# Notes on Weather Forecasting Websites

| Pressure | Approximate Height | | Approximate Temp | |
|---|---|---|---|---|
| **Sea level** | 0m | 0 ft | 15 C | 59 F |
| **1000 mb** | 100 m | 300 ft | 15 C | 59 F |
| **950 mb** | 610 m | 2000 ft | 11 C | 52 F |
| **850 mb** | 1500 m | 5000 ft | 5 C | 41 F |
| **700 mb** | 3000 m | 10000 ft | -5 C | 23 F |
| **500 mb** (steering flow) | 5000 m | 18000 ft | -20 C | -4 F |
| **300 mb** | 9000 m | 30000 ft | -45 C | -49 F |
| **200 mb** | 12000 m | 40000 ft | -55 C | -67 F |
| **100 mb** | 16000 m | 53000 ft | -56 C | -69 F |
| | | | | |

**Standard Pressure = 1013mb**

QFE (AGL) = Field Elevation

QNH(MSL) = Nautical Height

| | |
|---|---|
| **Aviation Weather Website Local Area Data** | http://www.flightplanning.navcanada.ca/cgi-bin/CreePage.pl?Langue=anglais&NoSession=NS_Inconnu&Page=lab&TypeDoc=html |
| **Aviation Weather Website Webcams** | http://www.metcam.navcanada.ca/hb/index.jsp?lang=e |
| **Best Weather Charts NCAR** | http://weather.rap.ucar.edu/ |
| **BLIP Forecasts** | http://www.drjack.info/BLIP/index.html |
| **College Of Dupage Satellite and Radar Data** | http://weather.cod.edu/satrad/index.php |
| **CWSU National TAF Metar Maps** | http://www.wrh.noaa.gov/zoa/mwmap3.php?map=usa |
| **Idonthaveawebpage.com General US Model Maps** | http://www.idonthaveawebpage.com/ |
| **Mount Forest – Environment Canada 7 day forecast** | http://www.weatheroffice.gc.ca/city/pages/on-89_metric_e.html |
| **NAM Convective Forecasting Cloud layer predictions** | http://www.emc.ncep.noaa.gov/mmb/namsvrfcst/ |
| **SpotWX – Canadian model Weather data graphs** | http://spotwx.com/ |
| **Weather Spark Weather data graphs** | http://weatherspark.com/ |
| **Wind Map** | http://hint.fm/wind/ |
| **Weather Forecaster General US Model Maps** | http://www.wxforecaster.com/ |
| **XCSkies** | http://www.xcskies.com/ |

# Notes on XCSkies Map Parameters

## Thermal Parameters

*Top of Usable Lift*

Measured in feet or meters above MSL (mean sea level), this parameter is commonly the most looked at by paraglider and hang glider pilots. The top of the usable lift is how high a glider could potentially thermal as the vertical velocity slows down near the absolute top of thermals. This accounts for a glider sink rate of about 250-300 feet per minute. This parameter does not consider the lapse rate changing due to cloud formation before the top of the usable lift is reached. In very moist parcels of air where condensation (cloud) occurs before the top of usable lift is reached, the lapse rate will change from a dry adiabatic lapse rate (DALR) to a moist adiabatic lapse rate (MALR). Because of the uncertainty of cumulus cloud formation within forecast models, it is not reasonable to attempt finding the true top of usable lift, which can at times be thousands of feet higher, and typically in large cumulus nimbus cloud formations (in which case you would not be flying...hopefully). The "Cumulus Cloud Depth" parameter will give some type of indication as to the potential for deep cumulus cloud to occur, along with looking at the "Precip/Thunder Storms" parameter. The Top of Usable Lift is not always "The minus 3" Thermal Index equivalent. In fact, the -3 thermal index often poorly defines where the top of the usable lift will be. Read more about this issue here.

*Top of Usable Lift Above Ground*

This parameter is the "Top of Usable Lift" minus the ground elevation for each given 1km area. This is a useful parameter when considering cross country routes across terrain. You may find that one route over another in a downwind direction gives you more "clearance" over the ground, thus increasing the potential to fly further and providing a little more safety.

*Thermal Tops (Thermal Idx=0)*

This parameter is where the absolute thermal top is likely to be in dry air. Again, this does not account for moist adiabatic lapse rates and so can be grossly understated in moist areas where large cloud formation occurs and over-development ensues. This is commonly where the Thermal Index (TI) is equal to 0, which simply means that the parcel of rising air has reached the same temperature of the surrounding air. Where the TI equals zero is often not the true top of lift depending upon the depth of the boundary layer. With a deep boundary layer, the velocity of some thermal updrafts reach the boundary layer (TI=0) and still have enough momentum to continue upwards even more. "Punching through" the inversion and broken or elongated haze domes are good evidence of this phenomena.

*Thermal Height Variability*

This parameter tells you what the top of the lift would be if the surface was just 2.2 more degree C (4 F) warmer. This characterizes the sensitivity of the air mass over a given location. Where you find areas of uncertainty, you can assume that the Top of Lift and Top of Usable Lift are likely to be slightly different in either direction--higher or lower. This parameter can give you an indication of over-development as well. When a small increase in temperature gives a top of lift value thousands of feet higher, you might expect to see large cloud formation even if the air mass is relatively dry near the surface.

Thermal Updraft Velocity

This is the average thermal strength or upward velocity, usually measured in meters per second or feet per minute. All thermals are different, having different sources and triggers, which also implies different localized surface temperatures. Because hang gliders and paragliders can turn in such small areas, we experience the very essence and micro characteristics of each and every thermal. A core will be stronger with turbulence near its edges, yet the entire parcel of air may be rising, and quite possibly have multiple cores. This parameter is simply the maximum updraft average of the entire thermal. There will certainly be weaker and stronger updraft velocities for any given location and time.

*XC Potential*

This parameter attempts to identify the locations where XC is possible based upon a comparison of 4 different criteria. They are the following:

1. Red. Buoyancy/Shear is greater than 6, average wind speed within the boundary layer (ground through thermal tops) is 10 MPH or less, thermal velocities are greater than 490 feet per minute (2.5 M/S), and the top of the usable lift is greater than 2,000 ft. above the ground.

2. Orange. Buoyancy/Shear is greater than 4, average wind speed within the boundary layer (ground through thermal tops) is 14 MPH or less, thermal velocities are greater than 490 feet per minute (2.5 M/S), and the top of the usable lift is greater than 2,000 ft. above the ground.

3. Blue. Buoyancy/Shear is greater than 4, average wind speed within the boundary layer (ground through thermal tops) is 18 MPH or less, thermal velocities are greater than 490 feet per minute (2.5 M/S), and the top of the usable lift is greater than 2,000 ft. above the ground.

The attempt to characterize good XC areas is of course subject to interpretation. One pilot's concept of good XC conditions is not necessarily the criteria for another's. Nevertheless, this parameter gives a quick review of regions where wind speed is low enough to not break apart thermals, and where that wind is not too strong. For those who are after huge XC distance, this parameter will likely not identify those regions due to a search criteria of relatively light winds aloft areas.

## Cloud & Weather Parameters

*Cumulus Cloud Base*

Finding cloud base is tricky due to deriving realistic dew point values from the model output. In addition, as thermals rise and mix with the surrounding air, the entrainment process will change the moisture characteristics of the rising air mass, making cloud base even more of a moving target to predict. With that said, this parameter tries to identify where cloudbase is likely to be when the surface moisture is lifted adiabatically to condensation (dew point). The parameter has validated well in dry areas across the planet, such as the U.S. Southwest, and poorly in more humid and lowland areas. We are working on providing better parameterization with cloud base, so use the current results skeptically.

*Cumulus Cloud Depth*

This parameter represents how deep cumulus clouds might be if cloud base exists below the absolute Top of Lift. When dew point is reached and clouds form, if the thermal is still rising, the lapse rate will change from a dry adiabatic lapse rate (DALR) to a moist adiabatic lapse rate (MALR). We do not attempt to apply a MALR to the rising parcel and assume where the Thermal Index reaches 0 is the top of lift. Where clouds do form well below the top of the boundary layer, if the general air mass is moist, over-development is likely to occur.

*Sky Cloud Cover*

This parameter comes directly from the forecast model output and is interpolated across the area it represents. The exact edges are likely to be slightly inaccurate but the gerenal location and cloud cover percentage represents what the models are predicting. This parameter includes all levels of clouds for any given column. Forecast models are known to poorly predict cloud cover, so the usefulness of this parameter is in question.

*Sky Cloud Cover (without high)*

The same as Sky Cloud Cover above, only without "High Clouds" represented in percentage of cover. High clouds can often be very thin and sometimes do not impact soaring conditions enough to even note them. Of course high clouds can also be very thick, having a high optical depth.

*Sky Cloud Cover (convective)*

This parameter describes the cloud cover percentages for given areas due to convective events. This parameter comes directly from the forecast model and likely only represents very large scale convection events, such as towering clouds as a result of severe over-development or thunderstorms.

*Precip/Thunder Storms*

This parameter utilizes several model variables to characterize thunderstorm potential. Most forecasts break the probability of thunderstorms into select categories. We have chosen the following:

T-Storms Likely: There is a great potential for thunderstorms in the area, and they will most certainly develop throughout that zone.

T-Storms Possible: Thunderstorms are possible within a given area, but may not fully materialize into mature storms or will only effect a smaller portion of the noted area.

Scattered T-Storms: Thunderstorms may develop within the area but will be widely scattered across the region. Storms will typically form over higher elevation and mountain tops, or very sparsely across flatlands. This type of forecast can be quite good for soaring as it indicates plenty of regional instability and enough moisture to likely form clouds.

Predicting thunderstorms and precipitation is a challenging task for forecasters. The parameters used are broken into thresholds for each category and come directly from the model output.

## Wind & Turbulence Parameters

*Wind Speeds at Levels*

For every 2000 foot interval we provide the winds aloft as an additional map layer. These winds are available to a 5km resolution grid, which should be plenty accurate for any given point. We have also provided the 10m surface winds. These surface winds will likely always be wrong for mountainous areas or near large bodies of water. The coarseness of the forecast models does not resolve the details of surface winds as they relate to the influences of terrain and localized modifiers. These surface winds will likely be much more accurate over large flatland areas, such as the plains of the Midwest U.S. We are skeptical to even present this information, but if it helps to characterize some regions it may be worth having available. Additionally, we have provided a single wind layer that shows the winds at the Top of Usable Lift. This will give you an indication of what the winds are expected to be when you top out lift, which is useful information for deciding what direction to maintain for cross country flights.

*Top of Usable Lift Wind Speed*

This is the wind speed that can be expected at the top of usable lift. These winds speeds come directly from the model output and represent the contoured levels of the Top of Usable Lift parameter.

*Thermal Top Turbulence*

A modified Richardson Number is used to characterize the potential for turbulence caused by wind shear near the boundary layer top. Specifically, we analyze each 1km profile slightly above and below the top of the lift and compare the wind vector values across that profile slice. A smaller number in our case represents low turbulence, where a higher number (truncated at 10) represents a very turbulent field. A true Richardson Number is actually the other way around.

## Surface Parameters

*Surface Temperatures*

Temperatures from the model output are generated to a 1km grid based upon the influences of elevation and their relative temperature profiles above the surface. Validating our temperature scheme across the U.S. for 5000 points observed within 15 minutes of our forecast time shows us that 80%-90% of those sample points are accurate to within 2 degrees C over a wide range of weather systems. To be expected, complex (mountainous) terrain accounts for the majority of temperature discrepancies. We are uncertain how well the surface temperatures represent other parts of the world because we do not have simple means to validate at this point. We will be implementing a solution soon for increased validation.

*Surface Heat Flux*

This parameter indicates the amount of available radiation which is used to invoke the thermal process on the ground. Heat flux values consider the sky cloud cover, soil moisture, and solar radiation. The interaction of the sun, ground, and everything in-between comprises the Energy Budget of the Earth. The flux parameters are critical in providing clues to the Heat Transfer mechanisms for thermals to form at the surface and rise upwards.

CAPE : The amount of buoyant energy available to lift the air > 1000 unstable.

Lifted Index: -ve values imply instability.

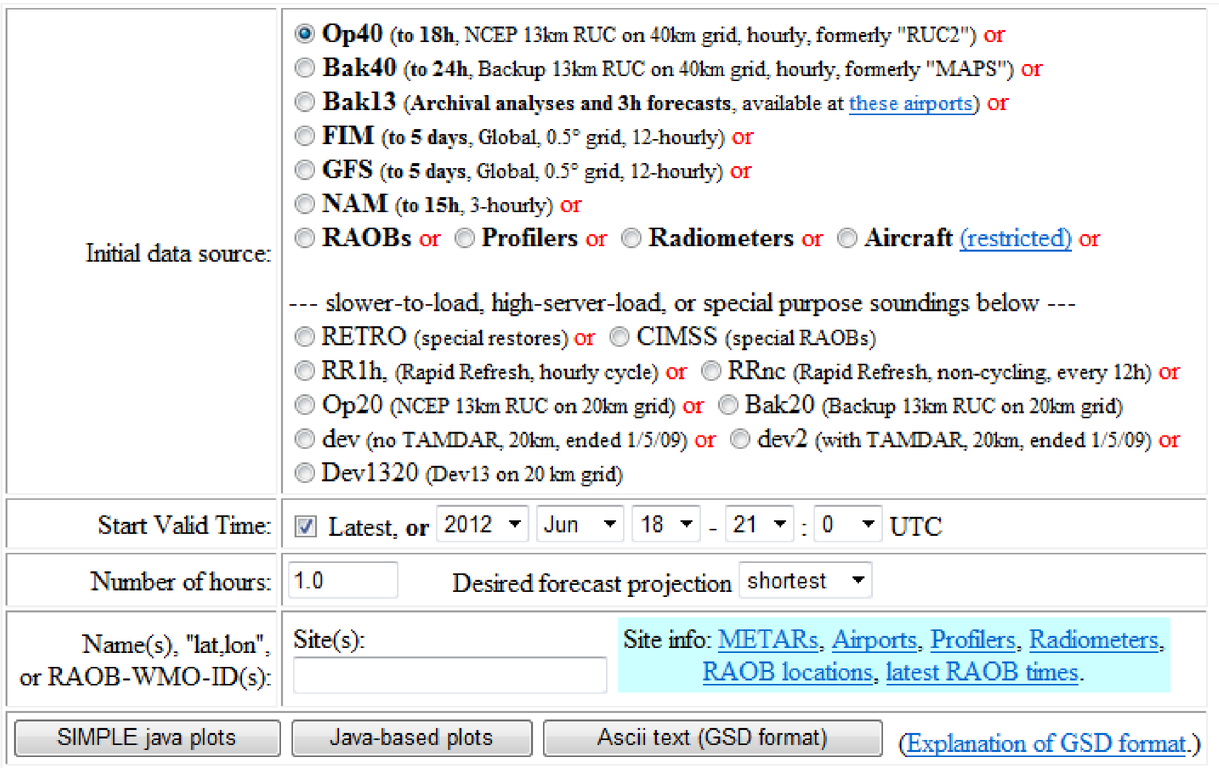
Thermal Index: Temperature difference between the actual temperature and the surface air lifted adiabatically from the surface

Walter Weirs Notes on his Tephi program

**HOW TO MAKE TEPHIGRAMS FOR GLIDING FORECASTS USING THE "TEPHI" PROGRAM**

Go to the website http://www-frd.fsl.noaa.gov/mab/soundings/java/

and see this box:


Initial data source:
Op40 (to 18h, NCEP 13km RUC on 40km grid, hourly, formerly "RUC2") or
Bak40 (to 24h, Backup 13km RUC on 40km grid, hourly, formerly "MAPS") or
Bak13 (Archival analyses and 3h forecasts, available at these airports) or
FIM (to 5 days, Global, 0.5° grid, 12-hourly) or
GFS (to 5 days, Global, 0.5° grid, 12-hourly) or
NAM (to 15h, 3-hourly) or
RAOBs or Profilers or Radiometers or Aircraft (restricted) or
--- slower-to-load, high-server-load, or special purpose soundings below ---
RETRO (special restores) or CIMSS (special RAOBs)
RR1h, (Rapid Refresh, hourly cycle) or RRnc (Rapid Refresh, non-cycling, every 12h) or
Op20 (NCEP 13km RUC on 20km grid) or Bak20 (Backup 13km RUC on 20km grid)
dev (no TAMDAR, 20km, ended 1/5/09) or dev2 (with TAMDAR, 20km, ended 1/5/09) or
Dev1320 (Dev13 on 20 km grid)
Start Valid Time: Latest, or 2012 Jun 18 - 21 : 0 UTC
Number of hours: 1.0 Desired forecast projection shortest
Name(s), "lat,lon", or RAOB-WMO-ID(s): Site(s):
Site info: METARs, Airports, Profilers, Radiometers, RAOB locations, latest RAOB times.
SIMPLE java plots | Java-based plots | Ascii text (GSD format) | (Explanation of GSD format.)

Click the option button "RAOBs" for actual soundings or "Op40/GFS/NAM" for forecast soundings. Use the dropdown menu to select the time for which you want the sounding. The only valid times for actual RAOBs are 0 and 12 UTC.

For forecasts enter the latitude and longitude of your gliding field in the text box under "Site". West longitudes are negative. Separate with a comma. Use degrees and decimals. Example: The entry for Seminole Lake Gliderport in Florida is 28.4,-81.8 You can alternatively enter the station's three or four letter designator. For RAOBS you must enter the designator for a RAOB station.

Click "Ascii text (GSD format)". A new page will appear containing the forecast sounding in text format. Use <File><Save as> or copy and paste to create a text file. Give it any name which allows you to recognize which sounding it is. If desired Op40(RAP or old RUC) soundings can be descriptively renamed by clicking "Name File(s)".

*See the NOTE below.*

Start the Tephi program, enter the maximum temperature expected for the day and click "Open

File". Open the text file you have saved and the tephigram will be plotted.

If you change the max temp and press <Enter> the sounding will be re-plotted with the new temperature. Same thing goes for the Max Alt box.

If you open multiple soundings they will open in separate windows. Click the Task Bar or use

ALT+TAB to view them individually.

NOTE: In Tephi Ver 4.00 automated file naming for RUC2 and MAPS files has been added. If you put a relatively high number in the "Number of hours" box you will usually get more than one sounding in the downloaded file.

If you leave the "Latest" box checked and put 12.0 in the "Number of hours" box you will usually get six or more soundings. Previous to ver 4.00 you had to separate and name each sounding by copying and pasting into a text editor. Now, with the addition of the menu item "Name File(s)", this process is automated for RUC2 and MAPS files.

Click "Name File(s)" and open the downloaded file. A message box will tell you how many files have been created. Then use "Open File" as usual to open the new files. Note that the name of the file appears on the Tephi title bar and gives a complete description of the sounding.

**EXPLANATION OF THE SOUNDING DIAGRAM**

The XY tephigram is a plot of temperature vs altitude. The red line is the dew point - the green line is the dry bulb temperature. The circles on the right side show wind direction with speed in knots.

The straight black line sloping upward from right to left shows how a parcel of air lifted from the surface will cool as it expands with increasing altitude. This line terminates on the surface at the Max Temp inserted by the user. The straight magenta line sloping upwards from right to left shows how the dewpoint of a rising parcel of surface air will drop as altitude increases.

If a parcel of air on the ground becomes warmer than the surrounding air it will begin to rise. As long as it stays warmer, and therefore lighter, than the surrounding air it will continue to rise with its temperature following the black line. Its dew point will drop at about 0.5 deg C per 1000 feet according to the magenta line. If it keeps rising until it gets to the altitude where the magenta line crosses the black line its temperature will be equal to its dew point and cloud will form. If it is still warmer than the surrounding air it will continue to rise - but now that it's saturated its temperature will follow the blue line and it will cool at only 1.5 deg C per 1000 feet rather than the previous 3 deg C per 1000 feet. It won't stop rising until the blue line crosses the greenline and its temperature is no longer higher than that of the surrounding air. When it stops, that will be the top of the lift - the top of the cloud.

If the black line crosses the green line before coming to the magenta line the parcel will stop rising because it is no longer warmer than the surrounding air - and there will be no cloud because the temperature of the parcel is still higher than its dew point. The crossing altitude will be the top of the lift. If there is more than one magenta line it's because dew point is increasing with altitude. Since a rising parcel of air will mix at least partially with surrounding air it will become wetter as it rises. Just where cloud base will form is anybody's guess!