SOARING METEOROLOGIST TOOLS AND SUPPORT

IWAWS Reno - May 28, 2020

Walter Rogers "WX" wrogerswx@gmail.com

* *Retired NWS Meteorologist 42 years*
* *Manager / CWSU Avation Support*
* *Contest Forecaster – Discus 2A: 4500 hours*
* *Barron Hilton Cup – West U.S. Winner 2008*
* *WGC Uvalde 2012 Technical Support Met*
* *Perlan Met Forecaster Sep 2019*

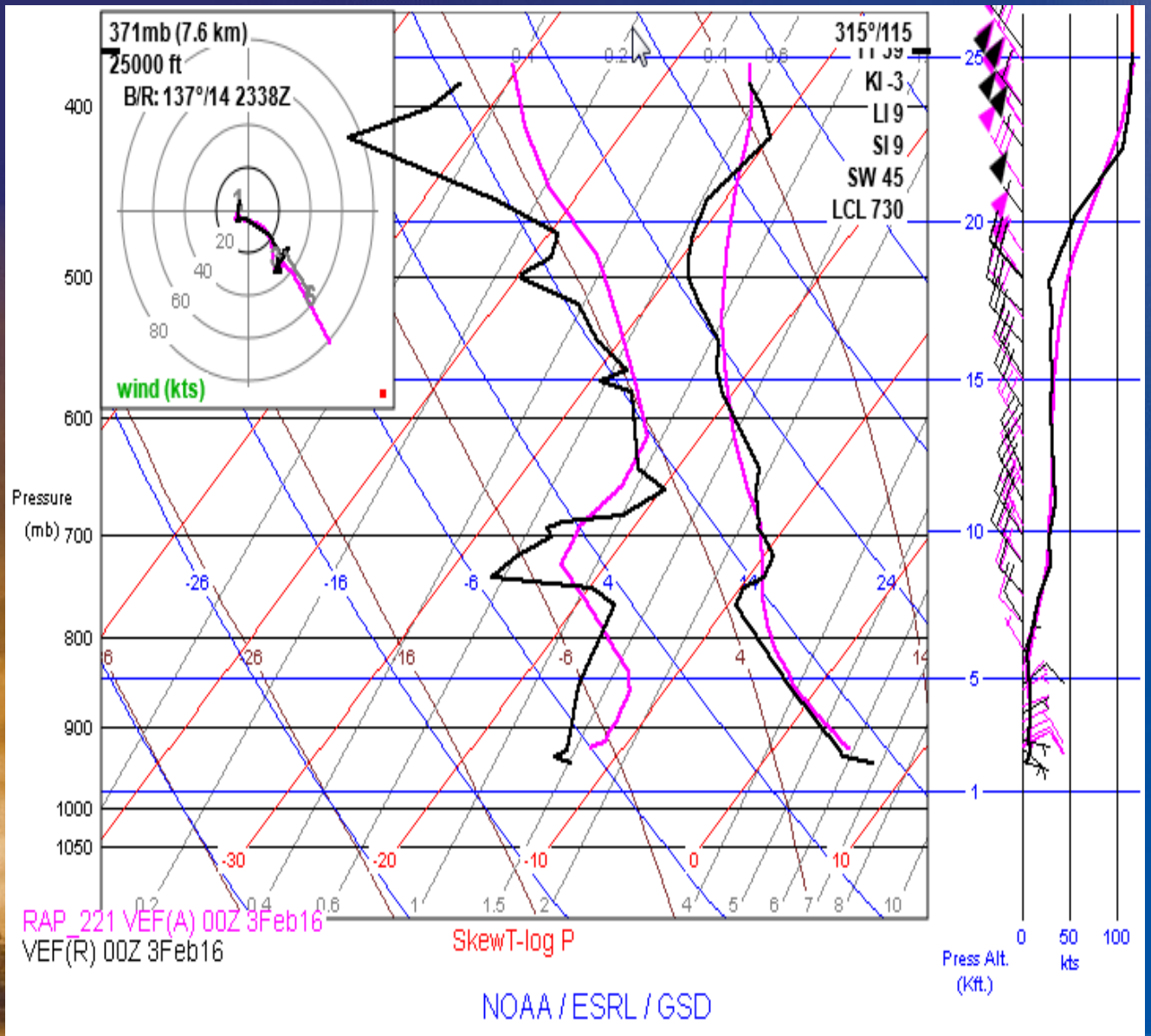
Overview – Strategies for a Making a Soaring Forecast

- Radiosondes - Evolving from paper plotted Skew-Ts
- To… Commercial Global web services for gliding
- Mountain Waves – Perlan Soars Above 76,000 Feet
- Tools that I use…
  - Time Series plots
  - 2D Maps of Soaring parameters
- Observational Sources – Radar and GOES high resolution imagery
- More Resources
  - Previous Presentations and URL links
  - Briefing Formats – fast and media rich…

Radiosonde – Legacy Obs

- Radiosonde Obs
  - Twice/day – 12Z 00Z
  - Approx 800 world wide; 92 U.S.
  - Detailed vertical temp, wind and rh data
  - Several 100's km separation from soaring forecast location
  - Not a good soaring forecast solution - Good for analyses

Radiosonde Ob Compared to Model Sounding



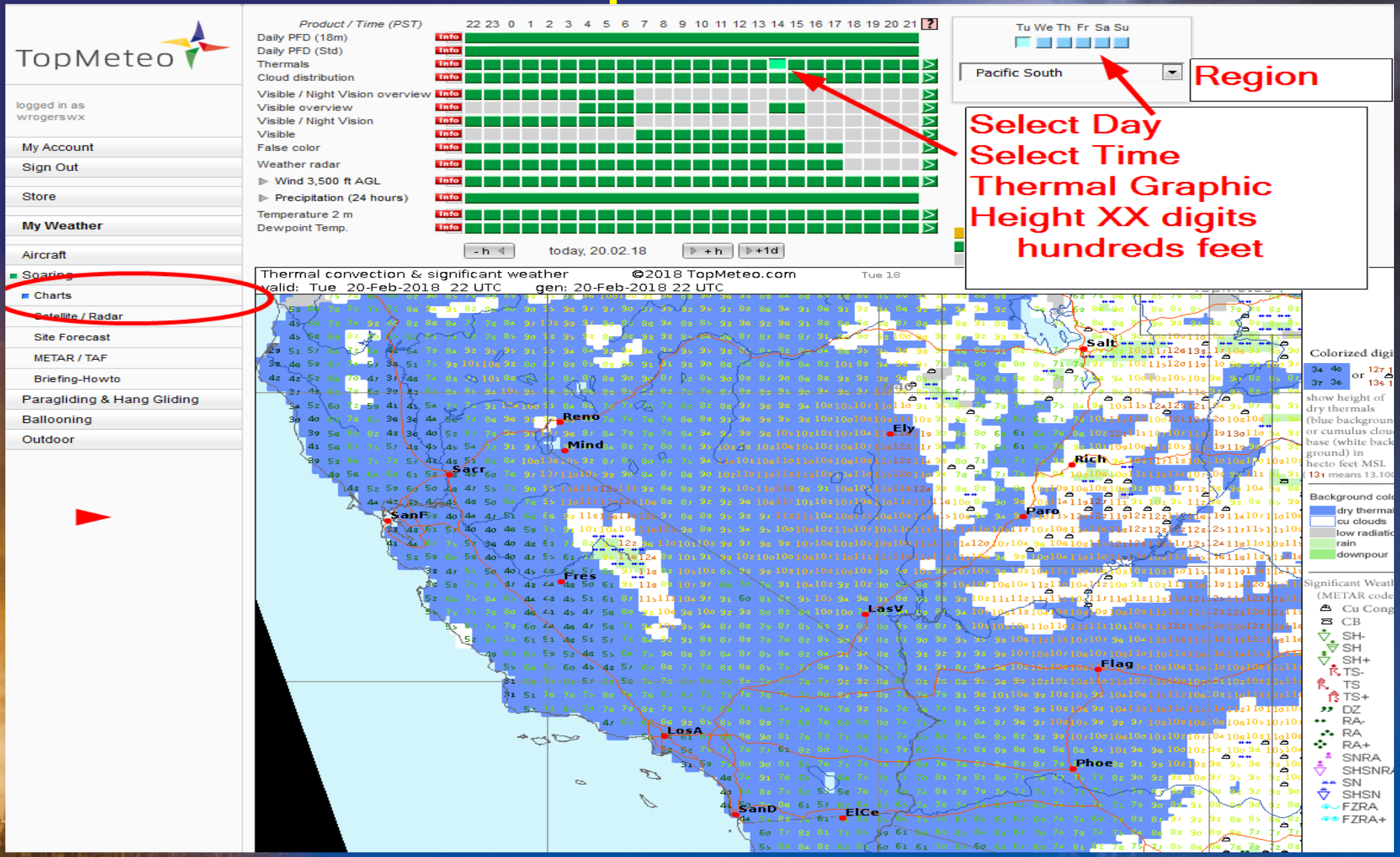
- Black – Las Vegas Raob
- Temp DewPt
- Valid 4pm PST
- Sharp boundaries at top Thermal Layer

- Purple – Model RAP Sounding
- Notice smoothing of features

Web Services Soaring Forecasts – The Top Four

- Skysight.io – Custom soaring parameters; WRF model for six days out; 16 Global Regions
- TopMeteo – Longest running International soaring forecast service
- XCSkies – All NOAA Models with soaring parameters for visualization
- Open Source RASP – Uses WRF run on PCs for small regions

Soaring Websites
TopMeteo



Soaring Websites
TopMeteo

TopMeteo

Who we are

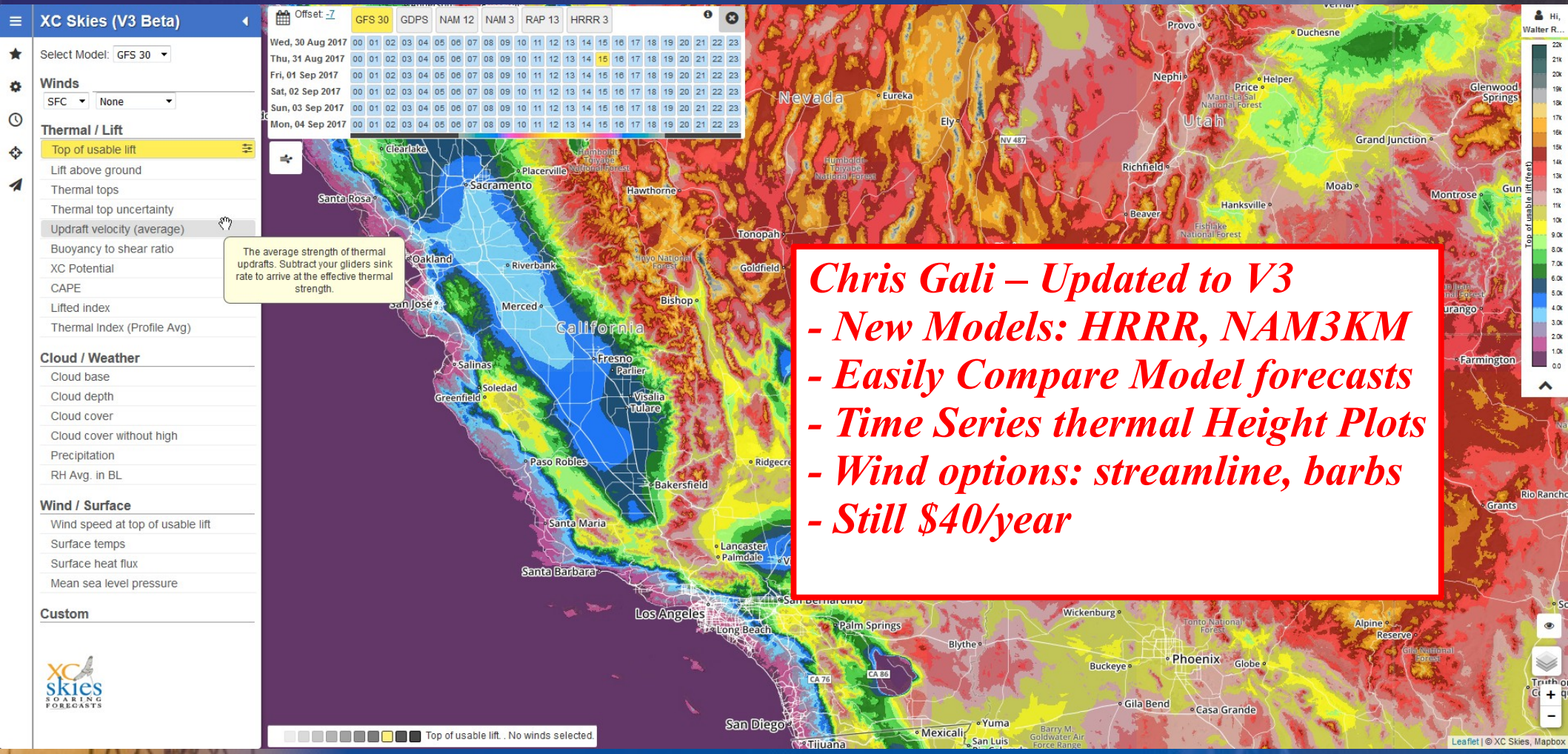
TopMeteo is a Team of:

- **Meteorologists,**
- **Model developers**
- **and Pilots**
  - Gliding
  - Aviation
  - Ballooning

Soaring Websites Features of TopMeteo

- View 10 Regions in U.S. - Charts include thermal height xx digit plots, Cloud Distribution, Potential Flight Distance, Winds aloft and Precip
- Satellite visible/infared false color GOES-16 15 minute intervals – Radar overlays
- Detailed Site Location soaring data in table form – Locations can be edited
- NOAA GFS model initializes regional model.. runs four times per day; 4-6 day forecasts - easy to compare
- PROs – Simple to use; avoids technical details
- CONs – Geo-referencing background maps need improvement; Difficult to read xx digit thermal heights

Soaring Websites XCSkies V3



Soaring Websites RASP

- Regional Atmospheric Soaring Prediction - BLIPMAP
- Dr Jack's original framework for running the WRF model
- Primarily maintained now by Paul Scorer
- Check out: rasp-uk.uk/info.html
- And drjack.info/RASP/
- Open sourced… volunteers around the world delivering web soaring services
- Many sites maintained with thousands and thousands of labor hours
- Thanks!

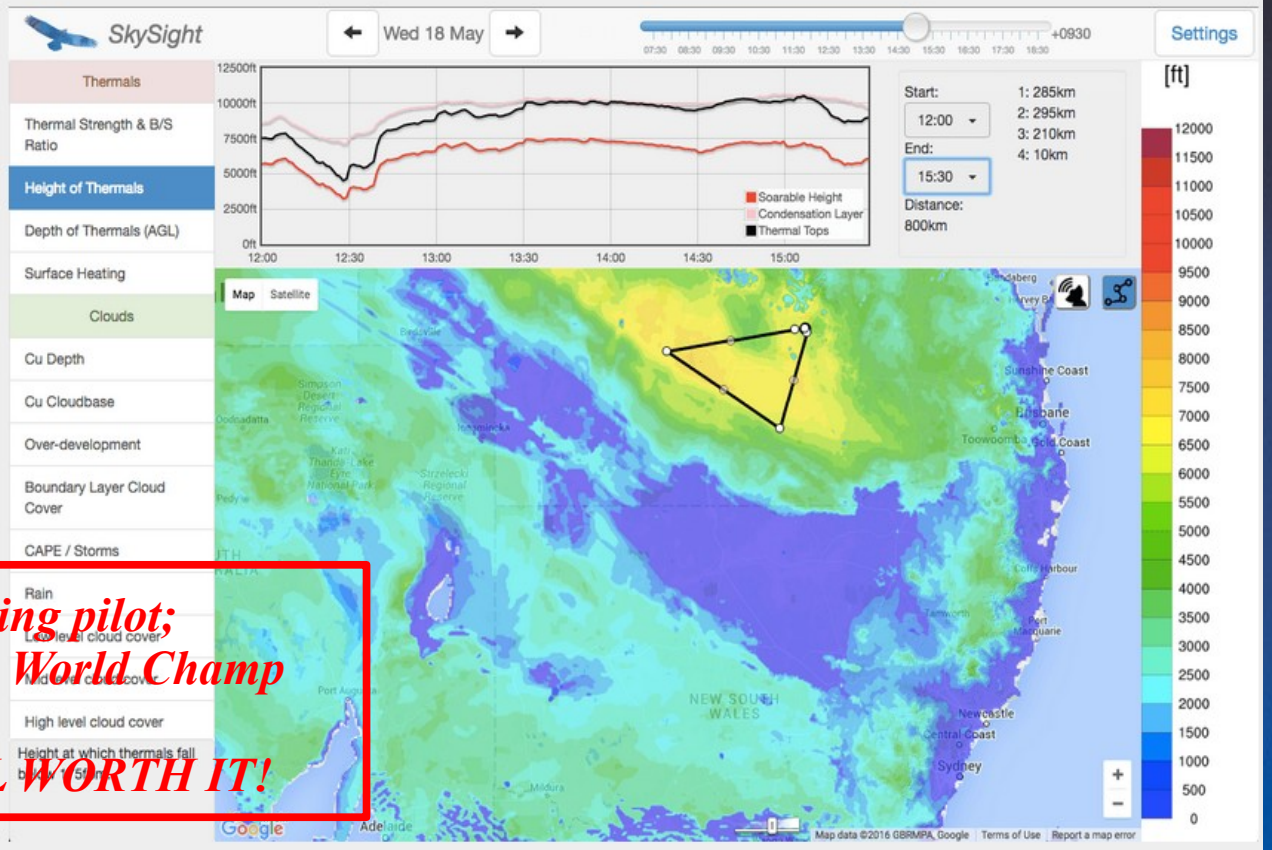
Soaring Websites -What's ***Skysight.io***

SkySight

SkySight | About | Technology | FAQ | Pricing | Contact

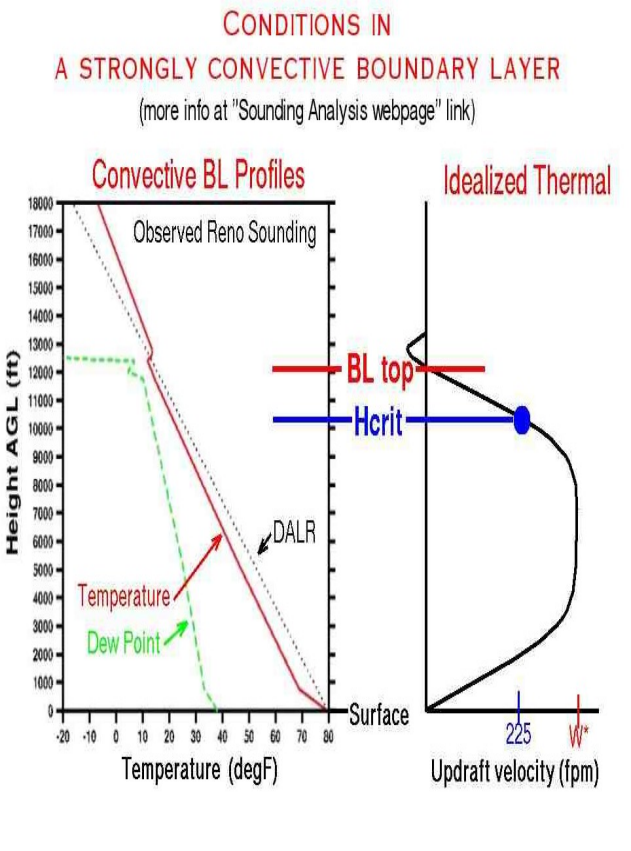
SkySight is the next generation soaring weather forecast for Australia, South Africa, Europe and North America

- 5+ days forecast range
- Half-hourly time steps
- High resolution forecasts
- Route forecasts
- SkewT forecasts
- Modern user interface
- Phone & Tablet friendly



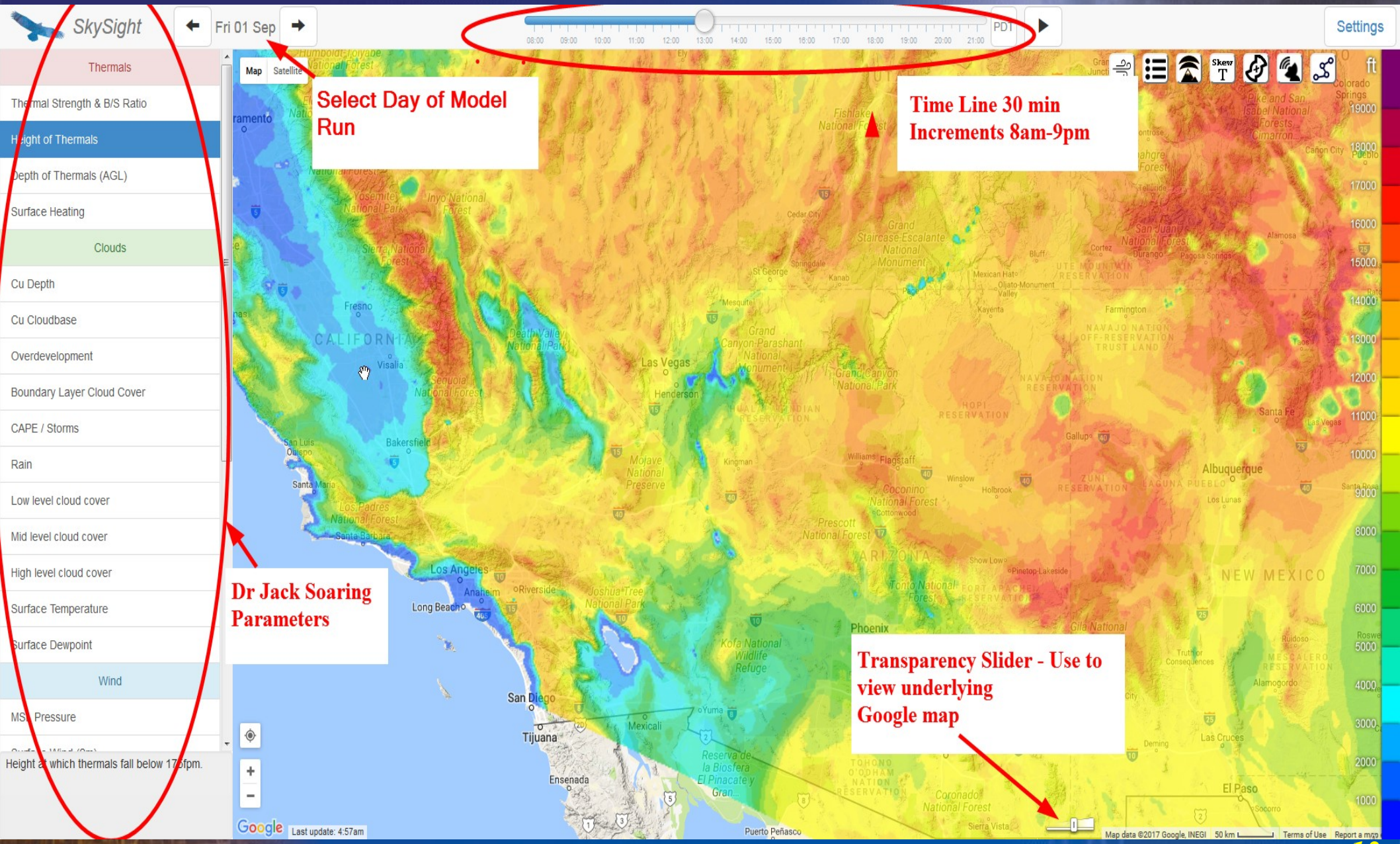
Matthew Scutter – Australian racing pilot;
Google software engineer. Junior World Champ
- Started in U.S. March 2017
- $10/month or $79/year – WELL WORTH IT!

Review Soaring Parameters

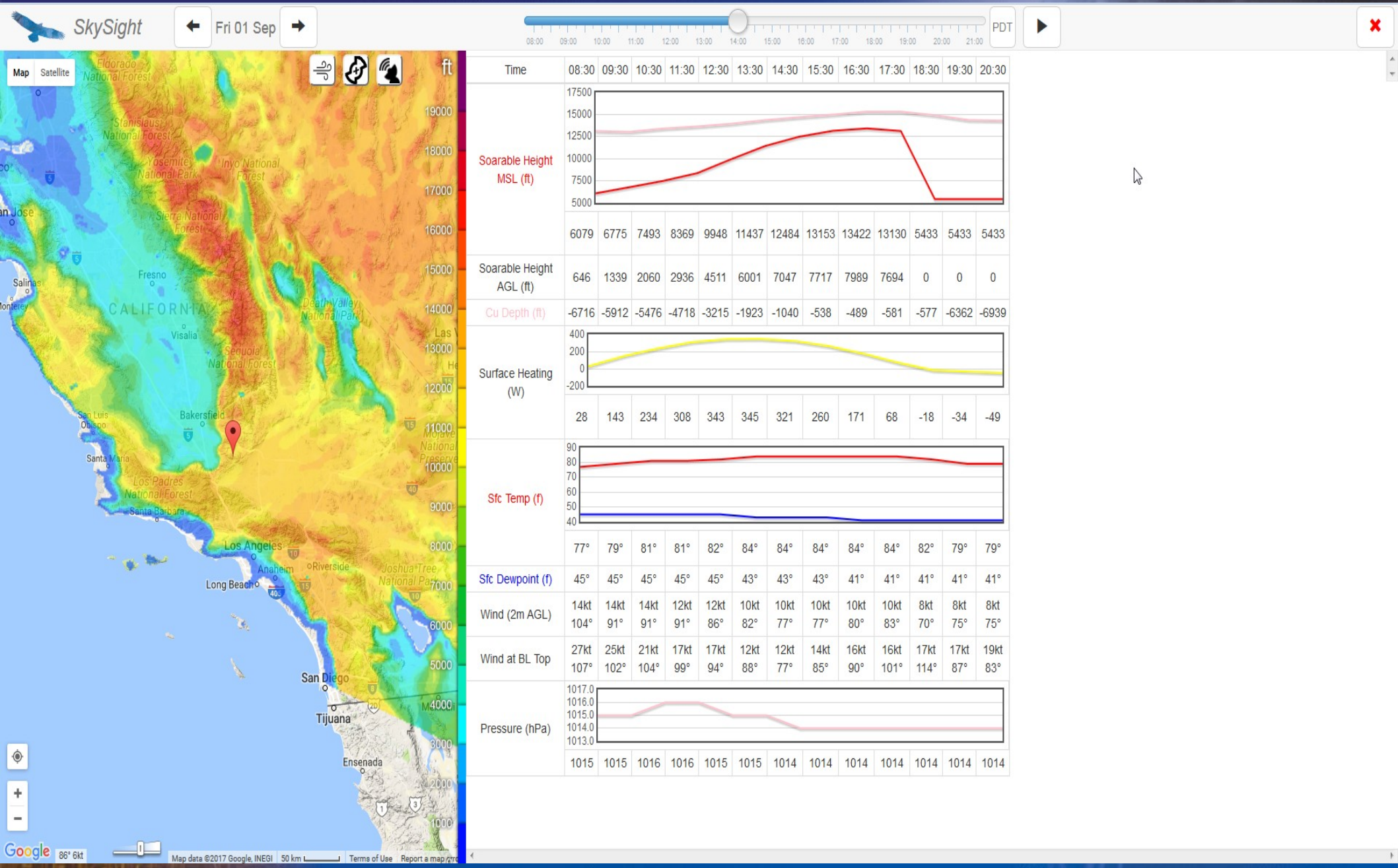


- Height of Thermals Maximum
  - TI=0, Max Hgt, PBL Hgt, Mixed Layer Height, Thermal Tops
- Top of Usable Lift
  - Hcrit, Top of Usable Lift, Height of Thermals (Skysight) – 224 fpm
- Cu Cloud Base and Coverage
- Convergence – shear lines
- Thermal Strength, W-star, fpm
- Buoyancy Shear Ratio - >5 is good

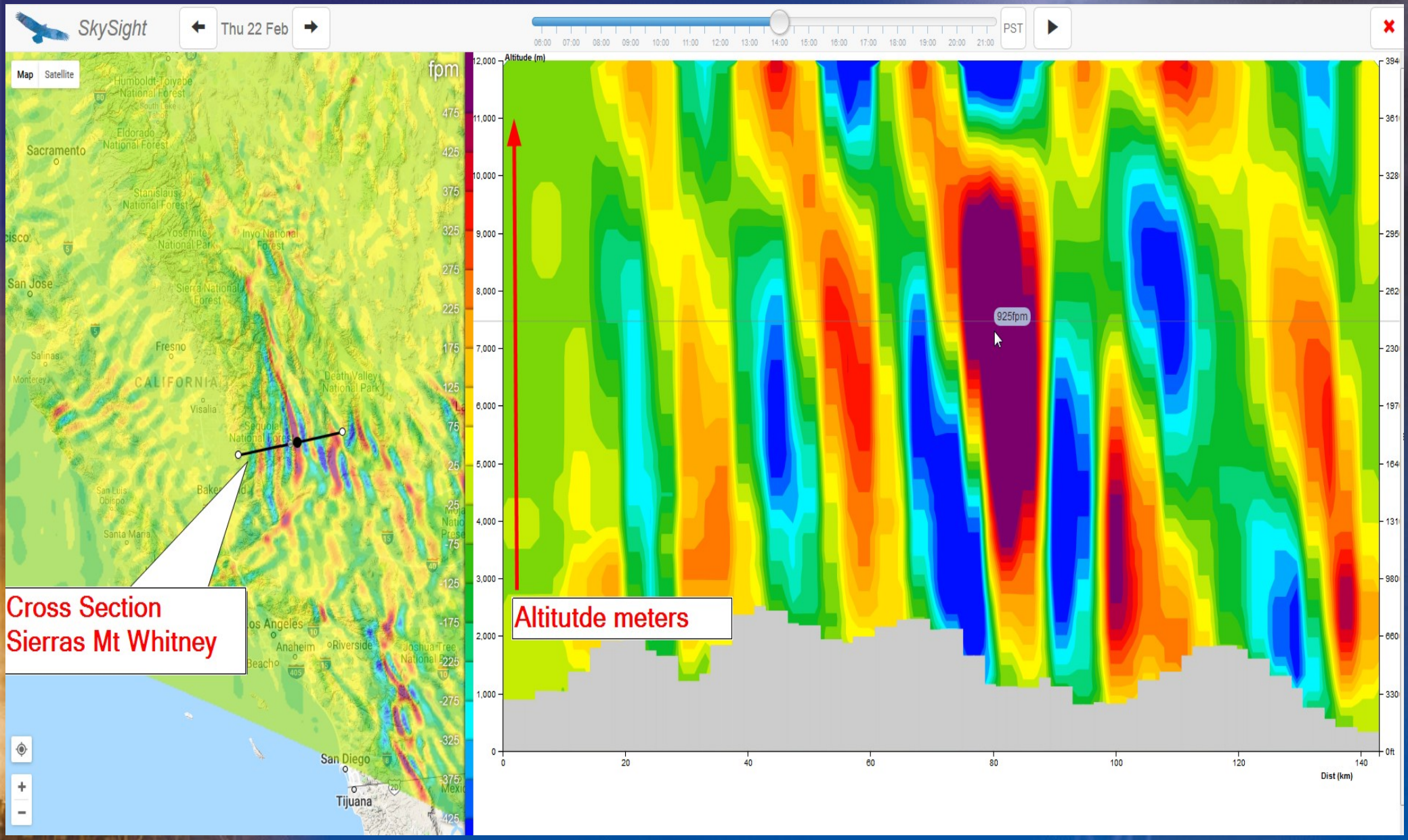
SKYSIGHT Demo



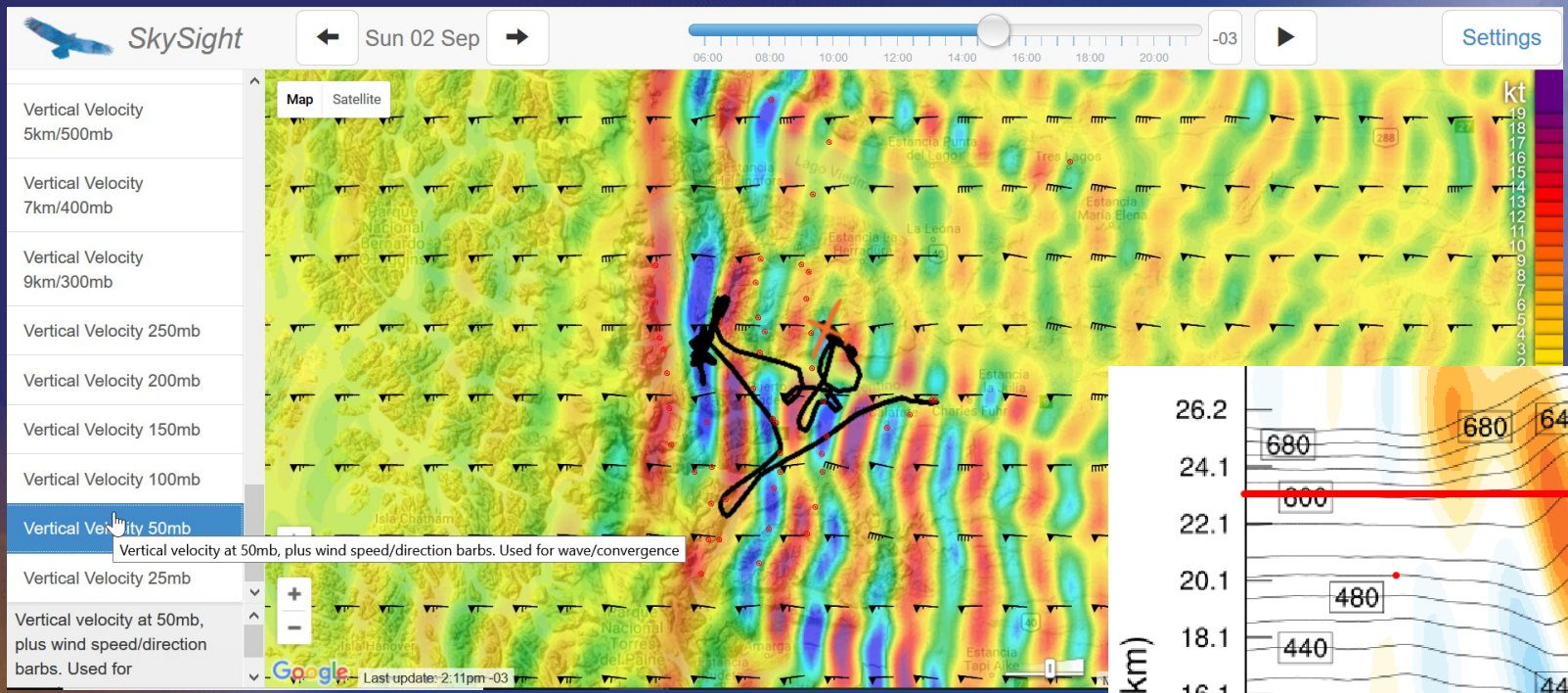
SKYSIGHT Demo

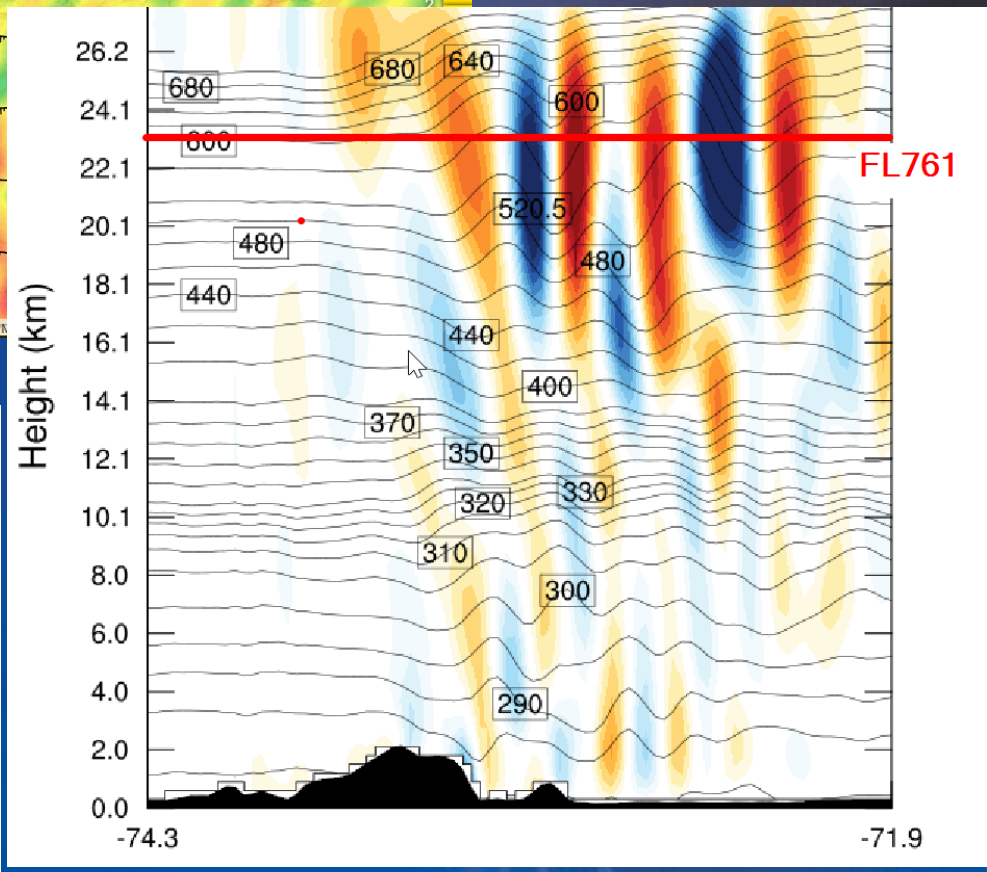


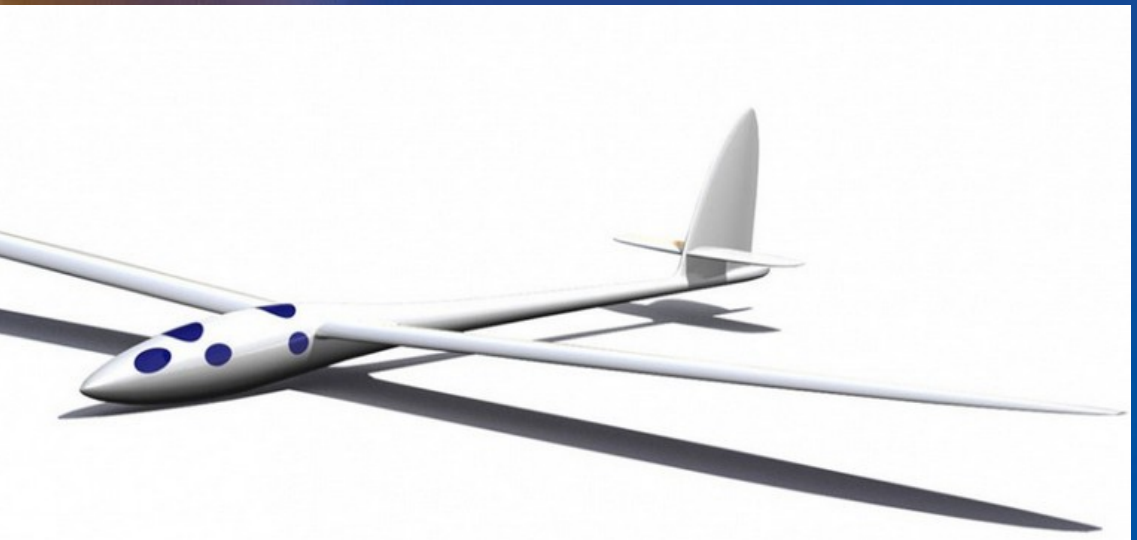
SKYSIGHT Demo



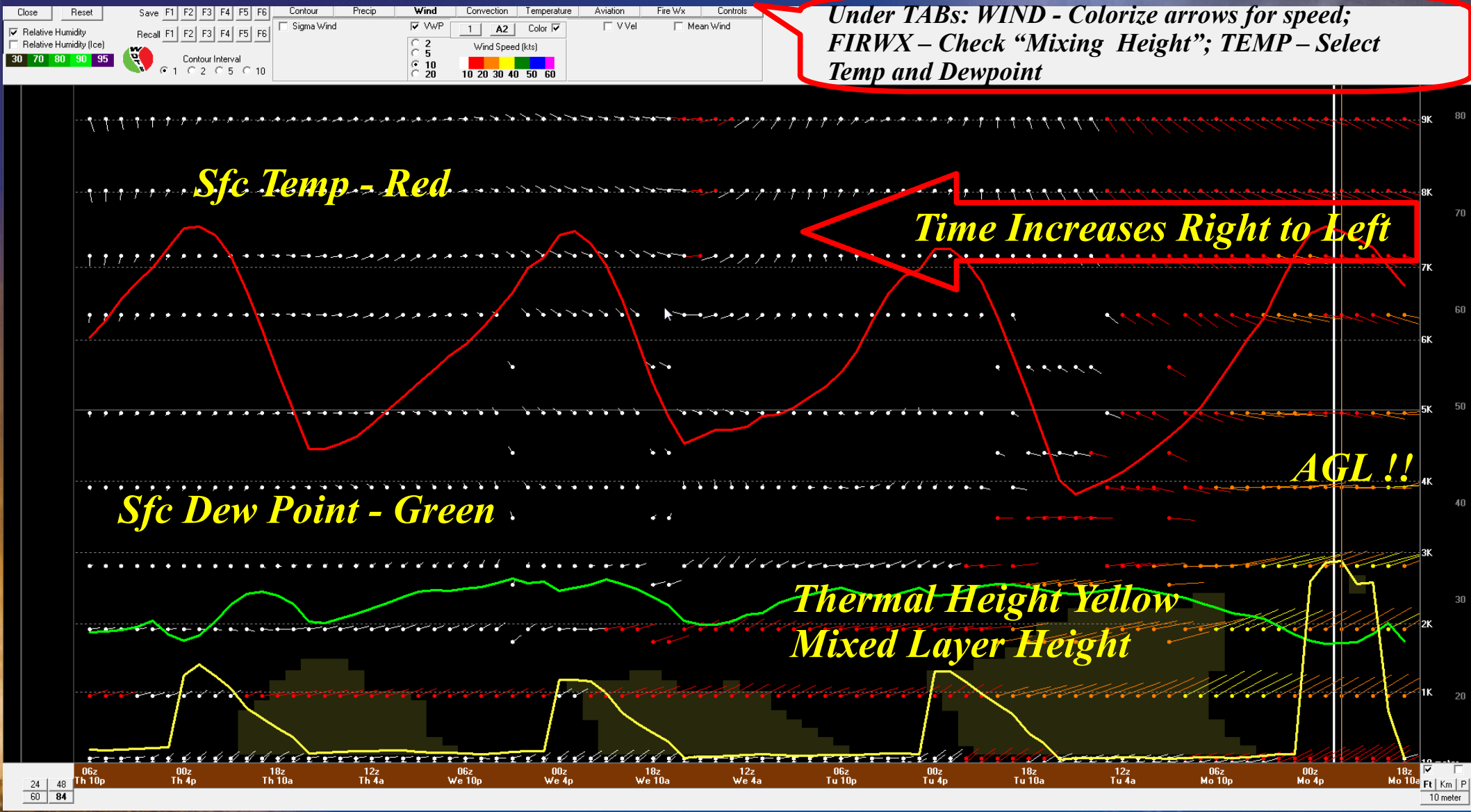
Perlan 2018 - FL761



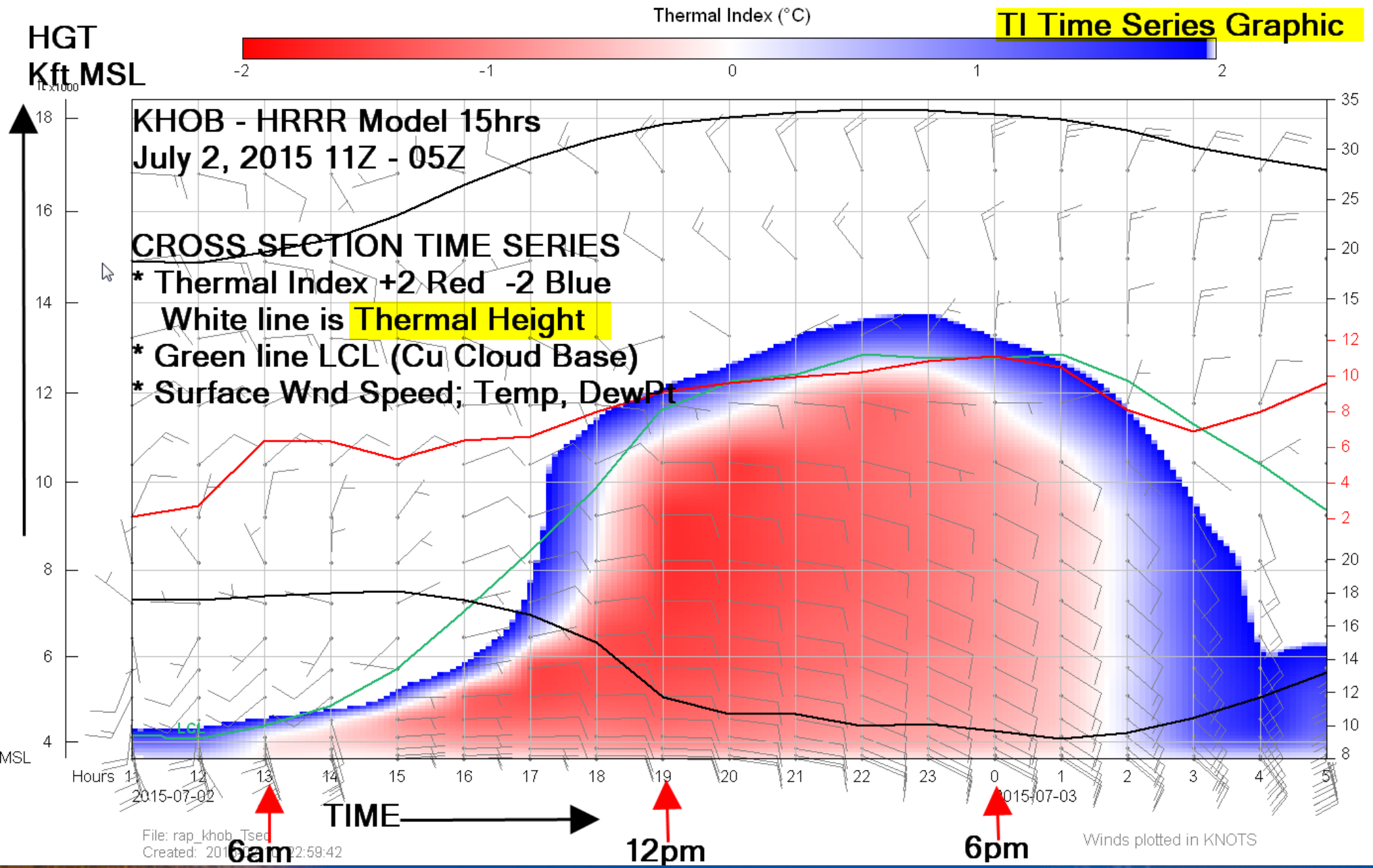




BUFKIT Sounding Viewer OVERVIEW

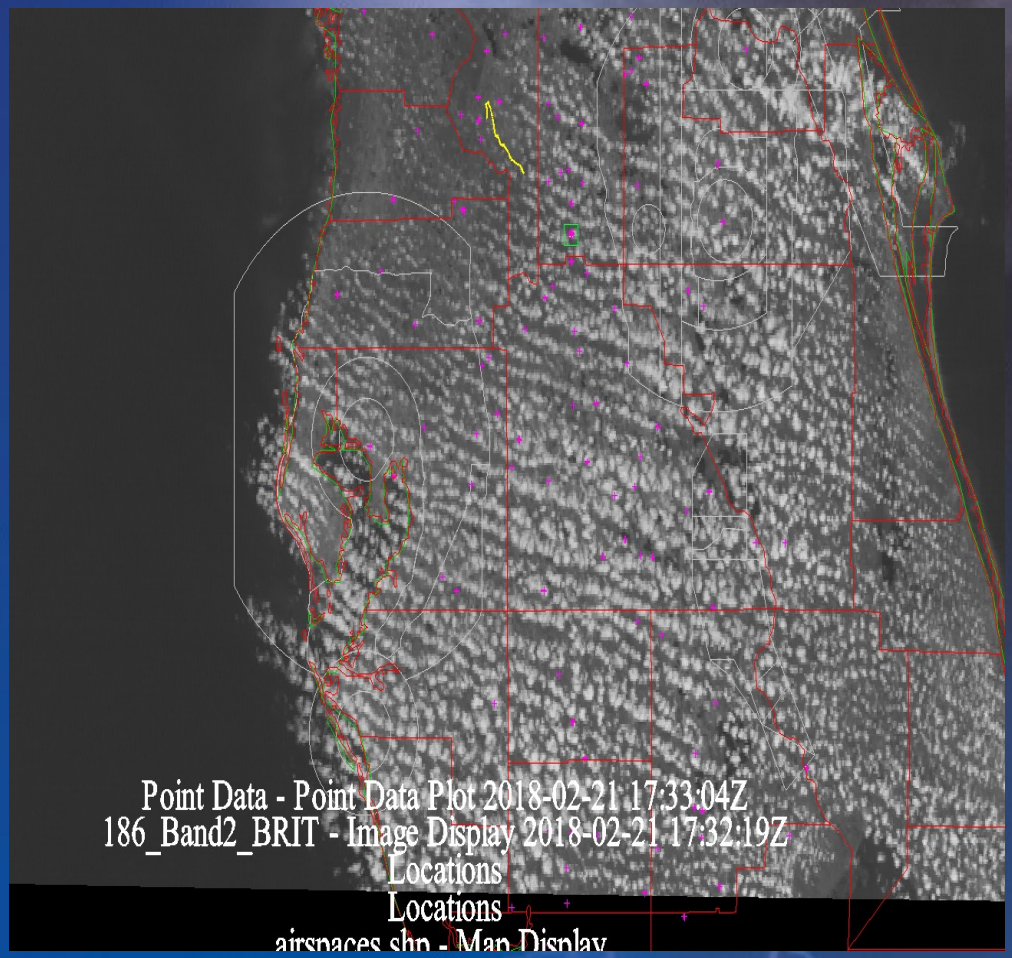


RAOB.com
Time Series Thermal Plot



Observational Sources GOES-16,17 Satellites

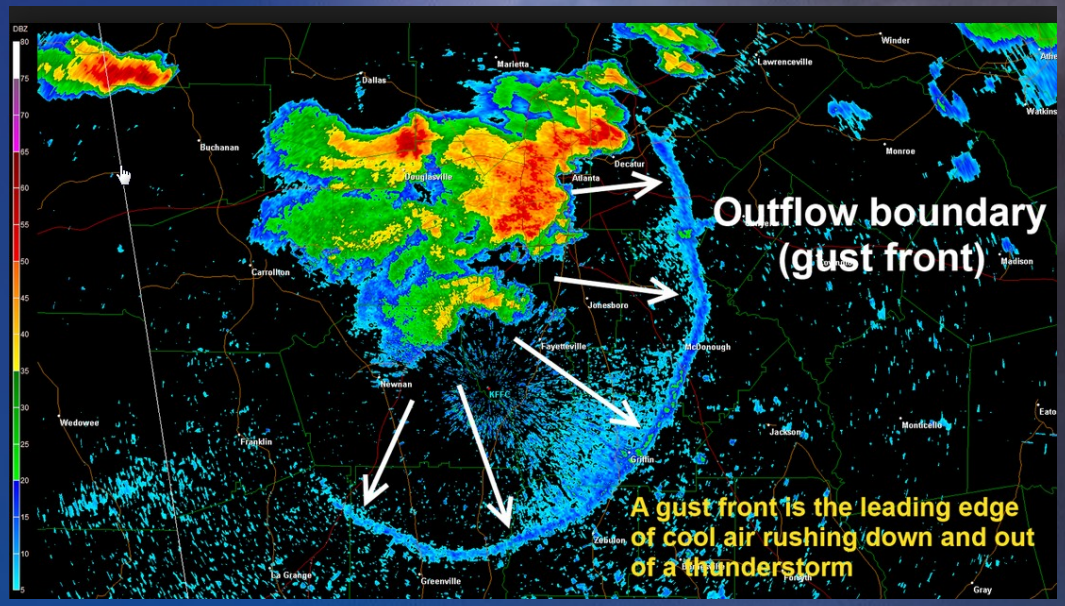
- Enhanced visible resolution 0.5km – Red Channel
- Update rates 5 mins; 1 min in special mesoscale sector
- Sixteen vis/infared channels.. improved dynamic range and sensitivity
- Lightning mapper
- posting site:
  ssa.org/SoaringWeather

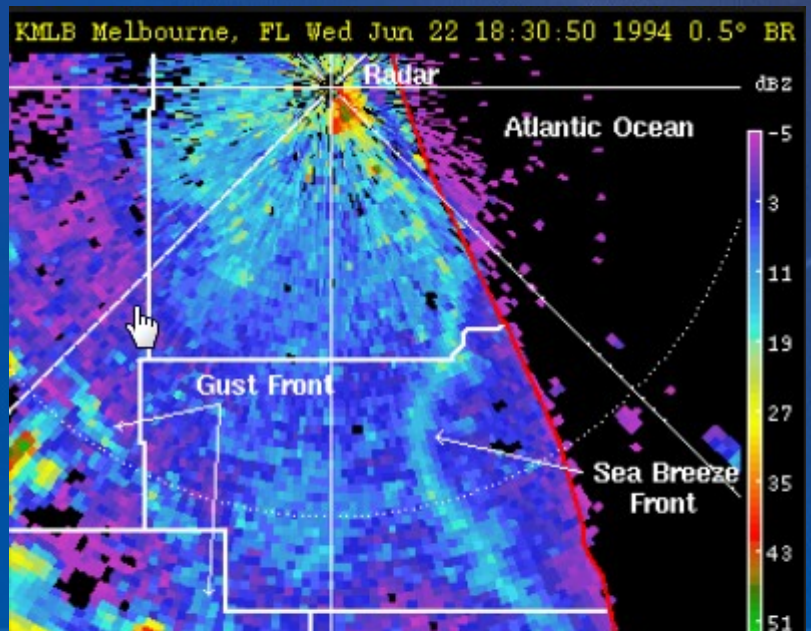


Example animation GOES-16 Seminole area Overlaid with igc glider track… John Mittel In yellow 10min trace. Airspace, TP plots And county lines. Click on to see mp4 video

Observational Sources RadarScope – PDA App

- Low Latency High Res Data!
- You can see clear air outflow boundaries, sea breeze front … and sometimes shear lines
- Precip hydrometeor types including hail
- Lightning data animation… not very common on other PDA radar apps
- Shows NWS warning polygons
- Great tool for after landing… Decide on “boxing it up”





In my opinion, RADARSCOPE is the best PDA app for gliding… It will use GPS to Display currnet location

Observational Sources
Mosaiced Radar - MRMS

MRMS
multi-radar multi-sensor

MRMS
multi-radar multi-sensor

Operational Product Viewer

2018 Feb 27 01:52 UTC

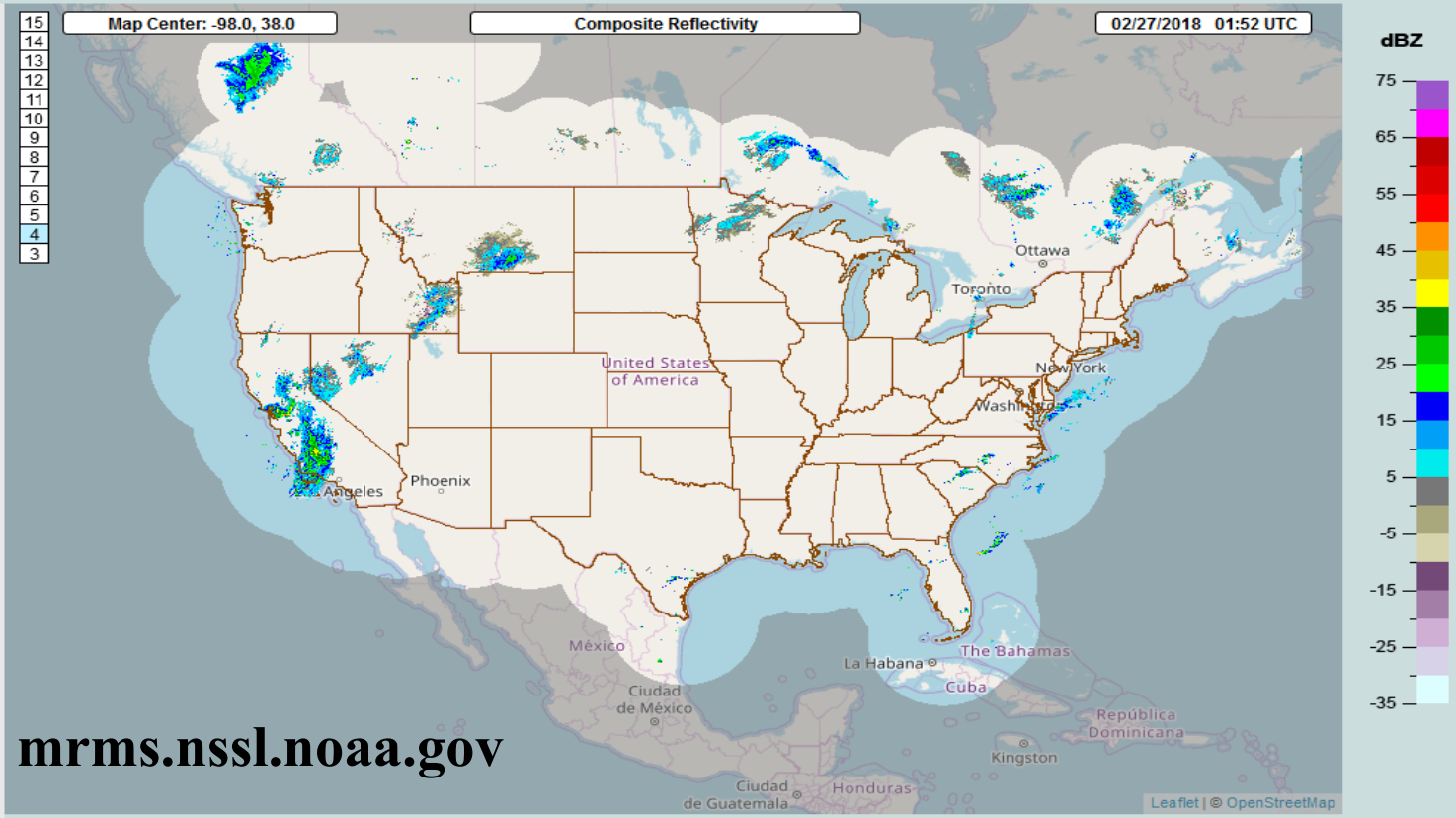
:00	:02	:04	:06	:08	:10	◄ 2 min ►
:12	:14	:16	:18	:20	:22	◄ 4 min
:24	:26	:28	:30	:32	:34	◄ 10 min
:36	:38	:40	:42	:44	:46	◄ 30 min
:48	:50	:52	:54	:56	:58	◄ 1 hr
						◄ 6 hr
						◄ 1 dy

Current Time Auto Update

Product Type

Base Reflectivity	CREF
Composite Reflectivity	Max Method
Seamless Hybrid Scan	1 hr Max
Refl At Lowest Altitude	Un-QC'ed
Layer Reflectivity	Height
Echo Top	
Layer Thickness	
3D Mosaic Levels	
Radar Quality Index	
Rotation	
Hail	
Lightning	
Gauge Influence Index	
FLASH	
Q3 Radar Only	
Q3 Gauge Only	
Q3 Gauge Corrected Rad	
Q3 Mountain Mapper	
Vertically Integrated Water	
Bright Band	
Precipitation Flag	
AutoNowCaster	

Opacity 0% 100%



Loop Image Reset Region mPING Legend Overlays

Enable Mouse Wheel mPING Reports None Base Map Layer

Previous Presentations and Resources

Soaring Society of America (SSA):

www.ssa.org/SoaringWeather?show=blog

Commercial Web Services for Gliding:

Skysight.io
TopMeteo.com
XCSkies.com
www.drjack.info/RASP/

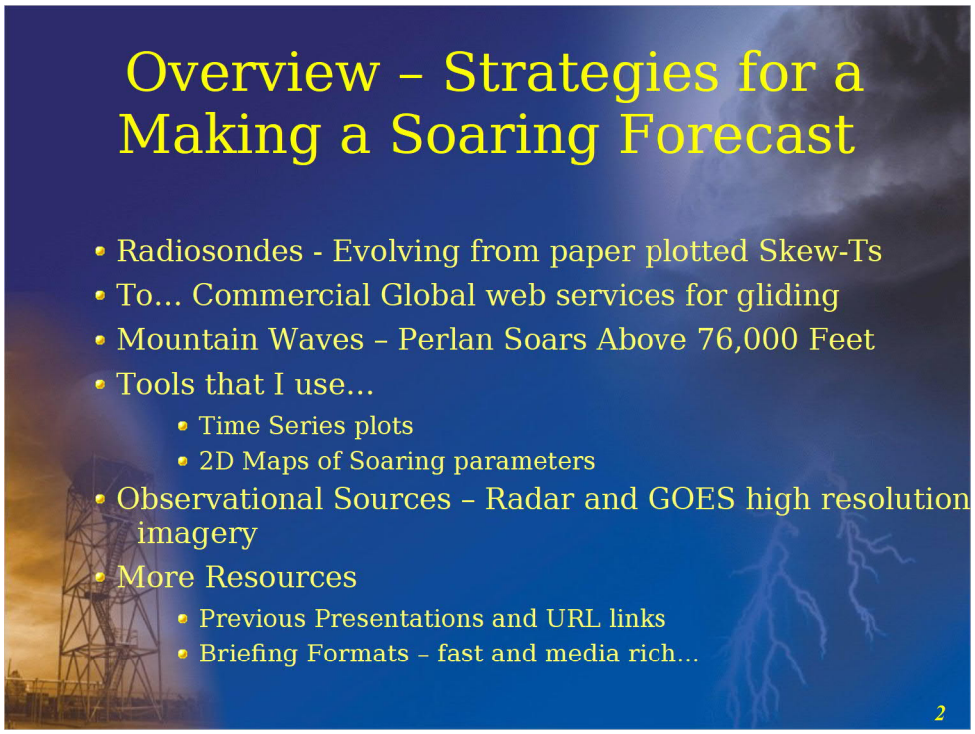
Perlan Project: perlanproject.org
Perlan Mission II: Three World Records in One Week
youtu.be/YmBoqvv0u5k

Collaborative Briefing Server: Codimd.org
More resources for soaring weather tools:
demo.codimd.org/s/S1AhBjL-r#

Hello... my name is Walter Rogers... also known as "WX" when in my Discus 2a. It's been 53 years since I started gliding at El Mirage Field. I've been watching the weather since I was a kid... always interested in meteorology. After numerous cross country hours in gliders, Regional and National championships... and 42 years with NWS ... many of this in aviation weather...I've learned a thing or two about soaring weather

Although this talk will survey a lot of soaring numbers from web sites and services... remember... it's easy to get lost in all the details. Don't sweat the details... look for the big features and day to day trends. How cloud cover and rain showers/thunderstorm convection will affect the soaring day is far more important to get a handle on than any of the "soaring parameter" numbers.

This talk will also cover new observational and model developments technology



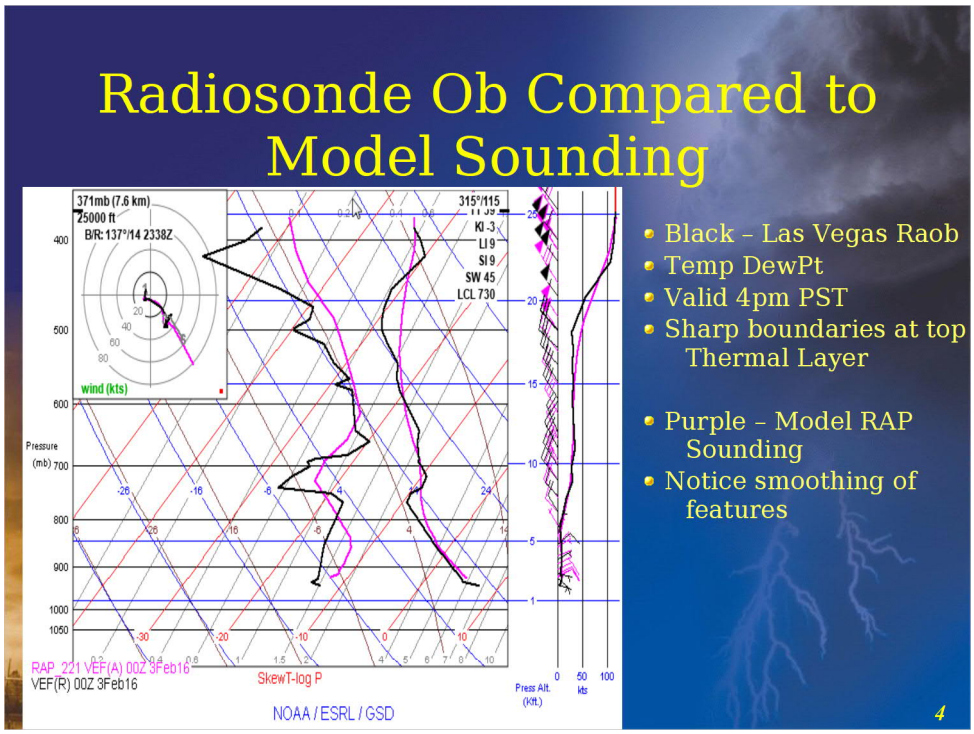
- We've come a long way from 40 years ago when soaring forecasts were based on plotting a balloon sounding (radiosonde) and analyzing it for the current days thermal heights
- By the 2010's… Soaring Web Services analyzing gliding weather parameters from NWP models took over
- This survey will give you a brief guide map to the services now available
- Mountain waves or gravity waves can now be detected by high resolution models. Perlan took advantage of this to set the world altitude record
- We'll look at the forecast tools I now use… time series plots and 2D maps
- … and the latest observational sources using radar and satellites

Radiosonde – Legacy Obs

- Radiosonde Obs
  - Twice/day – 12Z 00Z
  - Approx 800 world wide; 92 U.S.
  - Detailed vertical temp, wind and rh data
  - Several 100's km separation from soaring forecast location
  - Not a good soaring forecast solution - Good for analyses

3

- 12Z/00Z is 8am/8pm CDT ... 5am/5pm PDT are the designated internationally agreed times for radiosonde launches
- Balloon sounding are too sparse in both space and time



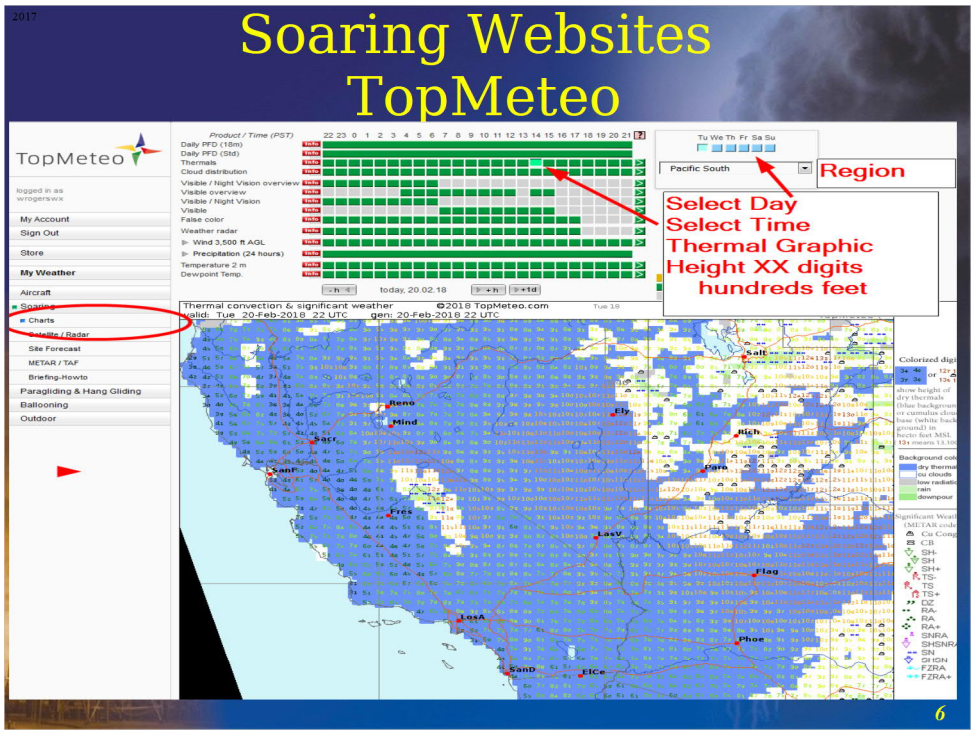
Radiosondes have much more detail and vertical resolution than the NWP model analyzed equivalents.

This example is from Bill Moninger's NOAA ESRL Interactive Skew-T web site. Much easier to create than plotting by pen and paper

XCSkies, RASP and Skysight are all based on the earlier work of Dr Jack and pioneering framework for displaying soaring parameters. Skysight is highly modified and with a much refined user interface (UI).

Skysight uses the WRF model running cloud services in up to sixteen separate regions around the world.. once each soaring day 8am-9pm ~4km grid for high resolution results. It's initialized by the GFS (NOAA's) global NWP model. Forecasts are available 5-7 days out. The UI make it easy to do day to day comparisons. It performs well in mountainous terrain where convergence lines and mountain waves are a factor

TopMeteo has been evolving for 20-30 years starting in Europe. Now it's run in several large regions across Europe, Africa, and the USA.



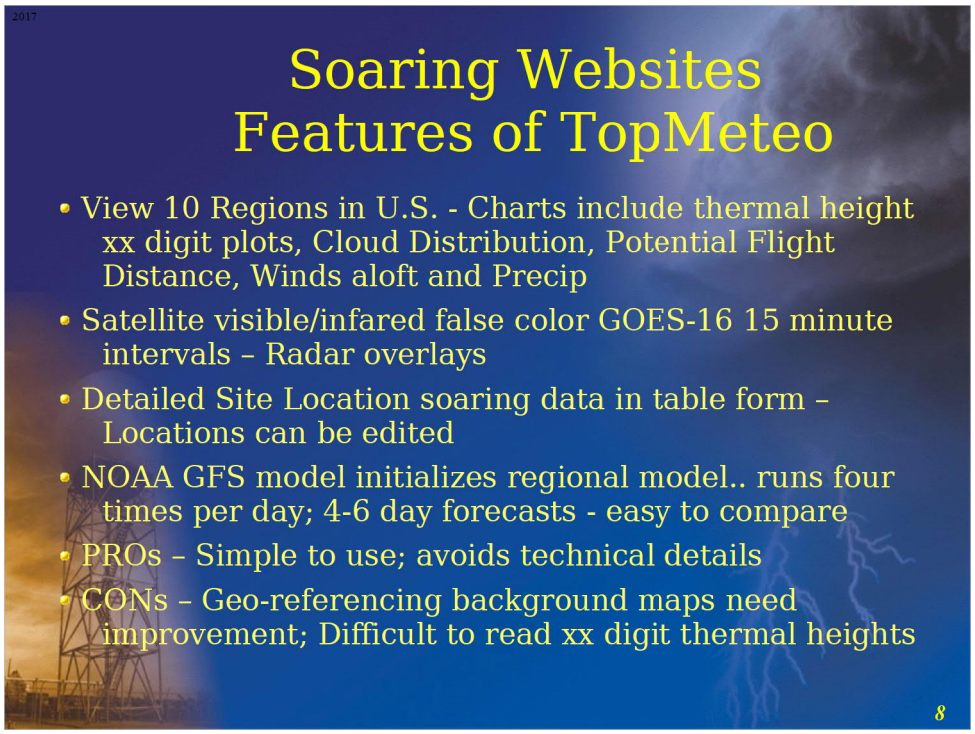
TopMeteo Charts are depicted here... the one most commonly used is for thermals.

Select one of the forecast days (4-6 days out), Region of U.S, and local time. Cloud or weather is plotted along with two digit XX thermal heights in hundreds of feet msl.

TopMeteo was announced for the U.S. at the 2016 SSA convention and released early 2016.

NEW for 2018 ... GOES-16 images

If you want the least technical web soaring service... with just the answers... especially the Potential Flight Distance (PFD), TopMeteo is the best choice.

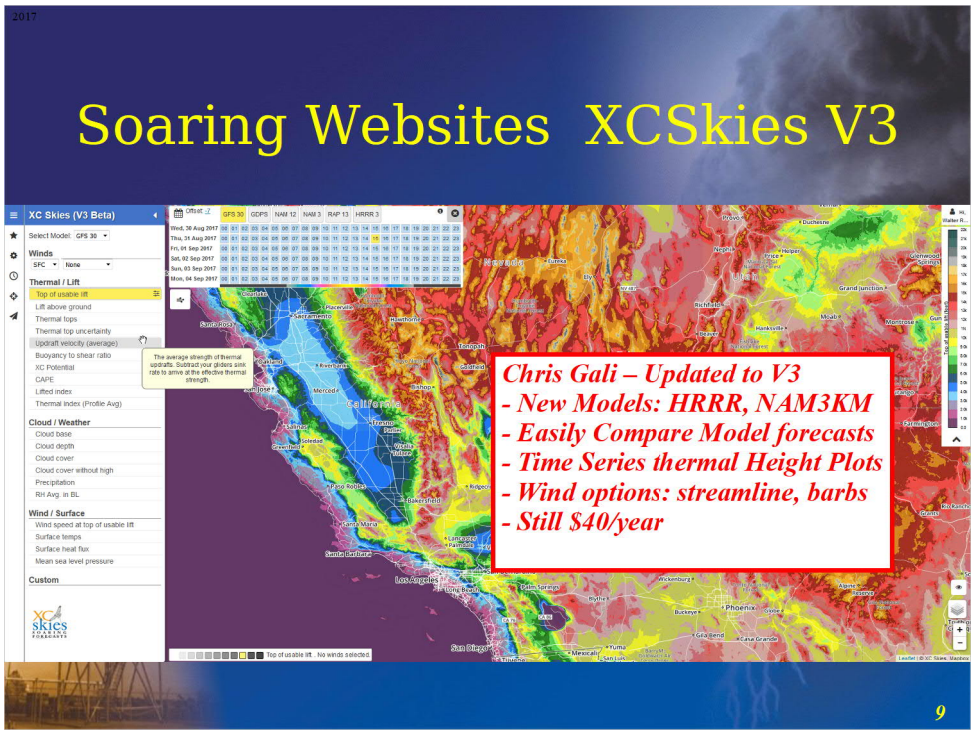


One can view 10 distinct regions in the U.S. ... charts include thermal height, XX digit plots, cloud distribution, Potential Flight Distance, Winds aloft and Precipitation

GOES-16 Satellite images visible/infrared false color at 15 minute intervals plus radar overlays

NOAA GFS initializes a regional model that runs four times per day. There are model runs for days 4-6 in the future

PROs – Simple to use; avoids technical details
CONs – Geo-referencing background maps need improvement; difficult to read xx digit thermal heights



Chris Galli started XCSkies in 2006 for para glider, hang glider and regular glider pilots.

This is the new XCSkies V3 Beta ... Announced March 30, 2017

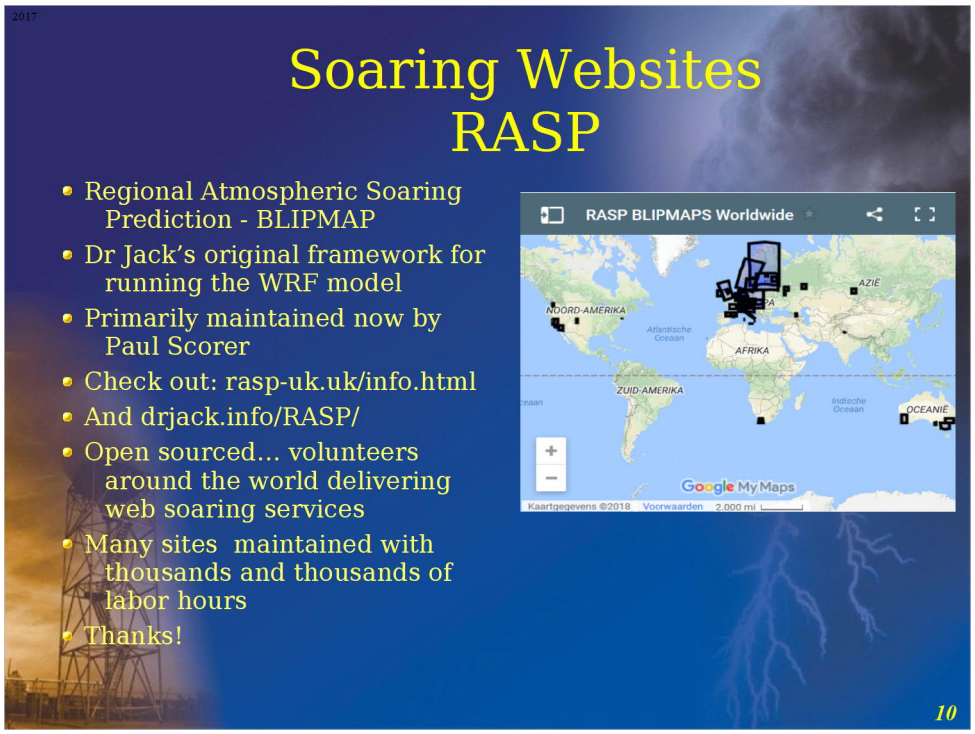
HRRR 3km native sigma levels for all 18 hours run every 6 hours.

NAM 12km hourly through 36 hours and then 3 hourly through 84 hours.

NAM 3km runs for the CONUS on the exact same grid as HRRR 3km.
There's a very nice comparison table tool for checking different models.

RAP 13km for all hourly forecasts run every 6 hours.
GFS .25 degrees, hourly for 5 days.
GFDS Global Canadian model at .25 degrees, 3 hourly for 48 hours, then 6 hourly through 4 days.

* all of these models are still parameterized to 1km resolution.

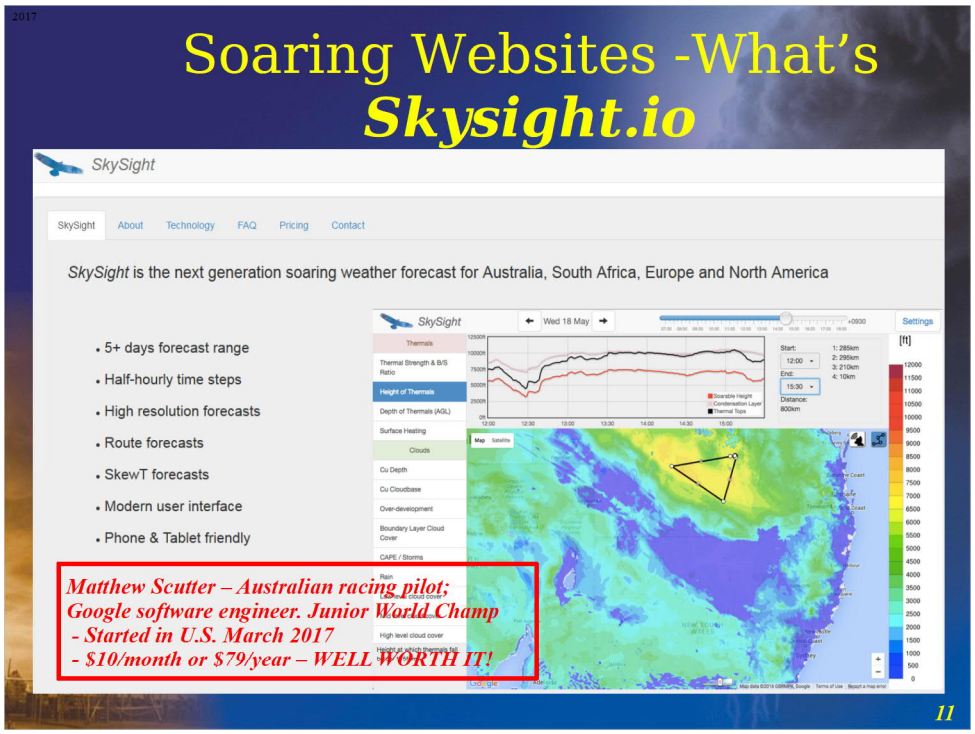


Up to this point I have only discussed the commercially available web soaring services.

Dr Jack still maintains his original NAM and RAP model soaring forecasts at: Drjack.info which serves the original BLIPMAP at no charge.

However, there are numerous RASP soaring web sites maintained by volunteers running their own WRF model in a framework. Paul Scorer in the UK is the defacto maintainer of this framework.

The quality and availability of these sites varies. But, the thousands and thousands of labor hours to create and maintain them is to be commended.



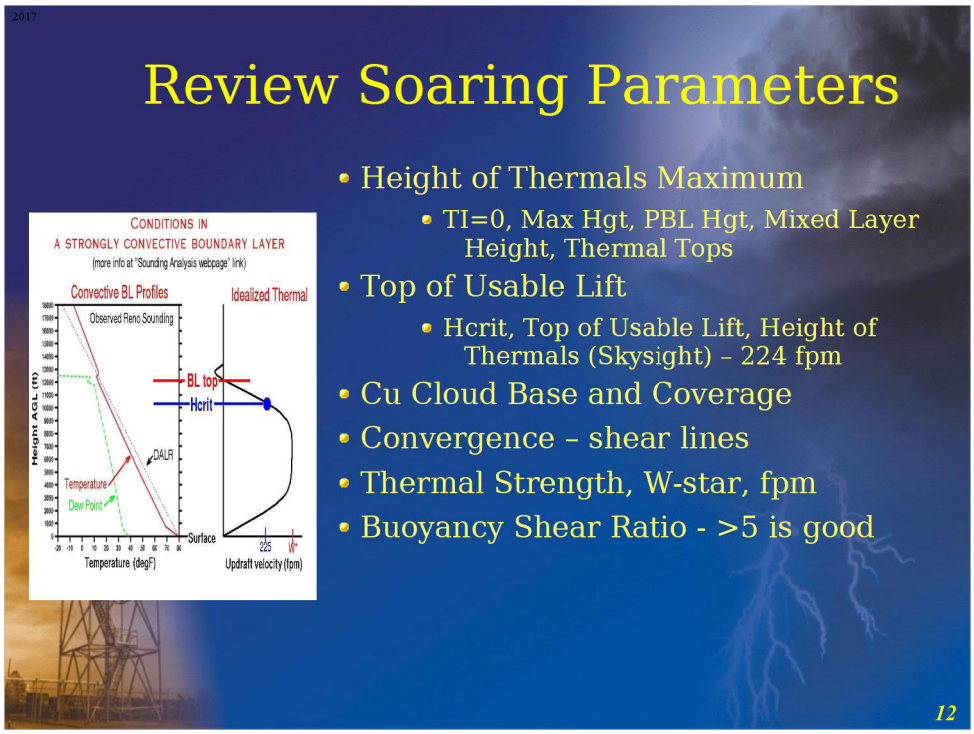
New for 2017 in the U.S. ...

Matthew Scutter's Skysight.io

Although it uses much of the RASP framework, Matthew has greatly enhanced the user experience. Besides being a Google software engineer.. .but now dedicated full time to this service... he really has a knack for scaling "Big Data" projects.

In his spare time, Matthew, races his Discus 2a, and has won a Junior World Championship.

In 2020... Skysight has added numerous features including the ability to important graphics onto modern glider flight computer displays. Check out their "Help" information and a lengthy detailed video overview



Skysight , RASP web sites and DrJack... all use these parameters

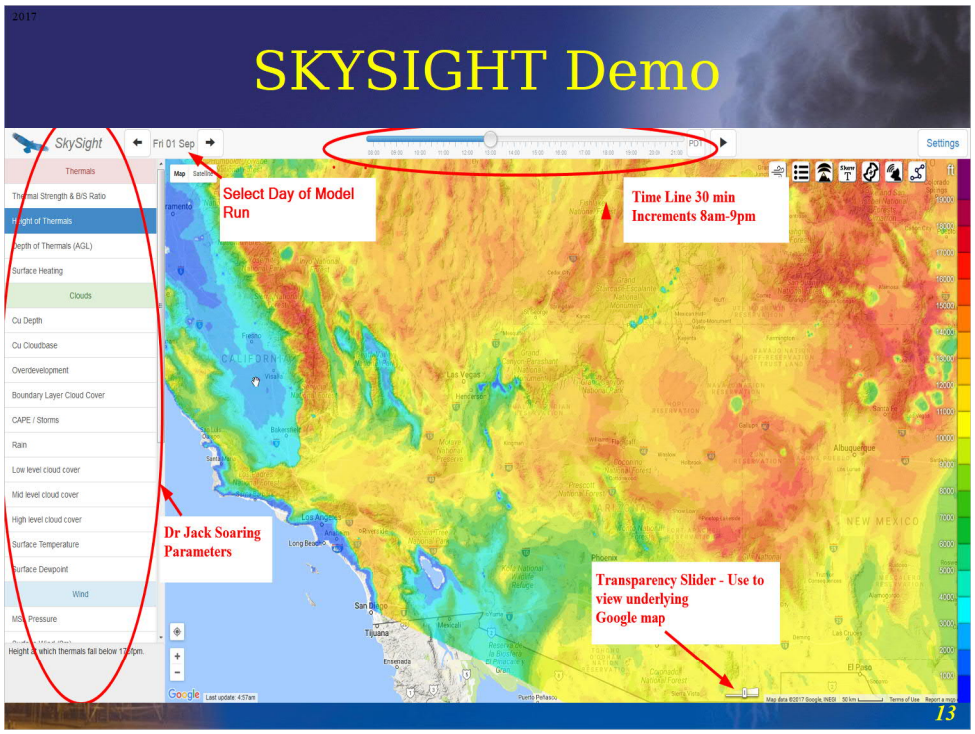
These are the most useful ones in my opinion... in declining order of importance. Thermal tops, max soaring height and cu cloud base are my favorites.

XCSkies uses some of these parameters... but modifies thermal height and strength based on a high resolution (1km) land surface model

TopMeteo... uses their own proprietary version of these soaring parameters. Max heights are either thermal max soarable height in clear conditions... or cloud base.

Convergence zones from high resolution models and cloud cover are very important.

Thermal strength and Buoyancy Shear Ratio ... are my least used parameters

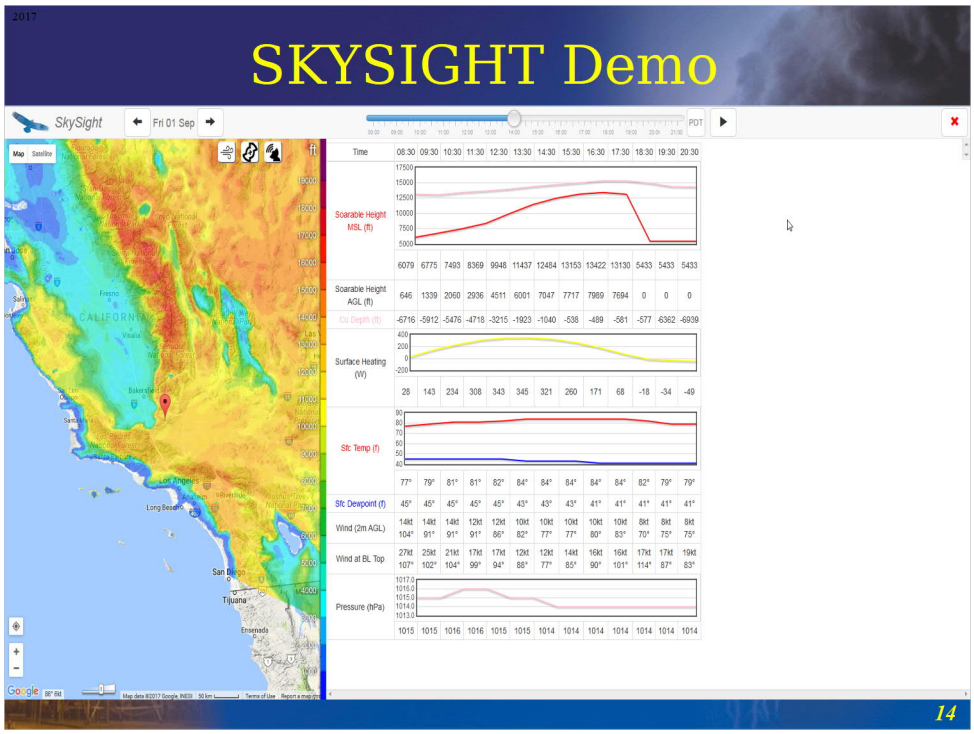


Here are the key user interface elements on the Skysight page. Select:

Soaring parameter, Day (0-5 days out).. or past days, Time during day (30min increments)

To geo-locate... use transparency slider at bottom to view background map

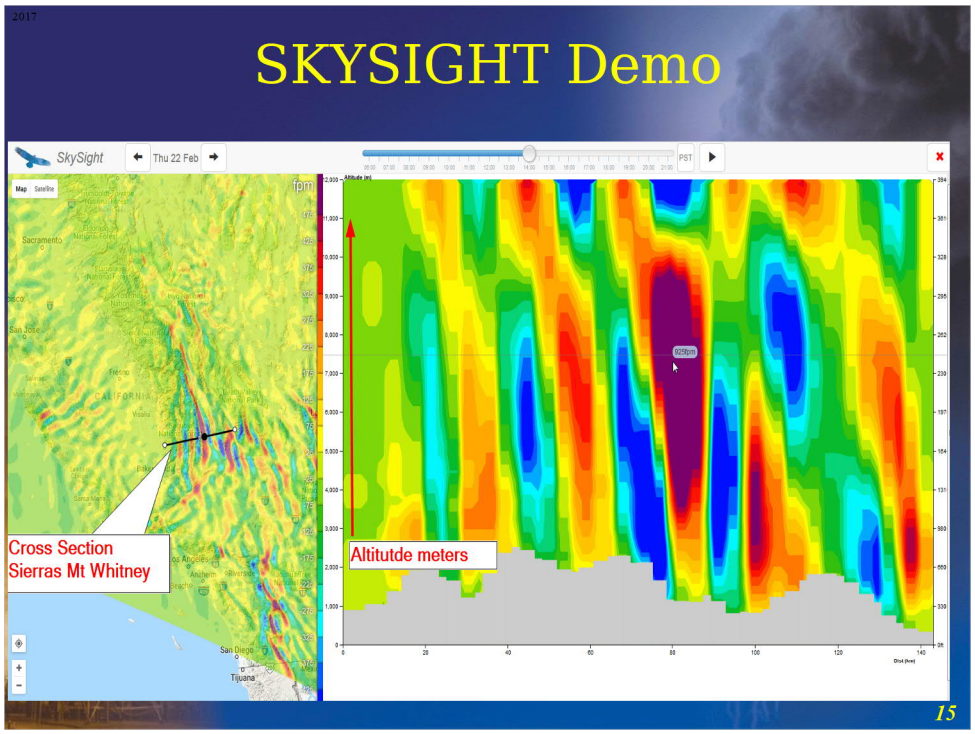
ICONS in top right... have been moved to the left side panel



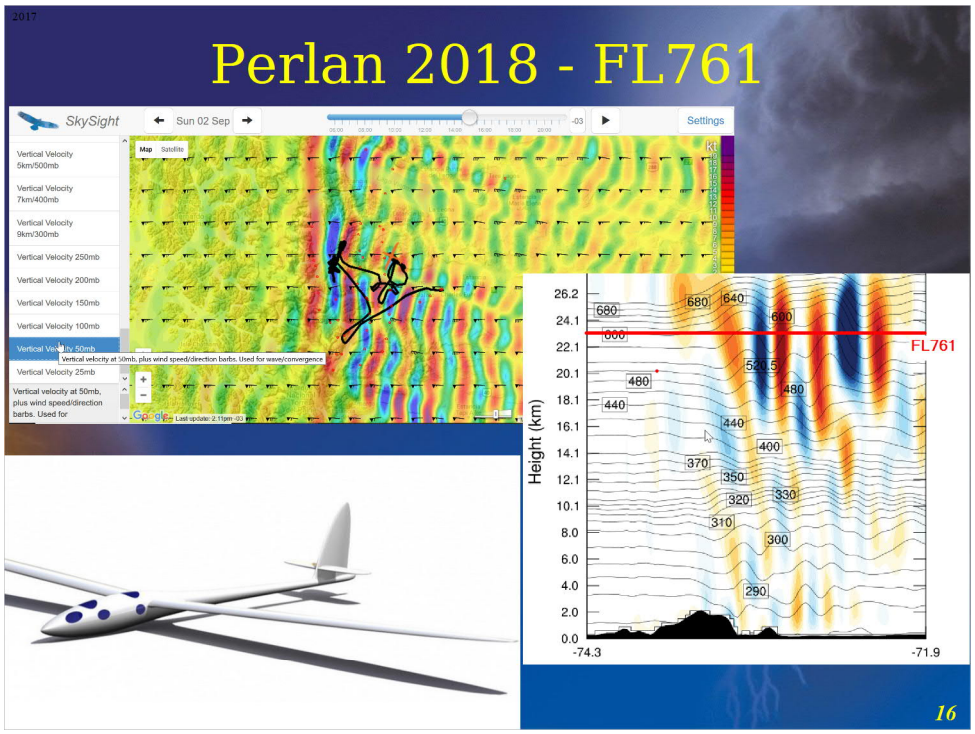
These are the surface parameters and information about the thermal layer

Red is maximum soaring height, comparable to Dr Jack's Hcrit... not the TI (Thermal Index) = zero highest thermal height

The pink higher line is the condensation level or cu cloud base

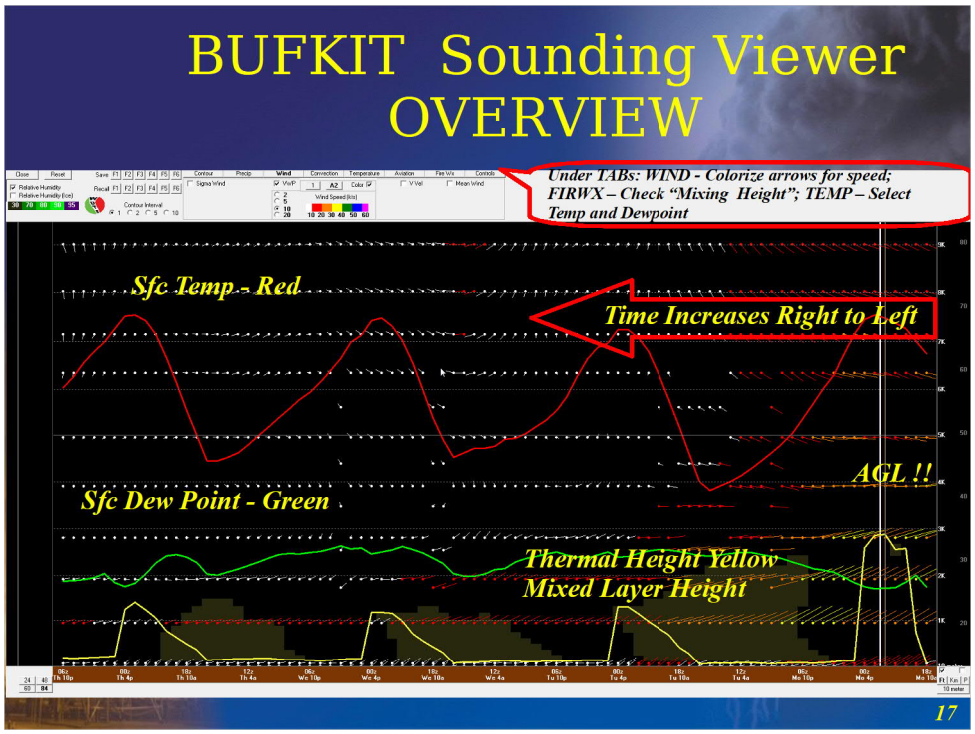


Using the Mountain Wave Icon... one can select a cross section across a mountain range to depict the vertical velocity versus distance (MW strength)



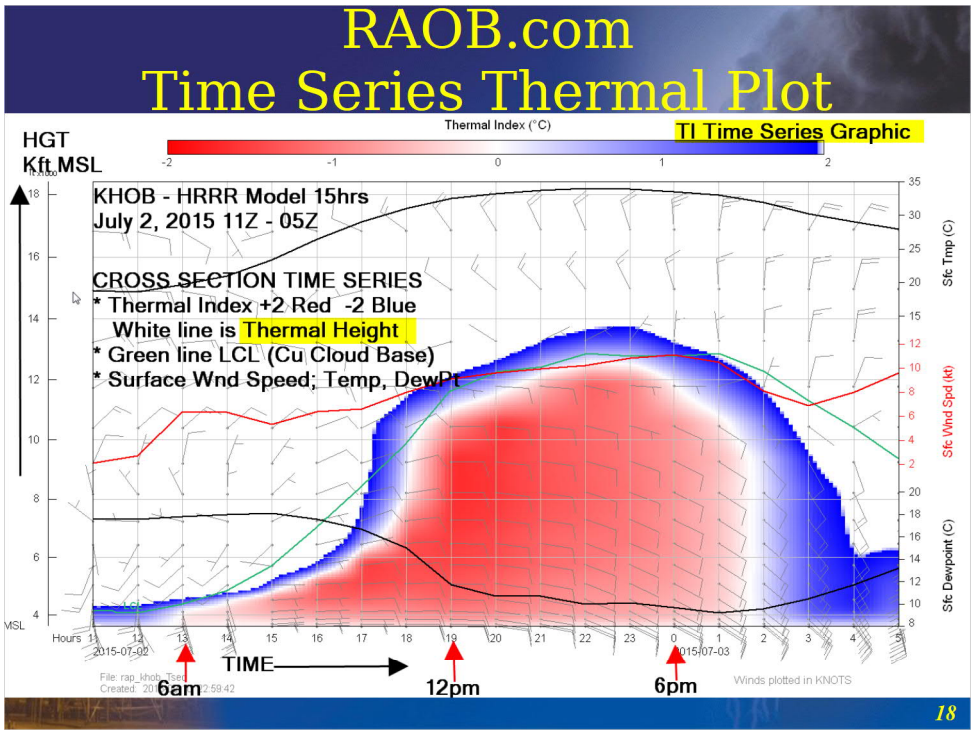
On September 2, 2018 near El Calafate in Southern Argentina, Perlan set the world record altitude for static flight in ALL aircraft... at near 76,000 feet.

Skysight's WRF model and Weather Extreme Ltd's high resolution model aided in finding the optimum location of these stratospheric gravity waves.

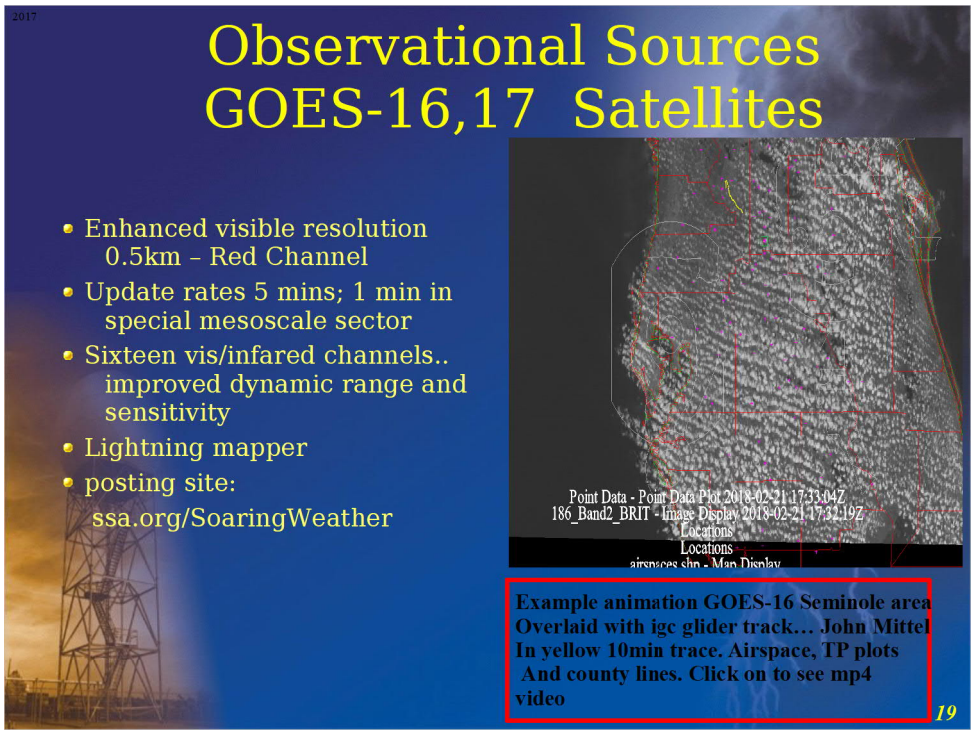


One of the important tools I used are NOAA NCEP model soundings from all the different models. My preferred model is the HRRR operating at around 3km resolution.

These model soundings show great vertical resolution and 1 hour horizontal resolution details in the boundary … or … thermal layer. Here we see yellow lines depicting the mixed layer height, or thermal height. Using the BUFKIT.exe viwer (freely available) one can look at many other parameters as well.



- This capability is the MAIN REASON I use RAOB.com's program
- Ability to look at time/height cross sections display thermal index
- Thermal Index plot is a custom graphic that I created
- It gives you a good idea of the variability in thermal height by looking at +2 DegC Red -2 DegC Blue
- LCL or cloud base is the green line
- Surface wind speed and 2meter (surface) Temp
- Notice that times goes from LEFT to RIGHT
- RAOB is a relatively expensive Windows PC program that takes some time to get used to. But, with scripting... I can rapidly create 24 hour to 120 hour hourly time series plots of the thermal layer



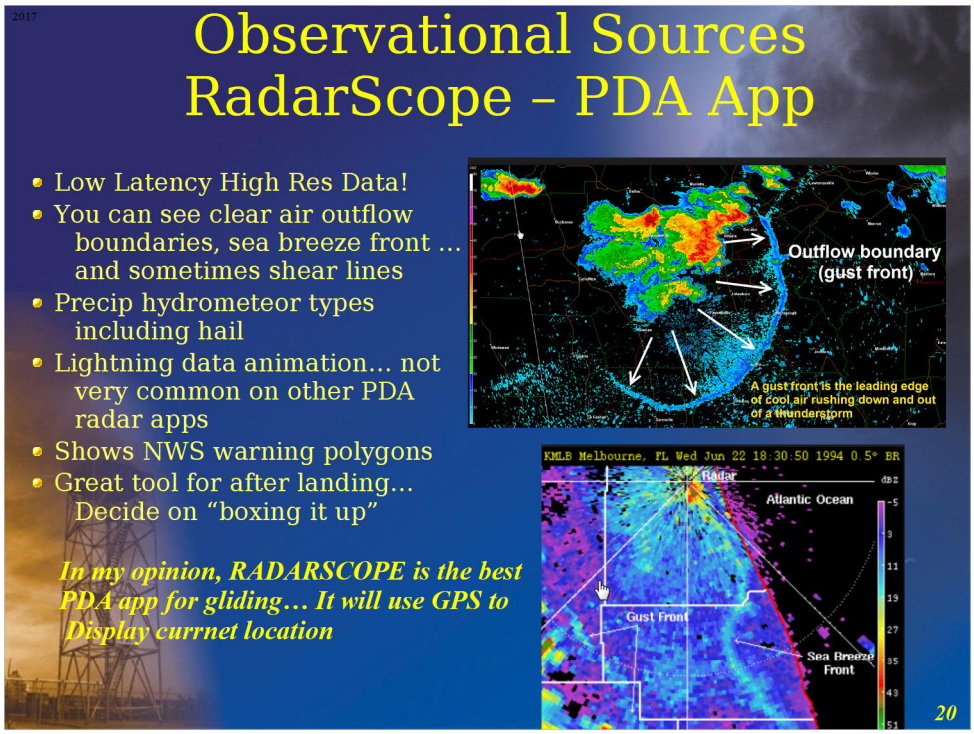
GOES-16 and 17 are now publicly available with 16 visible and infrared channels. It delivers 5min updates to CONUS, 10min global, and 1min to floating mesocale regions. There is a lot of info from GOES program office on this system.

Here, I've created an animation using the Unidata (NCAR) IDV viewer over central Florida... Seminole contest site. John Mittel... unknowingly... contributed his igc file that is shown as a "snail trail" on 5min high resolution imagery. It's only behind real-time by 4 minutes!

College of DuPage... has the best publicly data available on the web for GOES-16. But, with IDV I'm able to add turnpoints, landing sites, airspace and county lines. Check out ssa.org/SoaringWeather NEWS for URL References. Thanks to John Bird for creating netcdf track files from glider track files (igc).

For those of you with programming expertise, NOAA has placed the data in the Amazon cloud S3.

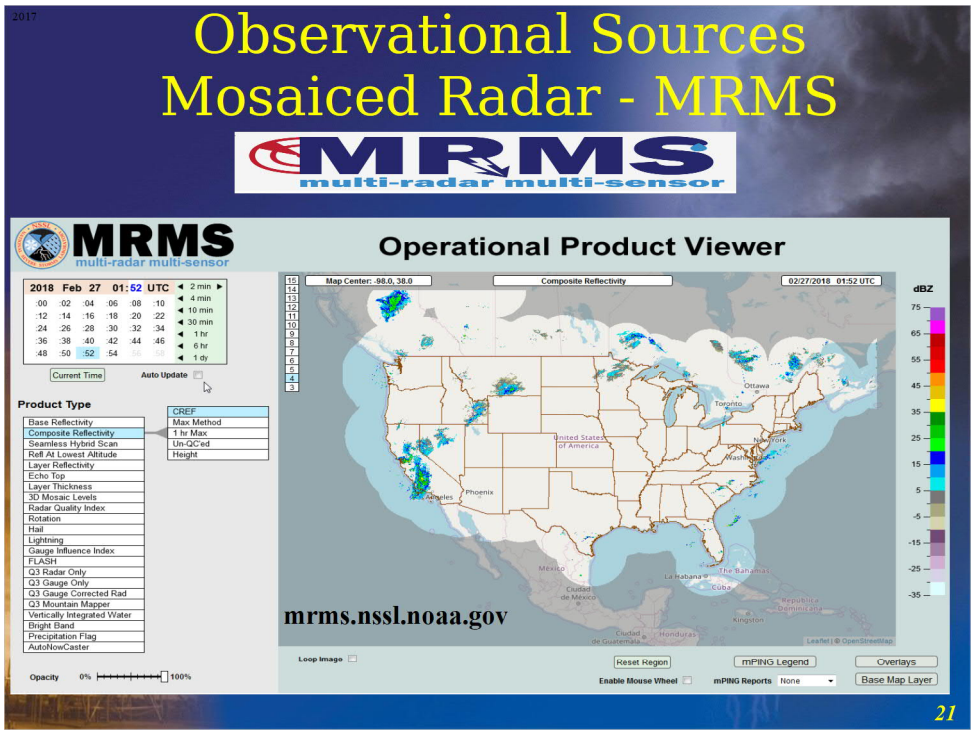
Cockpit real-time imagery is not too far down the road!



It's great for pre-takeoff and post-landing decision support … "Do I de-rig my glider over night?"

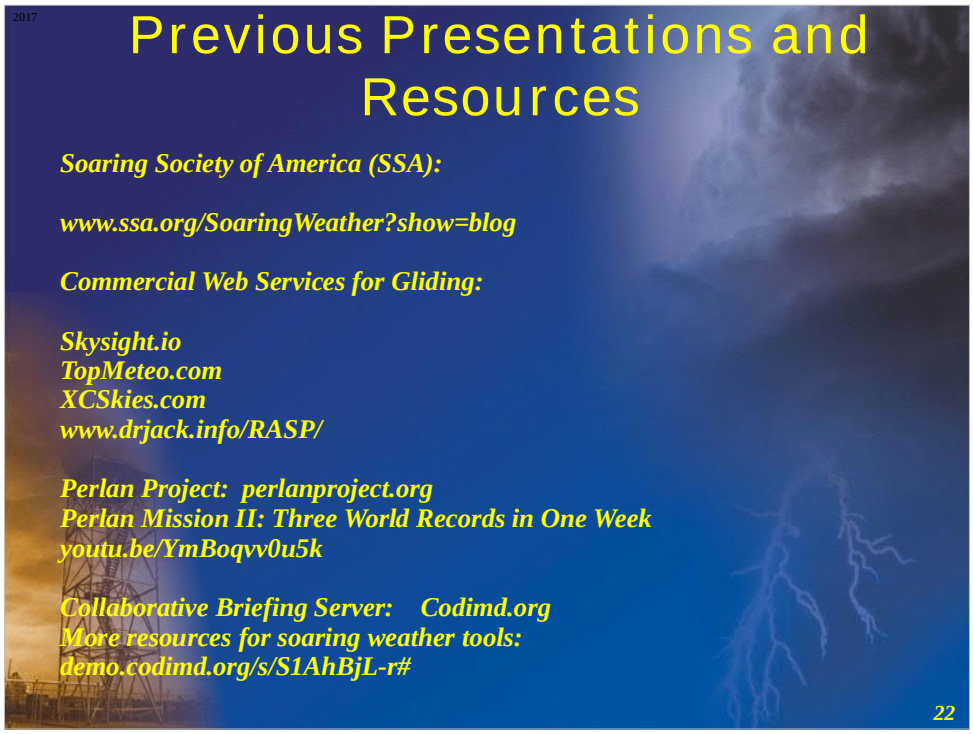
Never have used it in the cockpit
No comparable commercial Radar app for professional use with it's level of detail

With low thresholds of radar intensity (reflectivity) it can see features like these… sea breeze front and outflow boundaries around showers or thunderstorms



The National Sever Storm Laboratory (NSSL) and University of Oklahoma has created this spectacular framework for processing/mosaicing NEXRAD radars.

This web viewer has lots of archived data at varying spatial and temporal resolutions. It's also great for real-time radar imagery.



Go to the Soaring Society of America web site:

ssa.org/SoaringWeather?show=blog

For many other URL links and presentations that will give you background on what you've seen today. These came from presentations given in 2016 and 2018 at national conventions.

Take a look at the Perlan project web site and the short video summarizing the World Record Flights.

Finally, check out the codimd.org site for a fantastic tool to create rich media presentations with Markdown. I'm currently use this to deliver my remote soaring briefings.

2017

The End...
Spectacular Soaring!

Thank you...

Walter Rogers
wrogerswx@gmail.com

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