

The 5 Step Checklist System

- A proven method for
Avalanche Forecasting, Loss Prevention
and Safety

Presented By: Mike Wiegele





Mike Wiegele

Helicopter Skiing



Our mandate:

Risk Management Plan for Loss Prevention



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Reduction of human factors:

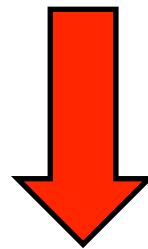
- Using the **5 step checklist** for avalanche forecasting and for safe travel in the mountains
 - It is a systematic method for stability rating
 - Reduces the human factors in making errors
 - Prevents missing any items that have an effect on the snowpack stability
- 45 years experience, over 30,000 snow profiles, ~ 1000 annually



The 5 Step Checklist

Forecasting snow stability rating

- ☐ 1. Daily weather data
- ☐ 2. Graphs
- ☐ 3. Snow Profile observations
- ☐ 4. Field observations
- ☐ 5. Ski test and stability ratings



Ski terrain choice & use of guiding procedures



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Nature's Complexity & Chaos

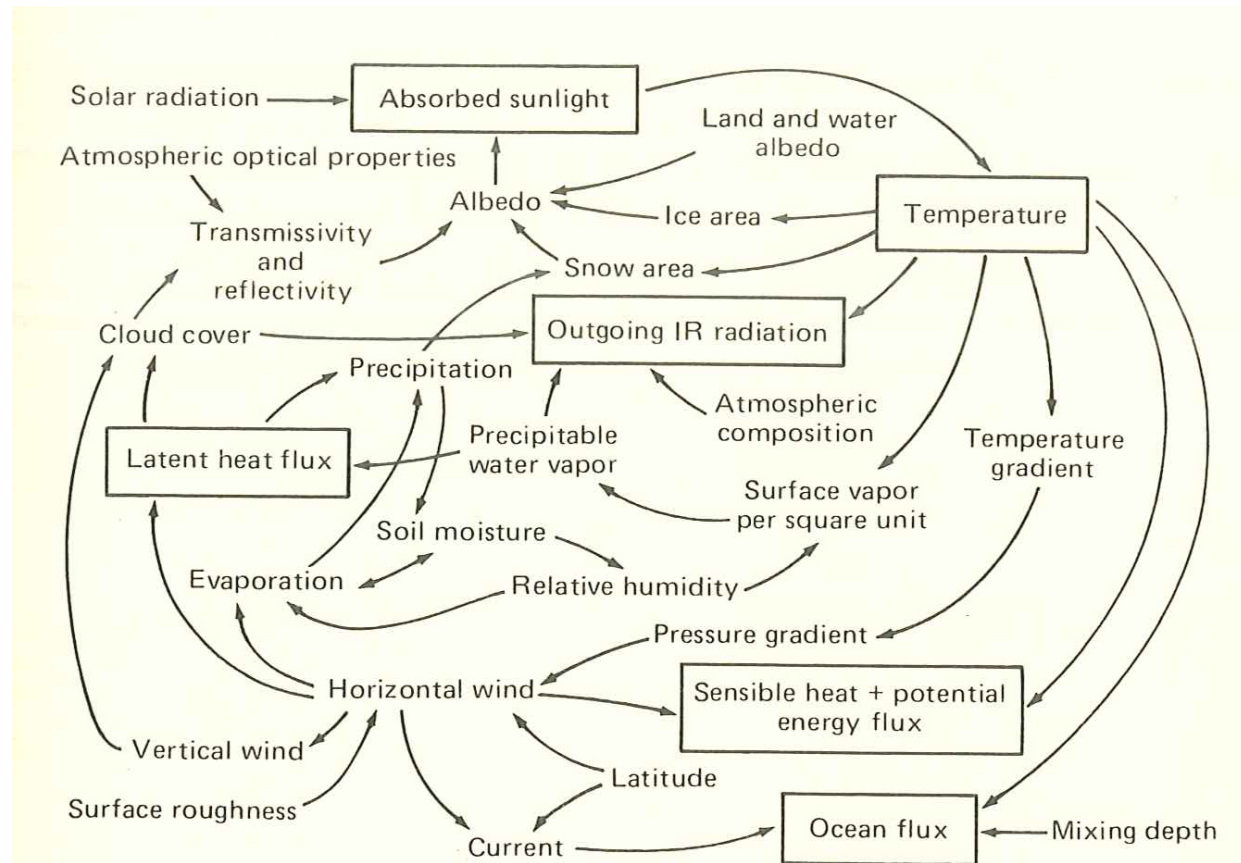


Figure 1.1. A model of the weather and climate machine illustrating its complex and intricate feedback mechanisms. The influence of several of the feedback processes are comparable in magnitude but opposite in direction. It is clear that variations in the energy input parameter at the top left may affect several of the meteorological parameters within the machine. From Kellogg and Schneider (1974).



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Our Professional Ski Guides Organization



CSGA (Canadian Ski Guide Association) & CIMS (Canadian Institute for Mountain Safety)



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Step 1

Daily Weather Data

MW DAILY WEATHER DATA MW

CARIBOO MONASHEE 2000m MTN. WIND
NEEL 3000m

DATE 060482
FREEZING LEVEL 5000' DPS 0 VISIBILITY 12
BAR P. 101.97 CEILING 7000' SKY ⊕

	Blue River 2240'	Mount St. Anne 6300'	Hoch Peak 8500'	Upper Level 9000'		
				Fr. George	Kelowna	Annette
Temperature	0	-6	-9	-15	-13	-14
Temperature max	0	-6	-9			
Humidity	97		96	96	79	100
Humidity (max)	2					
Precip. (mm)	2					
H ₂ O mm (H ₂ O)	18					
Density kg m ⁻³	2					
Ht. of Snow (m)	2	5				
LOAD CALCULATION						
Snow (mm)				-		
Wind (24hr run/30)				-		
Total				-		
MAXIMUM WIND GUSTS						
St. Anne				km/h -		
Hoch Peak				km/h -		
48				18	18	26
5W				NW	SW	NW
632						
Volcanic Cycle Mod. 705-720				High ~		
LAST LIFT: 1100						

SYNOPSIS
Ridge of Pressure
Building body + too
LAST UNTIL MID WEEK.

FORECAST
Today: Clearing, then
Sunny ☉
Tomorrow: Mooney ☺

IN SNOW TEMPERATURES



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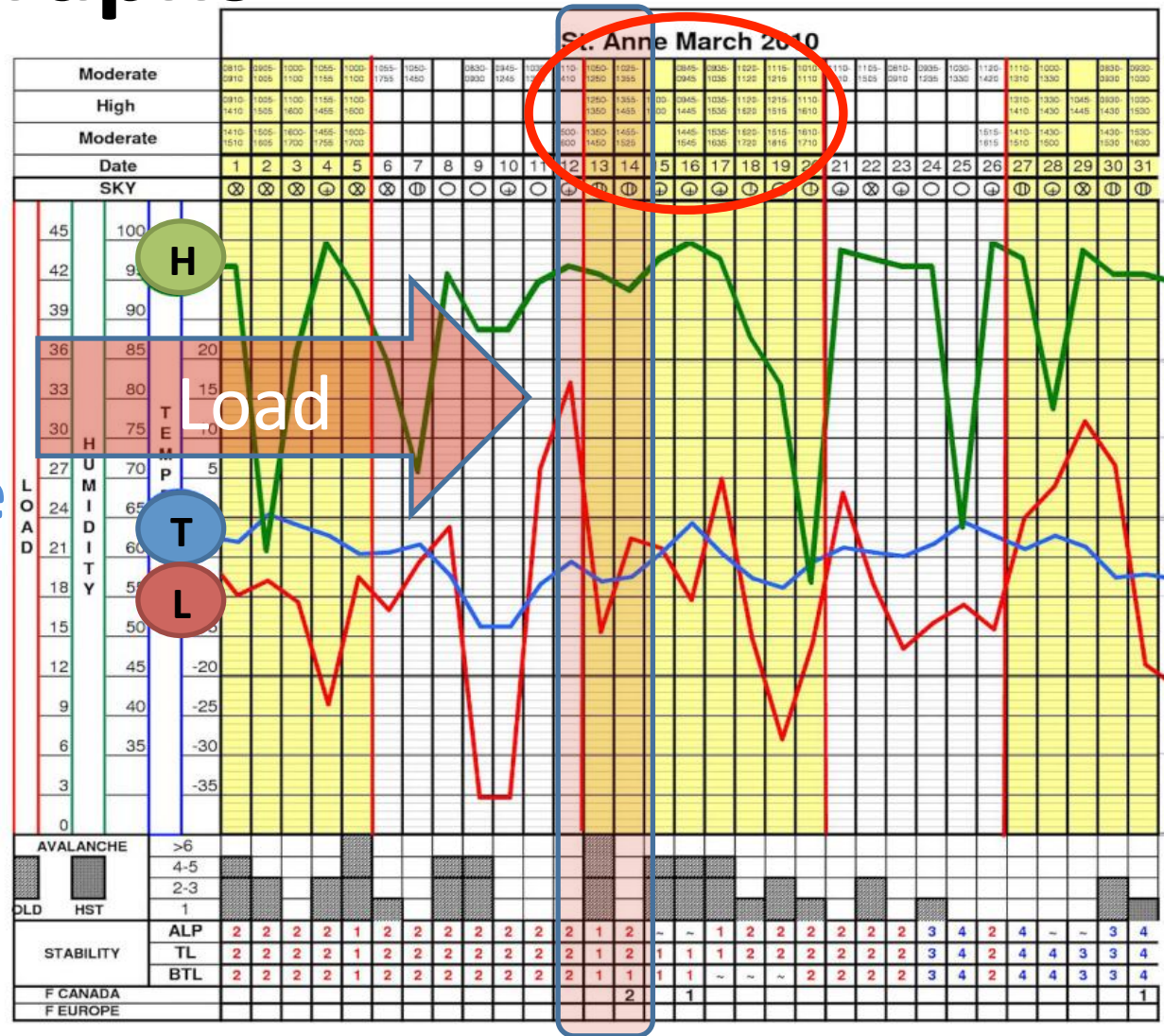
Step 2 Graphs

CSR (high cycle)

Humidity

Temperature

Load

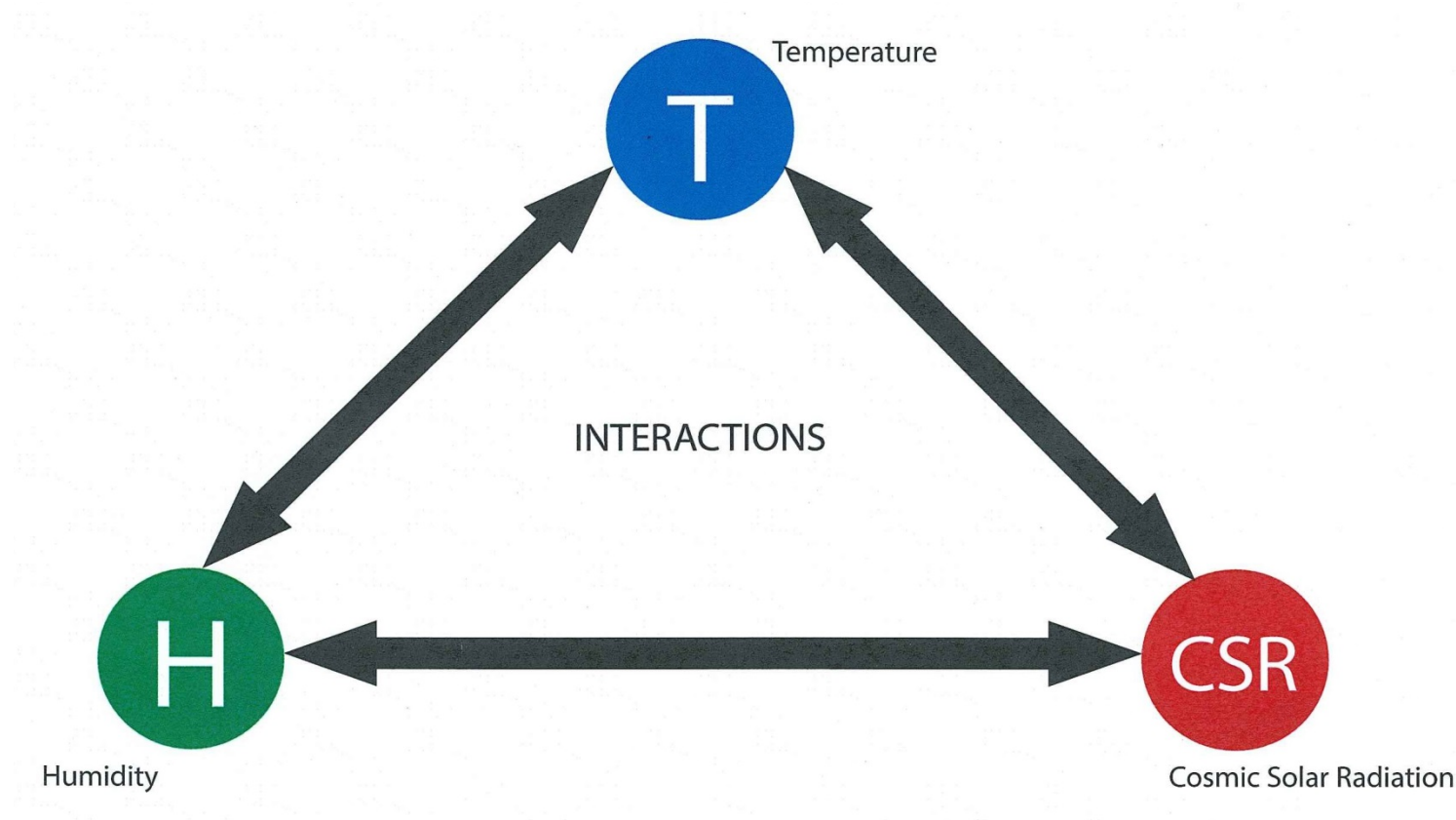


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Step 2

The 3 Major Contributory Factors for Stability Rating



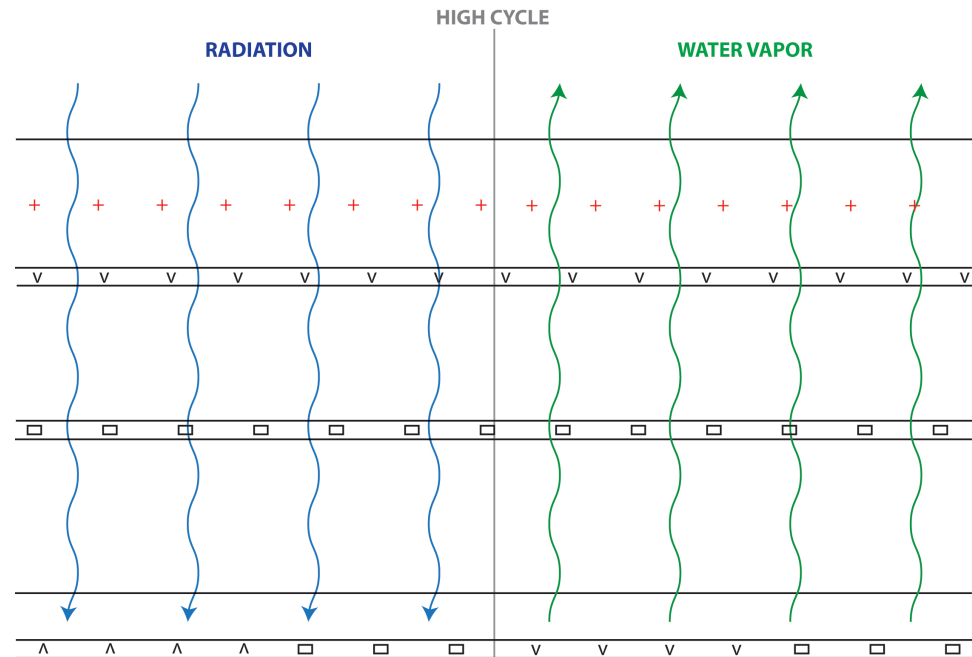
Cosmic Solar Radiation (CSR)

- Inflow of cosmic and solar radiation occurs in the high cycle related to the tidal chart/date/time.
- The universal system works in a well-organized and perfect manner.
- Cosmic rays are a stream of penetrating high speed atomic nuclei that enters the Earth's atmosphere.
- Energy is transmitted as electronic fields of waves of moving particles and is **invisible**.

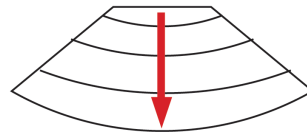


Step 2

COSMIC SOLAR RADIATION



A snow layer may lift during atmospheric pressure during high cycle. Snowpack is now saturated with water vapor causing downward tension.



The water vapor then returns to the surface, deteriorating the strength of the snow layers and ice, causing tension and creeping of snowpack - more so in high cycles - increasing the probability of snow pack failure and for natural of skier interference avalanches



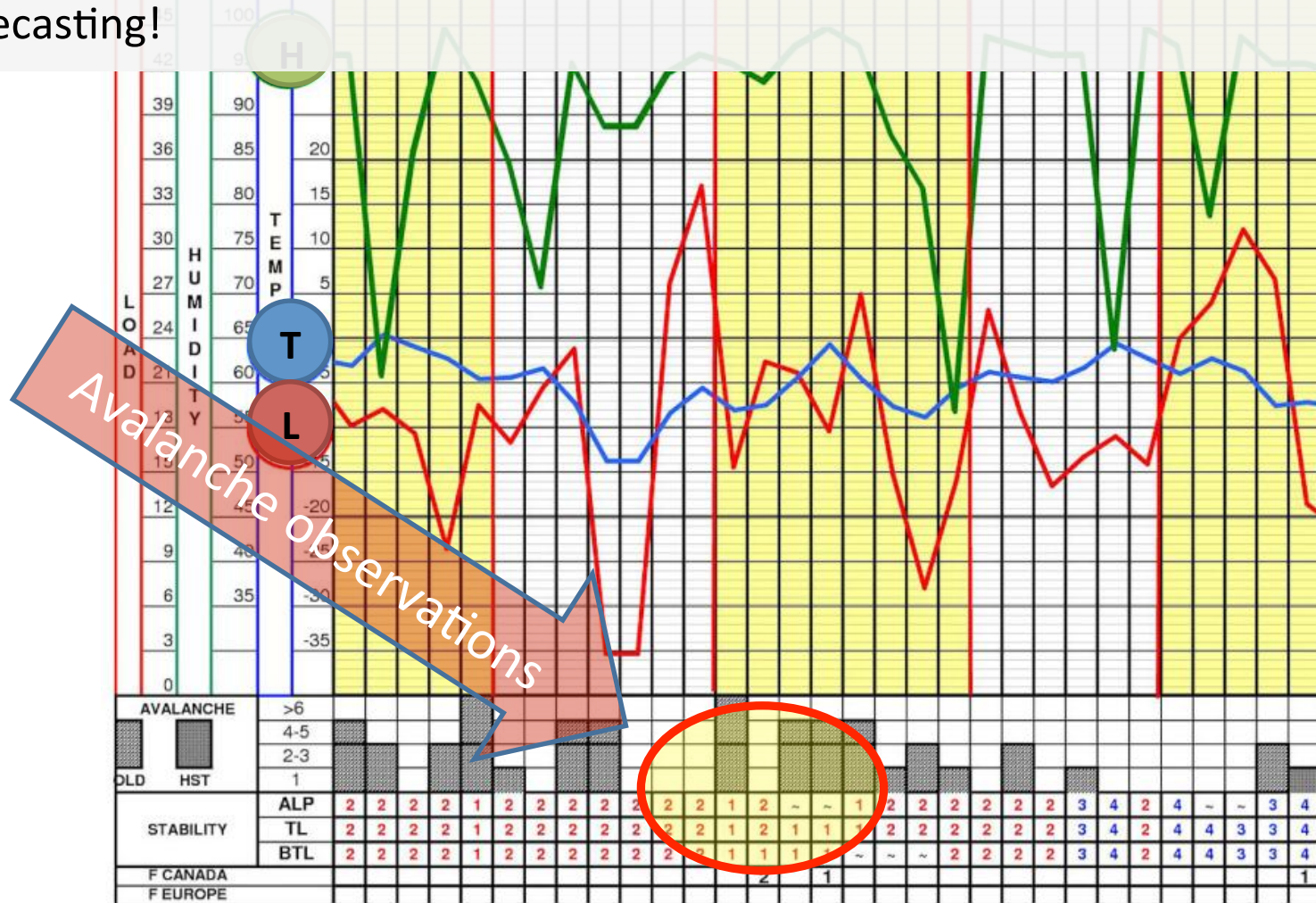
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Step 2

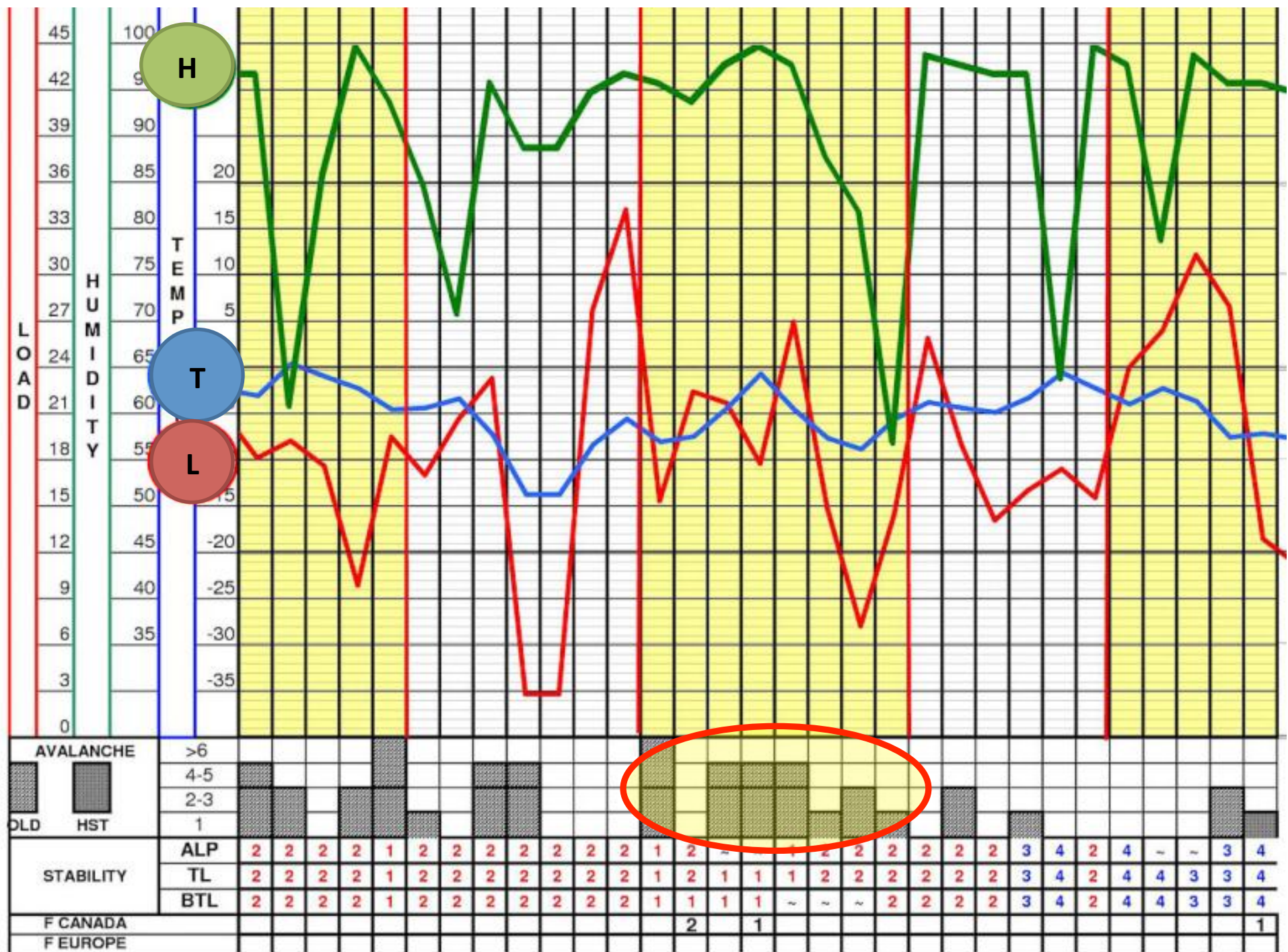
Observations

We have observed worldwide that most **avalanches, ice falls and fatalities** occur during high cycle. Not using CSR cycle is a missing link for accurate forecasting!



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Step 3 Snow Pack Profiles

“If you don’t dig, you don’t know”



Shovel Shear Test

Most reliable and effective method for measuring stability and ratings

- Substantiate your findings with 3 to 5 tests

Looking for a gliding layer



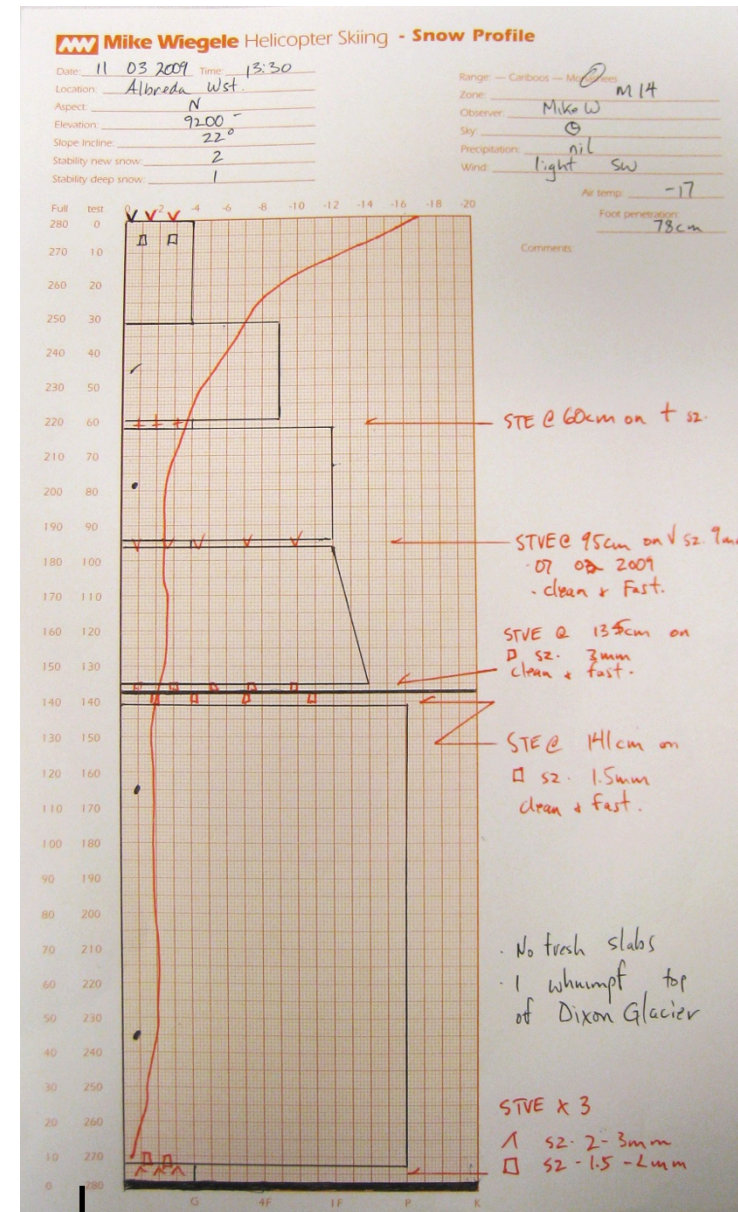
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Step 3

Major Gliding Layers

- ☐ 1. Depth hoar (Λ)
- ☐ 2. Surface hoar (V)
- ☐ 3. Facets (□)
- ☐ 4. Ice (-)
- ☐ 5. New snow crystals (+) (powder)



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Step 4 Field Observations

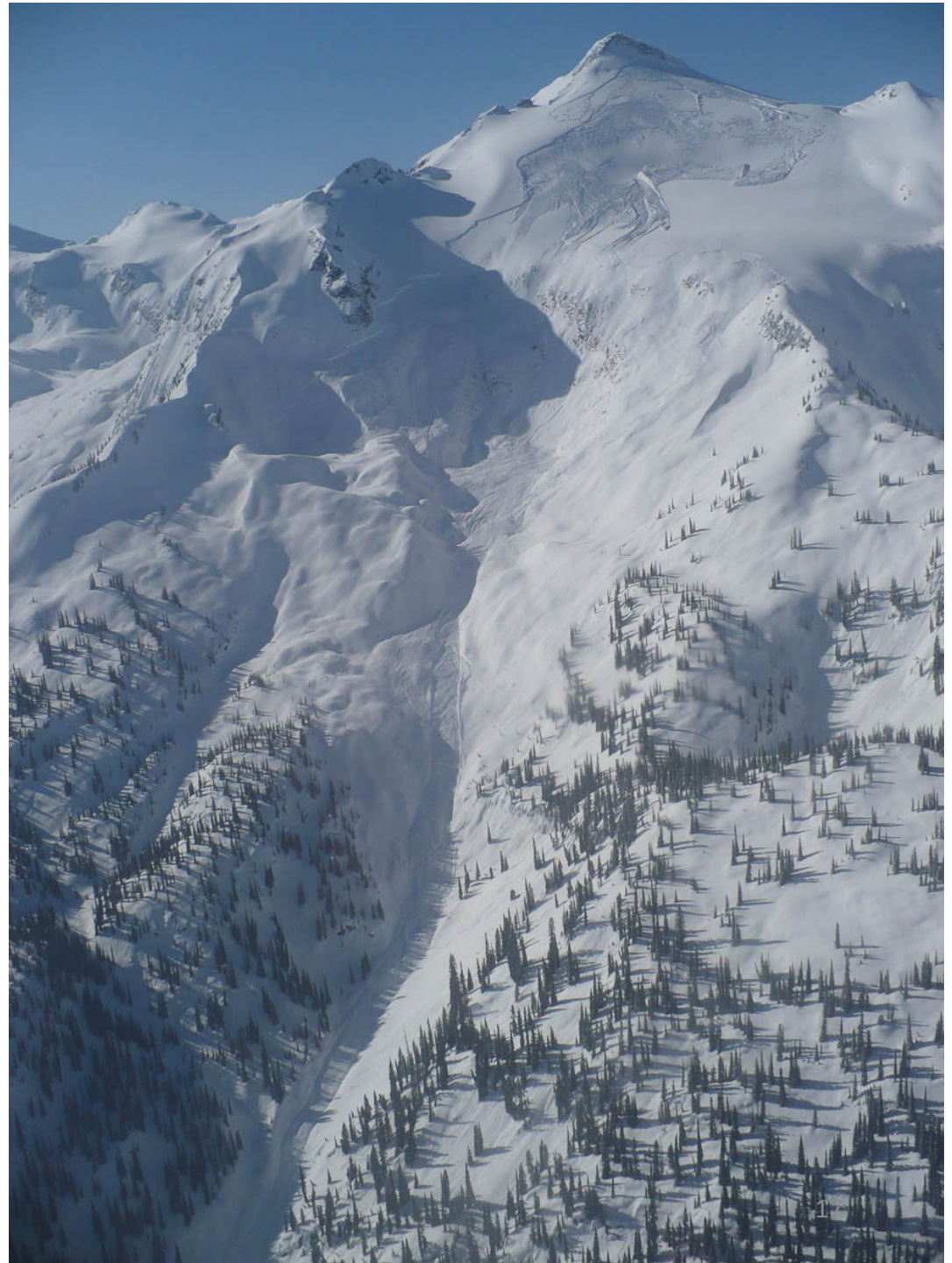
Natural avalanche
observations

override

snow profile tests



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Step 4

Field Observations

Natural avalanches alert us to changes taking place in the snowpack to very poor stability.

This avalanche occurred at the exact time of the CSR-cycle.

Ski tracks are from the day prior.



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Step 5

Stability Rating and Ski Tests



Every turn is a ski test



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Step 5

Stability Rating

All elevations and exposures

5 SNOW STABILITY FORECAST

DATE 051226 HIGH CYCLE _____ FORECASTER BILL M

#3	PROFILE	LAYERS	CM LOAD	#4	SHEARS	#5 STABILITY RATING				GUIDES COMMENTS
						N	S	E	W	
ALP		HST DEC 20 — 100 — NO NEW OBS. OLD DEC 9 — 120-130 — NO NEW OBS. DEEP NOV 25 — 130-140 — STM-STM A — 270				2 2 2 2 STORM 2 2 2 2 OLD 4 4 4 4 DEEP	FIRST DAY OF SKIING - - PROFESSIONAL TRAINING & INSTRUCTIONS - WARM UP RUNS - RECHECK @ CONDITION			
TL		DEC 21 — 50-70 — STE-STE DEC 20 — 70-80 — STE DEC 12 — 90-100 — STE-M NOV 25 — 100-110 — STE-M				2 2 2 2 STORM 2 2 2 2 OLD 4 4 4 4 DEEP	CHANGE - SKI CUT AND ROLLS - OBSERVATIONS			
BTL		DEC 20 — 50-70 — STE DEC 12 — 70-80 — STE NOV 25 — 90-100 — STE-M				2 2 2 2 STORM 2 2 2 2 OLD 4 4 4 4 DEEP				

ISOLATED AREAS WITH SPECIFIC SNOW PACK CHARACTERISTICS

Terrain choice and guiding procedures are applied accordingly.



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Step 5

Stability Rating Values

7 Stage Stability Rating Compared to 5 Stage

1	2	3	4	5	6	7
VP	Poor	Poor - Fair	Fair	Fair - good	Good	VG

VP	Poor	Fair			Good	VG
1	2	3			4	5

- **Fair ratings** are commonly used in the industry and are misleading and have created a false sense of security = tragic
- **Too much room for human error**
- Divide **Fair** into 3 sections
- Must be upgraded to 7 stage stability rating
- Better assists us in **terrain** selection and **guiding** procedure



TERRAIN FEATURES



If snow stability is the problem **terrain** choice is the answer.



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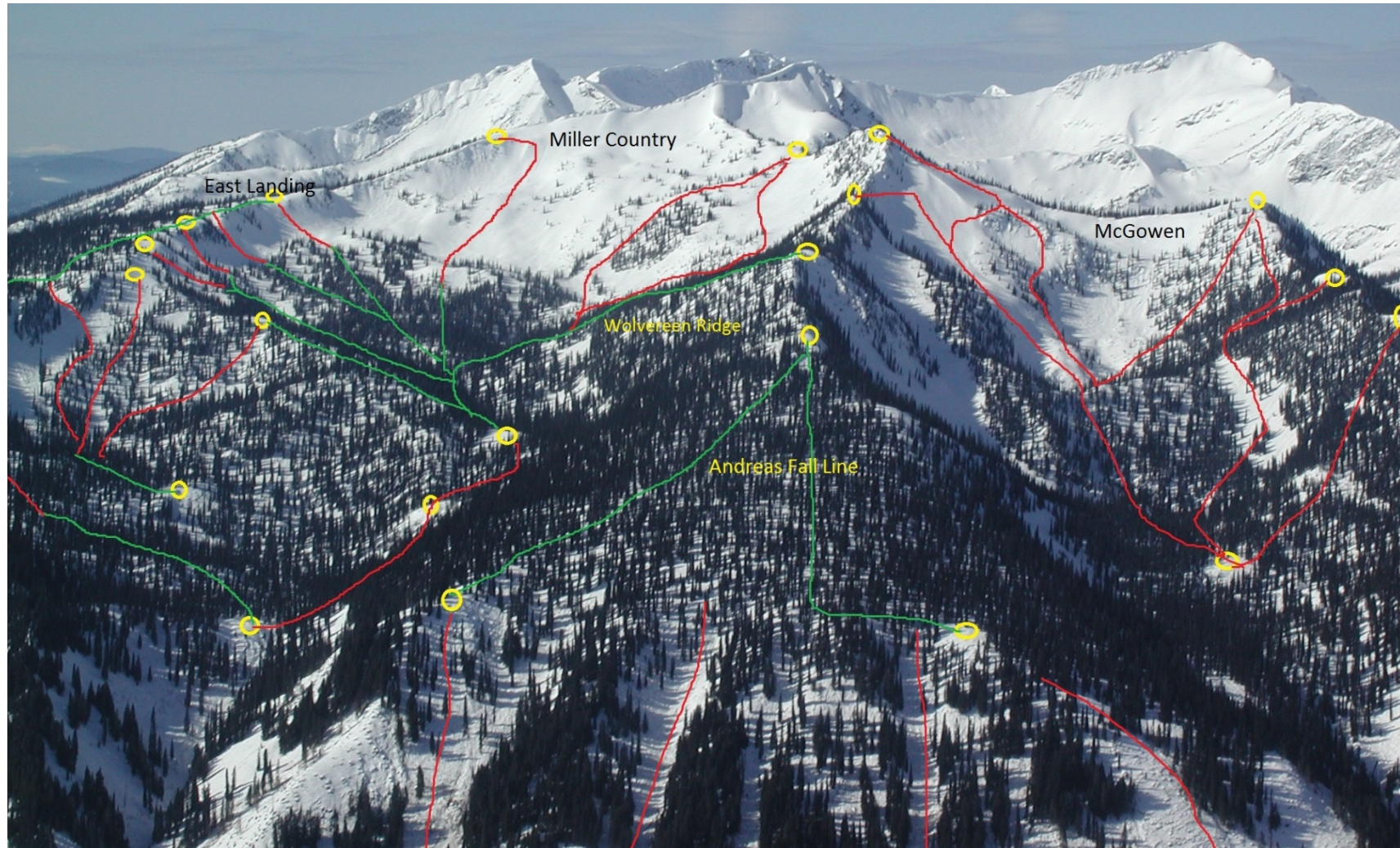


The most dangerous terrain features

- Glacier Icefalls & Crevasses
 - Cliffs
 - Trees
 - Gullies
- Unsupported Slopes



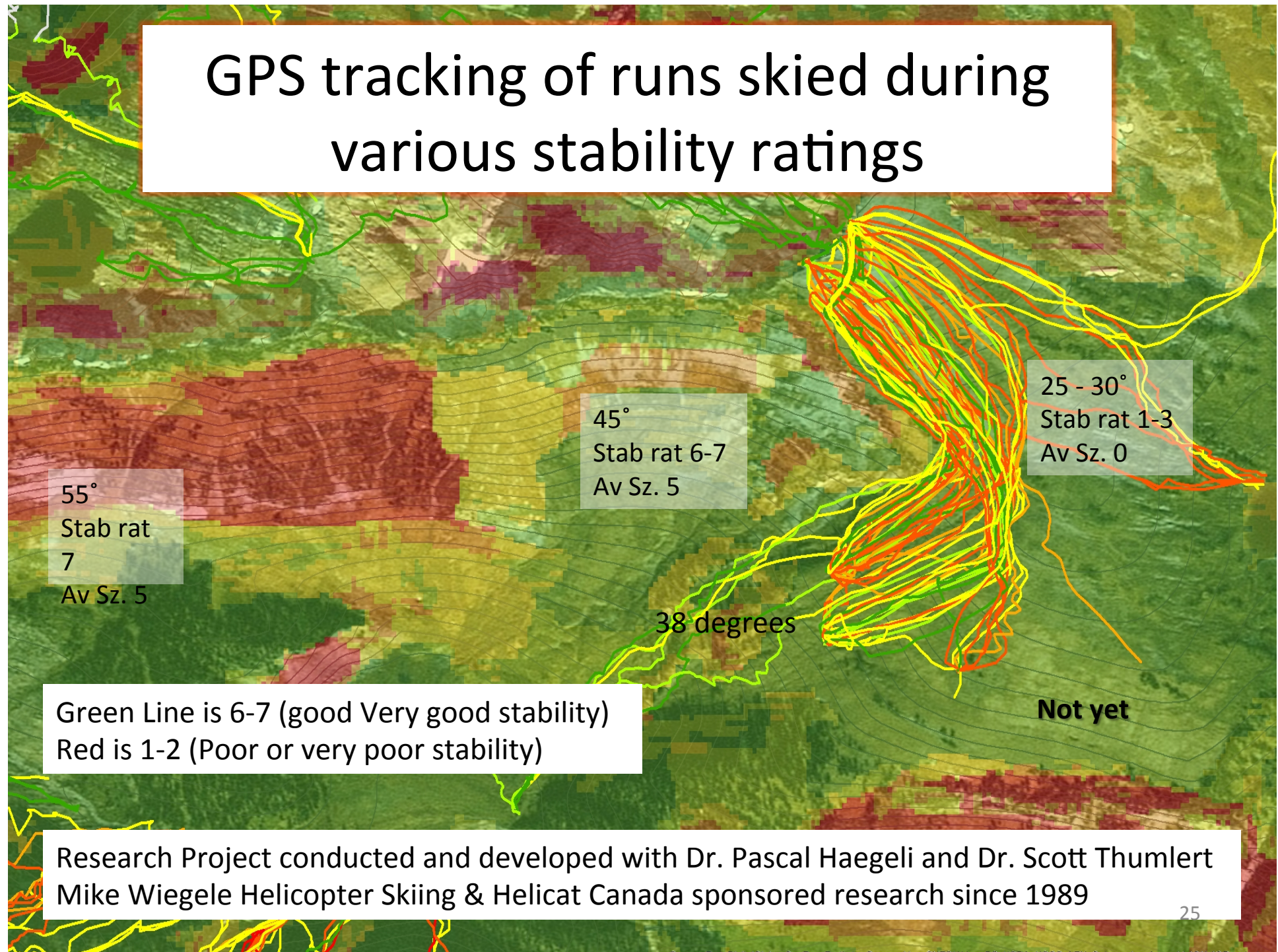
Route Selection



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GPS tracking of runs skied during various stability ratings



An aerial photograph of a vast, snow-covered mountain landscape. In the foreground and middle ground, there are dense patches of dark evergreen trees. The terrain is mostly white with some subtle shadows and textures indicating snow drifts. In the background, more mountain ranges are visible under a clear sky. The text 'Not yet' is superimposed in the center-right area of the image.

Terrain analysis based on snow stability for safe route selection

Not yet

Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
Mike Wiegele Helicopter Skiing & Helicat Canada sponsored research since 1989

An aerial photograph of a mountainous region, likely in the Canadian Rockies, showing a mix of rocky peaks, snow patches, and forested slopes. Overlaid on the photograph are numerous thin, brown contour lines that represent elevation changes across the terrain. The lines are more densely packed in steeper areas and more widely spaced in flatter or more gradual slopes. The overall color palette is dominated by the greys and blues of the rock and snow, and the greens and browns of the forest and vegetation.

Terrain analysis based on snow stability for safe route selection

Arial view of “Not yet” mountain

Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
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Terrain analysis based on snow stability for safe route selection

55°
Stab rat
7
Av Sz. 5

45°
Stab rat 6-7
Av Sz. 5

25 - 30°
Stab rat 1-3
Av Sz. 0

38 degrees

Avalanche terrain on “Not yet” mountain

Research Project conducted and developed with Dr. Pascal Haegeli and Dr. Scott Thumlert
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Terrain analysis based on snow stability for safe route selection

55°
Stab rat
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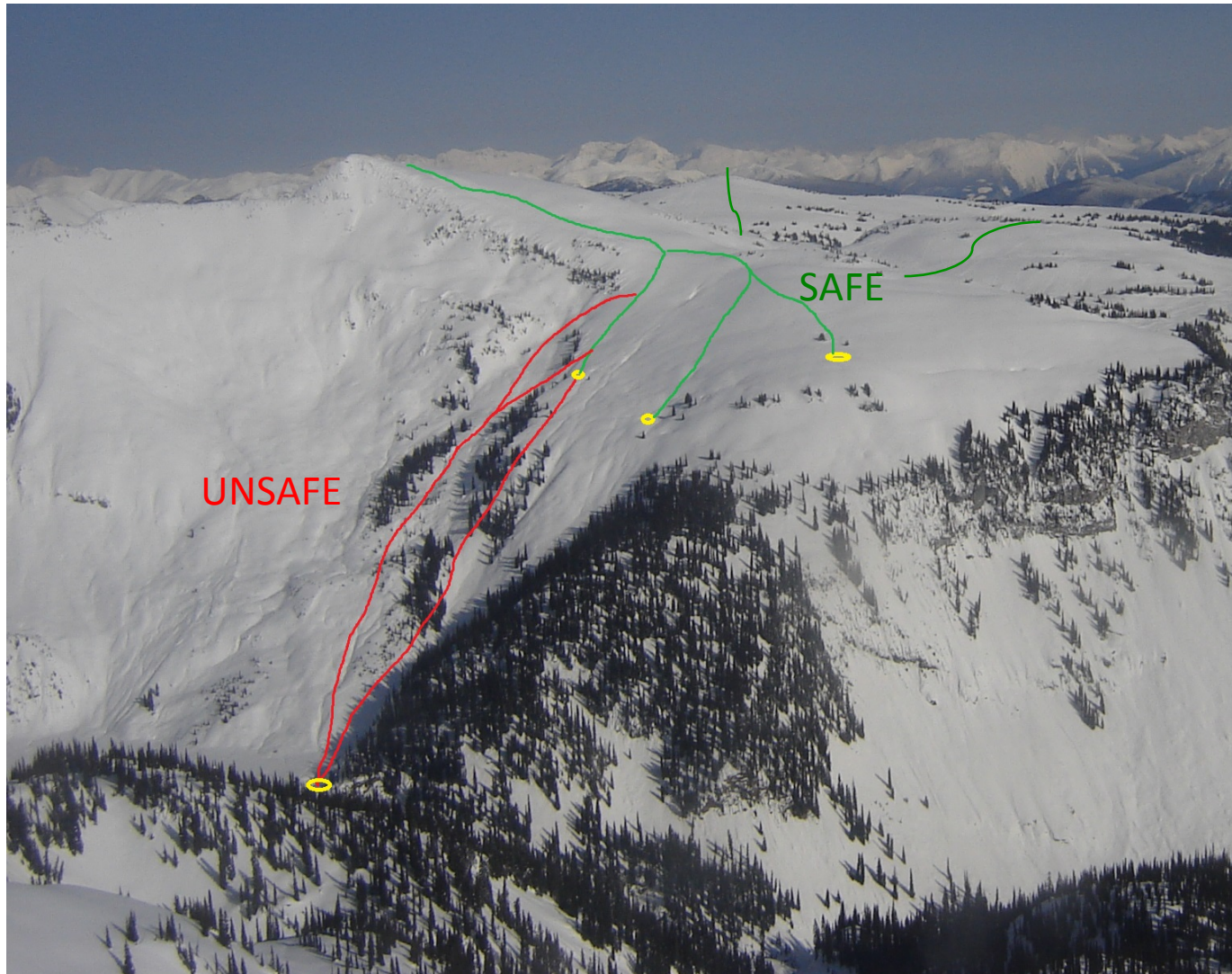
38 degrees

Runs skied on “Not yet” mountain
according to snow stability

Green Line is 6-7 (good Very good stability)
Red is 1-2 (Poor or very poor stability)

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Safe Terrain



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Guiding Procedures – **MUST DO**

prior to entering potential avalanche slope

1. ☐ Field book – data
2. ☐ Snow profile and stability rating
3. ☐ Gliding layer – look for weaknesses and hot spots
4. ☐ Load – what is the load on top of gliding layer?
5. ☐ Shear – Rating 1-2-3-4-5-6-7 classification with shovel test only
6. ☐ Natural observations
7. ☐ Ski cut test results
8. ☐ Exposure - Elevation
9. ☐ Contributory factors
10. ☐ **Communicate and compare notes with other guides**



Terrain selection and guiding procedures

- ☐ Recognize mountain hazards on descending route
- ☐ Avoid and limit exposure to hazards
- ☐ Be alert and move swiftly
- ☐ Select safe areas for regrouping
- ☐ One skier exposed to hazard only
- ☐ Appropriate spacing between skiers – 5 turns
- ☐ Partner skiing in trees
- ☐ Guests follow directions from hazard prevention awareness folder

Precise ski guiding procedures for loss prevention & fun

skiing



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Recommendations for Avalanche Forecasting

Industry should adopt the following best practices:

A measured system reduces human error:

1. Use the 5 Step Checklist
2. Use Shovel Shear Test for stability rating only
3. Cosmic Solar Radiation – CSR-cycle
4. InfoEx report must exceed current safety standards



Recommendations continued

5. Worldwide standards are not meeting the requirements for backcountry skiing safety.
6. Research, education, training and certification curriculum must adopt professional industry standards

This will sustain and grow hospitality and tourism economy.



A Measured system overrides intuition and human factors

Thank you

Have fun, be safe, do diligent work

Mike Wiegele Helicopter Skiing & Helicat Canada sponsored research since 1989.
Research Projects conducted and developed with
Dr. Bruce Jamieson, University of Calgary,
Dr. Pascal Haegeli and Dr. Scott Thumlert, Simon Fraser University,
Onno Werringer from Alta ski area



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