

Terrain, Speed, Scale and Communication

ATES for Operational Terrain Management in the USA
for motorized and non-motorized groups

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ATES is a trip-planning tool. Operations need a terrain-management tool.

Operational Terrain Management (OTM) turns a static terrain classification into a daily, defensible decision: a cataloged terrain unit, daily danger rating, and the leader's A3 membership and certification tier resolve to one authorized envelope.

The terrain matrix

ATES class × hazard rating × A3 tier → one output

A3	TIER	Non-avalanche [0]		Simple [1]		Challenging [2]		Complex [3]		Extreme [4]	
		LOW/MOD	CON/HI/EX	LOW/MOD	CON/HI/EX	LOW/MOD	CON/HI/EX	LOW/MOD	CON/HI/EX	LOW/MOD	CON/HI/EX
Affiliate	0	Allowed	Allowed	Pro 1 Supervision ¹	Pro 1 Supervision ¹	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
	1	Allowed	Allowed	Allowed	Pro 2 Consult ²	Pro 2 Consult ²	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
Pro	2	Allowed	Allowed	Allowed	Allowed	Pro 2 Consult ³	Pro 2 Consult ²	Pro 2 Consult ³	Not Allowed	Not Allowed	Not Allowed
	3	Allowed	Allowed	Allowed	Allowed	Allowed	Pro 2 Consult ²	Pro 2 Consult ³	Pro 2 Consult ²	Not Allowed	Not Allowed
	4	Allowed	Allowed	Allowed	Allowed	Allowed	Peer Pro Consult ³	Allowed	Peer Pro Consult ²	Peer Pro Consult ³	Not Allowed

Table 2. Combined terrain allowance matrix by A3 membership level and certification tier, ATES class, and danger band. LOW/MOD = Low/Moderate danger; CON/HI/EX = Considerable/High/Extreme danger. Superscripts give the communication type required (Table 4): 1 in person, 2 radio, 3 remote.

People and communication

Connecting A3 membership and certifications to terrain

TABLE 3 – A3 MEMBERSHIP LEVEL AND QUALIFICATION TIERS 0-4

A3	TIER	CERT. / EXPERIENCE
Affiliate 2 year min.	0	Rec L1 + Rescue min.
	1	Pro 1
Pro 4 year min.	2	Pro 1
	3	Pro 1, 6 season min.
	4	Pro 2

TABLE 4 – COMMUNICATION TYPES

LV	CONTACT	SUPERVISOR
1	In person: line of sight and vocal range	With the group
2	Radio	In the area, can help in person
3	Remote: satellite or end-of-day check-in	Off site

Terrain catalogs

OTM pre-defines terrain units – zones, runs, routes – each with a stable identifier, boundary, base ATES v.2 class, assessment scale, micro-terrain notes and travel-mode flags. Daily access is filtered from that standing inventory, the way heli- and cat-ski operations filter a run list.

THE ASK

Standardized tier-to-terrain matrix.

This is offered as a starting point – built on A3's existing credential and member structure, and treating motorized travel as a first-order design consideration. It should stay independent of travel mode, education-provider franchise and guiding association, differentiated instead by scale of travel and terrain catalog unit types appropriate to the mode of travel.

Scale sets catalog unit type, trip options

Non-motorized parties decide at the micro scale – one slope, one path, sequentially. Modern snowmobiles put a group at synoptic scale within a single outing, crossing drainages, faces and aspects in rapid succession at a range previously reached only by aircraft.

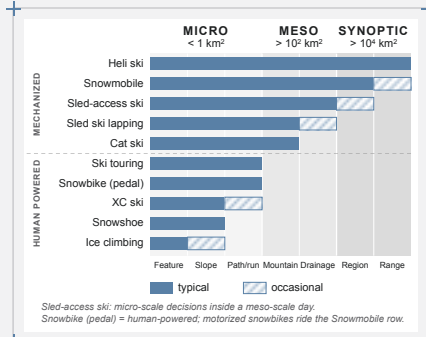


Table 1. Spatial scales for ATES assessment (Statham et al. 2018) and the scales at which each U.S. travel mode's decisions are typically made. Micro <1 km²; meso >10² km²; synoptic >10⁴ km².

The same ground may be one unit for a motorized group and several for foot travel. Sled-access ski programs need both: a zone-level rating and a path/slope breakdown over the same footprint.

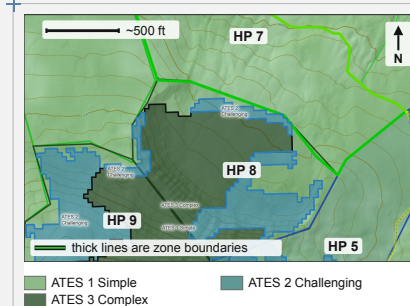


Figure 1. Motorized zone units over the operator's ATES layer, part of Hahns Peak, Colorado. Solid colored lines are zone boundaries. At roughly 1,500 ft wide, HP 8 alone spans Classes 1-3 – it would be a complex zone.

Motorized and synoptic scale travel

×64 the ground of a 5 km non-motorized day. At Hahns Peak, CO, a 40 km motorized envelope holds 91 observations – and 72% of it sits more than 5 km from any observation, against 0% of the non-motorized day.

TRAVEL AT SYNOPTIC SCALE NEEDS TO ACCOUNT FOR FEWER OBSERVATIONS AND MORE UNCERTAINTY IN THE FORECASTS, OR THE LACK THEREOF.

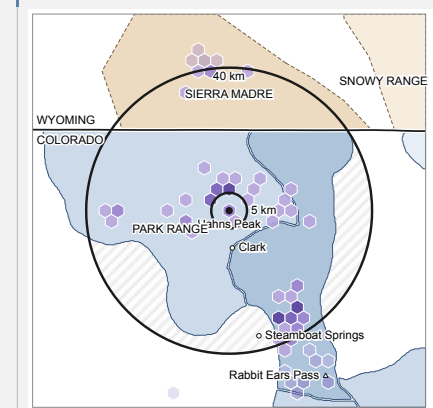


Figure 2. Forecast coverage and observation density: generalized single-day travel envelopes at Hahns Peak, Colorado, over forecast zone boundaries and 2025-26 field observations (CAIC and EWAIE).

Non-motorized - 5 km radius 9 observations - 11.5 per 100 km² 2.1 km to the nearest, typically 0% of it over 5 km from any observation	Forecast coverage Steamboat & Flat Tops - CAIC Sierra Madre - EWAIE, obs only Snowy Range - EWAIE, obs only Front Range - CAIC no zone mapped - no rating EWAIE issues observations only – no formal forecast and no danger rating. The double line divides one CAIC product into two areas that are occasionally forecast differently. Blank ground inside the rings is outside a forecast area and not a winter-use area.
Motorized - 40 km radius 91 observations - 1.8 per 100 km² 9.0 km to the nearest, typically 72% of it over 5 km from any observation 89 of them south of the state line, 2 north of it - nearest 37 km out	
Observations per 2 km cell 1-2-3 4-7 8-15	

SELECTED REFERENCES

Statham & Campbell (2025) ATES v.2. NHESS 25:1113-1137. · Statham et al. (2018) A conceptual model of avalanche hazard. Nat. Hazards 90:663-691. · Statham et al. (2006) ISSW Telluride, 491-497.

ACKNOWLEDGMENTS

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Toft et al. (2024) AutoATES v2.0. NHESS 24:1779-1793. · Hanke & Stewart-Patterson (2023) ISSW Bend, 962-965. · Coulter (2023) ISSW Bend, 1128-1132. · CAA (2025) GIAT. · Statham (2019) Workplace Avalanche Safety Plan – BYK, Parks Canada.

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