WeatherExtreme

THE PERLAN PROJECT & AVIATION WEATHER

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CEO & Founder

Tenth Southwest Aviation Weather Safety Workshop– April 21, 2023

WeatherExtreme

PERLAN PROJECT

Nonprofit organization where scientists, engineers and pilots volunteer their time to better the planet

Exploration | Innovation | Inspiration

WEATHER EXTREME

The Perlan Project

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Mountain PSC, Kebnekaise

Perlan or Nacreous Clouds 50,000 – 80,000 feet

Meteorological Conditions

- Prefrontal conditions are best
- Post frontal may be o.k. in the drier Andes (but not in New Zealand)
- Strong low-level winds in a stable atmosphere with ridge top winds 40 knots is best (25 knots will work)
- Winds within 30 degrees of perpendicular to ridgeline
- A gradual wind increase with altitude (Energy)!
- A weak tropopause will allow the wave to traverse into the stratosphere
- Region influenced by Polar vortex!

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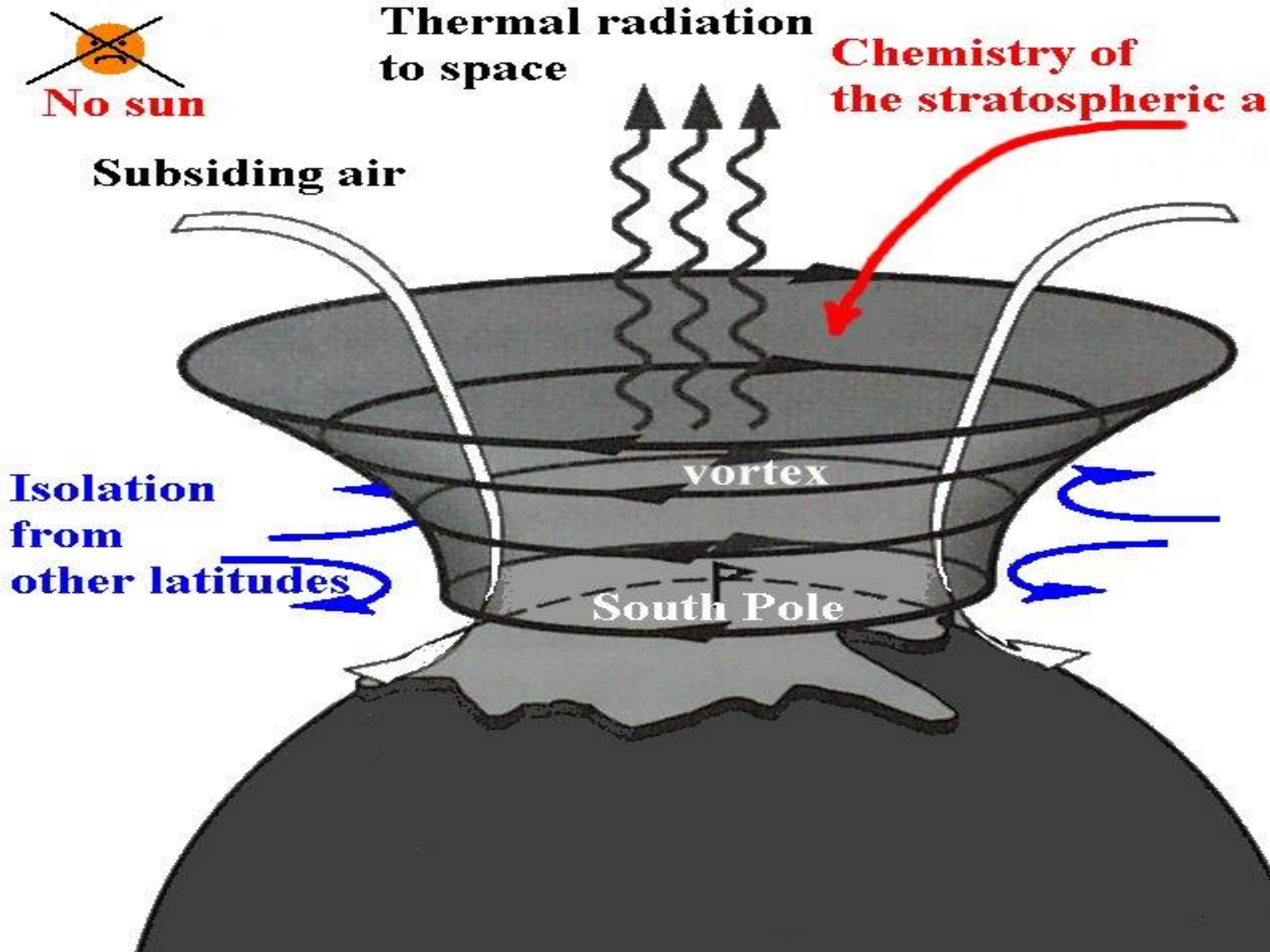
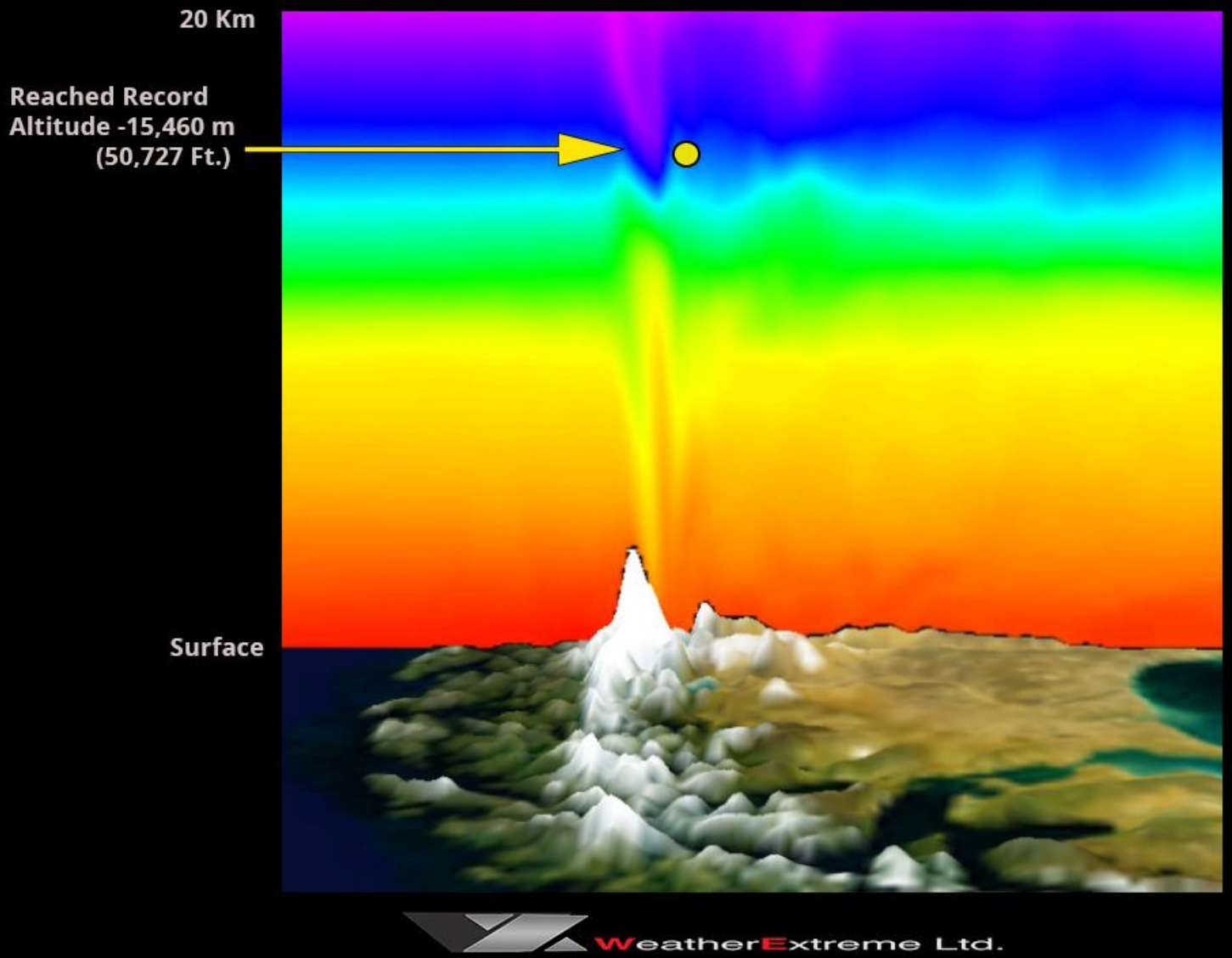

No sun
Thermal radiation
to space
Chemistry of
the stratospheric a
Subsiding air
Isolation
from
other latitudes
vortex
South Pole

Perlan Record Flight

Air Temperature - Cross Section



WeatherExtreme Ltd.

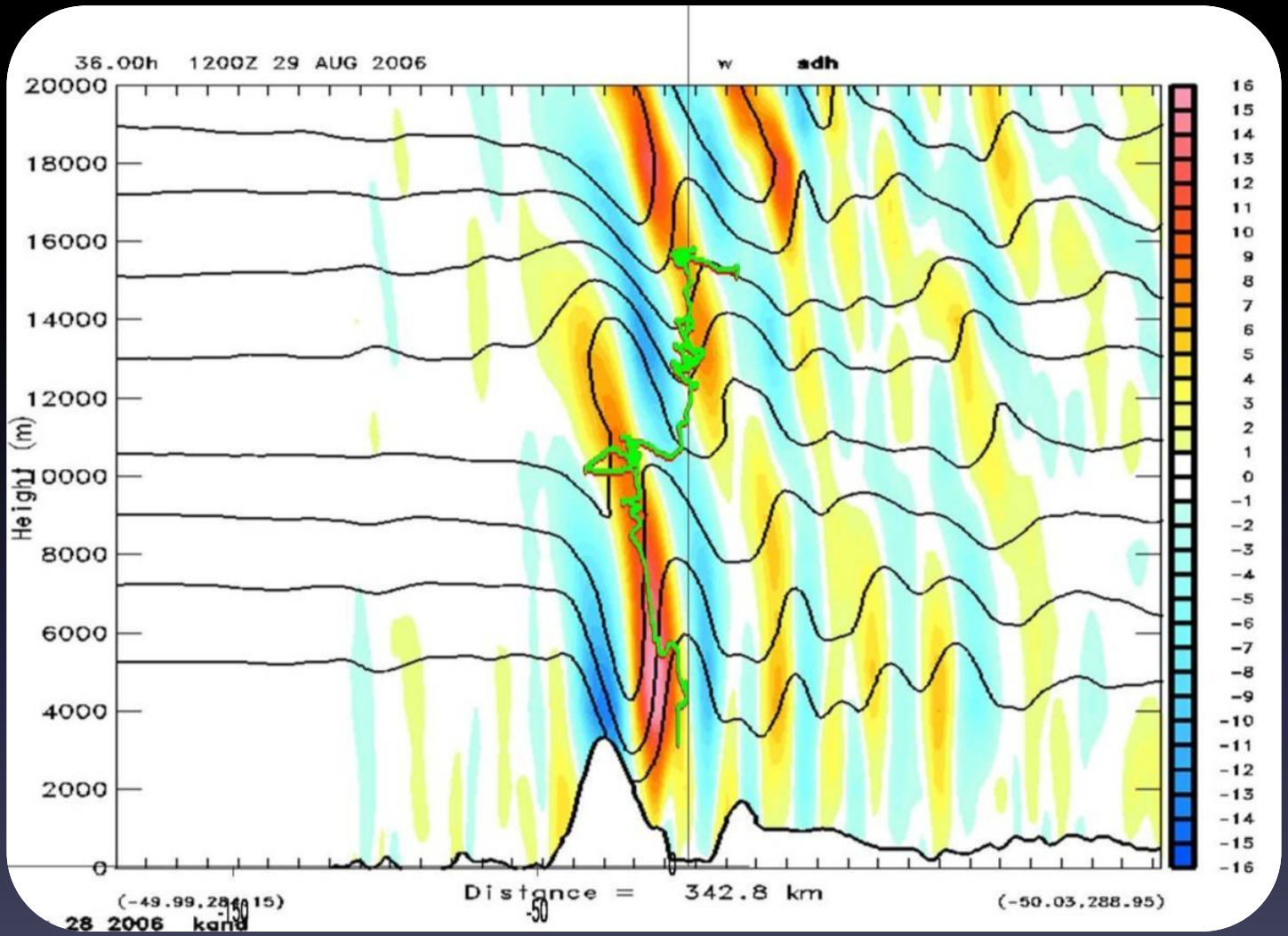
9_00:00:00
9_18:00:00

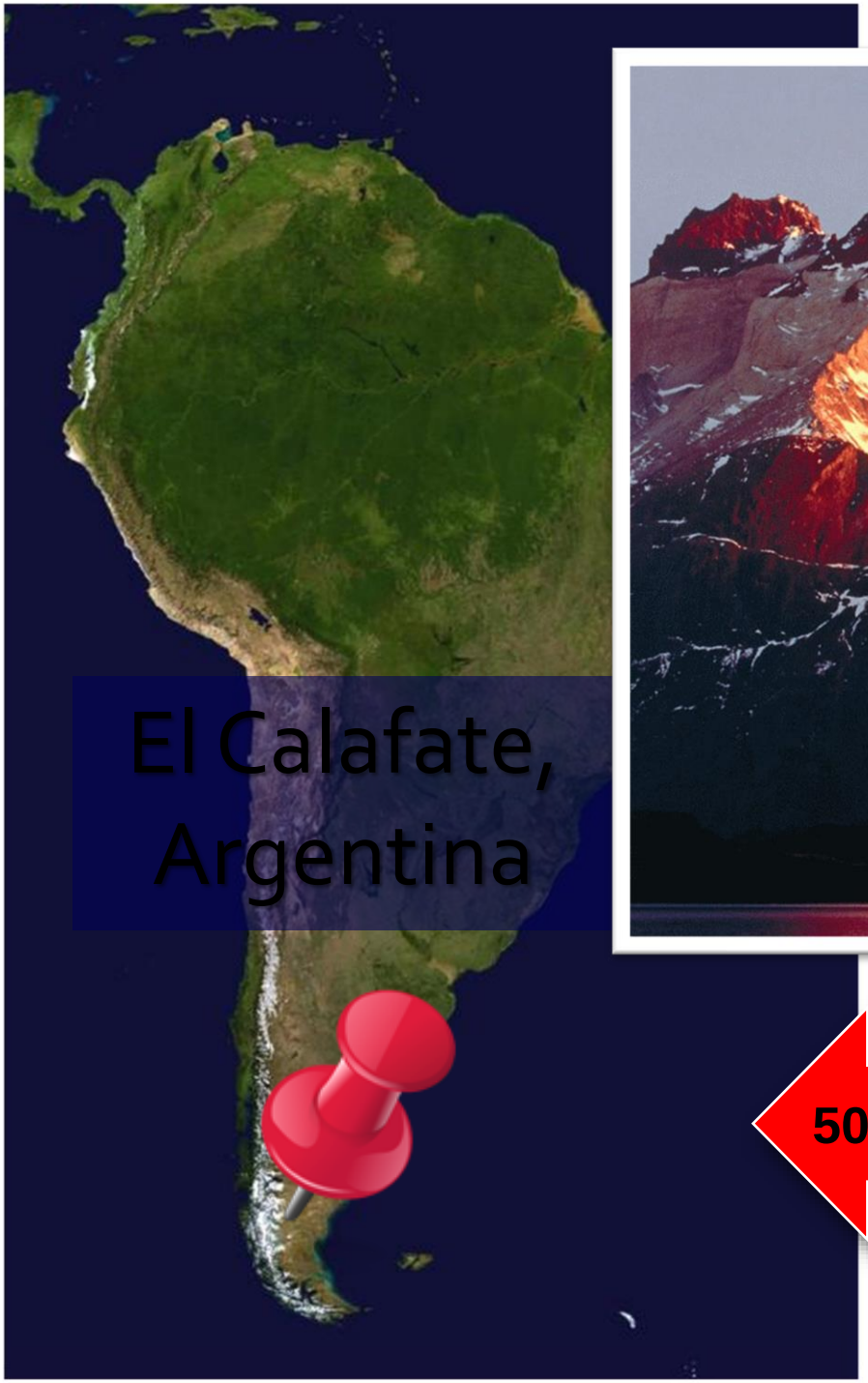
2) ; angle=90

-66.9

0 by 25

Record Flight Track with Lift and Sink

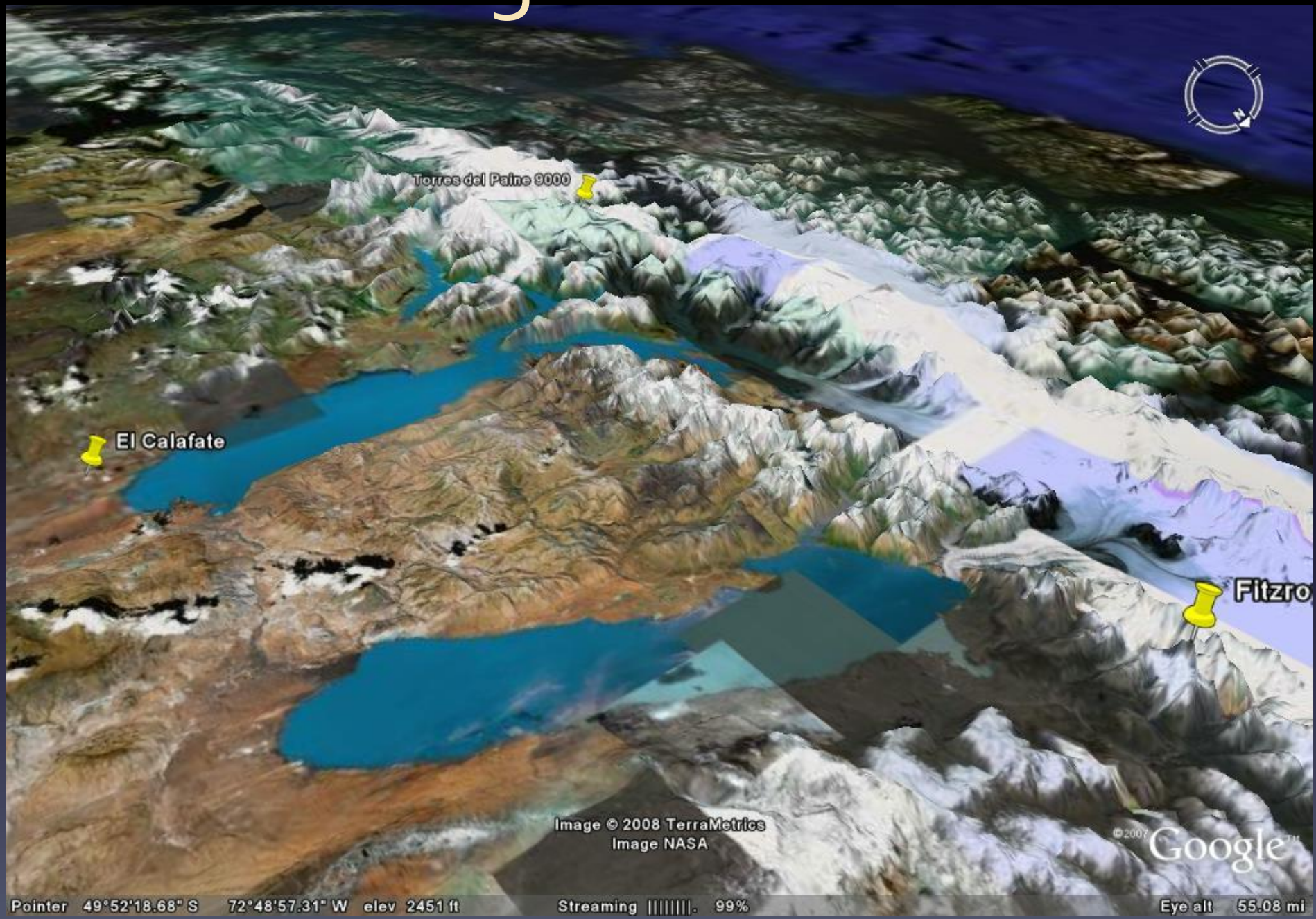




El Calafate, Argentina

50° South Latitude

Patagonian Andes

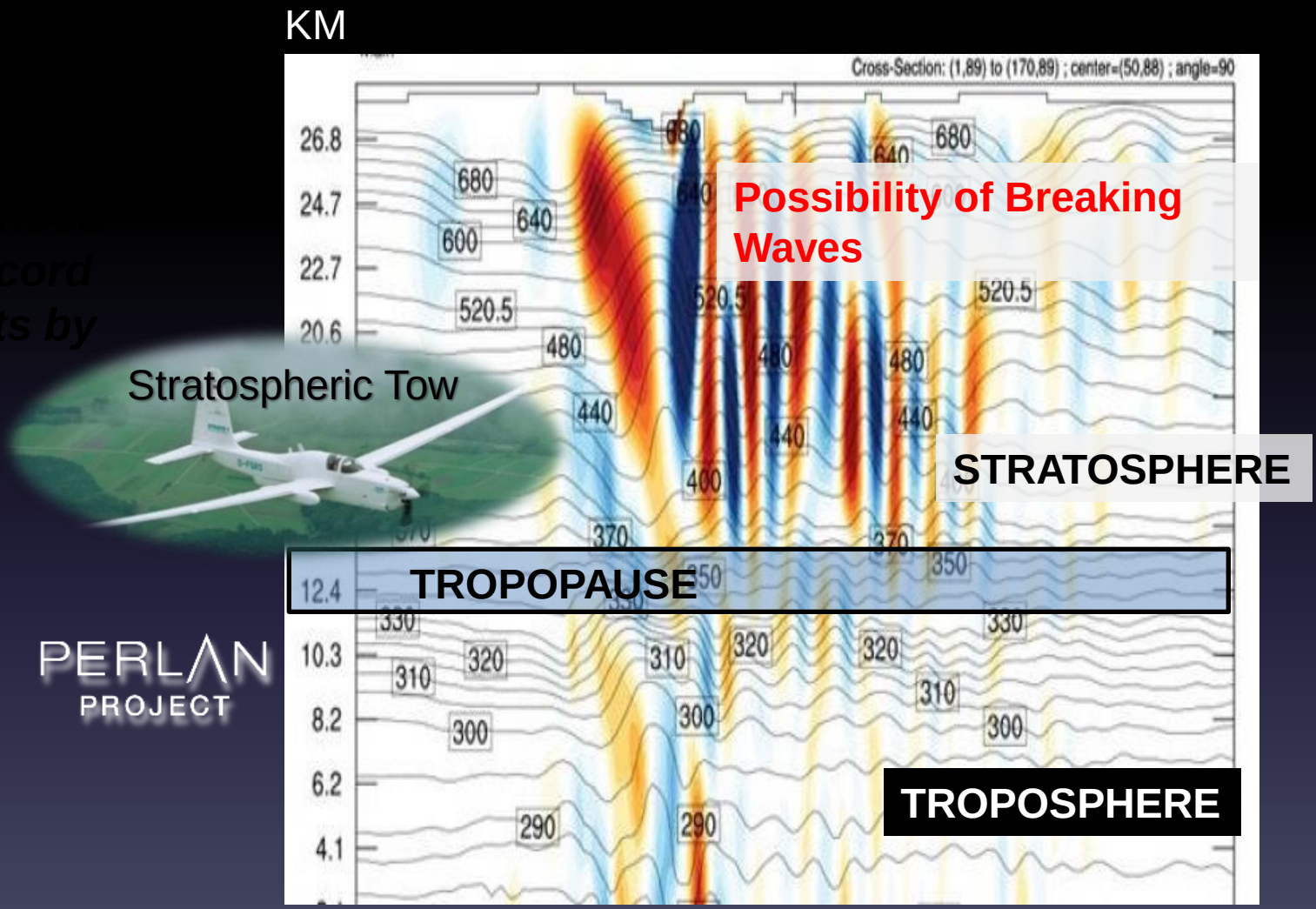


The Egrett Tow Plane

06.24.18

FIRST EVER TOW WITH EGRETT

In 2018 & 2019 we will tow directly into the highest waves



of record flights by 50%

Airbus Perlan Mission II
Record-Breaking Flight
September 2, 2018
76,124 feet

U2 72,000 feet
SR71 85,069 feet

Environmental Control and Life Support

- AIR in the CABIN

21% O_2 from Scuba Tank

De-Humidified Air

PILOT OXYGEN

Rebreather: 90-99% O_2

Humid re-circulated

AIRBUS

PERLAN MISSION II

VIRTUAL COCKPIT

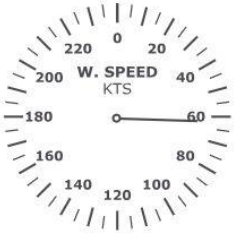
Imperial | Metric

GLIDER ALTITUDE: 34492 ft

VERTICAL SPEED: 0 kts

GLIDER SPEED:

WIND SPEED:



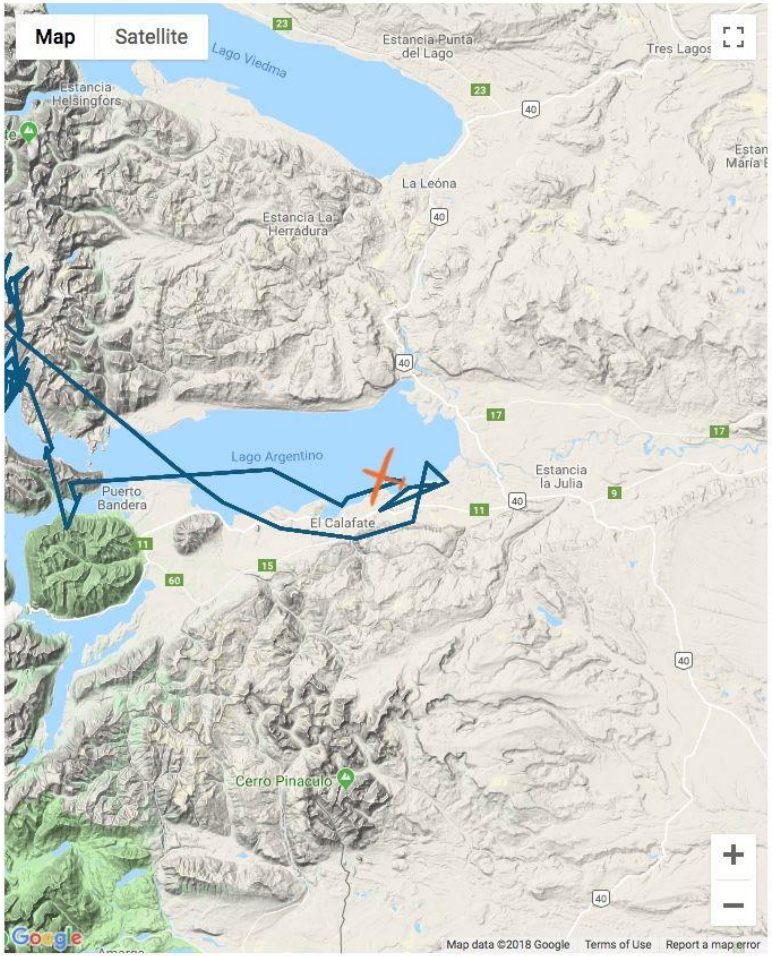
GLIDER HEADING: 289°

WIND DIRECTION: 267°

AIR TANK	O2 TANK	BATTERY
48%	76%	48%

MAX ALTITUDE: 62473 ft

FLIGHT TIME: 04:44:06



Tweets by @PerlanProject

Perlan Project
@PerlanProject

Get future notifications when the Perlan 2 Virtual Cockpit is live.
Sign up for email at perlanproject.org/contact
OR
Get text message alerts in the U.S. by texting "Perlan" to 57682#AirbusPerlanMission II

12m

Perlan Project
@PerlanProject

Update: After finding a bit more lift, the Perlan 2 #glider and its pilots Jim Payne and Morgan Sandercock are heading back to the airport in El Calafate. We'll do some #weather model testing on the downwind.#AirbusPerlanMission II
Follow our descent >perlanproject.cloud/VirtualCockpit…

16m

Perlan Project
@PerlanProject

Update: The Perlan 2 glider has topped out in this last pocket of lift. One more pocket to try.

Embed View on Twitter

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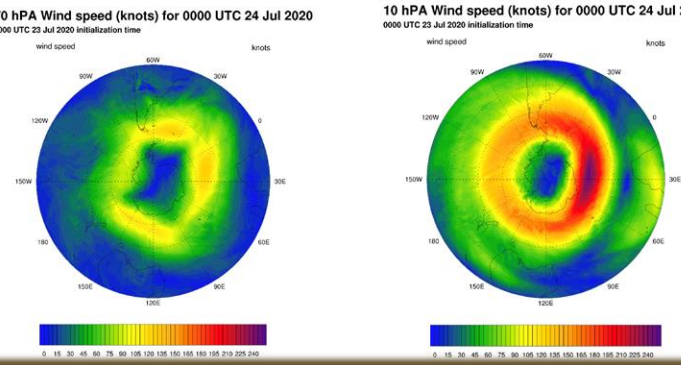
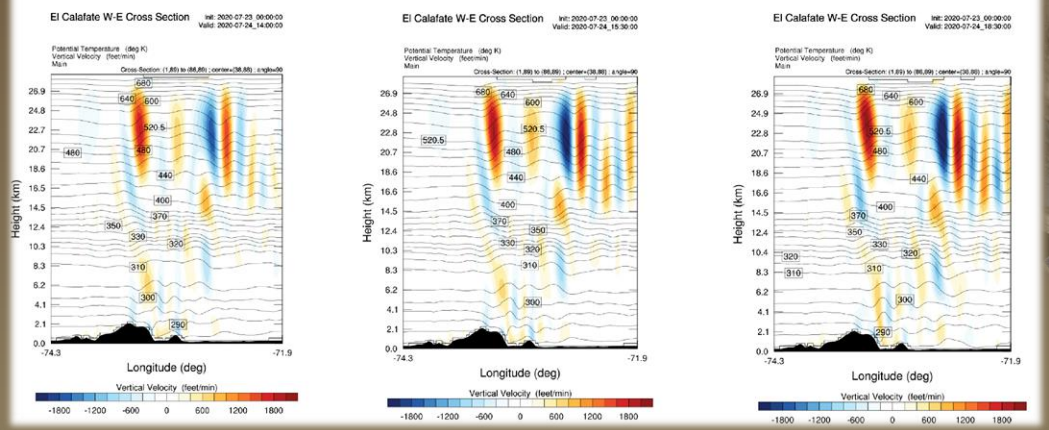
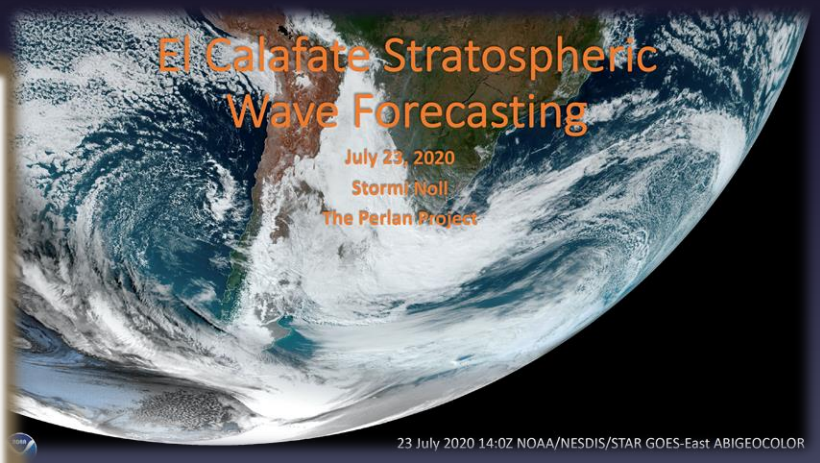
Briefings & Wx Forecasting

GFS polar jet depiction at 70 hPA and 10 hPA for July 24, 2020 0000 UTC initialized July 23, 2020 0000 UTC



WeatherExtreme experimental WRF El Calafate cross-sections for July 24, 2020 (14:00, 15:30, and 18:30 UTC) initialized July 23, 2020 0000UTC





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The Perlan Glider

Crew: 2

Cabin Pressure: 8.5 PSID

Empty Weight: 1544 lbs

Gross Weight: 2000 lbs

Wind Span: 84 feet

Wing Area: 263 sq ft

Aspect Ratio: 27

Core Atmospheric Scientific Packages on Perlan II

- **Cameras on Glider**
- **Ozone**
- **Ultra Violet (UVA/UVB)**
- **Pressure**
- **Air Temperature**
- **Electromagnetic Radiation (measures pilot exposure)**
- **Water vapor (calculated Year 1, measured Year 2-Picarro)**
- **Relative Humidity (measured) and Dew Point Temperature (calculated)**
- **Winds – horizontal and vertical**
- **Radio Occultation (water vapor)**

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Atmospheric Scientific Packages Ground/Space - Based Years 1 & 2

- **Time Lapse Camera(s)**
- **Soundings in Sierra & Argentina (GPS Ozone sondes in Argentina)**
- **LIDAR (array in Argentina- Dr. Jacobo Salvador Dir. Observatory of Southern Patagonia, Rio Gallegos, Argentina)**
- **NASA AIRS (Dr. Dong Wu- NASA Goddard)**
- **Satellite Imagery/Data (polar orbiting and GOES)**
- **Surface Weather Observations**

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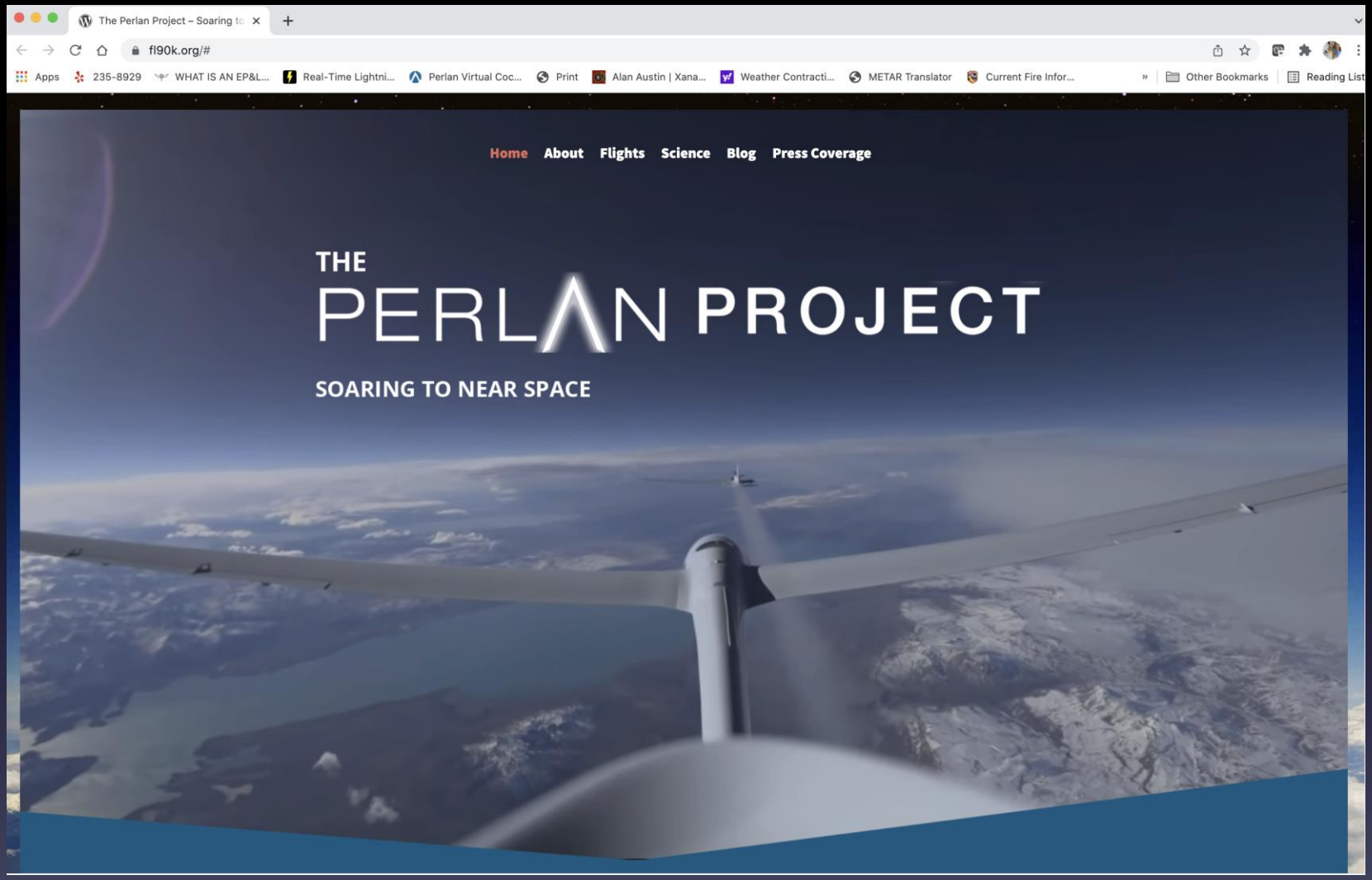
Perlan Data Archive



FL90k.org

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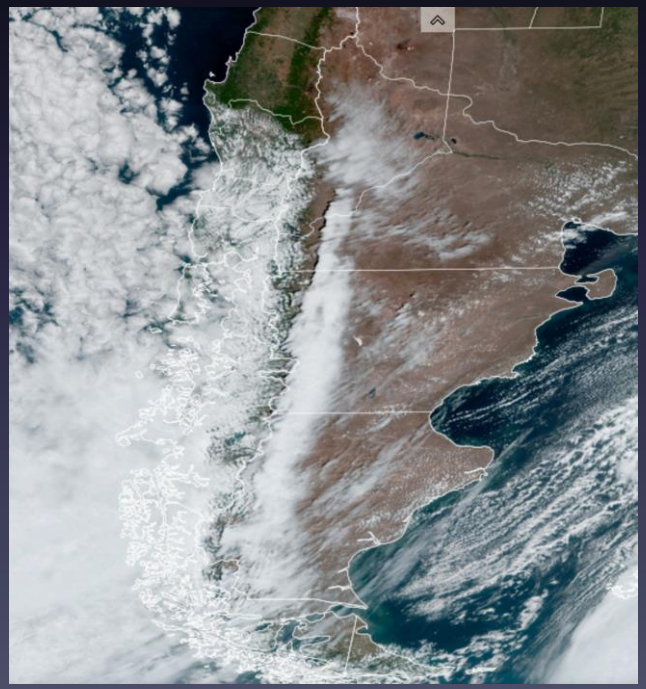
Live Web Cams



Live Web Cams

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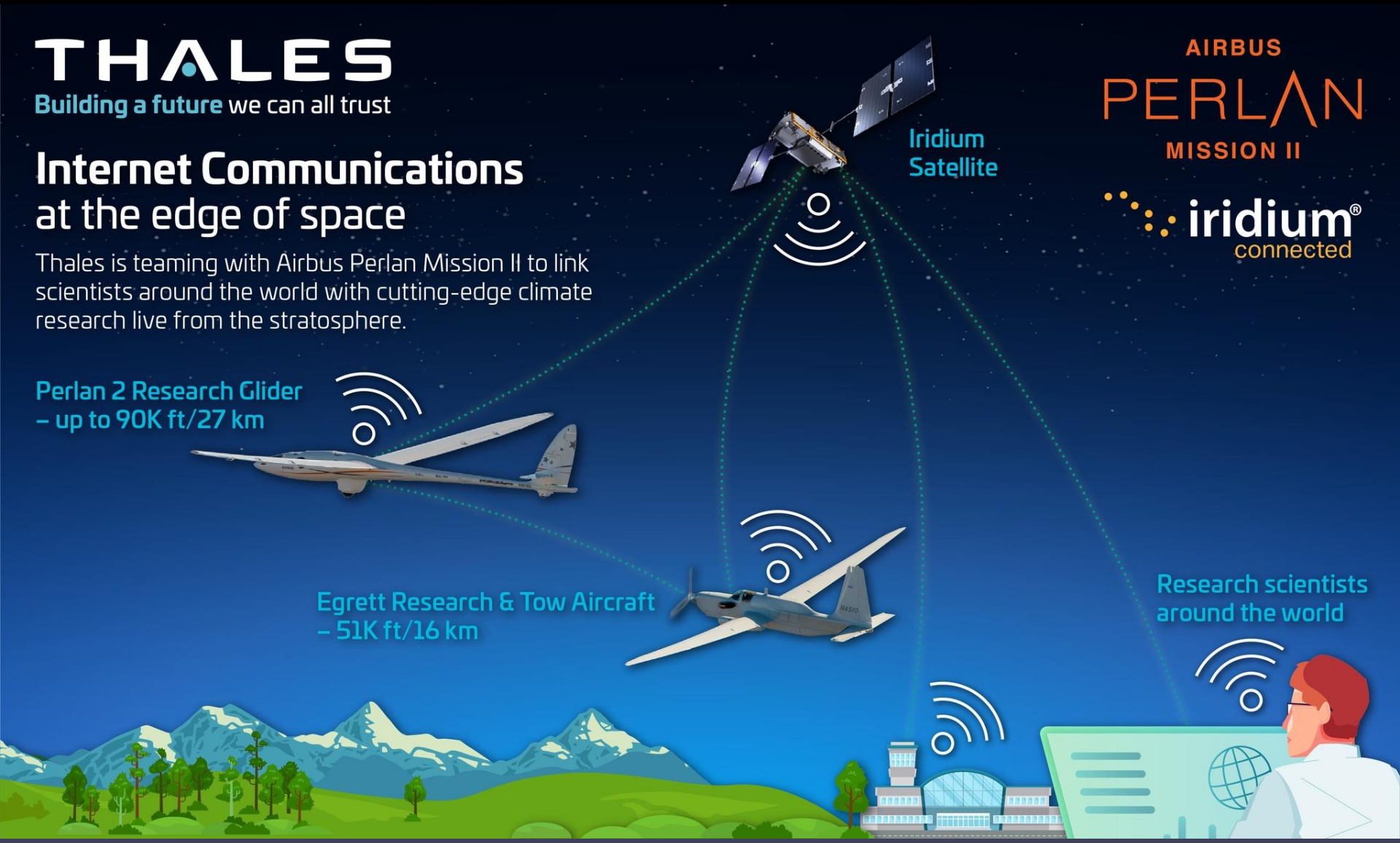

AI Wave Field Flight Path Optimization for Safety and Efficiency

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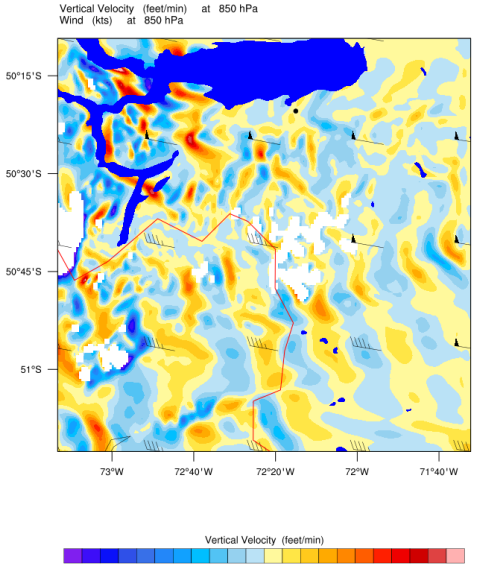
AI Wave Field Flight Path Optimization for Safety and Efficiency

Wave Structure for Sept. 3, 2017, World Record Flight

850 mb Height

Init: 2017-09-03_12:00:00
Valid: 2017-09-03_18:30:00



700 mb Height

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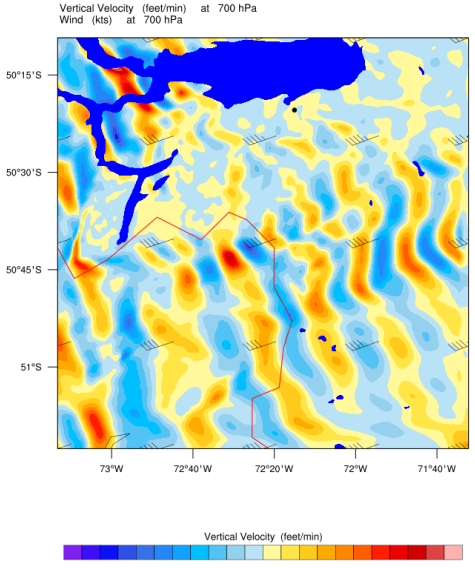

500 mb Height

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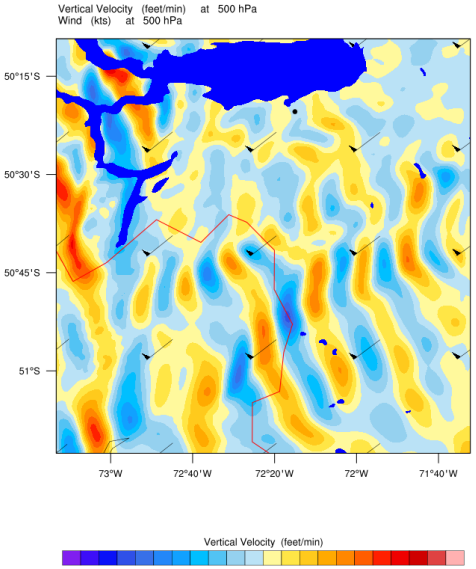

300 mb Height

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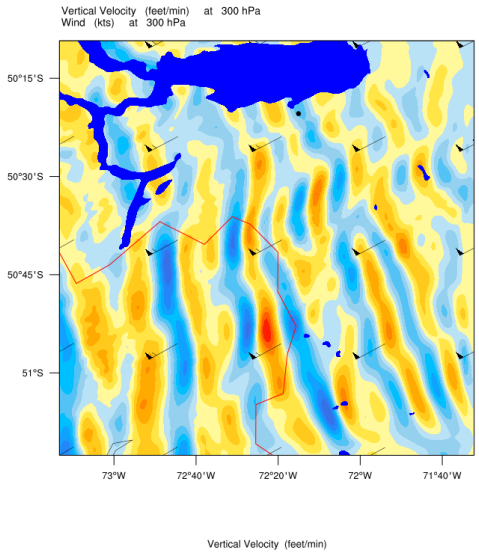

200 mb Height

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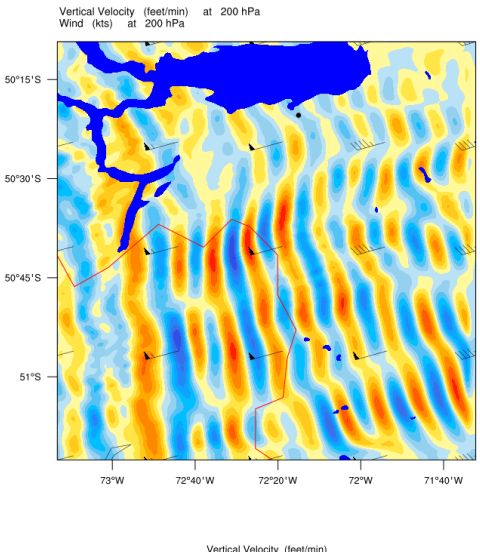

100 mb Height

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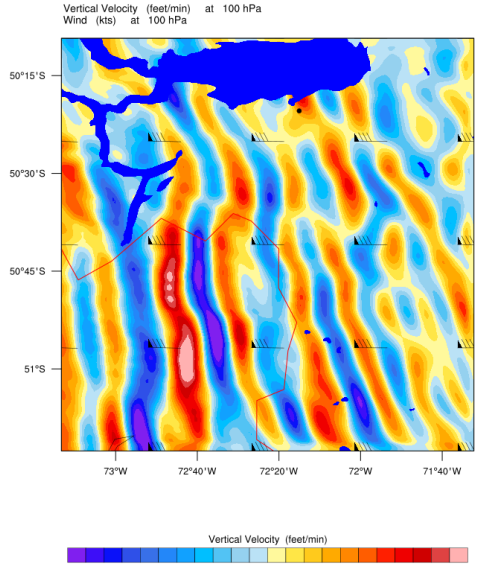
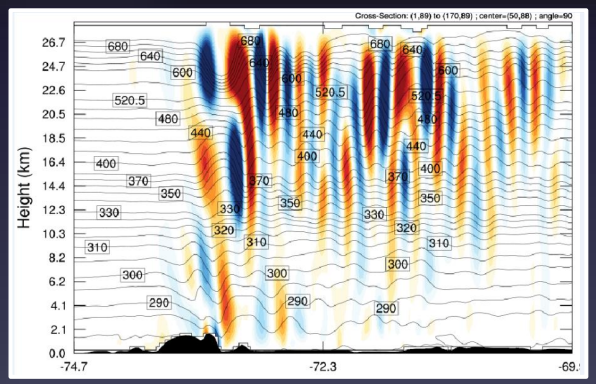


Aviation safety

Encountering invisible mountain waves can be a serious risk to aircraft and passengers



Cockpit displays of these invisible waves plus speed and flight path suggestions would help protect aircraft and passengers

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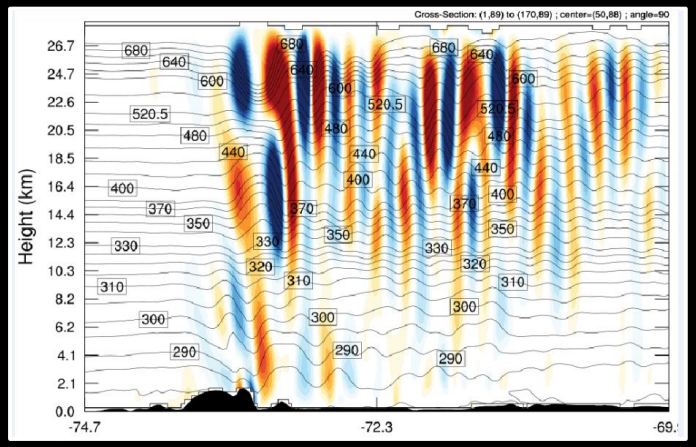
Riding waves: Provide a dramatic demonstration of the energy in atmospheric waves.

Altitude records broken using only wave power!

- ☑ U-2
- ☑ Concorde
- ☑ Commercial airliners



Next, the SR-71

Perlan's goal, 90,000 feet

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THANK YOU!

In memory of

Steve Fossett
(1944 – 2007)

Einar Enevoldson
(1932 – 2021)

Doug Perrenod
(1947 – 2022)

Preston Michie
(1949 – 2022)

WeatherExtreme.com
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