

Theme	Sub-Theme	Definition	S1 Interview Quote	S2 Observed Evidence (O = Observation, D = Debrief)
Missing Info	Explicit	Missing information is explicitly represented in data.	"They [weather stations] get stuffed up by weather... rime or whatever... they just stop reporting." P4	
	Implicit	Missing information must be inferred from the situational context.	"When you're modeling the natural world, you take shortcuts and there's simplifications [...] the co-linearity between many of the avalanche problems [...] they don't occupy fully independent places.... within our drive to communicate effectively, we sometimes have to have discussions about whether we want to be technically accurate, or whether we want to retain clarity [...] we sense that starts to get quite complicated. And so...frequently, we look for ways to simplify." P1	[Observed during discussions] "After having worked this job [Avalanche Canada] ... I sort of realize the big holes the operators leave in their writeups when it comes to work in this office using this information... because they are having face to face conversations... and maybe not putting that information into their writeup... saying this layer [of snow] does not exist in our area may not be helpful to them, but it really helps us here in this office." P8
Data Representativeness	Classification Overlap	Classifications are often not independent or mutually exclusive.	"When you're modeling the natural world, you take shortcuts and there's simplifications... The... major flaw of the conceptual model is the, the, the, the co-linearity between many of the avalanche problems and so... storms labs and wind slabs are heavily co-linear. So, you know, they, they don't occupy fully independent places." P1	[Observed during discussions] "Thinking about having all three [wind slab, storm slab, persistent slab], because they are so different right now.. There kind of always is a wind slab problem, but there was A LOT of wind so I want to capture that" P7
	Conservative Bias	Avalanche guides and professionals are conservative when faced with uncertainty in the field or in data.	"[If] we just like... puzzle it out, but then we still don't know. Like, I'll just start writing that... today, take a conservative approach" P2 "Oh, you know, this one operator was saying, you know, that they really found things touchy. So, I think I'm going to lean that way and be conservative, then there have been times where another forecaster would have said something like: 'Oh, well, you know, that... that person... Yeah, they always call that a little more than it actually is.' And then that may change... influence me to say: Okay, well, maybe I should not necessarily discredit it, but I put less weight into it." P3	[Observed unrecorded conversation about how to interpret an operators report considering their conservative bias caused by a recent incident involving clients] P3
	Circumstantial Definitions	Official definitions and unofficial practices for reporting data depend on the situational context.	"The CAA courses do quite a good job of standardizing those kind of threshold amounts and stuff like that [...but] people who have spent a lot of time on the coast, for example, may think 30 centimeters storm doesn't really do very much" P1	[Observed during discussions]"I like [Anonymized] point yesterday, wind slabs in the alpine are kind of like cornices that you find always... it is just a winter mountain hazard... it goes on the bulletin when it is elevated to more than normal caution..." P2
Analytic Practices	Subjective Hunches	Considering the behaviour, concerns, and hunches of others in the field to inform and guide analysis and interpretation.	"I might be reading that snowpack description like saying like... 'okay, are these guys still concerned about this?' That's what really matters to me more so than like the really nuanced low-level data." P2	[Debrief from video] "I feel good about who was in the operation. So, I felt that the test was valid and valid information that I should be thinking about." P3
	Immersion	Forecasters spend several days in forming a mental model through <i>undirected</i> review of contextual information.	"If I take over regions, I kind of try to ease into it. So, if I know that I've got five days on a certain amount of regions. I usually... The first day is just I don't... I may have questions in my mind, but I don't delve too deeply because it's just, it's too overwhelming." P4	[Debrief from video] "...It was just to give me an orientation to get my mental picture for forecasting in the Columbia [mountain region]. like where are we relative to the history... just a little bit of context... I don't know what that does for me exactly." P4
	Context-Seeking	<i>Directed</i> information search for	"if I'm really struggling I'll like... look for keywords like "oh ya... skiing, like, steep terrain in the Alpine, up to 40 degrees	[Debrief from video] "...so I reviewed a few avalanches to understand what was driving those

		supplementary contextual information.	and just exposed features. No problem." That tells me that not much is going on. Yeah, people are confident." P2	avalanches and why [Anonymized] added that persistent slab problem again." P6
	Mental Projection	Forecasters assimilate information by imagining and mentally visualizing the interactions of avalanche conditions, weather, terrain, and people.	"And, you know, by projecting yourself into the terrain. Actually, that's a technique that a lot of people use to help forecast and you know... kind of projecting yourself mentally, whether you close your eyes or you just have some kind of image of the kind of slopes, the kind of areas where the people are moving around in areas covered with trees, what the wind kind of might do, you know... I think it's pretty common to have some kind of, you know, visual representative little piece of terrain and you know, what people are doing. Users if you like, to help visualize, basically. So, you know, I think that experiential part, there is really relevant to the process." P1	
	Updating	Forecasters iterate over knowledge artifacts like their forecast as they conduct their analysis and update their own mental models.	"So day one, if you... if you inherent forecasts you can kind of slightly tweak them all. And by day two, I'm usually grabbing one or two and doing like a pretty significant revamp of it. This is kind of where I put my voice in it and any new insight that I might have in it. By day three, I probably... I've like updated all four of the forecasts. And I really put my voice into it. I have updated all the little tracking of the weak layers, that kind of thing. And then at that point, when you have a good feel for the regions like day four and five are a lot easier." P2	[Debrief from video] "I import yesterday's forecast... and I tweak my forecast, so it matches my nowcast" P6
	Deliberate Omission	Forecasters manage information overload by ignoring certain data	"It's a funny balance because much of the individual data points are not very consequential. And so, from an efficiency point of view, it's better if you let your brain just merge those and average those out and have some kind of general assessment." P1	[Debrief from video] "A result [snowpack test result] that's a little alarming...that I wouldn't expect under a low hazard... I am considering whether this layer is still a major concern. I decided my prior analysis still held [hazard is low]" P3
Analytic Challenges	Continuity	Forecasting relies on continuity of analysis and monitoring. Shift-changes disrupt this continuity.	"And there's a lot of variability in... in different people and what they... what sort of information and leave and... how much information they leave. But the idea is, you know that that's the first place I'll look and hoping that the forecaster the... previous forecaster has left enough information to start that picture, start getting an idea on what are the problems, and where are the uncertainties." P3	[Observed during discussion] "I don't think it was because it was a bad forecaster... it was because it had been in a few different hands... and then... someone did not have enough time to clarify it..." P2
	Translating Analysis	Forecasters struggle with communicating complex conditions with simple clarity to the public.	"You know, 'snow turned into rain might do this', or it's... I try to... try to explain like the myriad of possibilities, there's just not that much room to explain things like that. And to put that kind of simply, that's a really challenging one" P2	[Observed during discussion] "It is only on 30 cms... to me it seems more reasonable to call it a persistent slab because it captures it on all aspects. "Wind slabs will be most reactive on the SH layer..." I find that confusing and I am thinking of ditching the wind slab problem" P7
	Lack of Good Representations	Forecaster lament a lack of good visual representations to alleviate some cognitive effort.	"Wind is another one of those things... a lot of the wind output is all in degrees. And so, it's like an hour and the value of the speed and then it's the degree... but you know, if you just read like 256 to 240, 220, 180... it's actually kind of hard... I actually keep this compass rose at my desk and look at it in my head to see where it is. But I think there's way better ways to visualize wind" P2	[Debrief from video] "I opened up 3 windows of InfoEx... one for today, one for yesterday and one for two days ago." P6
	Lowering Danger Ratings	It is challenging for forecasters to lower danger ratings as data reveal instability rather than stability.	"it's because that ramp down is quite challenging. And, you know, it's... easy to go from considerable to high but it's hard to go down. It's easy to go from high back down to considerable but it's hard to go from considerable to moderate and it's even harder to go from moderate avalanche danger to low avalanche danger. Yeah, those are the hard steps... is actually coming down. And ...so anything to help us come to the conclusion that... you know, the problem is not acute anymore and we can ramp things down and come down off our you know, screaming to the high heavens that it's dangerous out there or whatever that is, I think is most helpful." P4	

Collaborative Sensemaking Strategies	Data Production	Forecasters facilitate collaborative work by producing hand-off notes and other internal knowledge artifacts.	"Or if I'm, if I'm uncertain about something... like that's what I might dive in more for the next forecaster [creating hand-off notes]... " It's like those little things like I am trying to take that ease and control that I have at day four or five, because I feel like I've got it under control and I give that to the next person so they don't feel like they have to do their process of discovery from ground zero essentially." P2	[Observation during discussions] "The notes [hand-off notes] thing is important... even if it's just a breadcrumb trail... even if it's just how you arrived at a conclusion... or even refer to {anonymized name} notes, it is just a carry-forward." P2
	Regular Discussions	Forecasters draw on each other's diverse knowledge through daily discussions.	"So, at two o'clock 230, we have our pow-wow where we all kind of go through our hazards and our problems. And, you know, does this make sense? Make sure that it's, it's, it's kind of like a peer review session."	[Observed and recorded several discussions during observations]
	Reaching out Directly	Forecasters call or email field operators for further information when faced with critical information gaps.	"...or am potentially missing something or I just don't feel comfortable with ...with what I have done, that's generally when I'll start picking the phone up and trying to find people in the area that can provide more... more insight." P3	[Observed forecaster making a phone call to an operator to inquire about conditions]
	Professional Exchange	Forecasters work with other agencies and operators to gain a deeper understanding of the nuances of how data are produced and what they mean.	"And the only way to really fully understand is to go and spend a bit of time with that operator. We try and facilitate that. We have professional exchanges go on. You know, we often go out. MOTI [The Ministry of Transportation and Industry] are really good partners with us. They're always happy for us to go and visit an operation." P1	

ID	Background	Study 1: Semi-structure interview	Study 2: Field Observations & CRD	Study 3: Design, Observation and Retrospective Interview
P1	Natural Science	X		
P2	Business, Communication	X	Obs	Design/Interview
P3	Engineering	X	CRD/ Obs	Design/Interview
P4	Mountain Guiding	X	CRD/ Obs	Design/Interview
P5	Mountain Guiding	X	CRD/ Obs	Design/Interview
P6	Mountain Guiding		CRD/ Obs	Design/Interview
P7	Engineering, Mountain Guiding		Obs	
P8	Mountain Guiding		Obs	
P9	Mountain Guiding			Interview
P10	Mountain Guiding			Interview
P11	Natural Science, Engineering			Design/Interview

P12	Communication, Mountain Guiding			Design/Interview
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