRYALL MOUNTAINS...WILLIAMS FORK MOUNTAINS...WINTER PARK
- 402 AM MDT TUE JUN 15 2010
- .TODAY...
- SKY/WEATHER.....SUNNY UNTIL 1200...THEN PARTLY CLOUDY(35-45%).
- SLIGHT CHANCE OF THUNDERSTORMS AFTER 1400.
- MAX TEMPERATURE.....54-64.
- 24 HR TREND.....10-15 DEGREES WARMER.
- MIN HUMIDITY.....26-36%.
- 24 HR TREND.....7-10% DRIER.
- 20-FOOT WINDS.....
- VALLEYS/LWR SLOPES...UPSLOPE/UPVALLEY 4-10 MPH BECOMING
- SOUTHWEST 8-12 MPH IN THE AFTERNOON.
- RIDGES/UPR SLOPES....UPSLOPE/UPVALLEY 4-10 MPH BECOMING
- SOUTHWEST 8-12 MPH IN THE AFTERNOON.
- HAINES INDEX.....3 VERY LOW.
- LAL.....1 UNTIL 1400...THEN 2.
- CWR.....0 PERCENT UNTIL 1400...THEN 10 PERCENT.
- 10K FT FREE WINDS...SOUTHWEST 15-20 MPH.
- **MIXING HEIGHT.....BELOW 1000 FT AGL UNTIL 0700...THEN**
- **10500-11500 FT AGL.**
- **TRANSPORT WINDS.....LIGHT AND VARIABLE.**
- **SMOKE DISPERSAL.....POOR UNTIL 1400...THEN GOOD.**

# Things to Consider when Forecasting for HG (S.Ford 10)

- What if none of the models agree very well?
  - **That's one of the reasons that I start with the forecast discussion.....** If the professionals are having a difficult time interpreting the data and providing a somewhat solid forecast then I will have at least that tough of a time forecasting for my purposes.
  - It may not be a good day to fly due to the disparity in forecast information.
  - It might be a better day for some other activity – use it to get something else accomplished so that the next flying day is all yours.
    - Surprise your S.O./spouse and suggest a day out (but don't start with "it's crummy flying weather, wanna....." )
    - Work for a comp day in the future.
    - Maintain your gear.
    - Bike/fish/etc.....
    - Accept that there are some things that are far beyond your control and instead learn to recognize the good flying days.

# Things to Consider when Forecasting for HG (S.Ford 10)

- Geography.....

- General trends that are useful to consider:

1. On high pressure days **\*with light winds aloft\*** the flow in mountain valleys is mostly driven by up-valley (or down valley after dark) convective flow. A great example of this can often be seen at Williams: Once the midday convection starts working, the valley floor will have flow from the NW and it may extend to altitudes above upper launch. But, if you call the Kremmling airport, the flow will be from the W or WSW 'cause that valley is oriented differently with regard to the Divide.
  - Steamboat and Aspen work pretty darn good with light WNW to NW flow aloft due to this same orientation thing.
2. Having higher mountains upwind (depends on wind direction obviously) of your site can create issues when winds aloft are strong!
3. Approaching weather systems can be delayed locally due to geographic features between you and the system (as well as heating in your area....)
4. The wind speed (airflow) across pressure gradients can be influenced by geographic features.
  1. An example is the acceleration of air (and increased downward component of that speed) from high pressure west of the Divide into a lee side trough (line of low pressure) on the eastern plains.
5. You might have to wait until the sunshine is heating the face of your launch site..... Slope aspect often matters when determining launch times since straight cycles are preferred.
6. Evaluate/develop “what if” escape routes for the flying site. This will also clue you in on key areas/developing weather to watch out for.....

# Things to Consider when Forecasting for HG (S.Ford 10)

- Differences in air masses.....General trends that are useful to consider:
  1. Approaching cold fronts from the Pacific or Pacific NW tend to produce a pre-frontal acceleration of the winds that are flowing along – and relatively parallel to - the frontal boundary in the airmass that is ahead of the approaching cold front. This can be often followed by a lull and then a shift in wind direction/velocity.
  2. When a lee trough is in place on the eastern plains of CO, the wind direction east of the Divide will tend to be \*across\* the isobars and perpendicular to the trough axis. (see downsloping....)
  3. “Shortwave” systems are rarely good for Lookout. Sometimes they will be accompanied by a developing surface front that will slip down the Front Range from the north, but flying will only be good – and for a relatively short period of time – if the surface feature arrives well before the “shortwave” which I tend to see as more of an upper level system carried on oscillations in the jet. Flow just after a shortwave is generally strong NW and mostly/all cloudy tends to be the rule.

# Things to Consider when Forecasting for HG (S.Ford 10)

- Differences in air masses cont'd.....
  4. The warmest days during late Fall through Winter and Early Spring are rarely the good Lookout days 'cause these are most often DOWNSLOPE days and the unseasonably warm day is likely a downslope day. Look for upslope days .... These are generally seasonable temps or cooler and preferably dry .
  5. Local heating can lift/block winds aloft or even approaching systems. So, local conditions can change rapidly when the heat goes away.....
    - Example: Where's that damned cold front that was supposed to get to Lookout midday?
    - The heating west of the Divide can hold deep (or "tall") Front Range cold fronts/post frontal upslope from crossing the Divide (or Sangre's) until the heating drops off (Sunday of Mem Day 2010 weekend at Villa for example....)
  6. A rapid change in cloud type can give you clues about impending weather changes!
  7. If you have seen the potential for an air mass change during your pre-flying forecast effort - i.e., an approaching cold front from the Pacific - and you are at the site in the days following your forecast look, watch for indications of the competing air masses coming together at your site:
    - Examples include: sudden, somewhat lasting changes in local winds including lulls and major direction and/or velocity switches; rapid changes in clouds; etc.

# Things to Consider when Forecasting for HG (S.Ford 10)

- Seasonal Differences..... General trends that are useful to consider:
  1. **CONVECTION** will tend to be the greatest during the Summer months. As a result, we can expect a much larger **gust differential** during Summer than we see during Winter, and Spring/Fall are transitional periods in this trend..
    - Mid Summer convection driven gust differential can vary midday/midafternoon wind speed from 0 to 25 mph (or more) on a local scale.
    - So, lets say you anticipate the surface winds at the site you choose to fly to be 10 to 15mph based on model predictions and winds aloft forecasts. That means that you might see worst case peak gusts of 30 to 35 mph or more over the midday/peak-heating during strong convection days with thermal blocks creating lulls down to 0! **And, these may be near the surface where you are launching/landing!**
    - I tend to think in terms of seasonal variation in gust differential when looking at forecast winds and the time of day that I will fly. A good example is Williams (or Wolcott, etc) with moderate/strong (15-20) west winds forecast to diminish a bit from morning towards evening in June: I'll wait for the late day (6pm or later) flight 'cause the midday is too dangerous when gust differential is thrown in. In contrast, a Late Fall (Oct/Nov) flight with a similar wind forecast might have an earlier launch time (1 to 3pm) due to less convection and shorter days.
    - Or in contrast, I may elect to fly midday from Williams upper launch **on a high pressure light wind day in June** anticipating my max wind speed to be manageable **\*but also knowing that choosing my landing cycle is of utmost importance due to convection driven wind speed and direction.\*** And, I will anticipate staying aloft for 3-4 hours 'cause I don't want to land near peak heating time when the gust differential is the worst
  2. The moisture "fetch" will tend to vary with the changing seasons – fuel for thunderstorms.
    - Watch how the Great Plains high pressure system develops during Summer, bringing moisture up from the Gulf of Mexico up the Rockies. Similarly, a low will often develop over/near Baja and fetch moisture from the Sea of Cortez to join up with that from the Gulf of Mexico..... Use the RH/Lifted Index loop on the Unisys website to gain insight.

# Things to Consider when Forecasting for HG (S.Ford 10)

## preflight look and while at the site

- Why are you going flying that day?
  - Have a basic plan for the day/site(s) based on the weather that you see happening in the forecast information. Try to set your boundaries for wind, etc and use that for determining potential launch times.
  - But, plan for contingencies in the event that what you observe at the flying site(s) does not fit with what you thought might happen – timing is the toughest part!
  - Use what you know/are learning about general trends to try to come up with why things might not be working the way that you thought – these observations will help you with future forecasts, particularly if you do a post flight-day look at what really happened using the same sources that you used the morning of/day before.
- What resources do you have when at the flying site?
  - Call a friend that has access to a computer, or who might be in an area closer to approaching weather to give you real-time info
  - Call flight services (800-WXBRIEF), get to a briefer, identify yourself as an ultralight/HG/PG pilot, and ask for updated winds aloft for the flying site appropriate forecast stations (for example Williams: GJT, RKS, DEN, MBW) as well as any update on approaching/changing WX.
  - Smart phone web access..... Useful at some sites
  - Local wind talkers (Lookout, Soda Lakes, Copper Mtn, Kremmling Airport, etc)

# Things to Consider when Forecasting for HG (S.Ford 10)

## Real time, at the site or in the air.....

- Local weather systems...General things that are useful to consider (or for this topic, “first it sucks, then it blows”)
  1. Developing cummi’s and the inflow towards them can affect the winds aloft and surface winds near them!
  2. Thunderstorm/squall line outflows may/will (obviously) affect the nearby winds, aloft and on the surface. Down and turbulent is what to expect after the initial up displacement.
    - Watch for developing systems and get down before they influence your area.
    - If you are too high to get down safely before a system influences your area, you may have to do the counter-intuitive thing and \*use the wedge lift to climb high enough to make a good safe run for it (using the “what if” escape routes that you’ve worked out, right?) or be high enough to wait it out as a small outflow passes\*. This is advanced stuff and usually (**preferably**) avoidable if you get down when you see the developing potential danger early.....
  3. An upper level cap (inversion – I’ve seen it at 18K MSL and higher...) can mask the visual cues of strong convection near/under clouds ‘cause the cloud tops aren’t booming up when trapped under this upper level cap – be aware of cloud suck indications when flying. (and look for forecast mentions of “upper level cap” or “strong upper level cap” when doing your weather forecast evaluation before you leave home)
  4. Watch for surface/aloft indications of strong convection changes or developing outflow conditions (or larger scale air mass changes when earlier forecast information shows that potential):
    - Dust and debris (up or down....)
    - Gust lines across water
    - Dust devils
    - Popping cloud tops indicating the breaking of the upper cap..... Popping cloud tops shearing or anvils that indicate shear enhancement of the mid/upper level instability
    - Rapid changes of cloud types.....
    - Rapid changes in wind velocity/direction
  5. Again, it’s real important to have evaluated your escape route possibilities for a site \*before\* flying it. Ask folks who have flown it about their plans based on different scenarios – the “what if” dialogue is pretty useful and I encourage you to practice it.

