The 2014 Damnation Facets

Don Sharaf

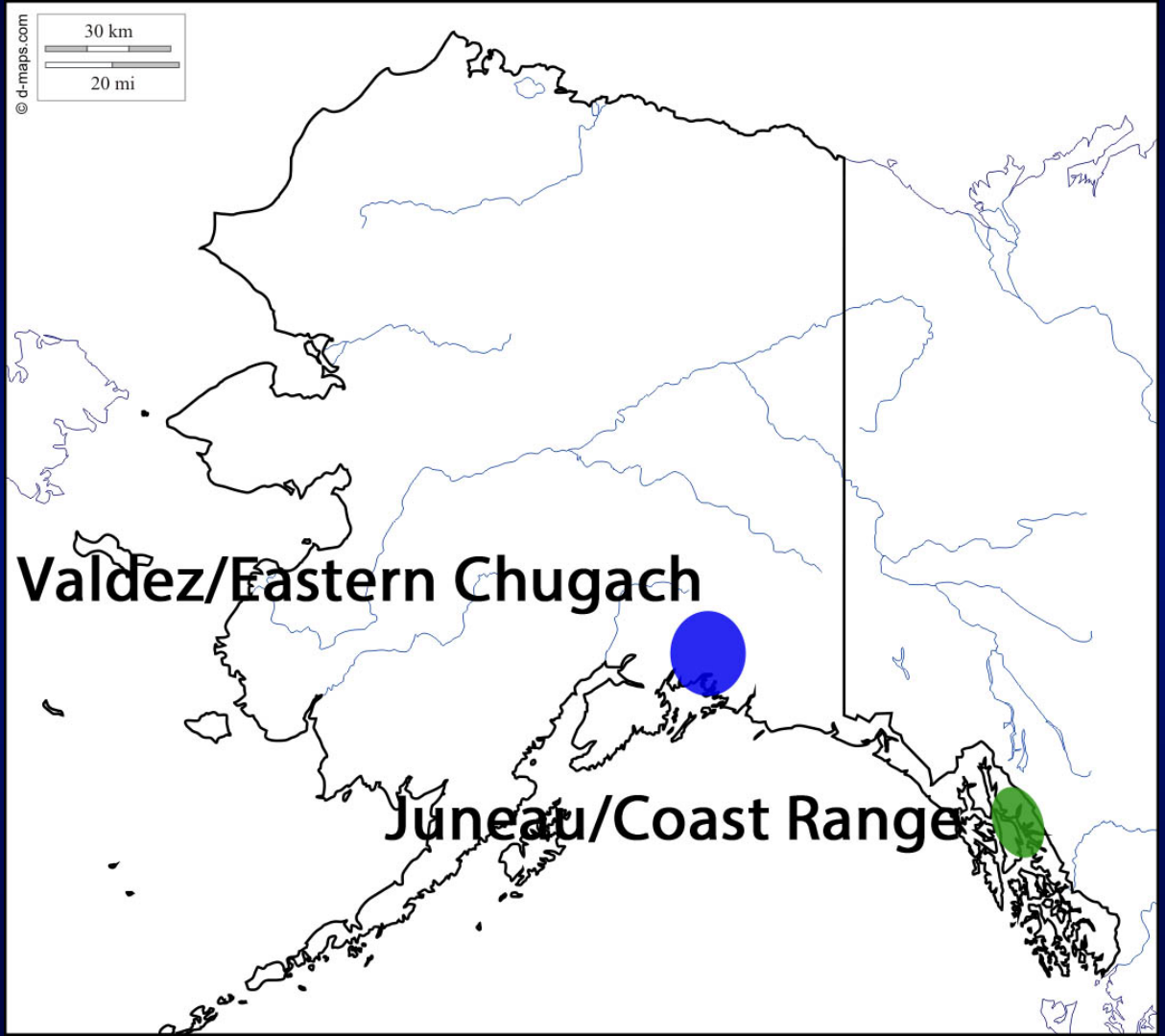
SAAW, Anchorage, AK

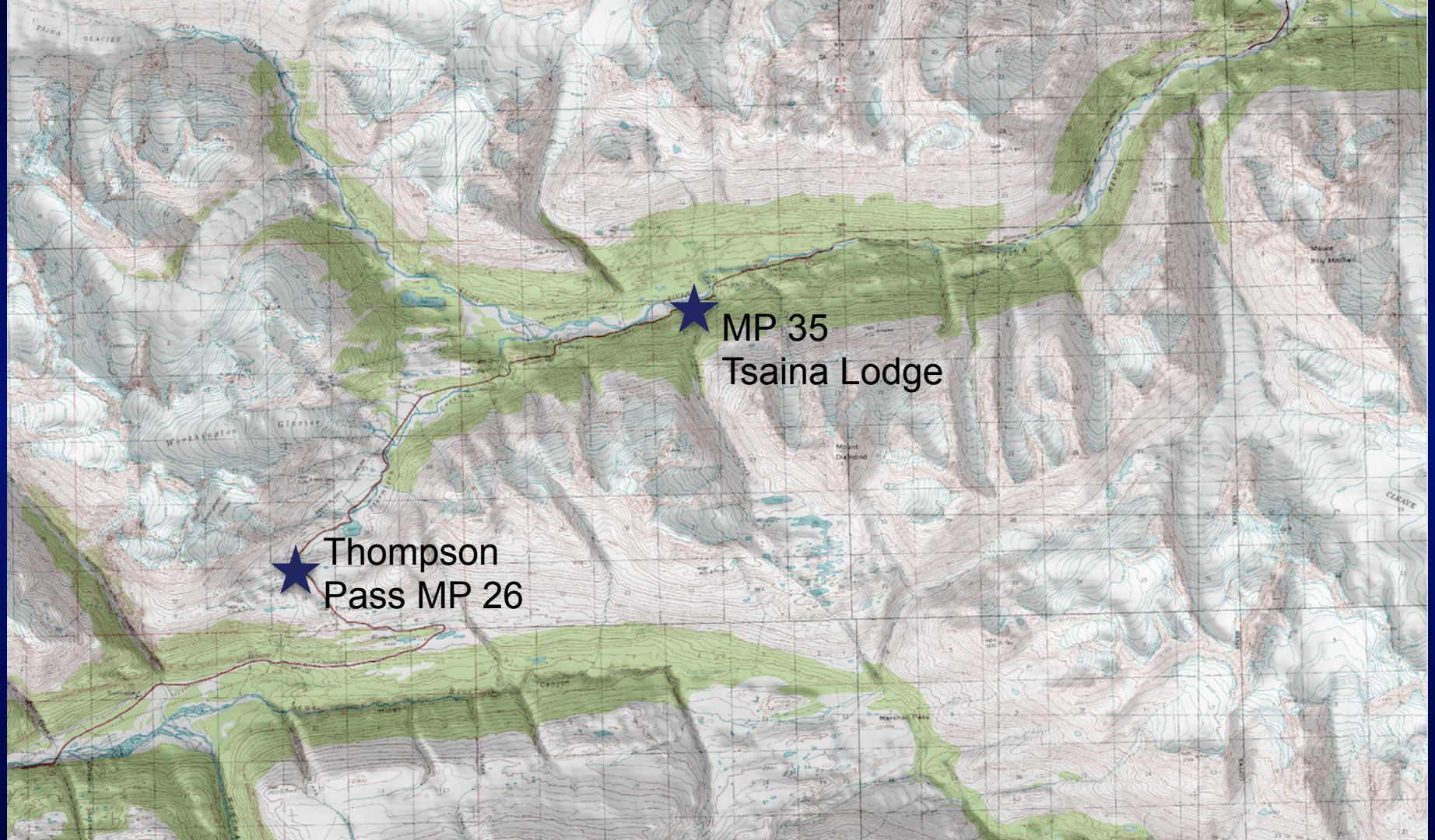
AMERICAN AVALANCHE INSTITUTE

VALDEZ HELI-SKI GUIDES

Format

- Season History focused on the Damnation Facets
- Remarkable things about this weak layer
- Lessons learned (and relearned)
- Future forecasting and communication considerations

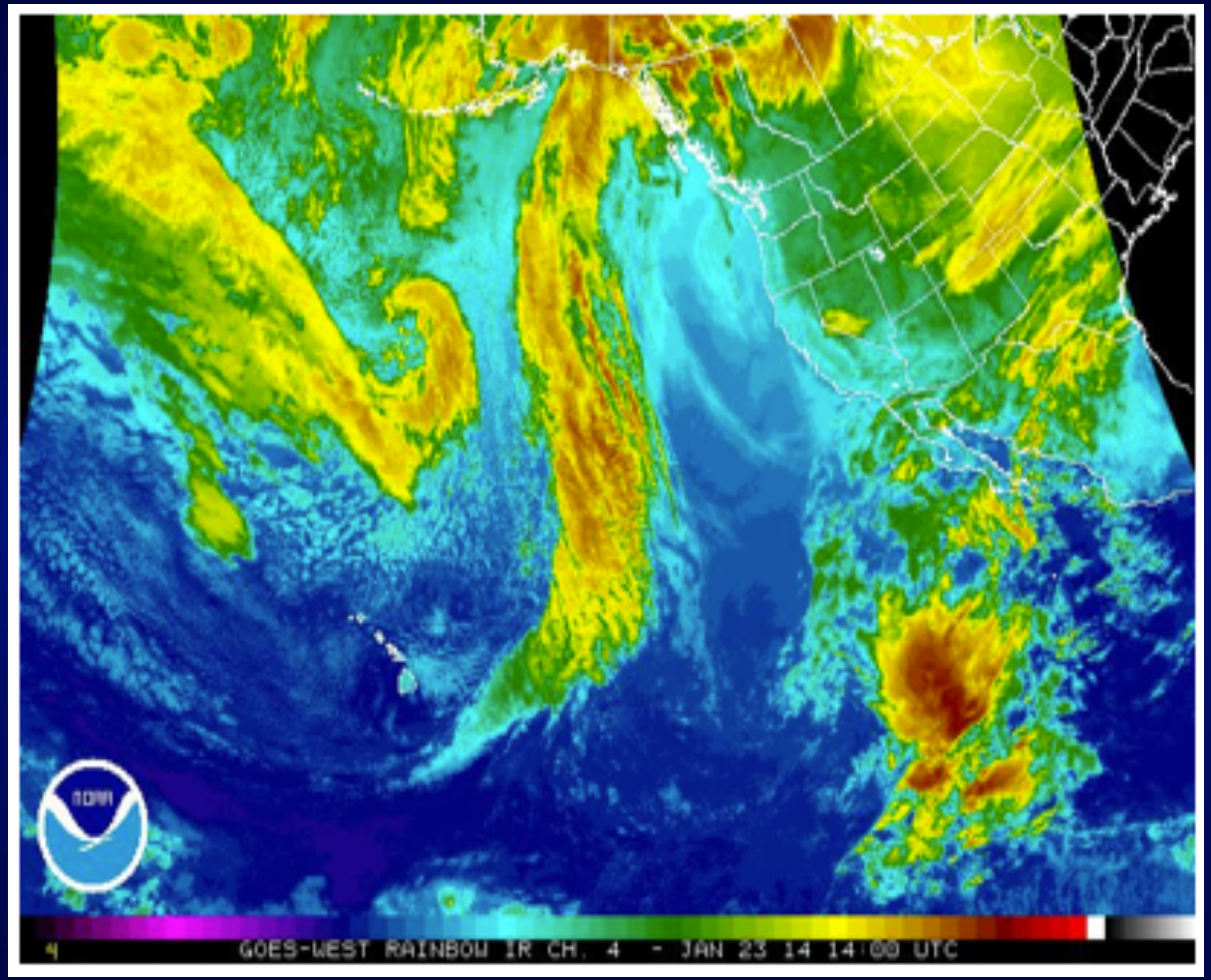

© d-maps.com
30 km
20 mi
Valdez/Eastern Chugach
Juneau/Coast Range


MP 35
Tsaina Lodge
Thompson
Pass MP 26


2013
October
November
December
January 17-25, 2014
January 24-25
January 26 – February 13
February 13 -18
February 18 – March 2
March 2-10
March 11-14
March 15-25
March 26 – April 11
April 12-23
April 23 – May 4
May 4 → ?

NOT TO SCALE


Chris Martin Photography


4
GOES-WEST RAINBOW IR CH. 4 - JAN 23 14 14:00 UTC

January 26 – February 13

February 13 -18

February 18 – March 2

March 2-10

March 11-14

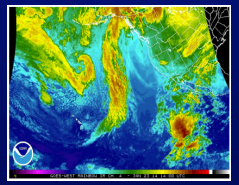
March 15-25

March 26 – April 11

April 12-23

April 23 – May 4

May 4 → ?



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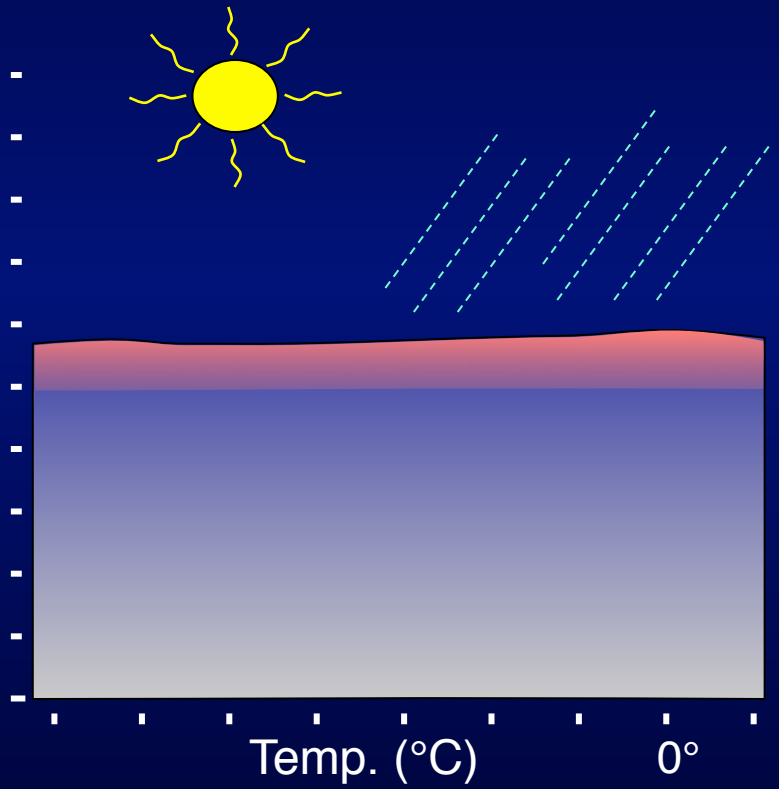
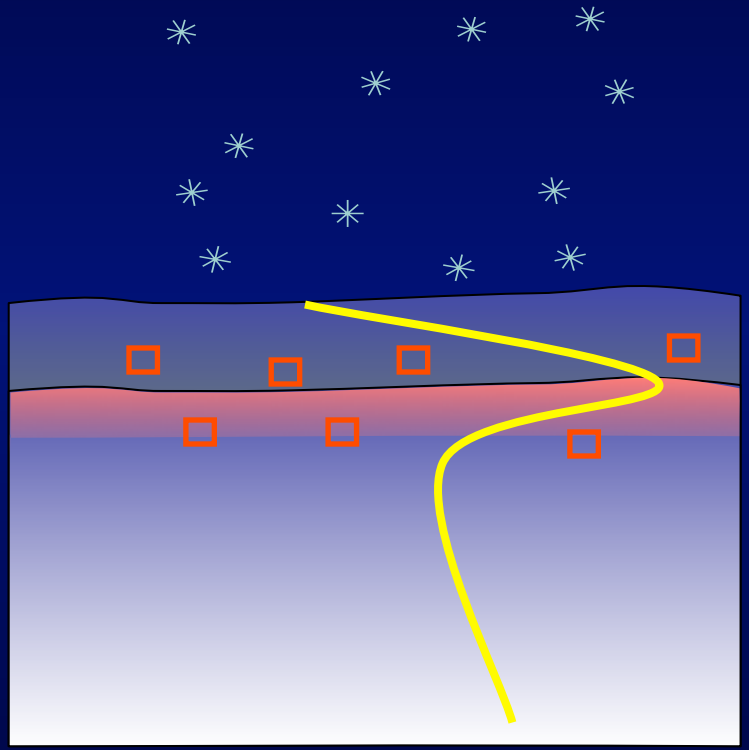
Melt-layer Recrystallization





Graphics by Ian McCammon

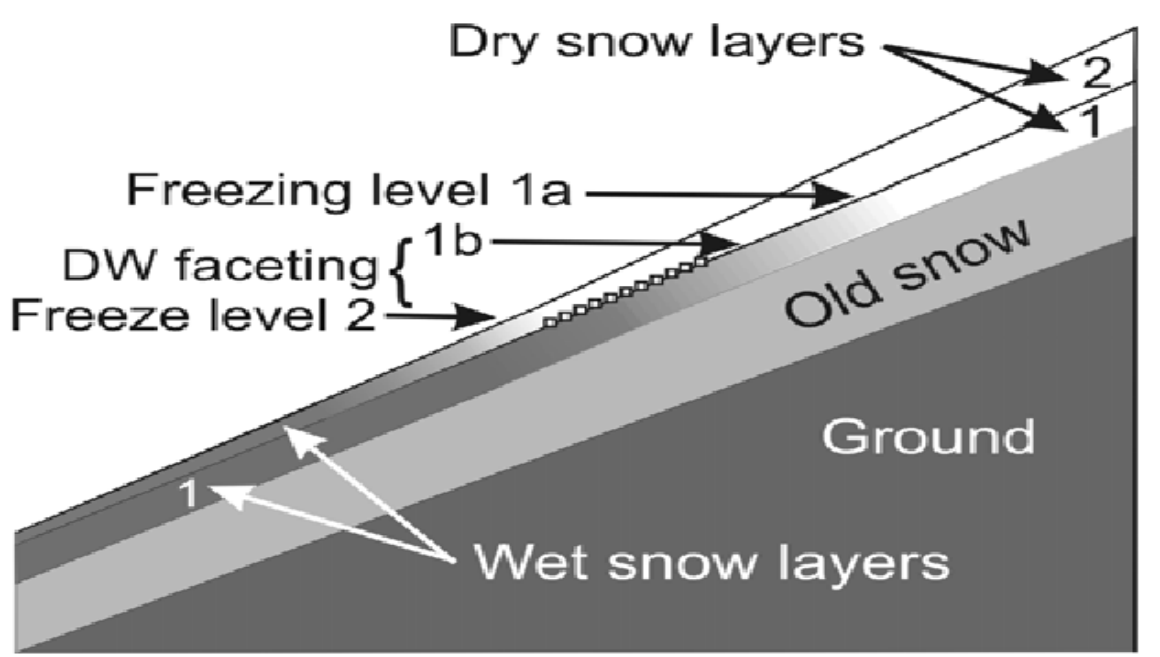
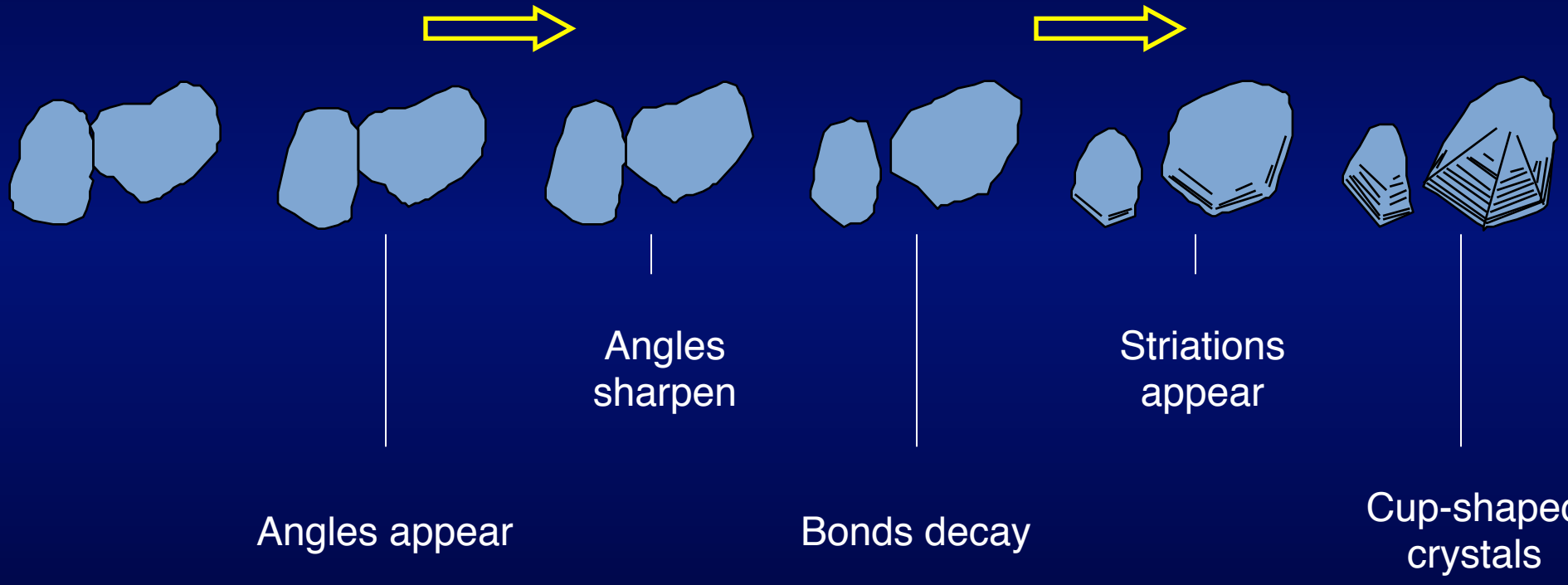


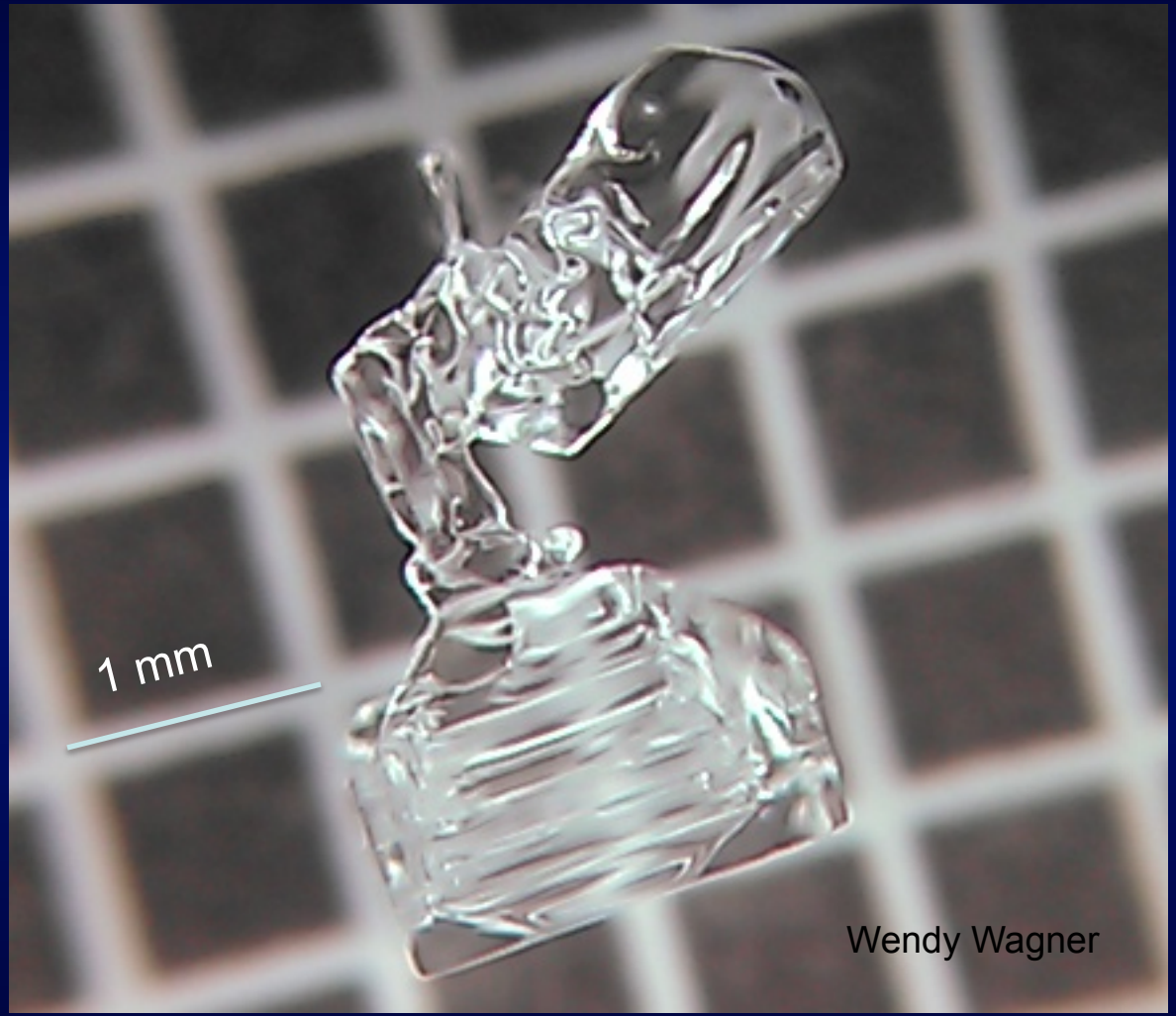
Fig. 4. Diagram showing that favourable condi-tions for dry-on-wet (DW) faceting occurs within a elevation band that is less than the difference in freezing levels in two consecutive

Graphic from Jamieson and Langevin, 2004


7202’
2195 m
4500’
1372m
2500’
762 m
1600’
487 m



Graphic courtesy of Ian McCammon


1 mm
Wendy Wagner

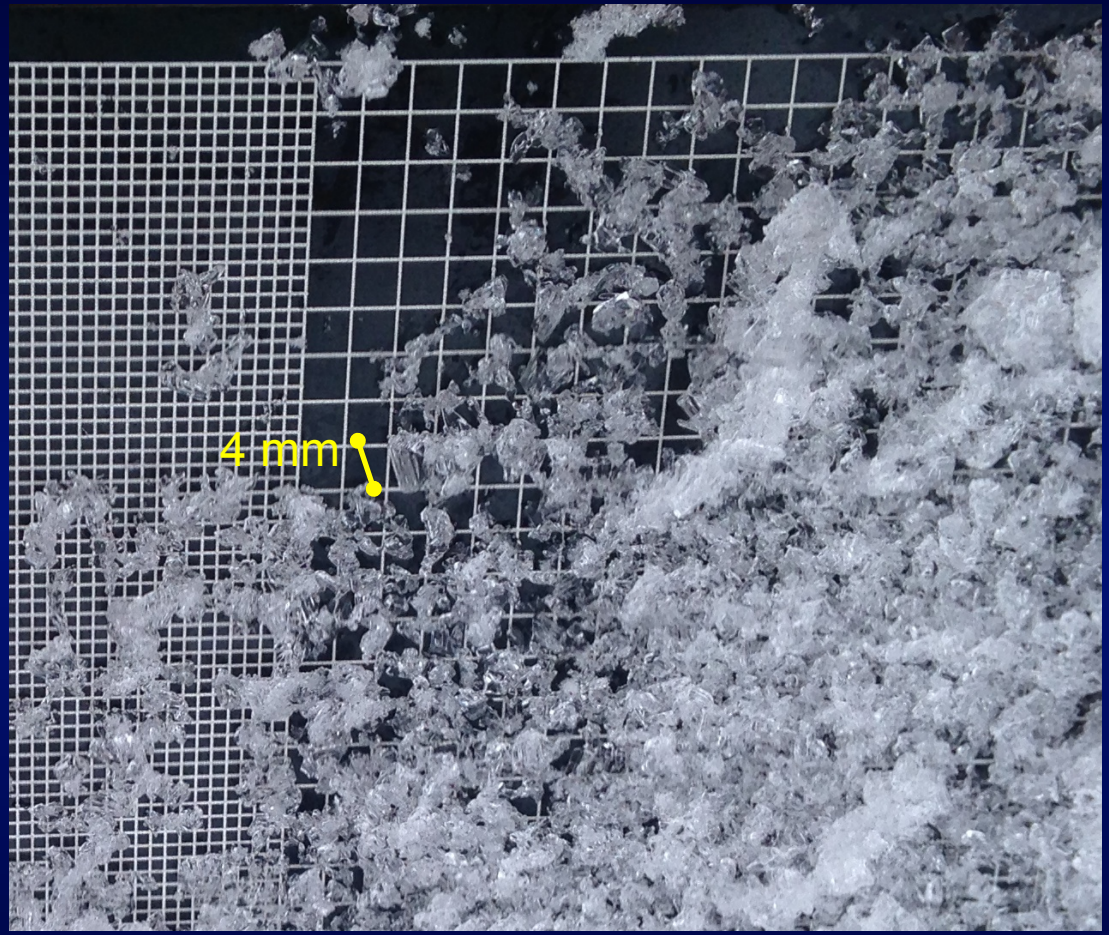


Photo: Eric Poore

Dam Facets Grain Classification

February 13 -18

February 18 – March 2

March 2-10

March 11-14

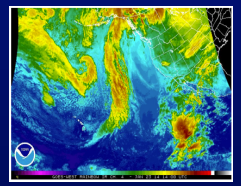
March 15-25

March 26 – April 11

April 12-23

April 23 – May 4

May 4 → ?



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Hey-are you thinking what I'm thinking?
JEMS

February 18 – March 2

March 2-10

March 11-14

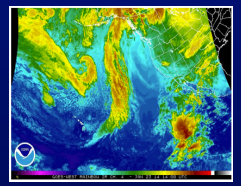
March 15-25

March 26 – April 11

April 12-23

April 23 – May 4

May 4 → ?



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Snow Pit Profile

Stairway:2nd Bench Gully
Chugach, AK
Elevation (ft) **2650**
Aspect: **350**

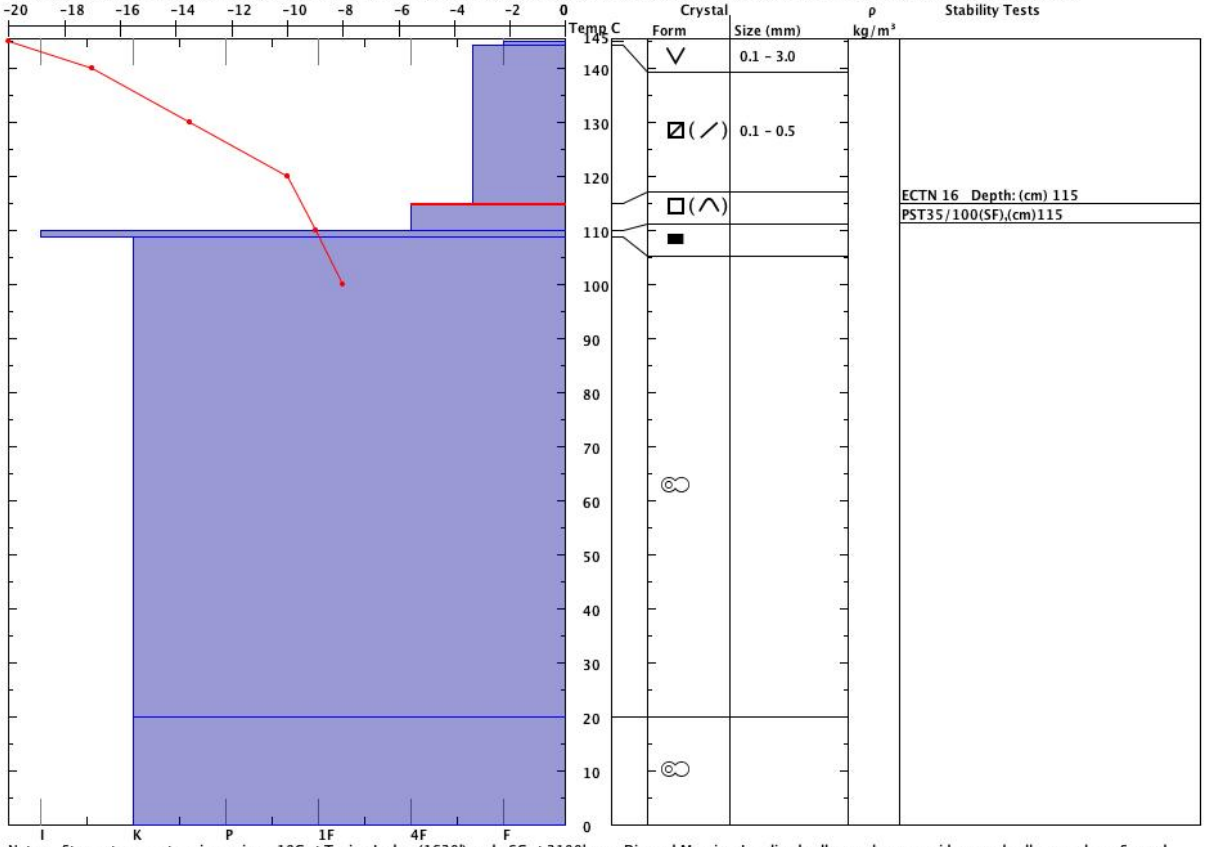
Observer: **Don Sharaf**
Mon Feb 24 16:05:00 AKST 2014
Co-ord: **N W**
Slope: **31**
Wind loading: **previous**

Stability on similar slopes: **Fair**
Air Temperature: **-11.5 C**
Sky Cover: **Clear**
Precipitation: **None**
Wind: **Calm**

PF30 HS145
Stability Test Notes:
115: ECTP 14 SC nearby
115: same result X3

Layer notes:
110-115: Problematic Layer
tiny perc columns
0-20: alders in this layer

Specifics: **Collapsing, widespread. Cracking. Recent act on sim slopes. Recent act on diff slopes. We skied slope. Ski tracks on slope. Snowmobile tracks on slope.**



Notes: Strong temperature inversion. -18C at Tsaina Lodge (1630') and -6C at 3100' near Dimond Moraine. Localized collapses became widespread collapses above Second Bench with propagation up to 20 meters. Almost ALL terrain above 2500' has collapsed and or fractured in previous week. We were getting collapses in areas that have previously collapsed and cracked. Near surface facets formed by melt layer crystallization are the culprit and they lie 20-30 cm down on top of the meter thick "Damalanche Crust" from mid January. These facets are chained and have variable hardness, but most are striated and heading towards cups

March 2-10

March 11-14

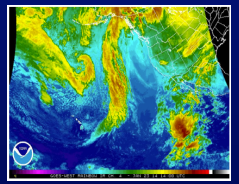
March 15-25

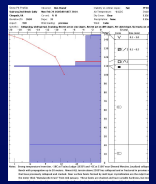
March 26 – April 11

April 12-23

April 23 – May 4

May 4 → ?





NOT TO SCALE

Photo: thebrigade.com

Snow Pit Profile
Cold Smoke-under LZ
Chugach, AK
Elevation (ft) **6200**
Aspect: **320**

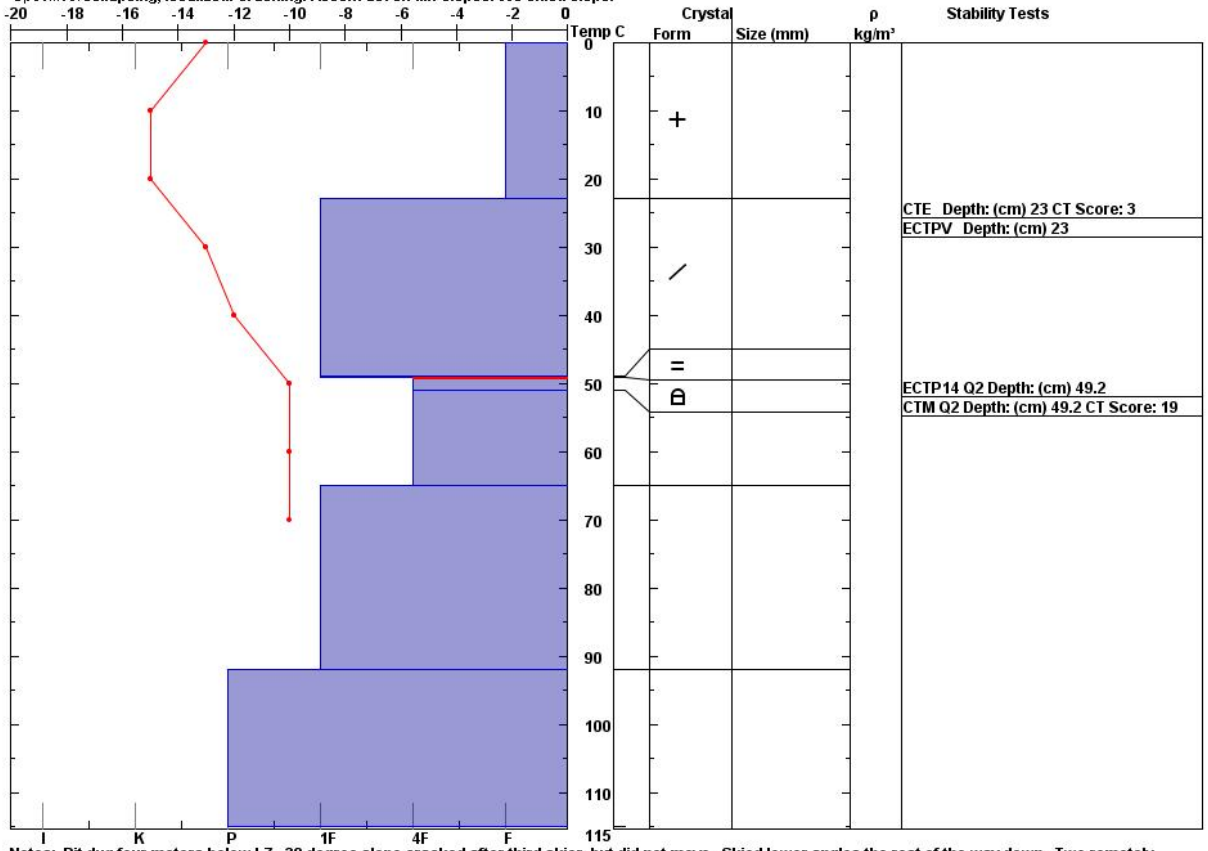
Observer: **Valdez Heli Ski Guides**
Thu Mar 06 15:30:00 AKST 2014
Co-ord: **N W**
Slope: **33**
Wind loading: **previous**

Stability on similar slopes: **Fair**
Air Temperature: **-12.5 C**
Sky Cover: **Clear**
Precipitation: **None**
Wind: **Calm**

PF50 HS385
Stability Test Notes:
23: PC
23: 8 taps
49.2: RP

Layer notes:
49-49.2: 2mm thick
49.2-51: Problematic Layer

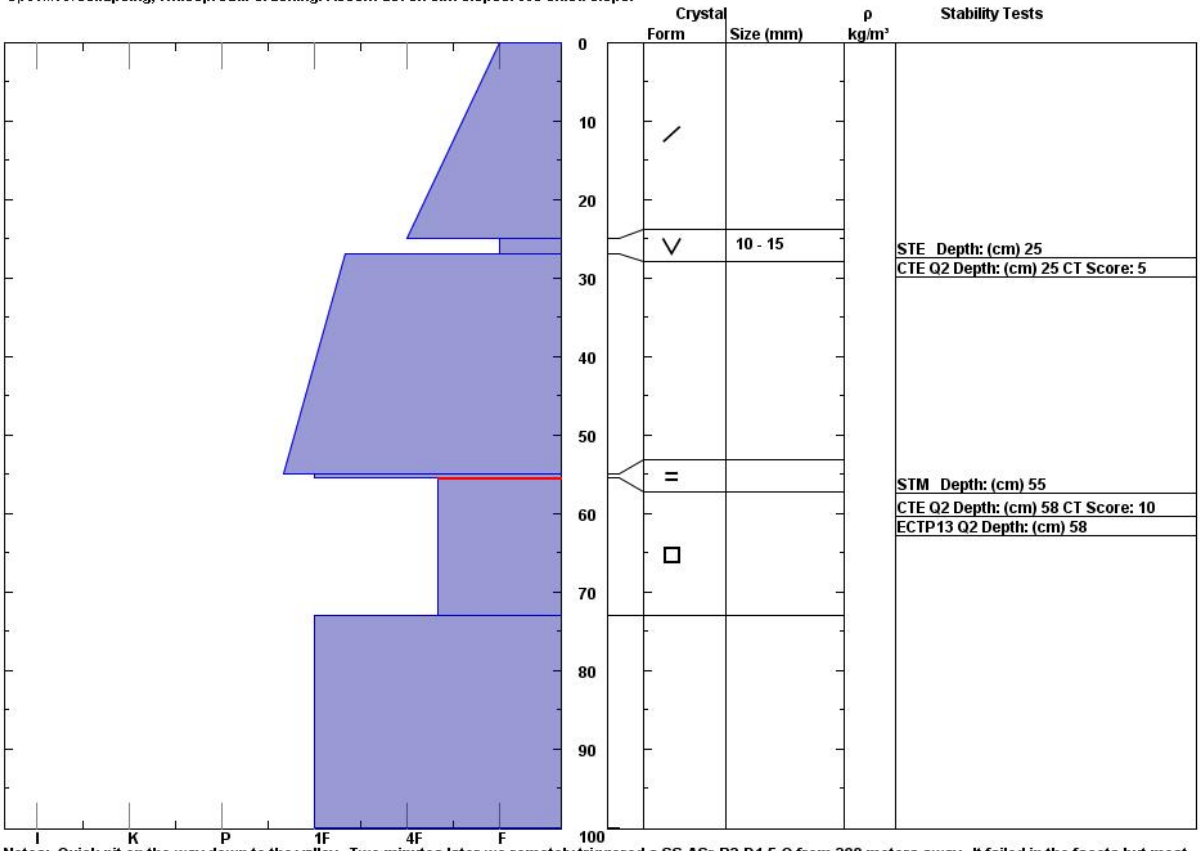
Specifics: **Collapsing, localized. Cracking. Recent act on diff slopes. We skied slope.**



Notes: Pit dug four meters below LZ. 38 degree slope cracked after third skier, but did not move. Skied lower angles the rest of the way down. Two remotely triggered avalanches running in buried SH and on Damnation Facets below 3500'. See pit from same day called Cold Smoke Lowers for more details.

Snow Pit Profile	Observer: **Valdez Heli Ski Guides**	Stability on similar slopes: **Poor**	**PF60 HS237**	Layer notes:
Cold Smoke Lowers	**Thu Mar 06 15:50:00 AKST 2014**	Air Temperature: **C**	Stability Test Notes:	**55-55.5: decomposing**
Chugach, AK	Co-ord: **N W**	Sky Cover: **Clear**	**58: RP**	**55.5-73: Problematic Layer**
Elevation (ft) **3880**	Slope: **33**	Precipitation: **None**		
Aspect: **10**	Wind loading: **no**	Wind: **Calm**		**73-100: 100 bottom of obs**

Specifics: **Collapsing, widespread. Cracking. Recent act on sim slopes. We skied slope.**



Notes: Quick pit on the way down to the valley. Two minutes later we remotely triggered a SS-ASr-R2-D1.5-O from 200 meters away. It failed in the facets but most of what ran was only as deep as the buried surface hoar 25cm down. Another 4m pocket pulled out on the way down and ran across very low angle terrain on the way to the valley bottom ~1200'. Sensitive snowpack overall particularly below 3500'. No buried SH in the pit below the LZ at 5900'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March 11-14

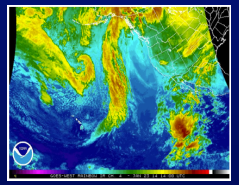
March 15-25

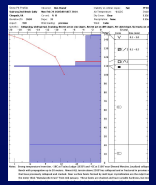
March 26 – April 11

April 12-23

April 23 – May 4

May 4 → ?





NOT TO SCALE

Snow Pit Profile
Stairway: 3rd Bench
Chugach, AK
Elevation (ft) **2700**
Aspect: **005**

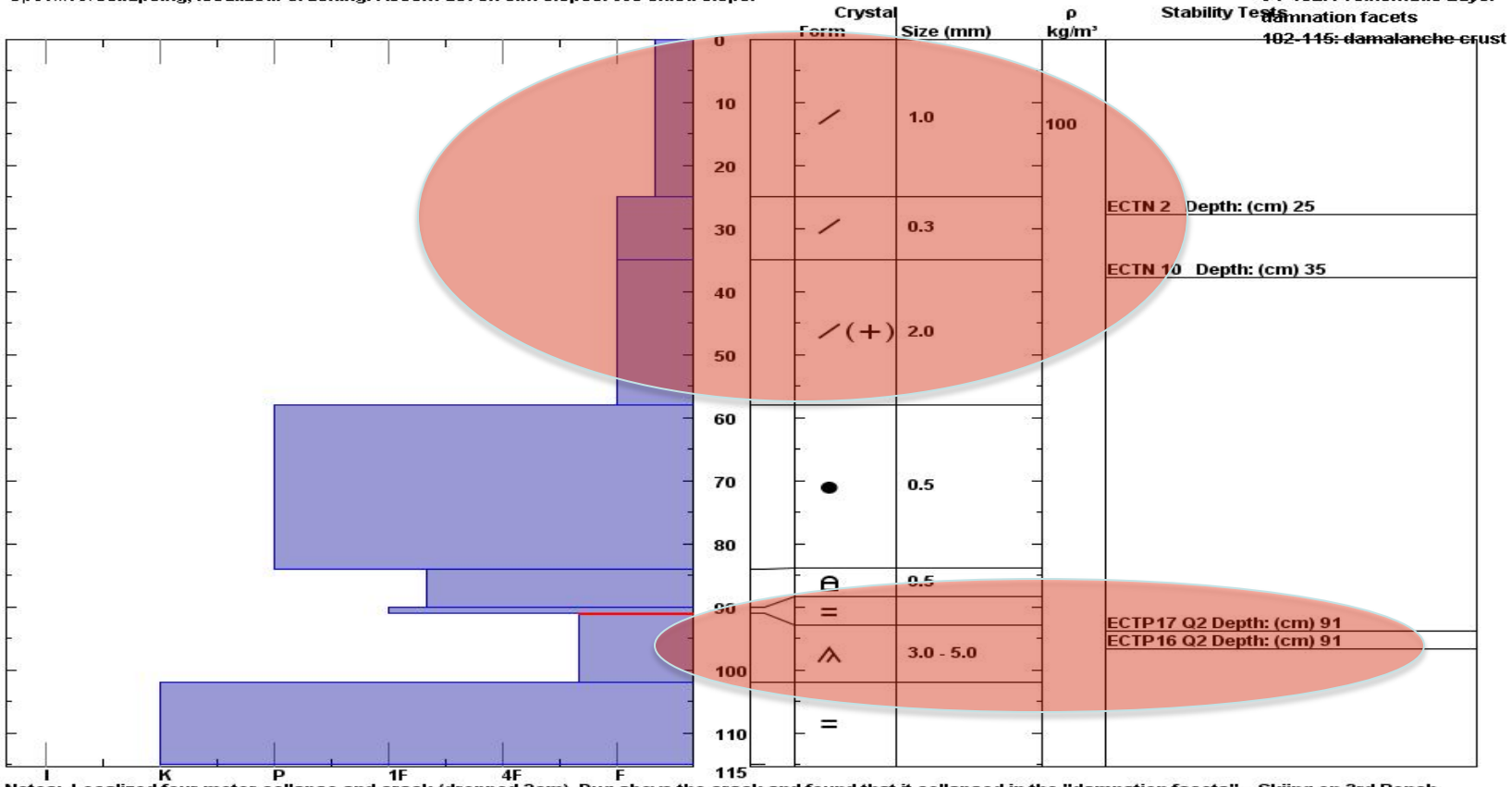
Observer: **Valdez Heli Ski Guides**
Tue Mar 11 11:05:00 AKDT 2014
Co-ord: **N W**
Slope: **32**
Wind loading: **previous**

Stability on similar slopes: **Fair**
Air Temperature: **0 C**
Sky Cover: **Fog**
Precipitation: **Snow - 2 cm/hr**
Wind: **S Light Breeze**

PS40 HS155
Stability Test Notes:
25: twice
35: twice
91: SC both times

Layer notes:
0-25: rimed
25-35: rimed
58-84: wind slab from 3/8
90-91: decomposing
91-102: Problematic Layer damnation facets
102-115: damalanche crust

Specifics: **Collapsing, localized. Cracking. Recent act on sim slopes. We skied slope.**



Notes: Localized four meter collapse and crack (dropped 2cm). Dug above the crack and found that it collapsed in the "damnation facets" . Skiing on 3rd Bench produced cracks, but no release on angles to 38 degrees. Second Bench a small pocket released on the fourth skier (65cm deep to dam facets) and only storm snow was moving on First Bench. HST from 1630 to 3000' averaged between 40 and 50cm. Estimated HSTW at base wa ~1.7" of water.Bottom of pit at 115 but "Damalanche Crust" continued to base of snowpack.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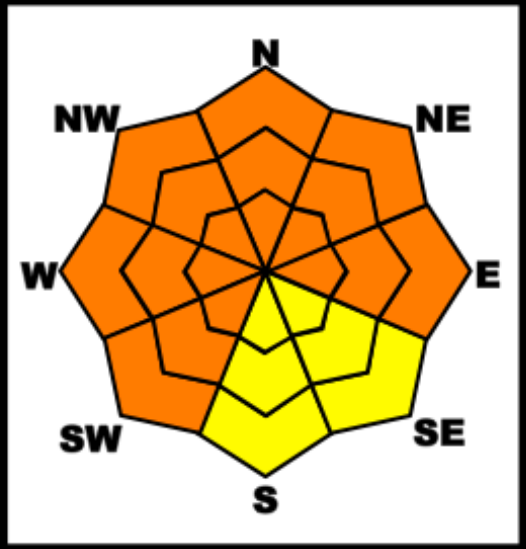
CONCERN: Persistent

Confidence: high — low



SENSITIVITY	LIKELIHOOD
UNREACTIVE	VERY UNLIKELY
STUBBORN	UNLIKELY
TOUCHY	POSSIBLE
VERY TOUCHY	LIKELY
	VERY LIKELY

D-SIZE D1 D2 D3 D4 D5

Buried 1-2cm tall surface hoar down 50-85cm overlies
Damnation Facets 5-15cm thick down 60-120 cm from the surface

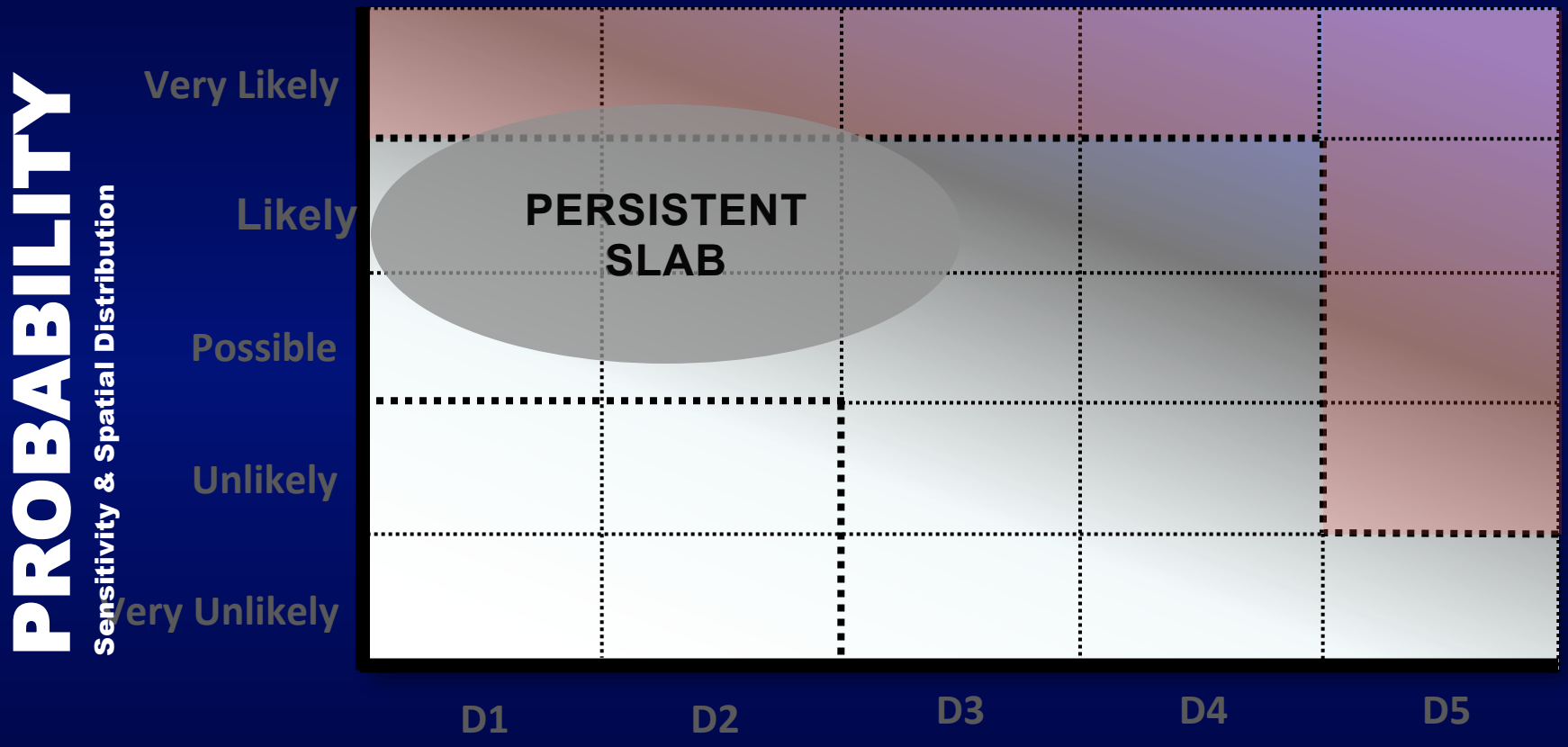
Poor structure (4-5 Lemons), Moderate Strength,
Variable Friction (Angle and Slab Stiffness dependent)
High Continuity (Widespread Distribution)

Greatest Depths on W/NW/N
Most sensitive between 2500' and 4500'

DEPTH 60-120 cm

TREND

SUMMARY: CONCERNS



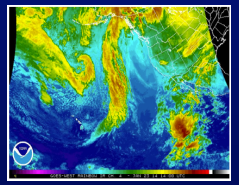
March 15-25

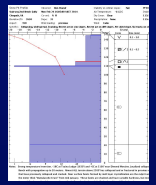
March 26 – April 7

April 7-23

April 23 – May 4

May 4 → ?





NOT TO SCALE

VHSG AVALANCHE AND STABILITY SUMMARY

DATE March 14, '14

Regions Skied: Heli #1 Backyard Heli #2 ____ Heli #3 ____

GUIDE:	J2/DS	KAK	DW	JW				RECON
RUN 1	B11-W	STWY W	B11 W	STWY-W				RHINESTO
RUN 2	KARAT 1	"	Karat 3	"				
RUN 3	STWY-W	PERCH W	Karat 2					
RUN 4			Stway P.W.					
RUN 5								
RUN 6								
RUN 7								
RUN 8								
RUN 9								
RUN 10								
RUN 11								

Comments can include avalanche activity, ski and boot pen., new snow depths, surface snow type, areas of recent wind load...

AVALANCHE LIST F/RECON

(1) RFS EXIT GULLY SS-AA-R1-D1.5

(2) CI SPLITTER RIDGE ENE
SS-N-R2-D2-O-80cm+

(3) C.I. FAR SKIERS (R) W50
NORMAL POCKET
SS-N-R2-D2-O

(4) CHERRY COULOIR
SS-N-R1-D1.5-O
Lower 1/3 of couloir

(5) & (6) NICKS
CENTER DOME
SS-N-D1.5 = NE
SS-N-D2 = NW

(7) SHALLOW 15-20cm
WIND SLABS
ABOVE STEEP CAMPS
HS-N-R1-D1 x3

(8) RFS LOWERS
SS-ASr-R2 D1.5-O
D.C. & B.C. 150-200m away

(9) STAIRWAY 4th Bench
SS-ASr-R4-D2-O ↓60-80
triggered from 1/4 mile away
MARCH 13, 2014 1500

(10) Back It In Moraines
SS-N-R2-D2-O↓60+ (x4)

E. CAT AREA Numerous Long collapses south

Rhinestone 4 second collapse

CI Lowest roll

AM WX (1) 0°C @ BASE @0900
10-25mph -9°C @5900'
@1100

PM OBS ⊕ → ⊗
S1

(14) RFS BOWL
SS-N-R2-D2-O↓80+

(13) MARCH 12 - CAT E ROAD
HS-ASr-R3-D1.5-O↓60-140 x2

BLACK HOLES
SHOTS - NO RESULTS
X3 MAGIC KINGDOM
JUDGES STAND

(11) SKIERS (L) & (R) of STWY-W COULOIR
SS-N-R1-D1.5-O during storm

(12) PROMISED LAND - MIDDLE COULOIRS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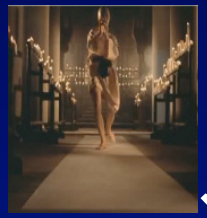

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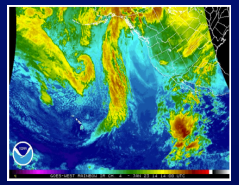
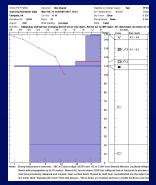
May 4 → ?





NOT TO SCALE

ARE WE GOOD, OR ARE WE LUCKY?

Defensive terrain choices have been important

Defendable ski cuts have been important

Recon has helped – dig as we move into new areas

High elevations have helped – be wary of runs with no high pick-up options

Don’t be afraid to back off.

Remember persistent layers are persistent for a reason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ECTX
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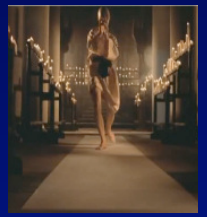
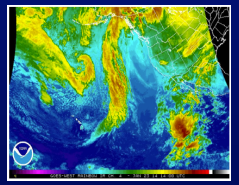
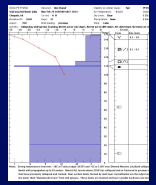


April 12-23

April 23 – May 4

May 4 → ?





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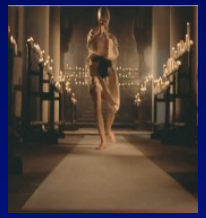
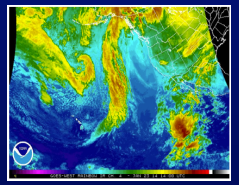
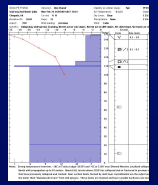


April 23 – May 4

May 4 → ?





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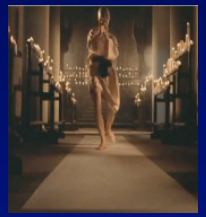
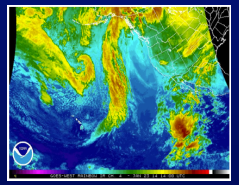
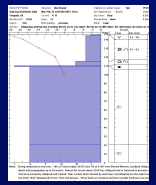


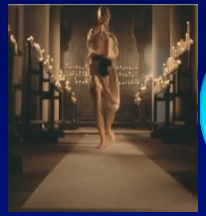
May 4 → ?

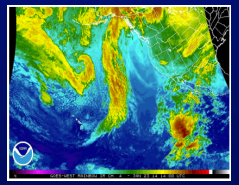


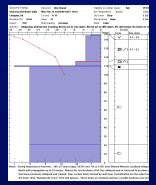


NOT TO SCALE



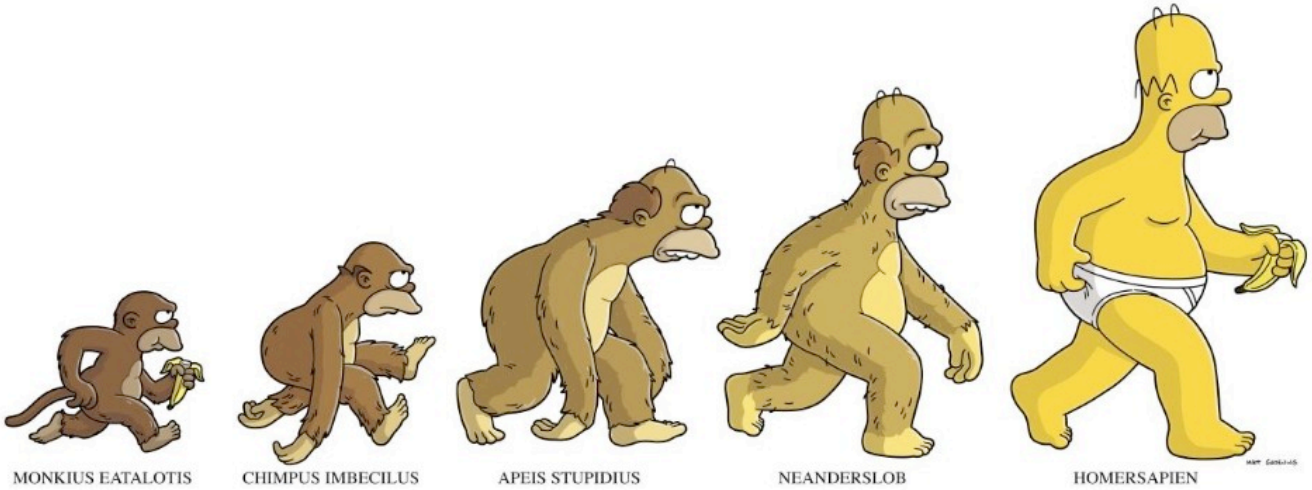






NOT TO SCALE

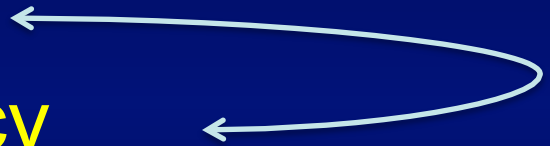
Forecasting Lessons

Evolution of a Weak Layer



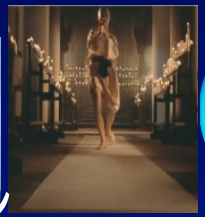
Evolution of a Weak Layer

- Formation
- Activity
- Dormancy
- Inactivity
- Removal

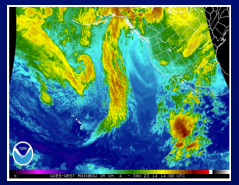



ACTIVITY (#1)

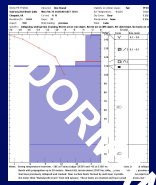

ACTIVITY (#2)




REMOVAL




FORMATION


DORMANCY(#1)

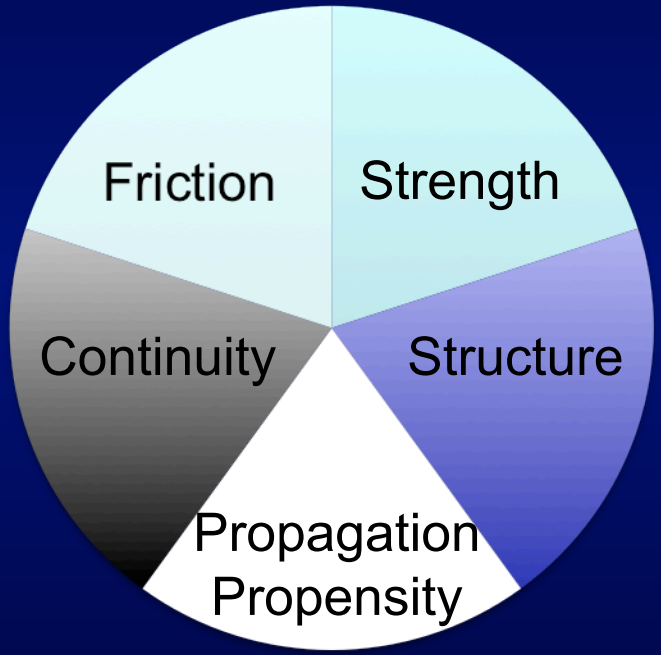

ACTIVITY (#2)


DORMANCY(#1)


ACTIVITY (#3)

NOT TO SCALE

Avalanche Release



What was consistent

- Strength remained moderate for the vast majority of stability tests. Only far into the third dormant period did the strength move into the “hard” realm.
- Strength had poor correlation with avalanche activity.

What was consistent

Structure was the most remarkable part of following this PWL.

Structure was “horrible” for months and more than any other factor demanded the continue wariness that we gave it.

As the structure changed VERY slowly it had poor correlation with avalanche activity.

What was consistent

Propagation lasted far longer than the avalanche activity.

The PST was helpful in discerning why we were often seeing propagation, but not release.

For this particular PWL, propagation in the ECT's was not a great index for avalanche release.

What was consistent

Continuity for this weak layer was exceptional.
Beware of Melt-Layer Recrystallization distribution

Continuity of the slab was ‘average’
Beware of times with high slab continuity

What was consistent

Friction was more dependent on slab stiffness and slope angle than on weak layer thickness, size, and shape.

Friction appeared to correlate with avalanche activity, but could not be viewed independently.

The Difference Between a Whumph and an Avalanche:

Why some avalanches need steeper slopes to run

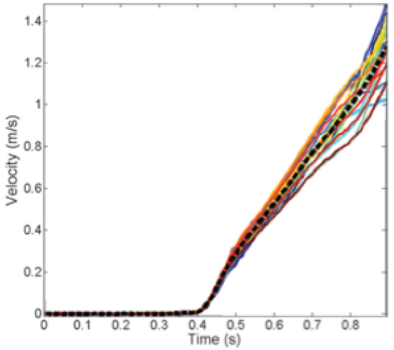
Story by Ron Simenhois, Alec van Herwijnen and Karl Birkeland

Many avalanche-minded folks have noticed that new snow avalanches and old snow avalanches tend to prefer different slope angles. In fact, in Colorado – where many avalanches release on persistent weak layers – the Colorado Avalanche Information Center tends to remind people traveling in avalanche terrain to be cautious on slopes steeper than 30 degrees. The slope-angle thresholds used by avalanche centers increases as you travel west, and the avalanche problem migrates from wind and persistent slabs to storm slabs. Ian McCammon *(2009)* already pointed out that the minimum slope angle for avalanching is not the same for different weak layers. However, he does not explain the cause behind this phenomenon. Thus, the reasons why storm-slab avalanches typically run on steeper slopes than wind- and persistent-slab avalanches has remained elusive. We decided to take a few measurements and see what we could find.

For an avalanche to release, two things must happen. First, a crack must propagate through a weak snowpack layer over a large area. Second, the gravitational pull on the detached slab

Date	Slab hardness	Slab type	Weak layer	Friction coefficient [μ]	Sliding angle [deg]	Avalanche activity
19 Dec. 2011	1F-	RGwp	DF	0.65	33	High
14 Feb. 2012	P	RGwp	PP	0.57	30	None
14 Feb. 2012	P	RGwp	PP	0.60	31	None
21 Feb. 2012	4F+	DFbk	PP	0.80	39	High
21 Feb. 2012	4F+	DFbk	PP	0.79	38	High
22 Feb. 2012	4F	RGwp	DF	0.79	38	None
22 Feb.2012	4F	RGwp	DF	0.75	37	None
11 Feb. 2013	1F	DFbk	DF	0.82	39	None
18 Feb. 2013	4F	DFbk	DF	0.88	41	High
21 Feb. 2013	4F+	DFbk	PP/DF	0.82	39	High

Table 1. Snowpack characteristics, related avalanche activity, and friction coefficient from the Kakuhan mountain range in Southeast Alaska.



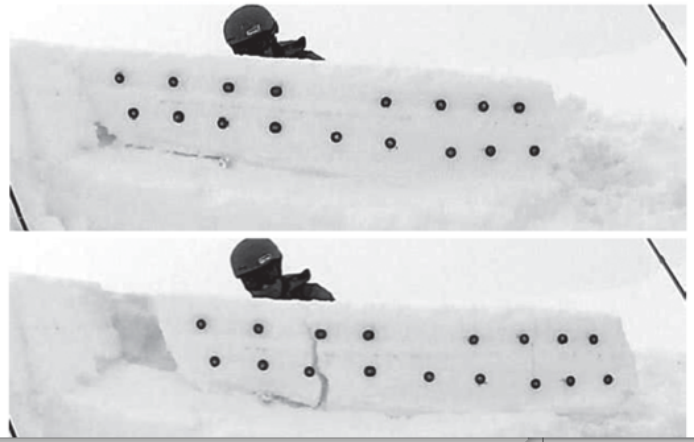
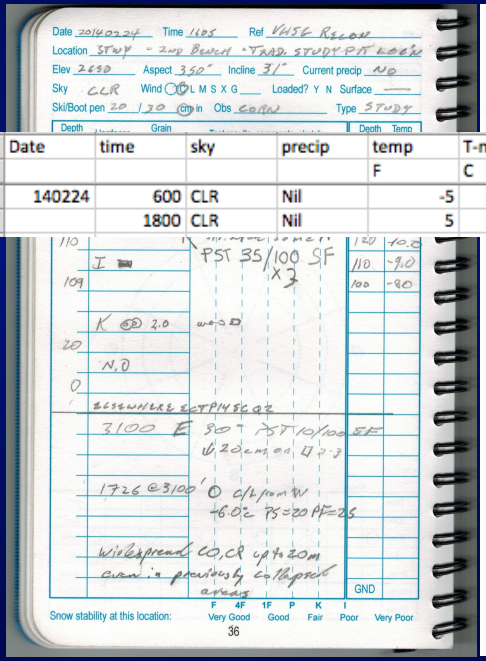
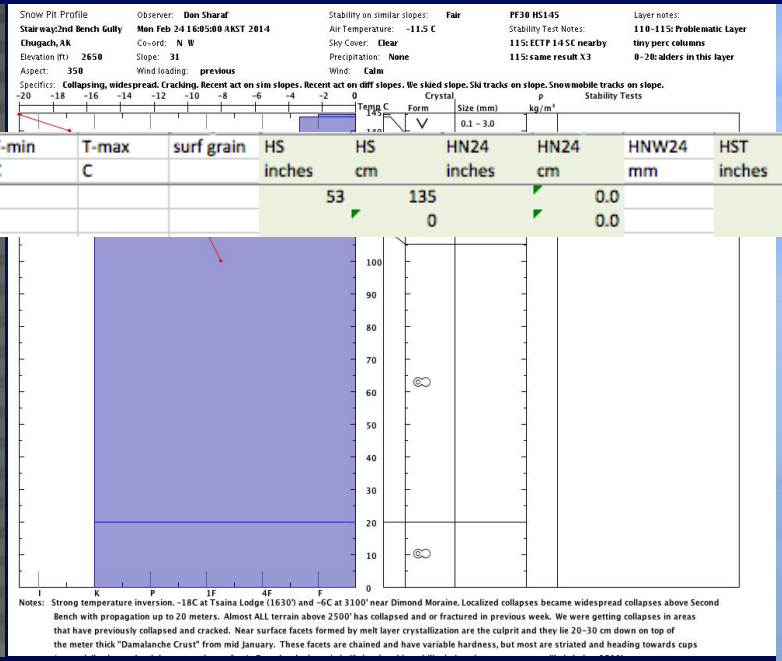


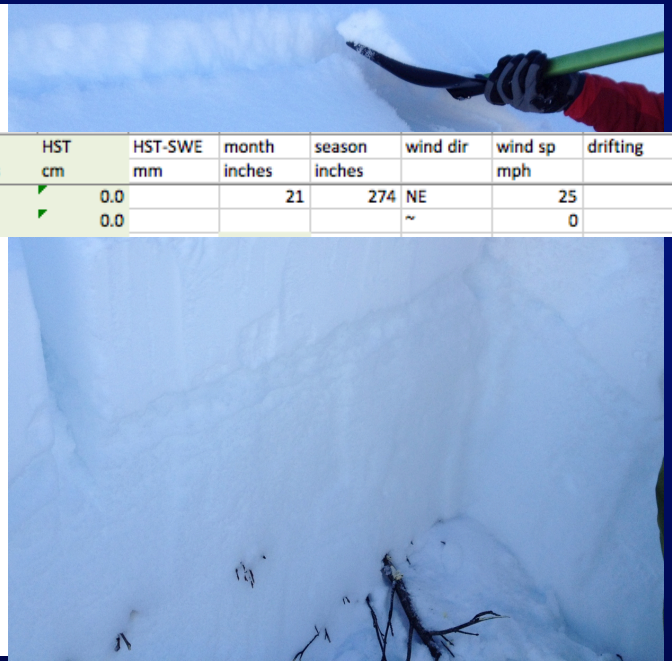
Figure 1. *Right:* Field setup of PST-like tests with markers. The images on the right are from a video sequence we used to obtain the friction coefficient. The top image is the last image before a fracture sets in,

File Sharing

Keep a narrative account of the season







Date	time	sky	precip	temp	T-min	T-max	surf grain	HS	HS	HN24	HN24	HNW24	HST	HST	HST-SWE	month	season	wind dir	wind sp	drifting
				F	C	C		inches	cm	inches	cm	mm	inches	cm	mm	inches	inches		mph	
140224	600	CLR	Nil	-5				53	135		0.0			0.0		21	274	NE	25	
	1800	CLR	Nil	5					0		0.0			0.0				~	0	

20140224 – Clear and cold (-20 C). Light NW wind. No transport today. Backyard tour to 3100’ on E. Dimond Moraine. Widespread CO (up to 20m prop.) above 2nd Bench. Widespread evidence of avalanche cycle at end of 2/14 storm –D1.5 avalanches and widespread old cracks even on low 30 degree terrain. Slab has disintegrated with NSF, so even though there is prop in some pits, it doesn’t appear to be ready to avalanche currently (high friction?). FC/DH ABOVE Damalanche Crust are large, sharp, and striated. This layer will seemingly be with us for a long time. No other concerns other than this PWL. Want to see how this layer is distributed by elevation and throughout our other circuits.

Tracking weak layers

Pay attention to “All the pie slices”

Distill your observations into patterns and outliers. The narrative can help here

Document/Photo/Record the weird stuff.

Get out when “nothing” is happening.

Thank You

Mike Janes

John Fitzgerald

Doug Krause

Peter Carter

Ron Simenhois

Karl Birkeland

Andy Lapkass

VALDEZ
HELI-SKI GUIDES

QUESTIONS

Photo: Mark Bedenbender