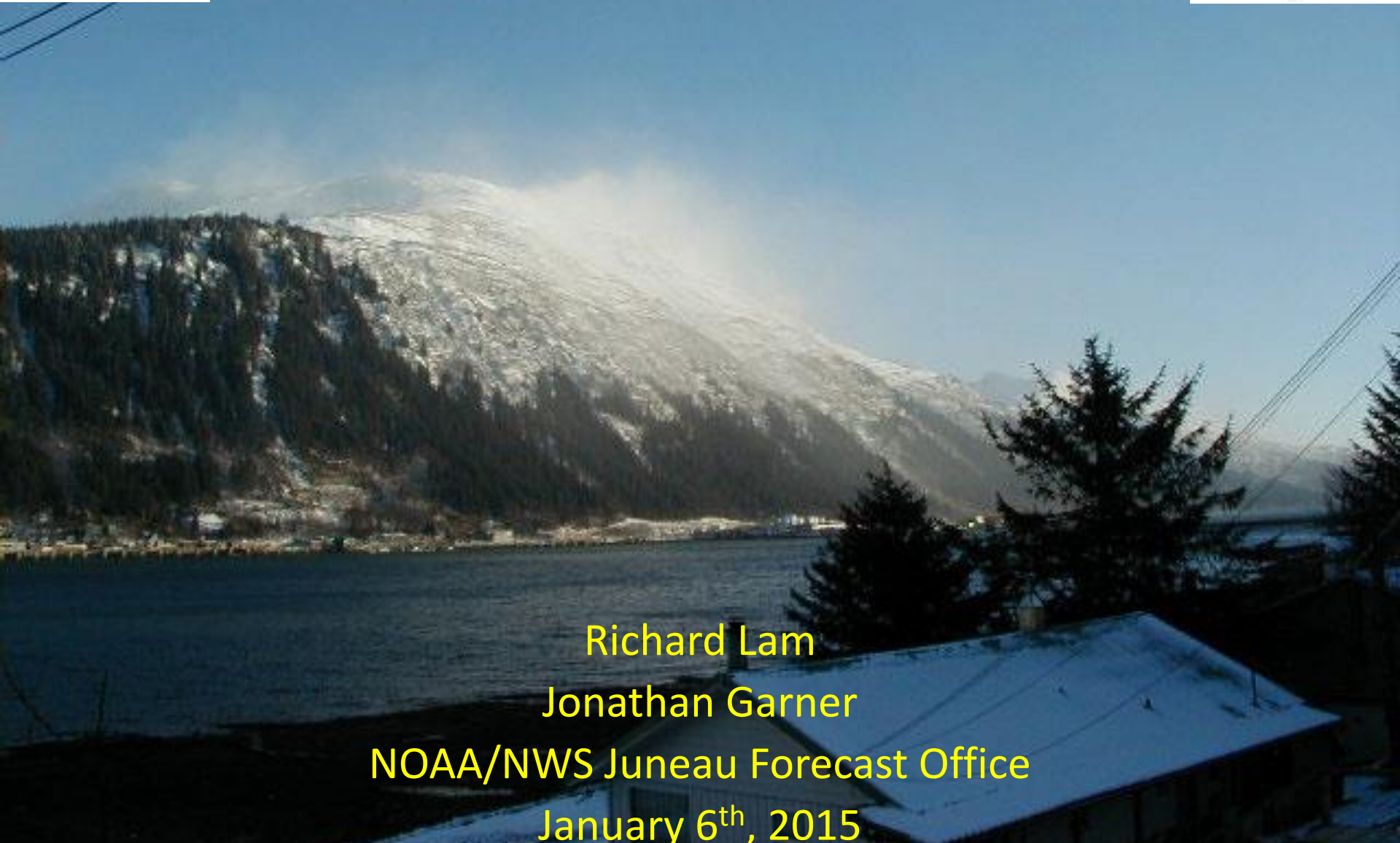




Late Season Mountain Wave Wind Event in Juneau, Alaska



Richard Lam
Jonathan Garner
NOAA/NWS Juneau Forecast Office
January 6th, 2015

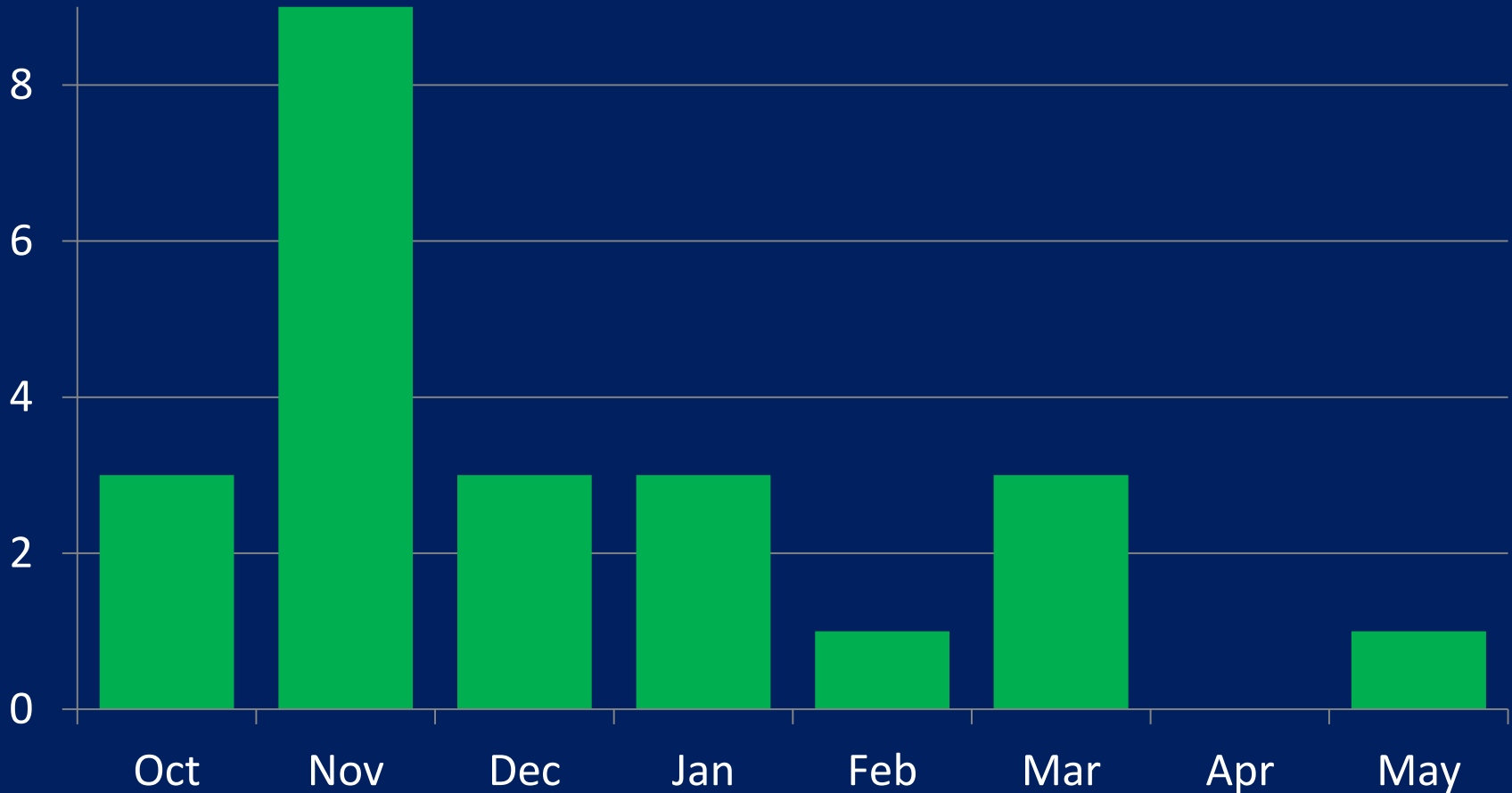
Event Synopsis

Video Credit: Misty Smith, taken on Jan. 4, 2015, at South Douglas Boat Harbor.



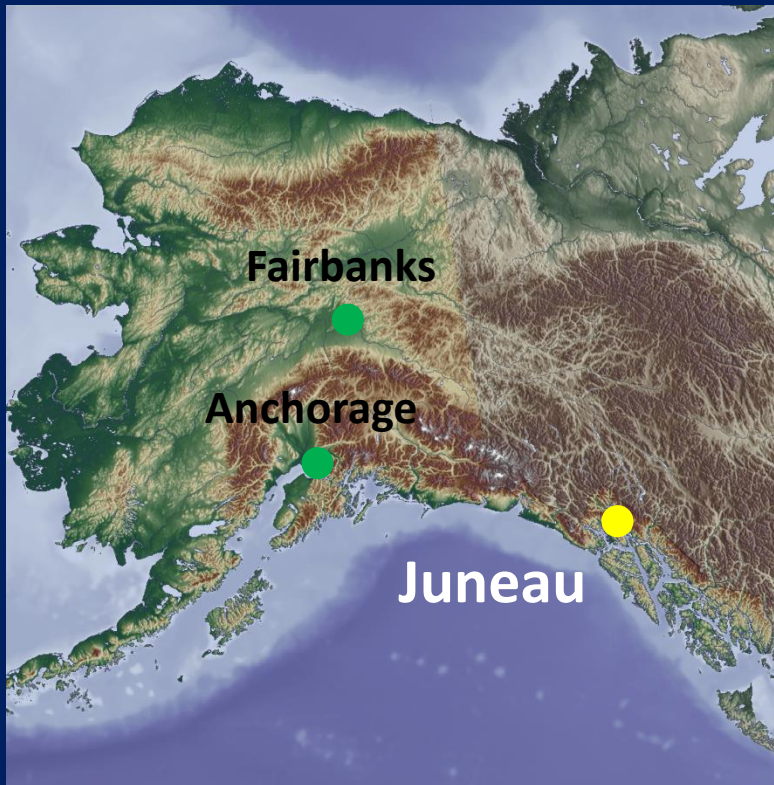
- Evening May 2nd, 2014
- Unseasonably late high wind event
- Frequent gusts > 60 mph
- Impacts: residents, cruise ship visitors, aviation & marine
- High Wind Warning issued
- Social Media utilized

High Wind Warning Climatology (2007 – 2014)



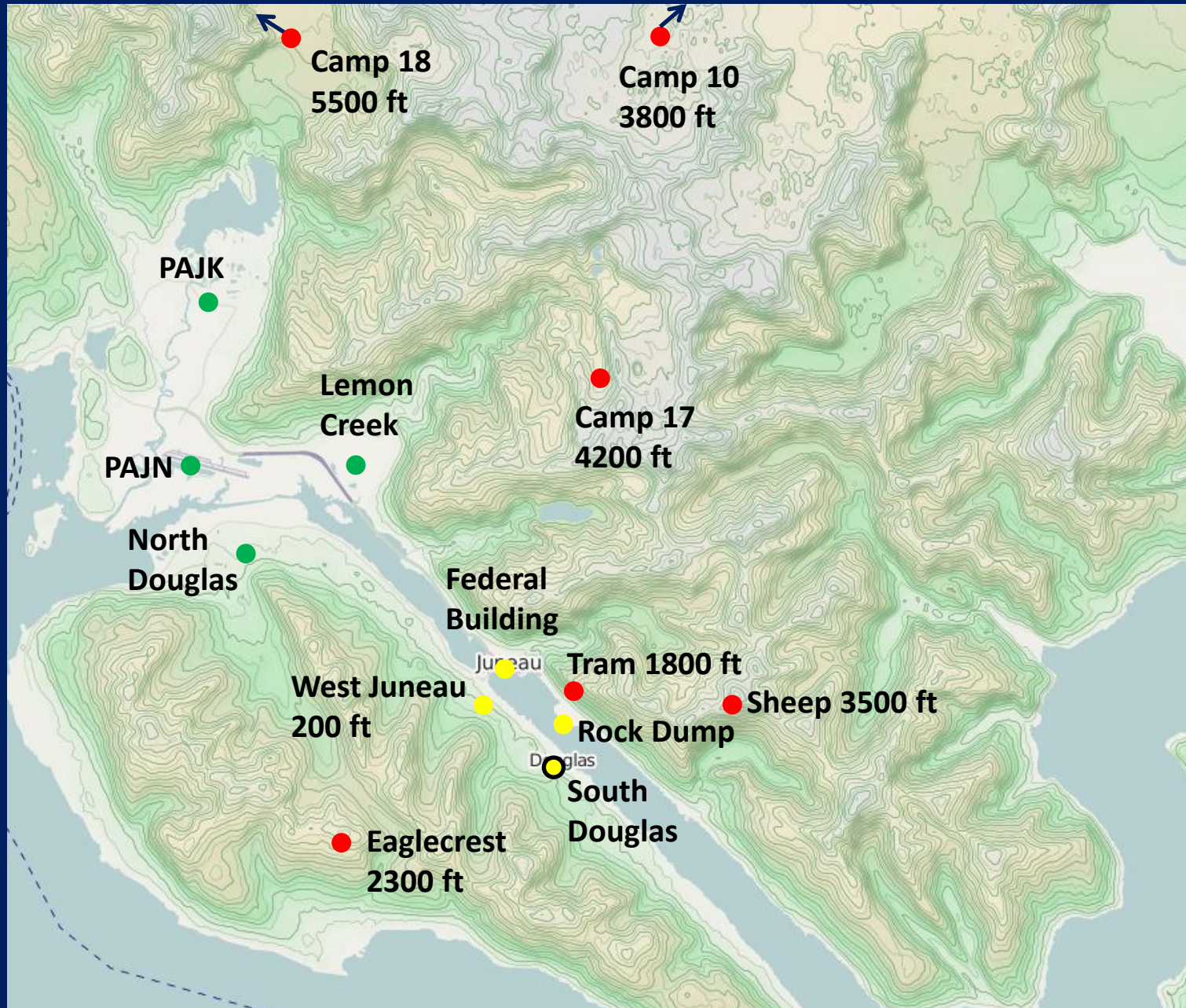
Juneau, Alaska

- Southeast Alaska
- Valley vs Downtown
- Downtown: complex terrain



Juneau Mesonet

- Valley stations
- Downtown stations
- Higher elevation stations



Aerial View of Downtown Juneau (July)



Ingredients for Downslope Windstorm

1. Strong Cross Barrier Flow @ ridge level
2. Low-level Inversion
 - Top of inversion @ ridgetop level → strong stability
3. Critical Level around 400 mb to 600 mb
 - Preferred
 - Reverse shear
 - Transition from subcritical to supercritical flow
 - **Wave-breaking! → downbursts of max wind**

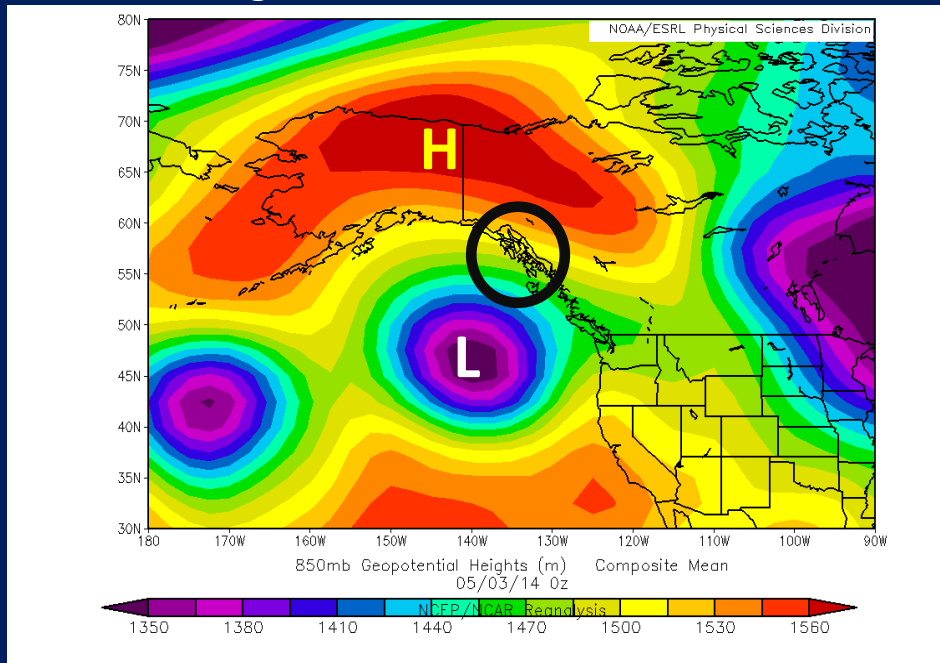
Schematic of preferred setup for critical level



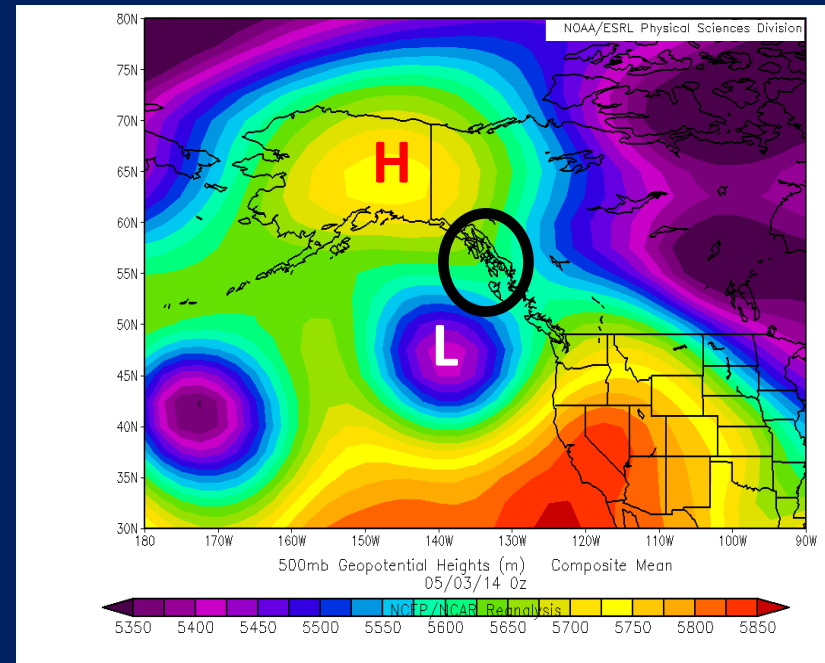
Synoptic Setup

- Tight gradient enhances NE cross barrier flow
- Flow weakens w/height
- Warmer than normal aloft
- NE wind → downsloping → further heating

850 mb Height



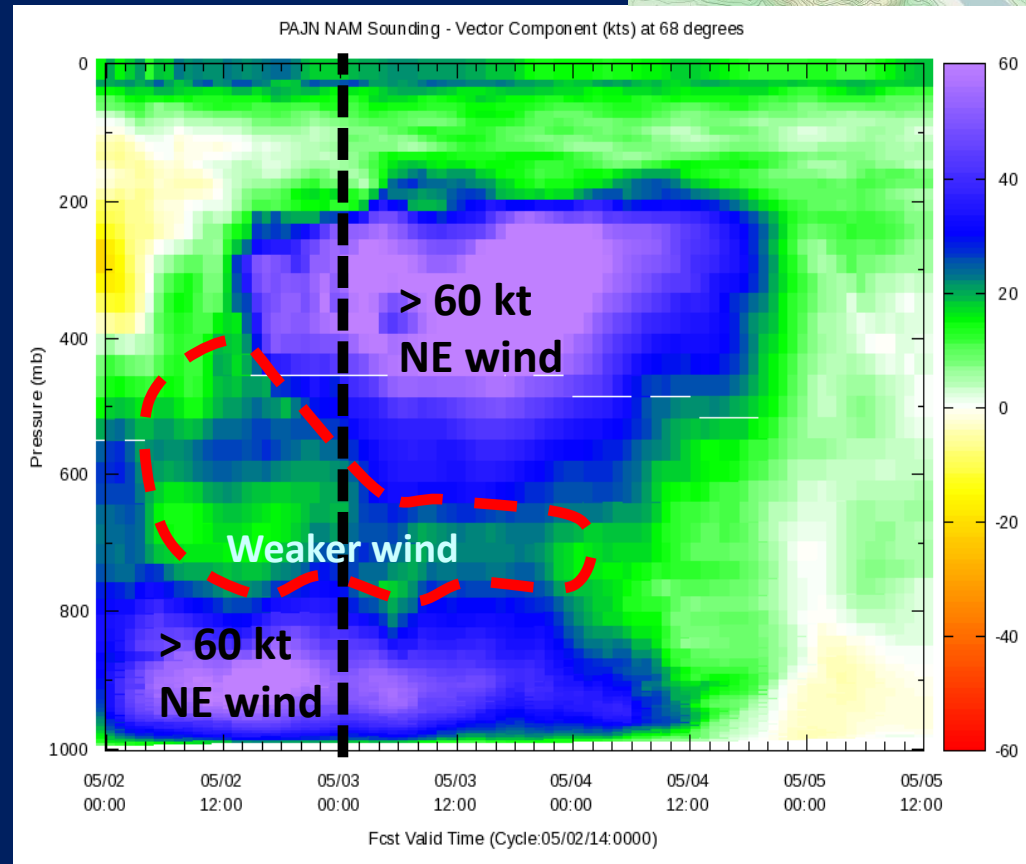
500 mb Height



Mesoscale Features

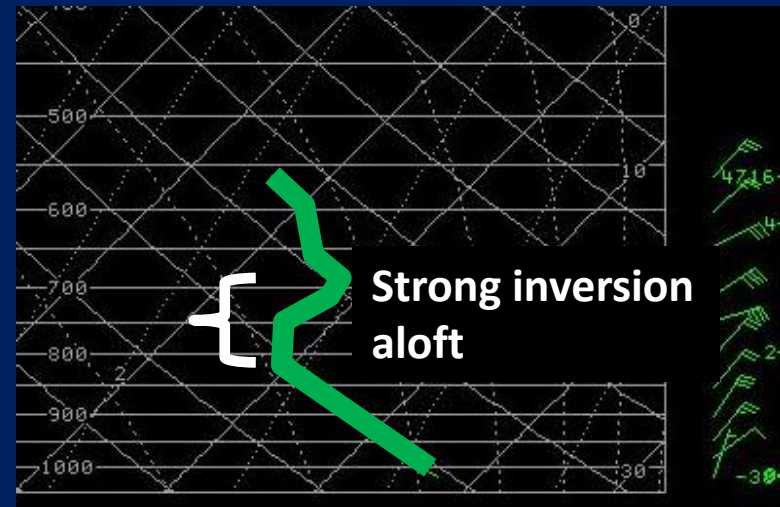
- Strong cross barrier flow
 - > 60 kt below 800 mb
- No pre-existing critical level
 - Weaker wind above 800 mb
 - > 60 kt NE wind above 500 mb
- Reverse shear
 - Wave-breaking

NAM forecasted proximity sounding—NE wind component at Juneau Airport



Mesoscale Features

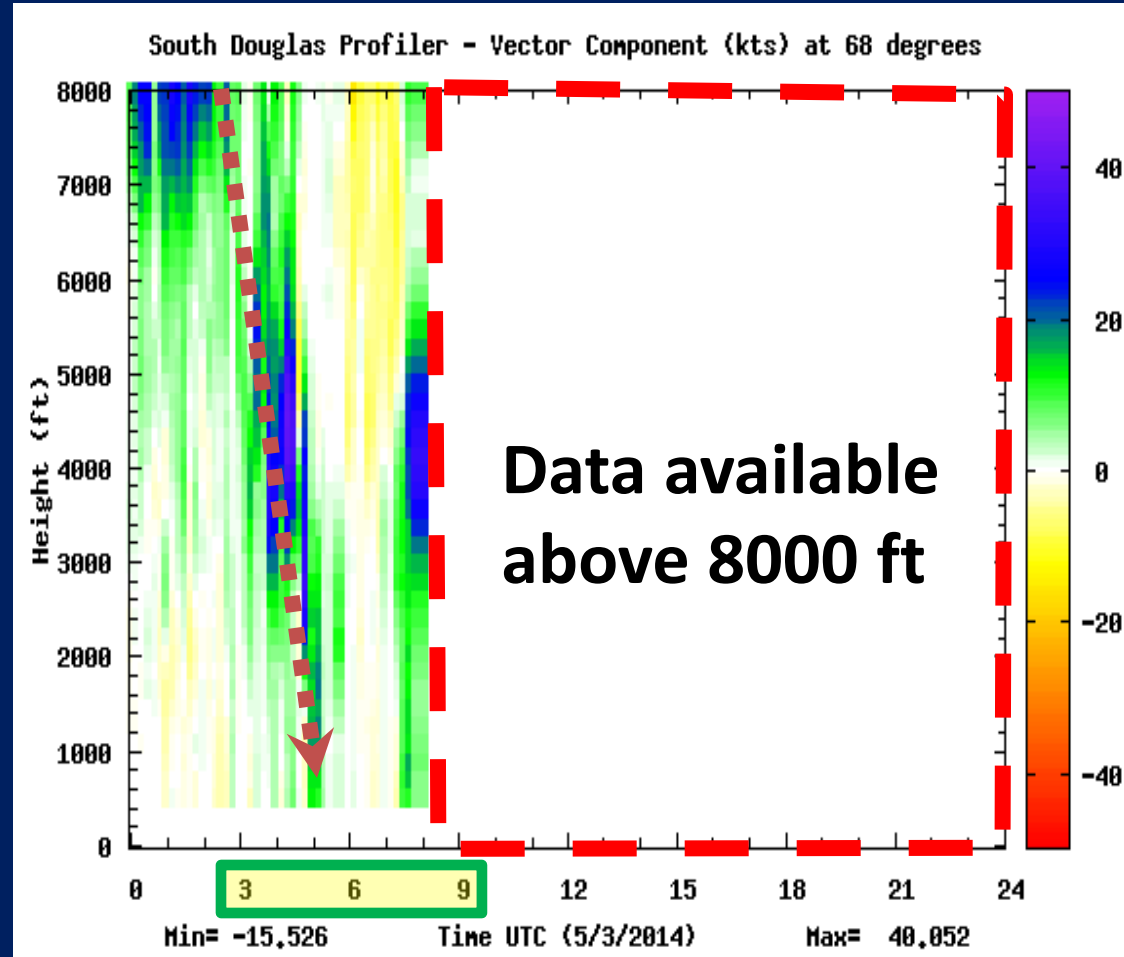
- Inversion
 - Descending air → adiabatic warming
 - Strong inversion developed @ ridge-top
- Self-induced critical level
→ **Downslope windstorm**
 - Ingredients evolving with time



Aircraft sounding at 7 pm AKDT
May 2nd, 2014

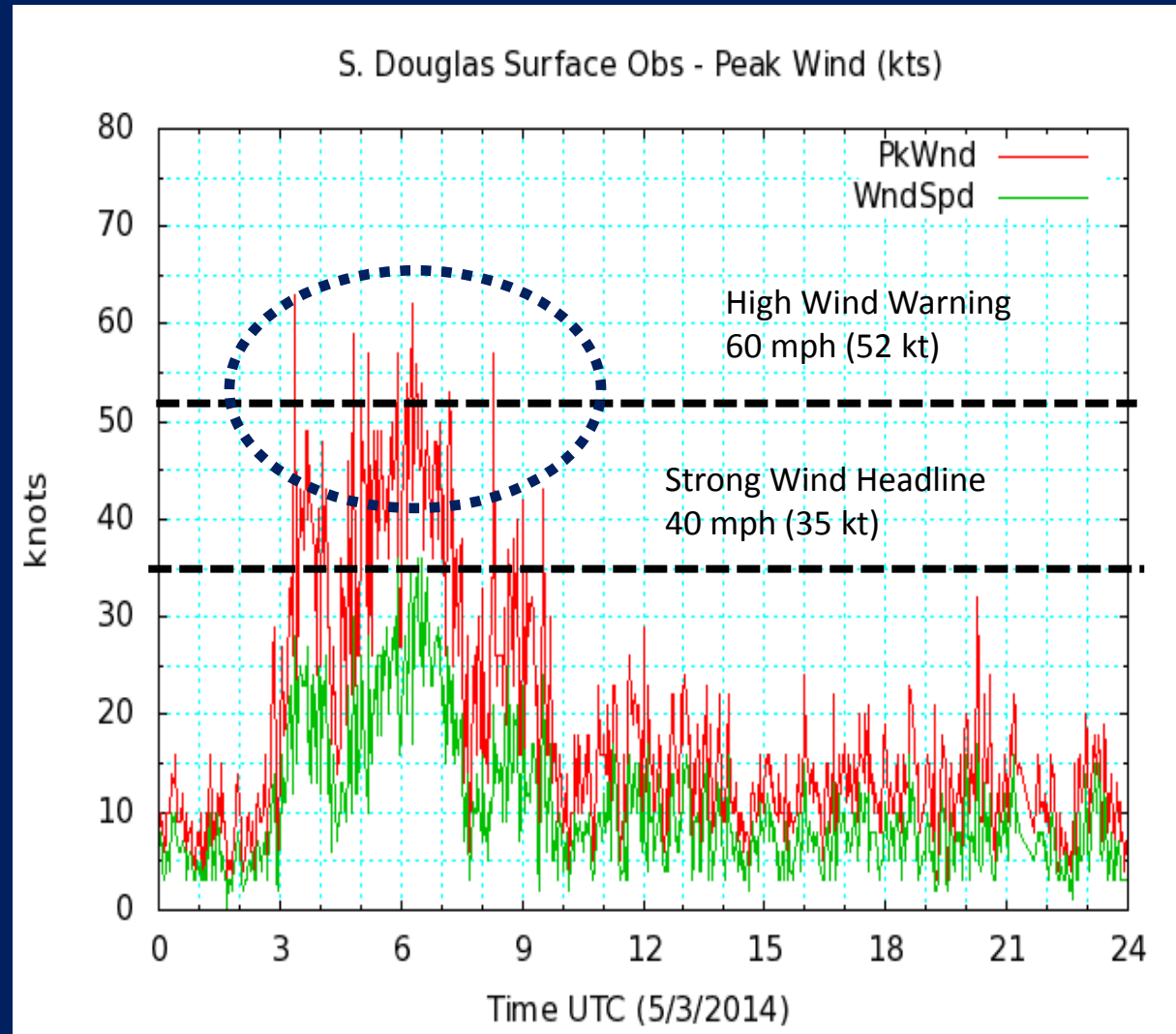
Weather Observations

- Profiler
 - Mean wind
 - Turbulent flow
- Time of strongest wind gusts
 - 3Z to 9Z
- Mountaintop
 - 70 mph (Sheep Mt.)
- Downtown
 - 70 mph (South Douglas)
 - 65 mph (Federal Building)
 - 40 mph (Rock Dump)



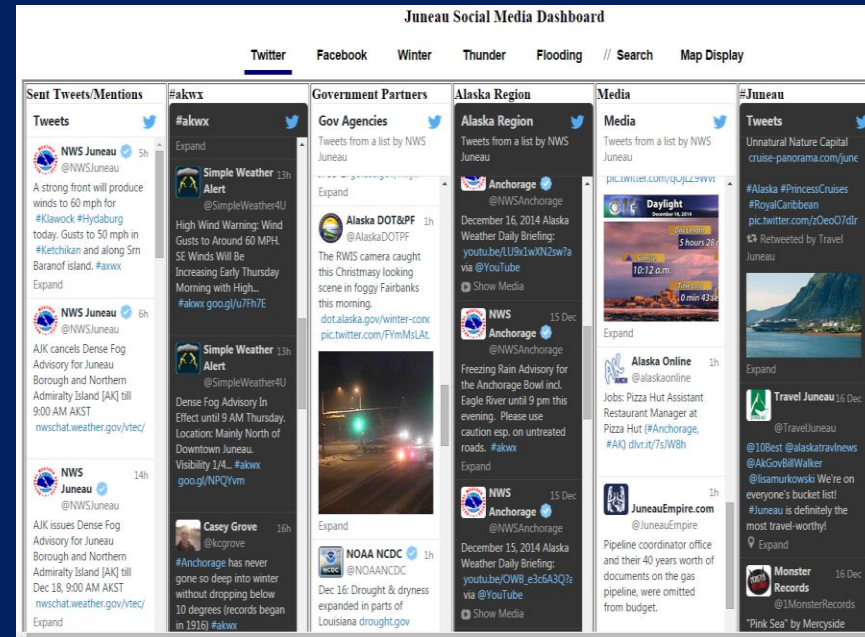
Weather Observations

- Timing
 - 6 pm to 12 am
- Frequent gusts
 - 52+ kt
- Bursts of high winds



Local Storm Reports

- Phone calls
 - 65 mph gusts & blowing dust (NWS Employee)
 - 70 mph gusts (Douglas Harbor)
- Facebook
 - NWS Alaska
- Twitter
 - @NWSJuneau
 - Tweet Report: “Falling asleep to 65 mph wind gust...”



weather.gov/Juneau



@NWSJuneau #AKWX



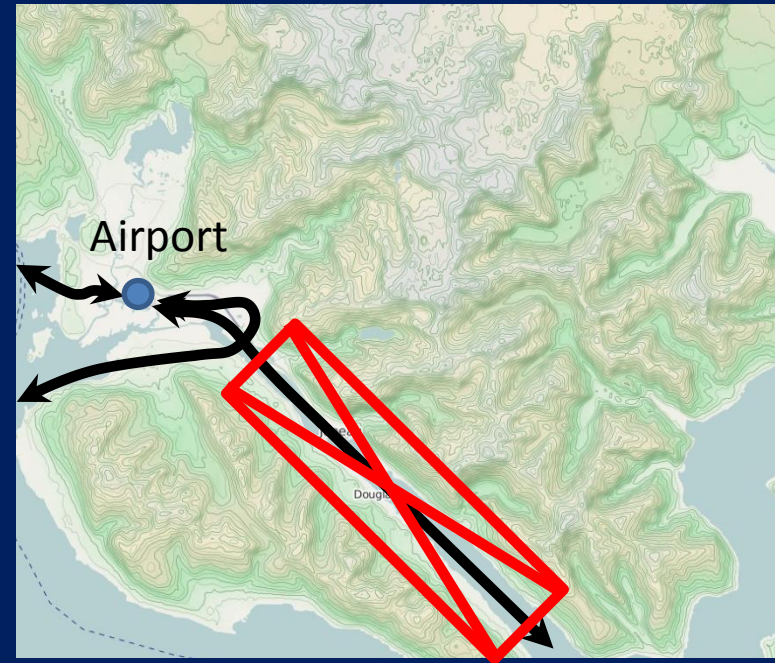
facebook.com/NWSAlaska

Decision Support Services

- High Wind Warning issued (**Enhanced Wording**)
 - **LOCALLY VERY WINDY...NORTHEAST WIND 10 TO 20 MPH...EXCEPT 30 TO 40 MPH WITH FREQUENT GUSTS TO 60 MPH NEAR DOWNTOWN JUNEAU AND DOUGLAS.**
- Social Media updates
- Contact Mt Roberts Tramway
 - First day of operation (first cruise ship of the season)
 - 40 mph shutdown threshold

Impacts

- Residents:
 - Flying debris
 - Loose objects blowing around
 - “start of summer”
- “First Friday” Gallery Walk (outdoor crowds)
- Aviation
 - Strong wind shear prohibited SE approach to Juneau Airport
 - Departure Delays (Need lull in gusts for safe **tailwind takeoff**)
- Marine
 - Wind waves (Storm Force gusts)
- Tourism
 - Visitors impacted by high winds



Summary

- Unseasonably late wind event
- Evolving ingredients
 - Pre-existing critical level absent
 - Self-induced
- Frequent gusts to 70 mph
- High Wind Warning issued
- Impacts
- Further work to be done this season



References

- Colman, B.R. and C.F. Dierking, 1992: The Taku wind of southeast Alaska: Its identification and prediction. *Wea Forecasting*, **7**, 49-64.
- Dierking, Carl. "Forecasting Downslope Winds." *Forecasting Downslope Winds*. Warning Decision Training Branch, 1 Oct. 2012. Web. 5 Dec. 2014. <http://www.wdtb.noaa.gov/courses/winterawoc/IC8/lesson1/player.html>
- "Mountain Waves and Downslope Winds." *Mountain Waves Print Version*. COMET Program, 1 Jan. 2004. Web. 18 Dec. 2014. <https://www.meted.ucar.edu/mesoprim/mtnwave/print.htm>



Questions?



Credit: Jonathan Garner

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