The Front

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# New 30-Hour TAF to Affect Aviation Coding Worldwide

*By Michael Graf, NWS Aviation Services Branch*
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In response to requests by long haul operations for better service, the International Civilian Aviation Organization has made provisions for a 30-hour Terminal Aerodrome Forecasts (TAF) in Annex 3 for the Meteorological Service for International Air Navigation, Amendment 74.

This code change, which takes effect this November, will affect all TAFs, worldwide. Specifically, each change group in a TAF will now have a date. This TAF code change applies to all states, even those not providing 30-hour TAFs.

NWS recommends that meteorological providers, vendors and users evaluate whether their software will work with the new TAF code and what publications and training you need to revise to make sure your users are ready for the change. The following site will help you prepare for this change: www.weather.gov/os/aviation/taf_testbed.shtml

### Sample Forecast

The example below is a 30-hour TAF using feet and knots. More examples and explanations of the 30-hour TAF are online at the following link: www.weather.gov/os/aviation/pdfs/30-hr_taf-examples.pdf

*Typical US TAF using the new 30-hour period*
*TAF for KABC (Anywhere State (ST)):*

TAF
TAF KABC 152335Z 1600/1706 13018KT P6SM BKN020
TEMPO 1608/1612 17025G45KT 1SM TSRA SCT010CB BKN020
FM170100 15015KT P6SM BKN020

### Meaning of the Forecast

The following is an explanation of what the TAF code means.

TAF for Anywhere, ST, issued on the 15th of the month at 2335 UTC valid from the 16th 0000 UTC to the 17th 0600 UTC; surface wind direction 130 degrees; wind speed 18 knots; visibility greater than 6 statute miles, Sky condition broken at 2000 feet; temporarily between 0800 UTC on the 16th and 1200 UTC on the 16th surface wind direction 170 degrees; wind speed

## *Inside*



### When's the Next *Front?*

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The Front

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### *Mission Statement*

*To enhance aviation safety by increasing the pilot's knowledge of weather systems and processes and National Weather Service products and services.*

25 knots gusting to 45 knots; visibility 1 mile in a thunderstorm with moderate rain, scattered cumulonimbus clouds at 1000 feet and broken clouds at 2000 feet; from 0100 UTC on the 17th with surface wind direction 150 degrees; wind speed 15 knots; visibility greater than 6 Statue miles; and broken clouds at 2000 feet.

## Sample TAFs With New Format

```
FTZA42 FAJS 261015
TAF FAJO 261000Z 2612/2718 34010KT 9999 SCT040
     BECMG 2612/2614 22010KT FEW045CB SCT050
     PROB30 TEMPO 2613/2618 5000 TSRA
     BECMG 2620/2622 CAVOK FM270900 27008KT 9999 SCT040
     PROB30 TEMPO 2713/2718 5000 TSRA TX25/2612ZTN12/2704Z=

FTXX90 KWBC 131130
TAF KABC 131128Z 1312/1418 14005KT P6SM SCT025 OVC040
     FM131600 13015G23KT P6SM OVC015
     FM132100 13015G22KT P6SM OVC008
     TEMPO 1321/1401 1SM -SN
     FM140100 09015KT 3SM BR OVC006
     TEMPO 1401/1405 2SM -SN BLSN
     FM141500 01015KT 5SM BR OVC006=

FTXX90 CWAO 301140
TAF CZZB 301140Z 3012/0118 13015KT P6SM BKN030 TEMPO
   3018/3023 17025G40KT 1SM TSRA OVC020CB
   BECMG 3023/0101 SCT015CB BKN020
   FM011000 15015KT P6SM SCT030 PROB40 0110/0112 2SM BR
   RMK NXT FCST BY 301800Z=

FTXX90 KWBC 301400
TAF KABC 301128Z 3012/0118 14005KT P6SM SCT025 OVC040
  TEMPO 3012/3016 OVC025
  FM301600 13015G23KT P6SM OVC015
  FM302100 13015G22KT P6SM OVC008
  TEMPO 3021/0101 1SM -SN
  FM010100 09015KT 3SM BR OVC006
  TEMPO 0101/0105 2SM -SN BLSN
  FM011500 01015KT 5SM BR OVC006=

FTXX90 KWBC 281754
TAF KABC 281128Z 2812/2918 VRB05KT P6SM SKC
  FM281800 21012KT P6SM SCT050 BKN120
  FM282100 21015G30KT P6SM FEW040CB SCT070 BKN120
  FM290100 27015KT 3SM -TSRA SCT030CB BKN070
  TEMPO 2902/2904 VRB15G45KT 1/2SM TSRA BKN015CB
  FM290500 27010KT P6SM SCT030 BKN090
  FM291500 VRB05KT P6SM SCT100=
```

### Important Points to Consider

- All TAFs will have to conform to the new Date-Time Standard on November 5, 2008, but some countries may be late, so decoders should be able to handle both formats.
- Decoding software will likely need to be changed
- Training publications will need to be changed

You can find a template for the TAF, Table A5-1 at the following link:
**www.weather.gov/os/aviation/pdfs/TAF_template.pdf** ✈

# CWSUs Take Steps to Reduce Weather Related Airspace Congestion

*By Charles A. West, Ph.D., Meteorologist in Charge, Atlanta Center Weather Service Unit*
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In 2005, the Atlanta Center Weather Service Unit (CWSU) conducted a case study of commercial air traffic holding for the Atlanta Hartsfield- Jackson International (ATL) airport. The study, which ran from October 1, 2002 through September 30, 2003, sought to quantify the affects CWSU services have on traffic movement plans and programs within the National Airspace (NAS). The study also offered an opportunity to redefine the CWSU's forecast focus on "en route aviation meteorology." The following is an excerpt from that study and a report on changes the CWSU has made in its products and delivery methods since the study was conducted.

The "Atlanta Holding Case Study: Identifying a need for the Advancement of En Route Meteorology Programs" (West and Sellars, 2006) identified the following:

> En route aviation meteorology differs from traditional aviation meteorology in that it shifts the focus from the pilot as the primary user, to the air traffic controller. This shift makes traditional terms, such as Visual Flight Rules (VFR), Marginal Visual Flight Rules (MVFR), Instrument Flight Rules (IFR), etc., obsolete in the air traffic management profession. The study identified that VFR, IFR and MVFR are not as important as the unique altitude criteria established for an individual airport's maximum traffic flow capability.
>
> Airport traffic flow capability and maximum capability are unique to each major airport, and depend on the number of runways, their configuration, and customer demand. Maximum capability is the number of aircraft an airport can land and depart during a given time frame. What this study refers to as a "push time" is a period which the airports demand exceeds its maximum capability. This is a phenomenon that is common in most major airports in the United States, and is especially a problem at ATL. Weather conditions become most critical to aircraft movement and safety during these push times.
>
> Aircraft and passenger safety become a factor when aircraft are held at major airports and the airspace and altitudes designated for aircraft to hold becomes full. This makes the margin of error for an air traffic controller much smaller. The "big sky" theory has been used as a theoretical philosophy to cushion the fear that near misses or aircraft collisions may occur, believing that the sky is so large and aircraft are so small that two will never occupy the same space. This theory becomes less acceptable during times of holding when more and more aircraft are placed in the same vicinity. Thus, there is a need to anticipate and alleviate weather-related holding at major airports. Not necessarily just during severe weather events, but during any weather condition that would restrict the ability of a large airport to land aircraft at a normal rate.

To reduce the amount of holding caused by the weather conditions, the Atlanta CWSU added several new briefing and data display methods on its Website. Although the CWSU is collocated with Air Route Traffic Control Center (ARTCC), one of the issues identified was the staff's inability to access all the FAA facilities. Specifically, CWSU staff need access to the Terminal Approach Controls (TRACONs) and Air Traffic Control Towers (ATCTs) at the same time as FAA staff. Weather information provided by various sources is funneled to one briefing site that provides the TAF, arrival and departure gate forecasts, upper level winds to 12,000 ft., and Webcast audio TRACON briefings. (**Figure 1**.)

NWS Weather Forecast Offices (WFOs) are responsible for issuing the TAF. The TAF's primary focus is on the first few hours of the forecast. At the Atlanta airport, NWS staff collaborate with the CWSU and

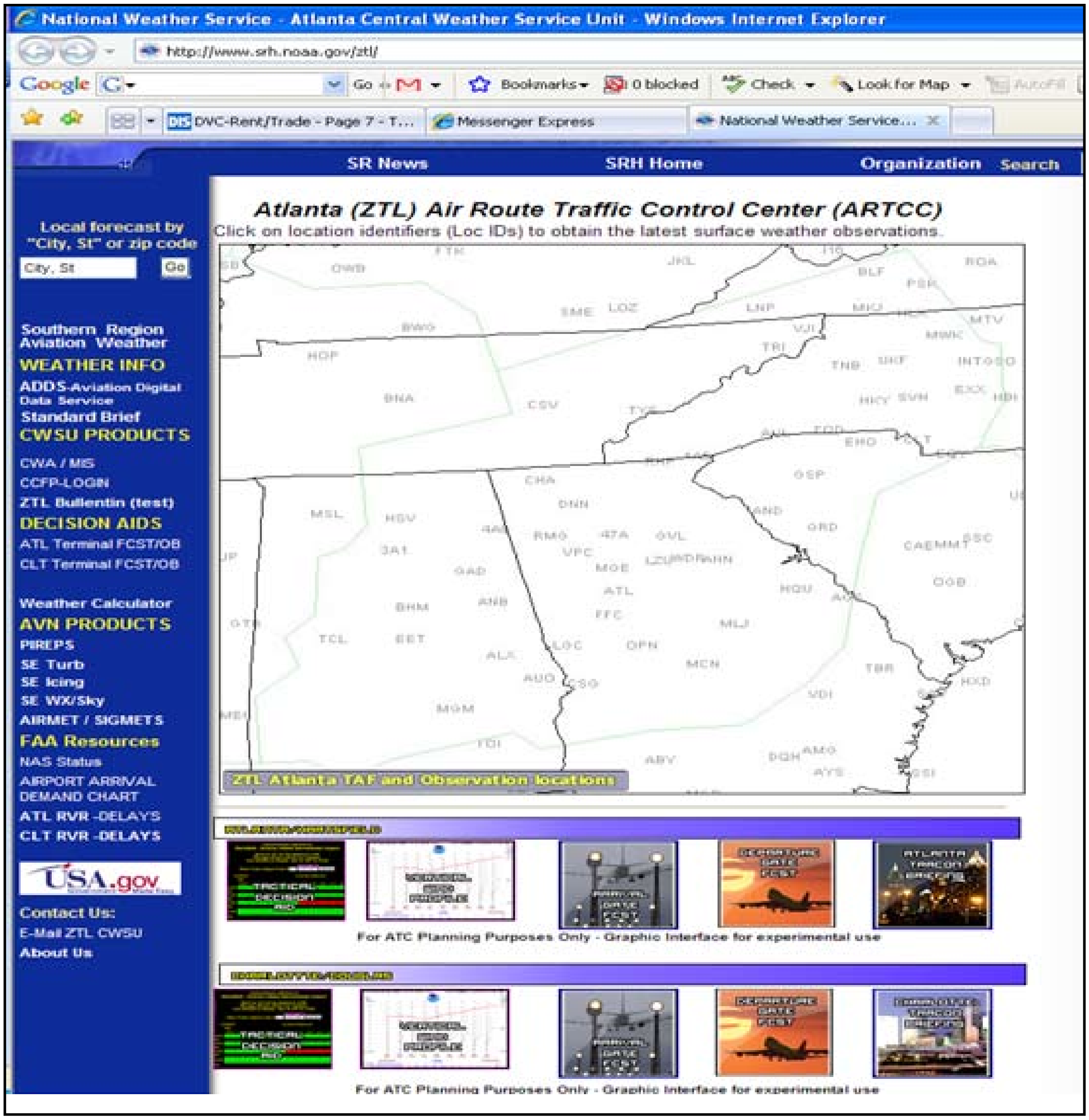


*Figure 1. The Atlanta CWSU briefing page.* [www.srh.noaa.gov/ztl.](http://www.srh.noaa.gov/ztl)

local user groups via phone several times a day. The TAF is then displayed on the Web in plain text and as a Tactical Decision Aid (TDA). The TDA color codes allows users to color code the TAF for their specific needs. Currently the Atlanta site uses two versions of the TDA: the Seattle CWSU version (**Figure 2.1**) and the Houston CWSU version (**Figure 2.2**), both of which can display any TAF.

The Atlanta CWSU has two pacing airports: Charlotte Douglas International (CLT) and Atlanta Hartsfield Jackson International (ATL). Each airport has different cloud, visibility, weather and wind thresholds that restrict its ability to allow aircraft to land. To help traffic managers reduce delays and traffic flow issues in the terminal area during final approach, the Atlanta CWSU produces Vertical Wind Profile (VWP) graphic forecast up to 12,000 ft. (**Figure 3**) for a 9-hour period.

This display system, developed by the Seattle CWSU, uses model data obtained through Bufkit. Although the user can select any model data, the Atlanta CWSU regularly uses Rapid Update Cycle (RUC) to stay consistent with other FAA upper level wind systems that use RUC data, such as the User Request Evaluation Tool (URET). The VWP graphic also allows the forecaster to display the freezing level, when it is below 12,000 ft., with a red line. Similar to the TAF TDAs, this product's wind barbs are color coded for easier interpretation.


*Figure 2.1. Seattle CWSU TDA design layout.*

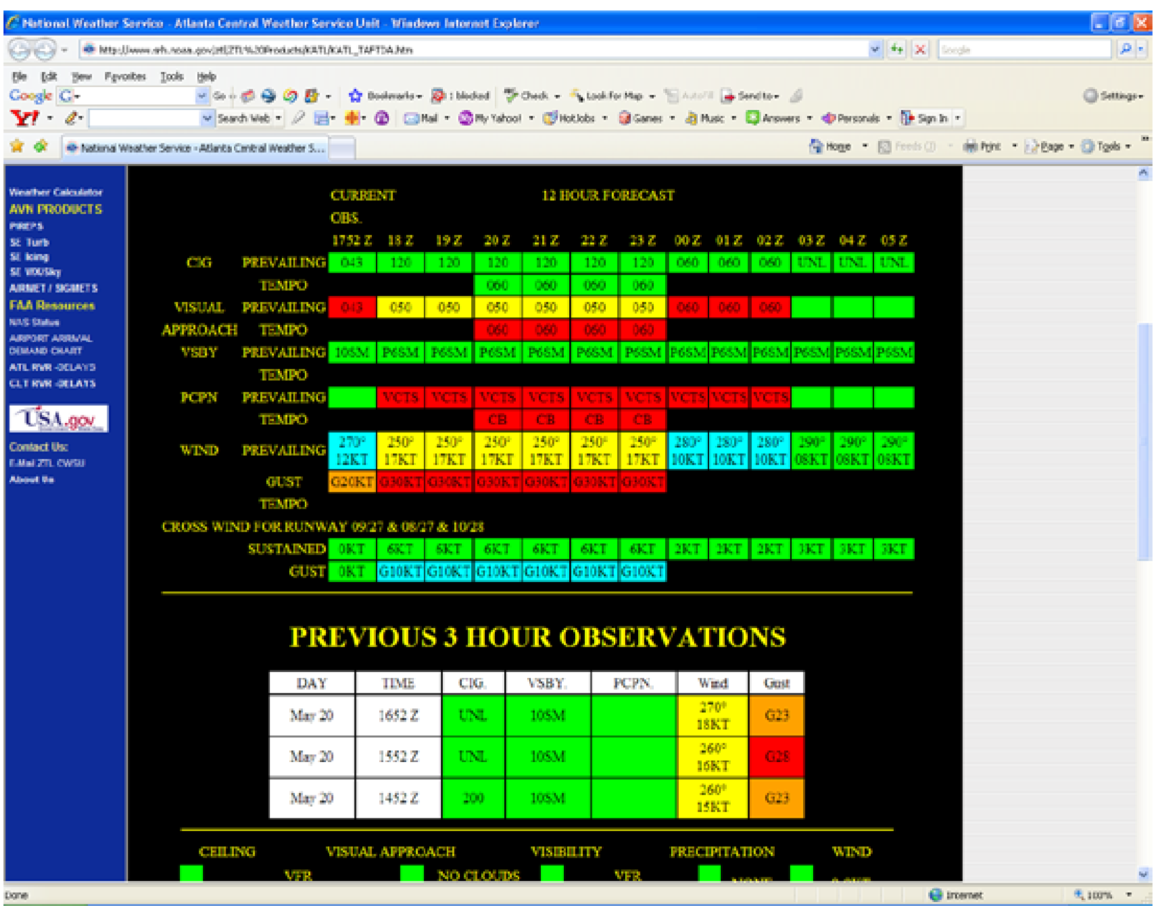


*Figure 2.2. Houston CWSU TDA design layout.*

In addition to the TAFs and the VWPs, a third forecast product essential for air traffic planning, is the arrival and departure gate thunderstorm probability forecast. High volume airport arrival rates are greatly reduced when they lose one or more of the arrival gates, and may have issues on the ground if they are unable to let aircraft depart because of thunderstorms blocking departure gates. Generally, major airports have three to six arrival gates, or corner posts. These posts are usually on off cardinal headings (i.e., NW, NE, SE and SW) 40 miles to 50 miles from the airport. Departure gates are usually noted with cardinal headings (i.e., E, S, W and N). Currently, several CWSUs are producing gate thunderstorm forecasts for their customers. These products take on different forms, focuses and appearances.

The Minneapolis CWSU produces two forms. The first uses graphical maps produced by gridded forecast data. The second form is a box or "chiclet" style (so called because it resembles a piece of Chiclet gum) that produces 1- to 3-hour interval forecasts per chiclet. These forecast products focus on either probability of thunderstorms or the percentage of sector coverage of thunderstorms,

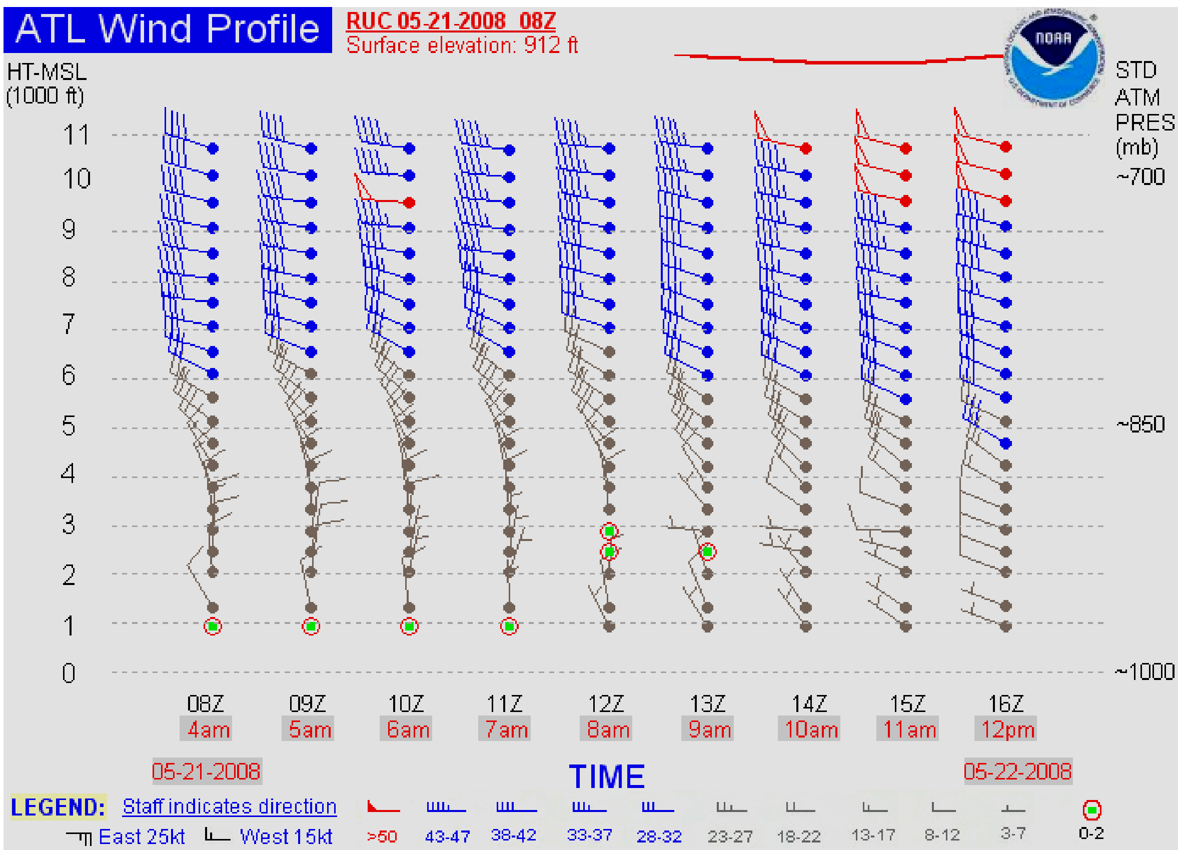


*Figure 3. Vertical Wind Profile (VWP) for Atlanta.*

depending on costumer preference. Atlanta CWSU produces probabilistic chiclet style forecasts for both of its major airport's arrival and departure gate sectors. The chiclets are accessible by the TRACONs, ATCTs and air traffic manages via the Web (**Figure 4**).

Probably the most important product produced by the Atlanta CWSU are remote Webcast briefing products. These products ensure all traffic managers within the airspace make decisions based on the same weather information. Traditionally, the CWSU meteorologist only conducts scheduled briefings to ARTCC personnel twice a day.

In addition to the traditional ARTCC standup briefings, the information is placed on a PowerPoint Webcast for other FAA customers. These briefings take two forms at the Atlanta CWSU: the Webcast TRACON verbal brief recorded with Camtasia, and the Center Weather

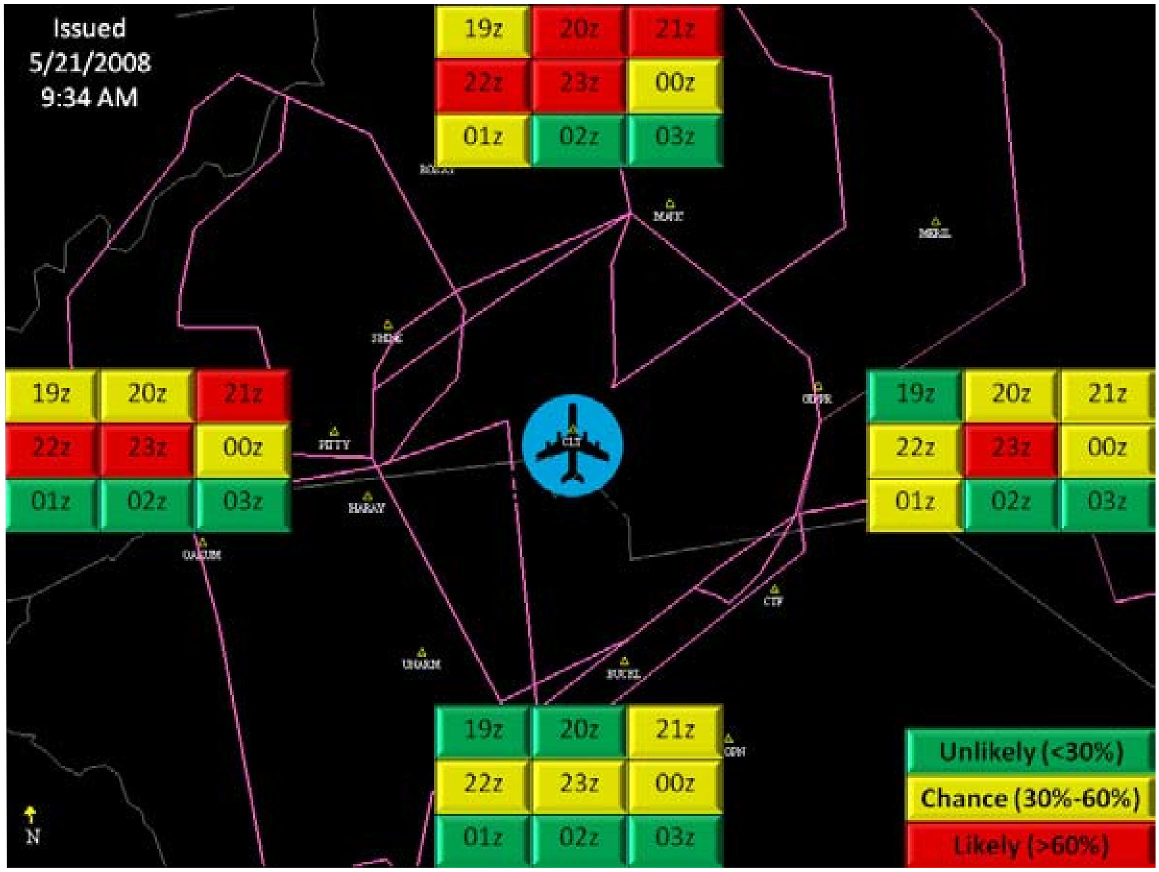


*Figure 4. Charlotte Douglas International Airport probabilistic departure gate forecast.*

Bulletin (ZWB), a single page briefing sheet. Both products are updated by the CWSU meteorologist and are designed to give detail to the other forecast products such as coverage, movement and confidence. An individual Webcast briefing is produced for ATL and CLT. The Webcast focuses on the TRACON area, which is 14000 ft. high with a 40 mile radius around the airport. Although these are audio briefings, they are written so controllers can read the briefing as it plays. These briefings are online at www.srh.noaa.gov/ztl.

The ZWB, on the other hand, is designed for all air traffic control personnel at any facility within the ZTL airspace. The ZWB focuses on aviation hazards at all altitudes out 9-12 hours and depicts the forecasted synoptic situation, the TAF, arrival gate thunderstorm forecast, and VWP for ATL and CLT. It also includes forecasts for ceilings below 5000 ft. and altimeter settings above or below 29.92 inches for en route controllers. The ZWB (**Figure 5**) is online. Printed copies are given to all ARTCC supervisors three times a day.

CWSUs can provide en route meteorological support to the FAA in the form of forecasts customized to the critical thresholds of each major airport within the ARTCCs airspace. These forecast products go beyond traditional TAF and CWSU product criteria. Meteorological products for an ARTCC and TRACON need to differ from traditional aviation forecast products and take on a more "decision aid" look. Because of increasing demand and the need for time-critical decisions, traffic managers in the FAA do not have time to read multiple weather products. Meteorological tactical decision aids can provide real-time and short-term forecasts that provide a "yes" or "no" answer on whether aircraft operations will be impacted by forecasted conditions.

Several CWSUs are developing tactical decision aids for traffic managers. Accurate tactical decisions aids, regardless of the weather phenomena, may allow a majority of the weather-related decision processes to be automated, providing a green, yellow and red indicator for each weather element on an hourly basis. Technology has provided the aviation weather community an opportunity to shift traditional paradigms and make aviation meteorology support more effective.

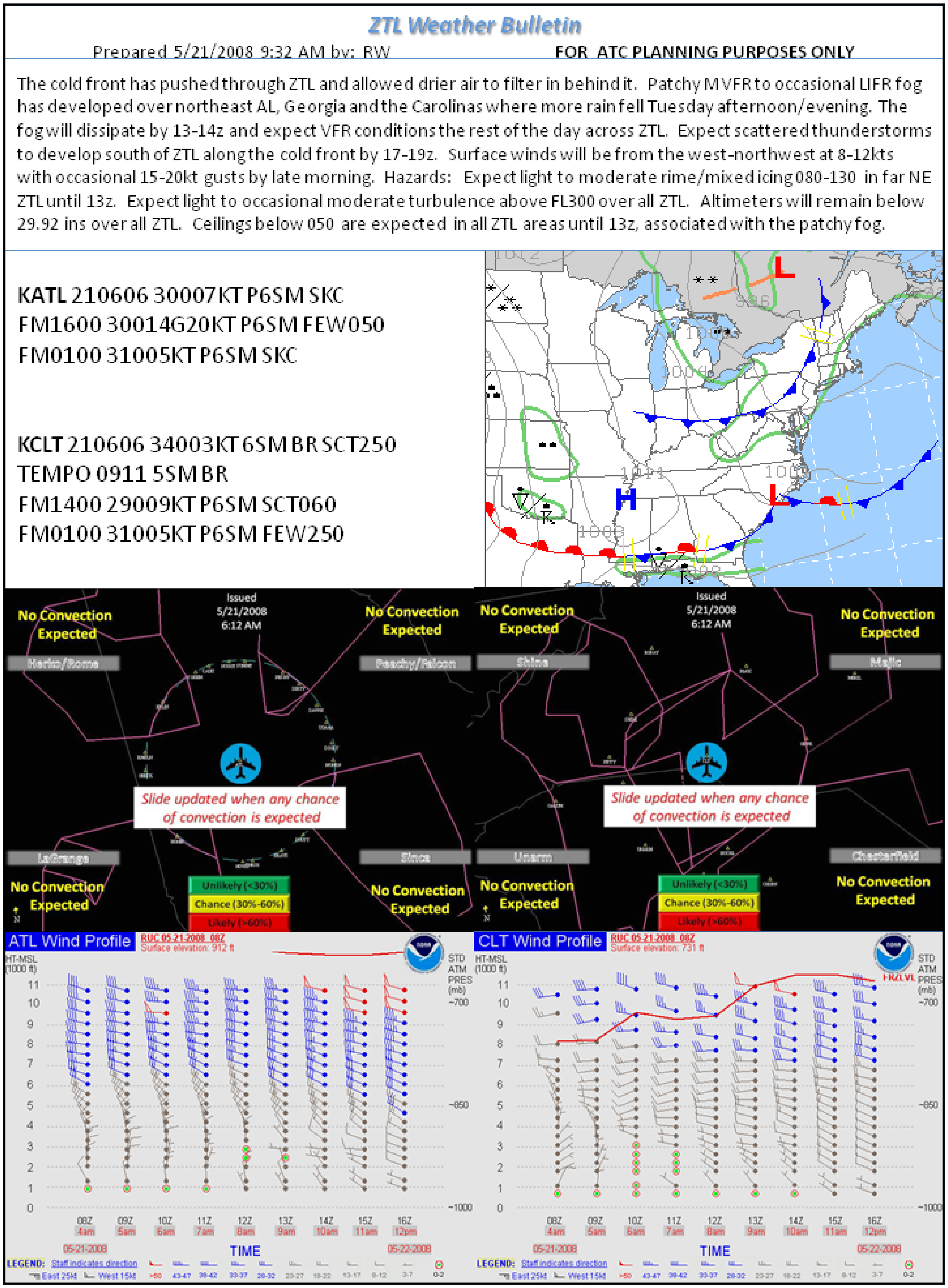


*Figure 5. Center Weather Bulletin (ZWB).*

As the Atlanta holding case study (West and Sellars, 2006) shows, major airports operating at or above maximum capacity are holding more and more aircraft based on traditionally acceptable weather conditions. When the skies become too congested, lives are put at risk. To improve airline safety, the CWSU meteorologist can now exploit this unique Webcast briefing technology to ensure a more efficient and safer National Airspace.

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# Aviation Concerns Regarding Hazardous Thunderstorms

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Every year from late February through November the United States is riddled with thunderstorms. One of the many challenges forecasters face is predicting thunderstorm movement accurately. Since a good portion of flight planning is based on reliable weather forecasts, forecasters are expected to be as accurate as possible. Some ways NWS tries to improve these forecasts include studying the history of past thunderstorms and convective SIGMETs. From these reviews, forecasters begin to understand typical patterns that thunderstorms may follow, depending on the time of year and location. This is really no different from the pilot flying over one area for a long time and learning where thunderstorms tend to form or dissipate.

For this article, we will view thunderstorm climatology from March 2006–October 2006 in the hopes of offering insight on the probable movement of thunderstorms and their associated warning product, the Convective SIGMET. First, here is a brief review the Convective SIGMET.

Convective SIGMETs were introduced in 1977 after an aircraft accident in New Hope, GA. The aircraft flew through a thunderstorm and ingested massive amounts of water and hail, causing the aircraft to lose both engines and make an emergency landing. The pilot was unable to land the aircraft safely, resulting in 63 fatalities on board and 9 fatalities on the ground (AOPA, 1998).

What defines a Convective SIGMET? Convective SIGMET are issued by the NWS Aviation Weather Center (AWC), when the following conditions are occurring or, in the judgment of the forecaster, are expected to occur.

- A line of thunderstorms at least 60 miles long with thunderstorms affecting at least 40 percent of its length.
- An area of active thunderstorms affecting at least 3,000 square miles covering at least 40 percent of the area concerned and exhibiting a very strong radar reflectivity intensity or a significant satellite or lightning signature.
- Embedded or severe thunderstorm(s) expected to occur for more than 30 minutes during the valid period regardless of the size of the area.

Forecasters may issue a special Convective SIGMET when any of the following criteria occur or the forecaster thinks they are likely to occur for more than 30 minutes of the valid period.

- Tornado, hail greater than or equal to 3/4 inch, or wind gusts greater than or equal to 50 knots.
- Indications of rapidly changing conditions not sufficiently described in the existing Convective SIGMETs.

Thunderstorm clouds tops are found by using a satellite derived cloud-top tool on two different NWS computer systems. A forecaster also has can use WSR-88D echo tops (See **Figure 1**).

## Methodology

Archived data from the Aviation Weather Center and National Climatic Data Center (NCDC) was used for the analysis of Convective SIGMETs. The data analyzed was from March 2006 through October 2006. The Convective SIGMET data was broken down by speed, direction, tops and location of the activity in the U.S. (West, Central and East) and by month.

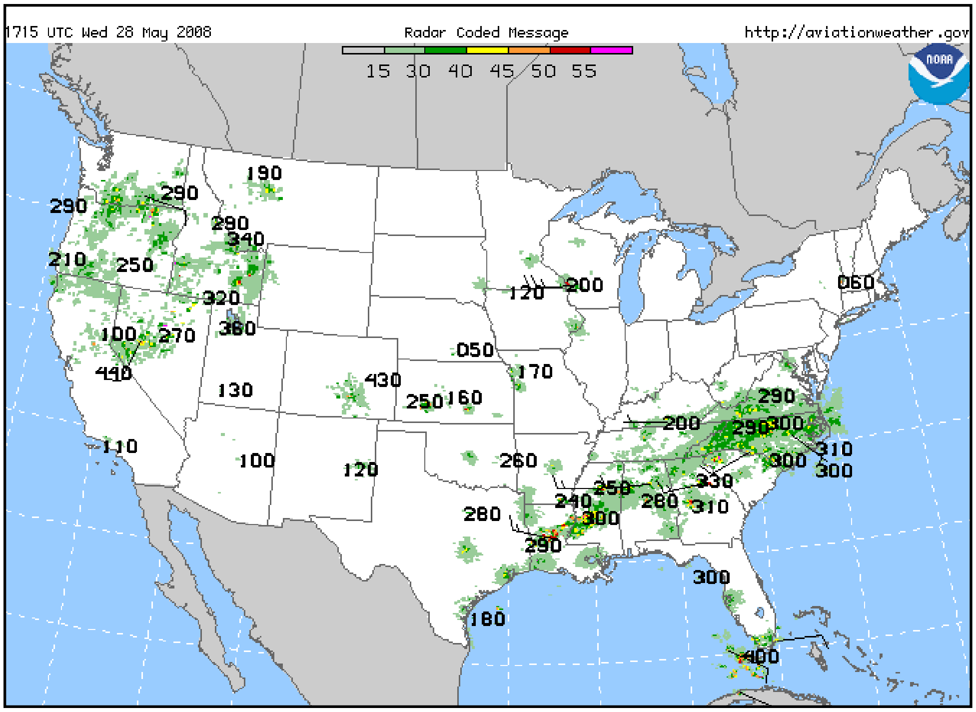



*Figure 1*

*Convective SIGMET example.*

WSUS32 KKCI 282055

SIGC

CONVECTIVE SIGMET 83C

VALID UNTIL 2255Z

TX NM

FROM 20SSW TXO-40ESE ROW-30W MAF

LINE TS 25 NM WIDE MOV LTL. TOPS ABV FL450.

The data were analyzed to calculate the frequency of convective cloud tops from FL180 to FL450 (including greater than FL450) in intervals of 10kft, direction 0° through 360° in intervals of 10 degrees as well as speed from LTL (little movement) up to 65 kts. The totals were calculated for three U.S. regions: East: East of 91°W, 2; Central: West of 83°W and East of 110°W, 3; West: West of 103°W.

## Results

For this study, we analyzed more than 27,000 Convective SIGMETs. In the NWS Eastern Region, the direction for most Convective SIGMETs was from the West (270°). The fastest, most common speed of 40kts occurred in March and the slowest common speed, 10kts, occurred in August (See **Table 1**). From March until August, the speed of Convective SIGMETs decreased from 40kts to 10kts. After August, the speed of Convective SIGMETs began to increase. Tops ranged from FL350 to FL400, with the lower tops near the beginning of the convective season. The only months that had a direction of little or no movement or direction (LTL) were August and September. Another interesting finding is that the tops are spread out over the scale (FL200-FL450) at the beginning of the season, but towards the end of the season, the majority of the cloud tops were AOA FL450.

For the Central region, the majority of Convective SIGMETs are from the West (270°). The most common top speed, 40kts, occurred in March. The most common low speed, 15kts, was in August (See **Table 2**). Just like the East, the speed of Convective SIGMETs decreases throughout the

**Table 1**

| East | Direction | Speed (kts) | Cloud Tops |
|---|---|---|---|
| March | 270 | 40 | FL400 & 350 |
| April | 270 | 35 | ≥450 |
| May | 270 | 25 | ≥450 |
| June | 270 | 20 | ≥450 |
| July | 270 | 20 | ≥450 |
| August | LTL | 10 | ≥450 |
| Sept | LTL | 20 | ≥450 |
| Oct | 270 | 30 | ≥450 |

**Table 2**

| Central | Direction | Speed (kts) | Cloud Tops |
|---|---|---|---|
| March | 240 | 40 | ≥450 |
| April | 270 | 30 | ≥450 |
| May | 270 | 20 | ≥450 |
| June | 270 | 20 | ≥450 |
| July | 270 | 20 | ≥450 |
| August | LTL | 20 | ≥450 |
| Sept | 270 | 20 | ≥450 |
| Oct | 240 | 25 | ≥450 |

season. For Central Region, the findings are similar to the East, with the cloud tops spread out over different cloud heights. As summer ended, the majority of the clouds tops were AOA FL450.

The Western region is particularly interesting. The majority of SIGMETs exhibited little or no movement from June through September (See **Figure 2**). Only March showed SIGMETS significantly from the West (270°). April, May and October most frequently observed wind direction

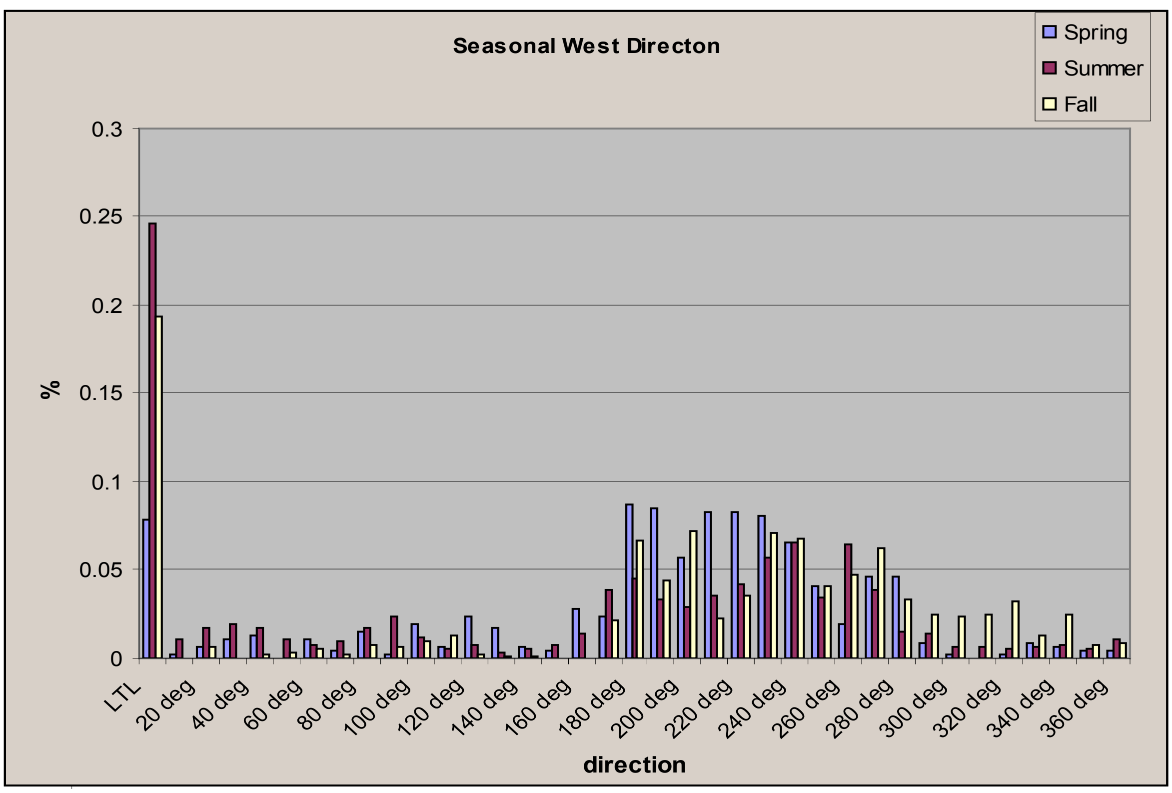



*Figure 2*

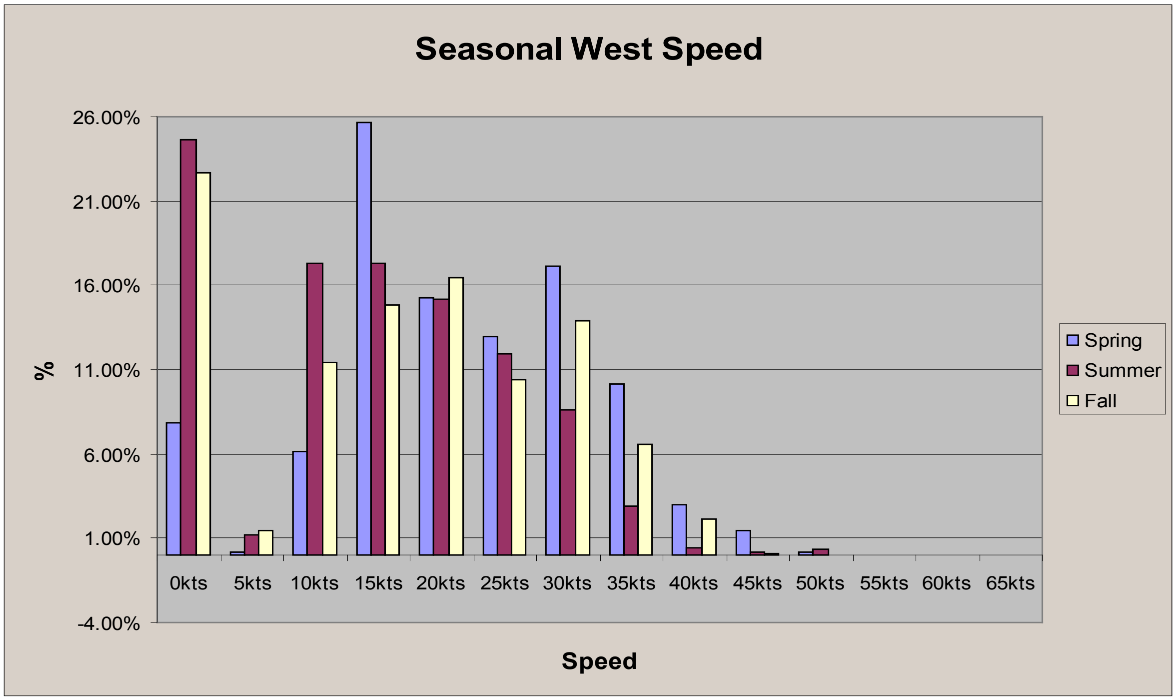



*Figure 3*

of S or SW (180°-190°). The most common speed at the start of the season was 15kts. This speed increased to 25kts by June, however, from July through September, the speed was LTL (See **Figure 3**). The cloud tops in the West do not show the same trend as they do in the Central and East. In the West, cloud tops start out low (FL250) and increase to above FL450 towards the end of summer into the early fall. By October the cloud tops are slowly decreasing to near FL350 (See **Figure 4**). To further explain Table 1 and 2, please see the appendix.

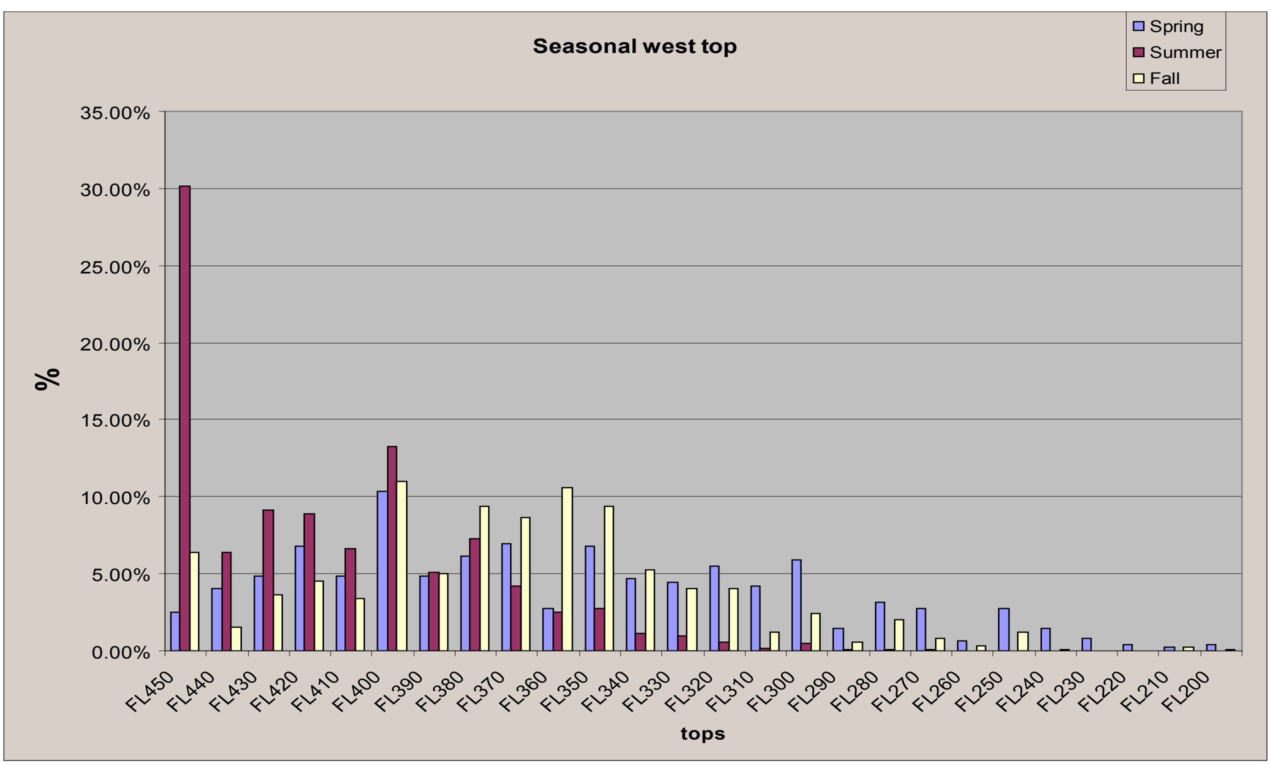
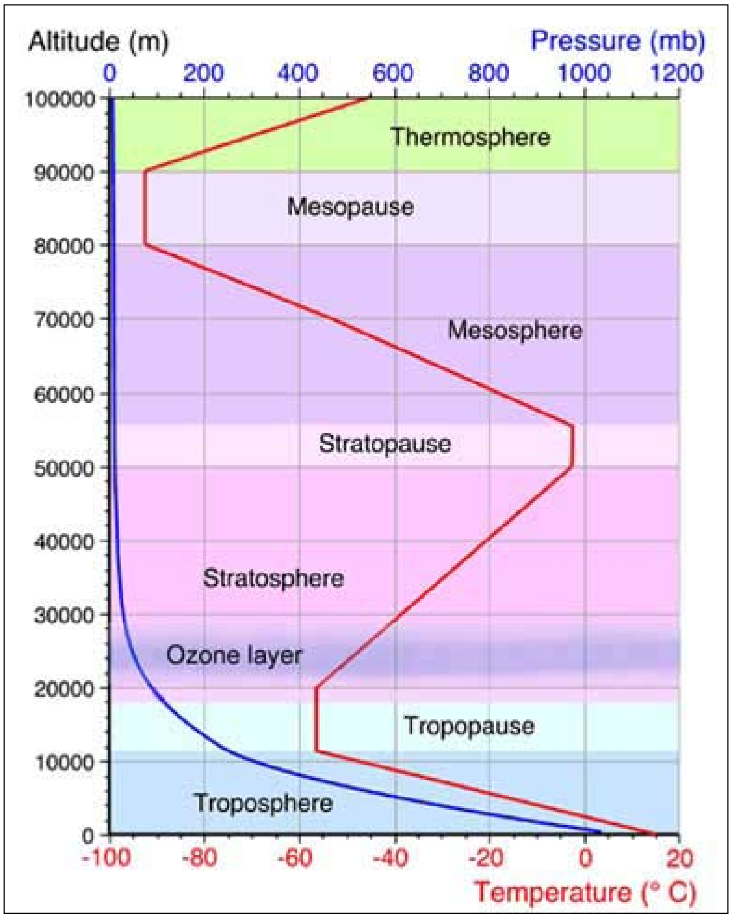



*Figure 4*

## Conclusion

This study shows that the direction, cloud tops, and speed of Convective SIGMETS varied significantly with the season. In the Central and Eastern Regions, the speed of Convective SIGMETs decreases through the season as the weather pattern changes from March to October. Near the beginning of the convective season, several synoptic low pressure systems travel across the United States. As the convective season progresses into summer, these synoptic systems become sparse as high pressure builds over the West in late July or August. The high pressure will then begin to oscillate between the Plains and the West through the remainder of the summer.

The pattern previously mentioned is also the cause for the change in cloud tops. Cloud top heights are the result of the tropopause height (See **Figure 5**). The Convective SIGMETs in the West are influenced by synoptic weather patterns, but they are also influenced by the mountain ranges.




The direction of most Convective SIGMETs at the beginning of the convective season is from the West. Upper level low pressure systems tend to move over California in the spring, changing the Convective SIGMET direction to southerly. As July approaches, high pressure begins to build over the West, which in turn causes the speed and direction to become LTL because there is no upper level steering wind. Quite often thunderstorms will develop continuously over the terrain causing no movement in a Convective SIGMET area. Cloud tops are affected similarly in the West as they are in the East and Central.

## Reference

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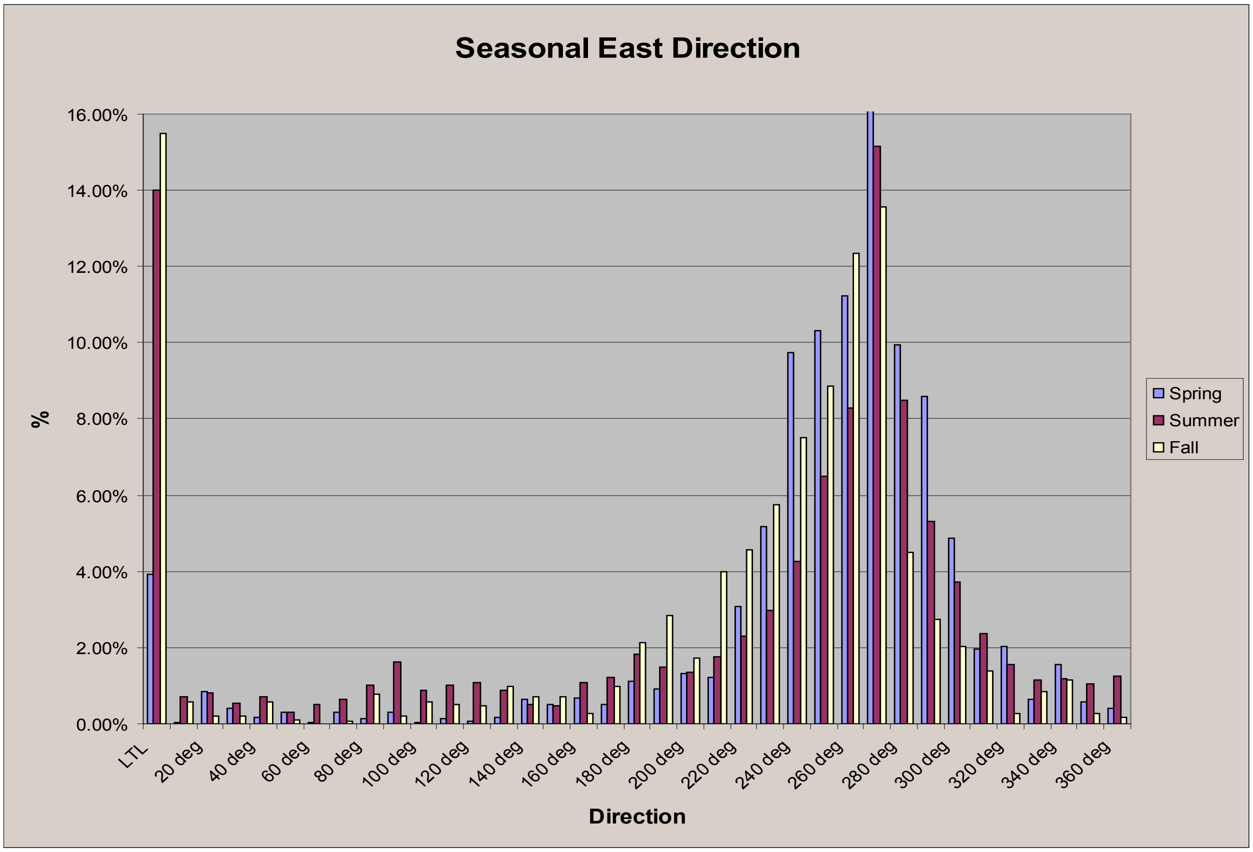
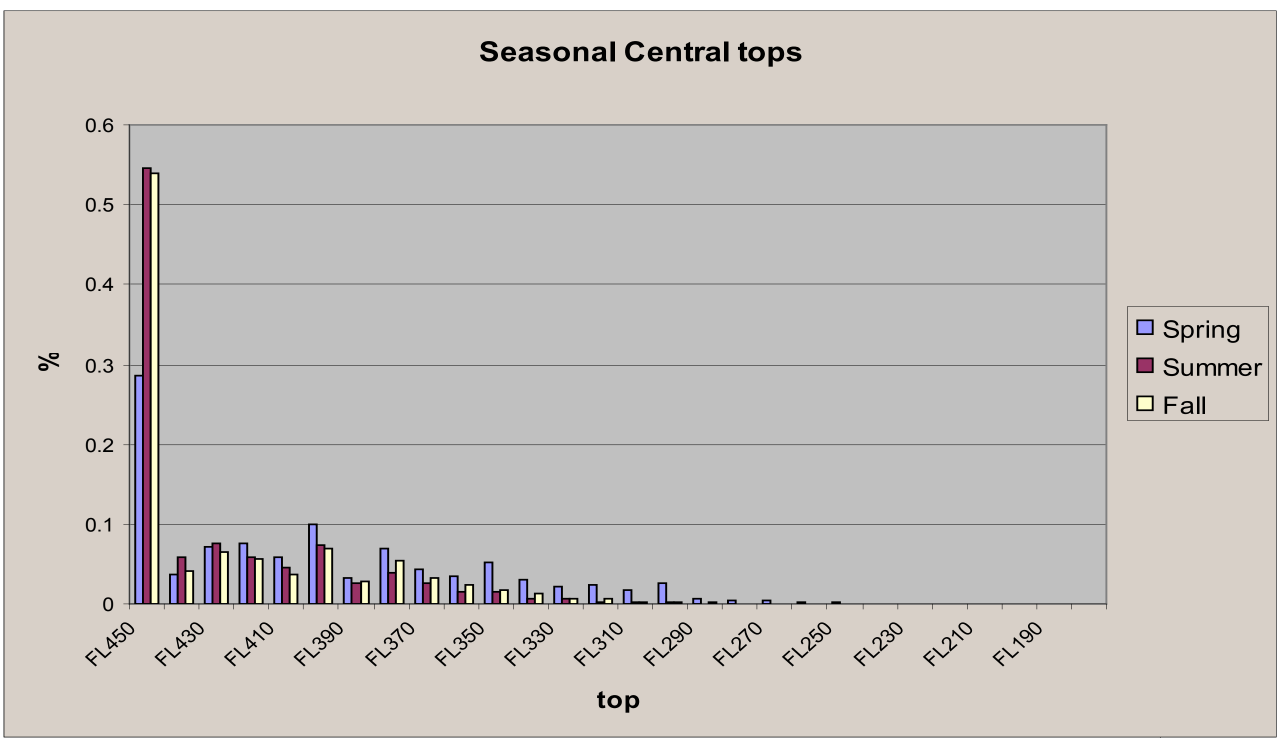
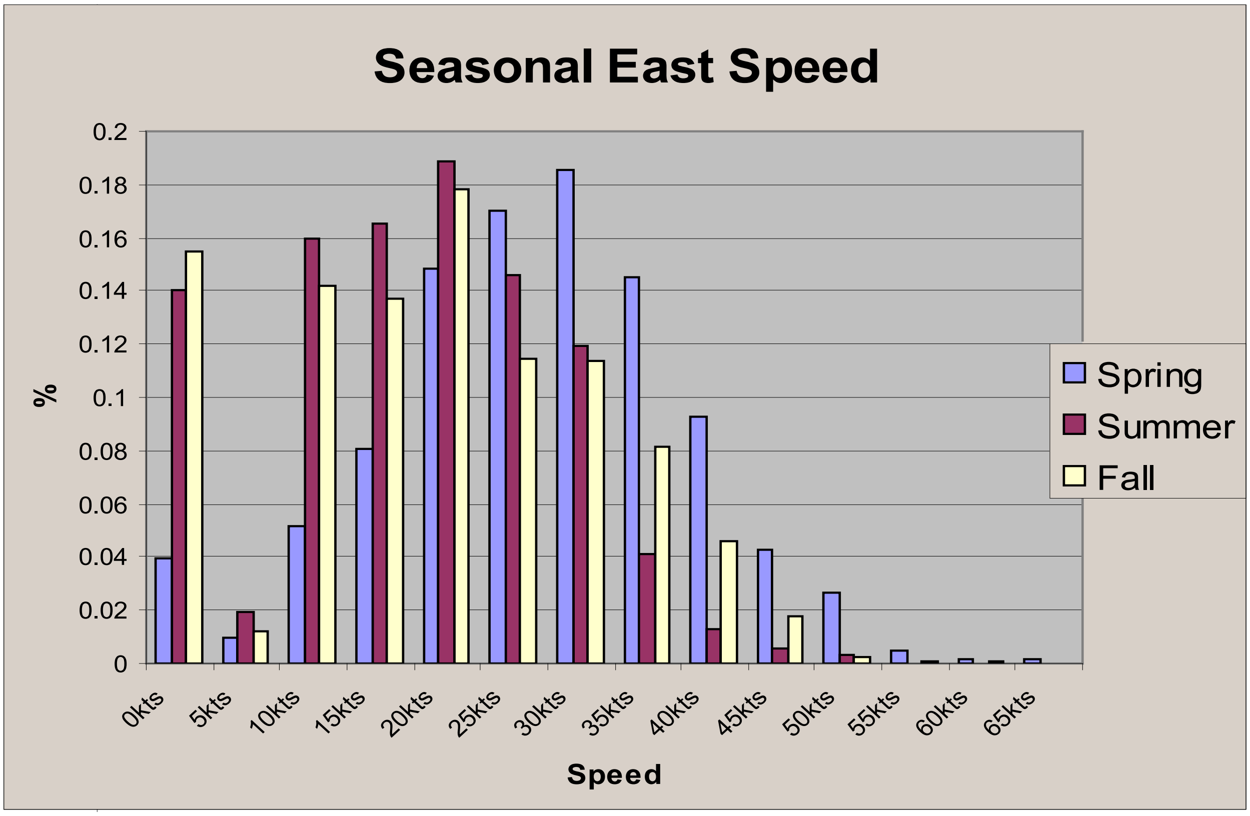
# Appendix



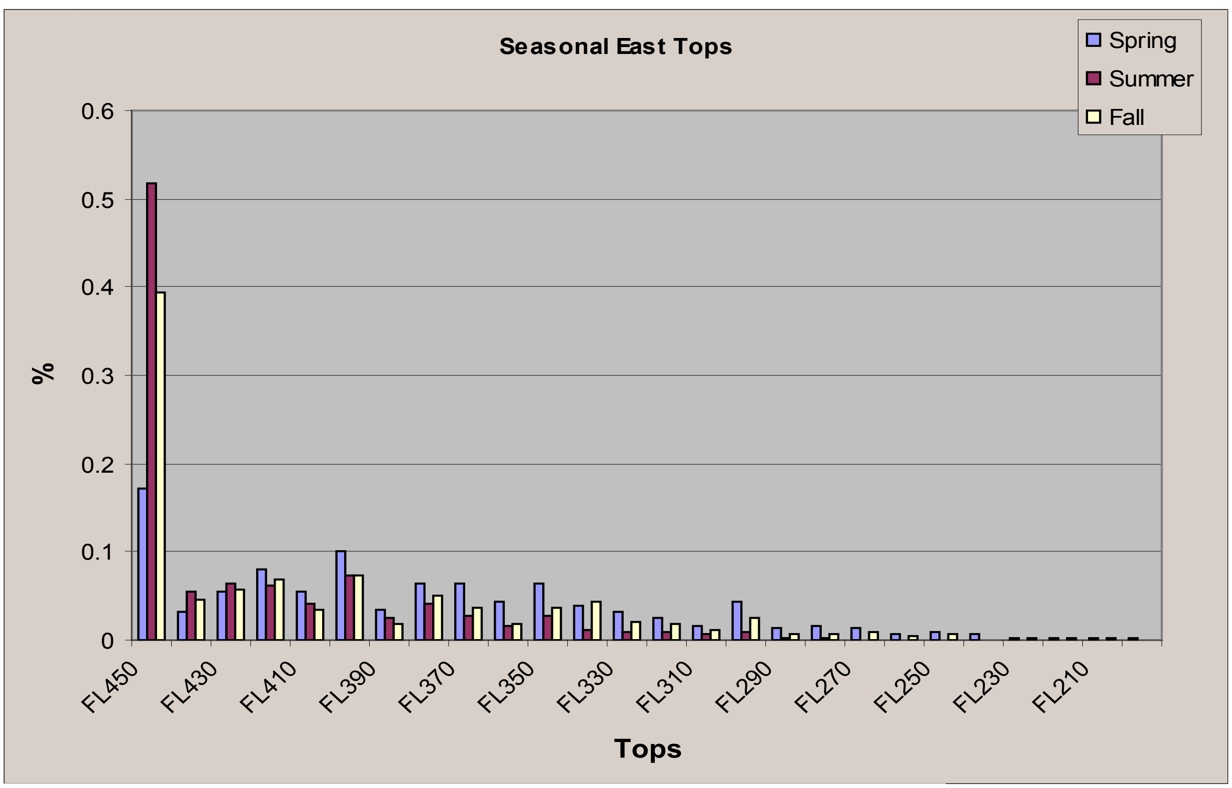

*Direction of Convective SIGMETs in the East for the Spring (March, April and May), Summer (June, July and August), and Fall (September and October).*




*Cloud tops in the Central for the Spring, Summer, and Fall.*




*Convective SIGMETs Speed in the East for the Spring, Summer and Fall.*

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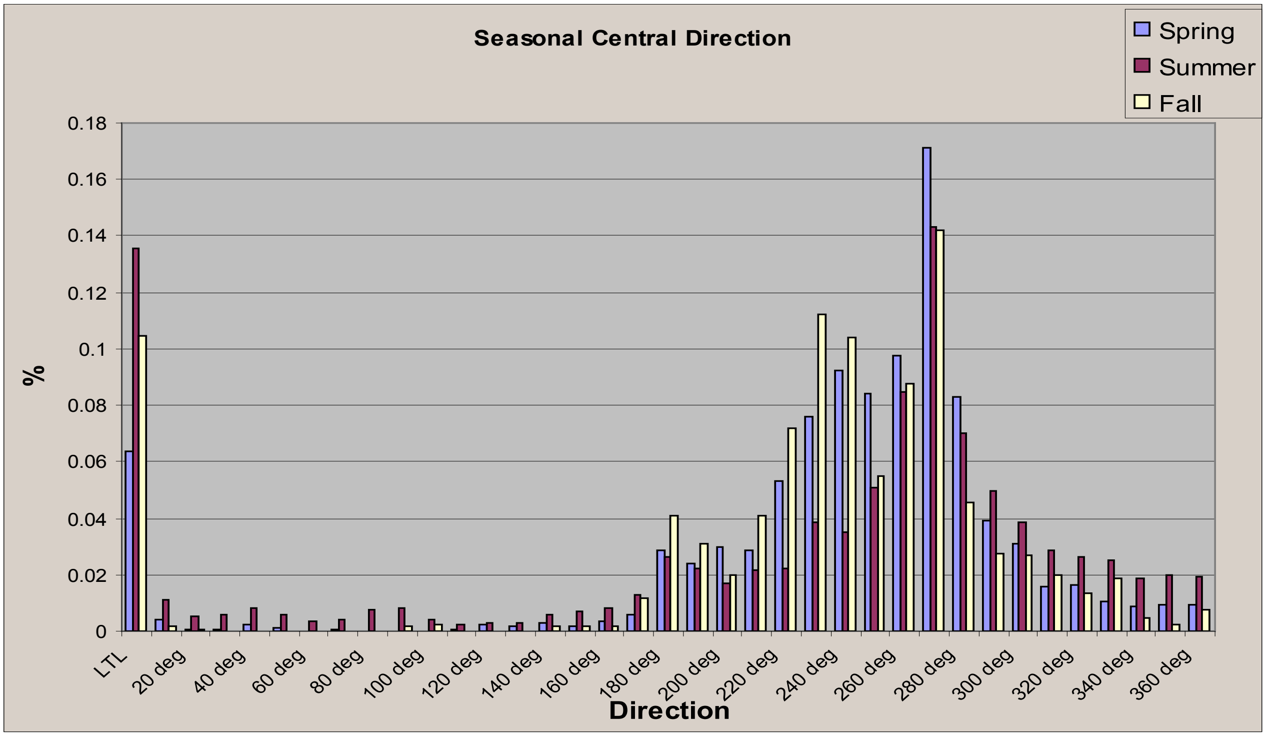


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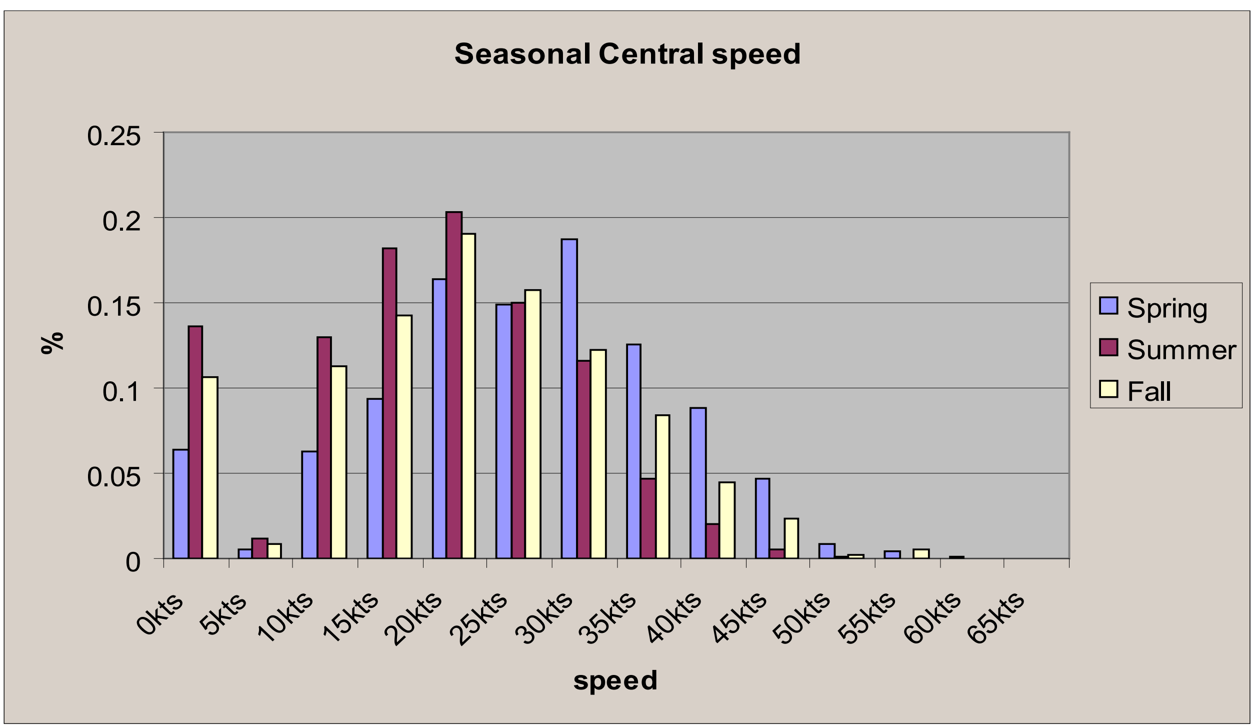


*Convective SIGMETs speed in the central for the Spring, Summer and Fall.*