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A Proposed Aviation Weather Knowledge Taxonomy for GA Pilots

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Outline

- GA pilots as a specialized user group of meteorological products
- The need to organize aviation weather guidance—current listing of aviation-weather related advisory circulars and other documents
- A proposed organizational structure for aviation weather knowledge
- Version 1.0 of the Aviation Weather Knowledge Taxonomy and its possible applications
- Q&A

The Need to Categorize Users of Weather and Climate Information

- Different communities of users have different needs for weather and climate information products
- It is necessary to define categories of users in terms of their weather and climate knowledge in order to determine level of complexity of products
- This User Identification Table evolved over a period of 20 years based on first author's USAF Weather experience along with study of literature
- We also felt it necessary to define categories of weather and climate information *providers*—also based on a combination of professional experience and literature review

The User (and Provider) Identification Table (Lanicci, 2016)

← User → ← Provide →

	Lay person	Lay "expert"	Amateur practitioner	"Novice" practitioner	"Journeyman" practitioner	"Expert" practitioner
Professional	No	No	No	Yes	Yes	Yes
Level	None	None	None	Entry	Mid-level	Senior-level
Knowledge base	None to some experiential	Experiential, some course(s)/ training	Experiential, some course(s)/ training; could also be coop observer, storm spotter	Basic formal education & training; none to experiential	Advanced formal education & training; experiential	Advanced formal education & training; experiential
Information source(s)	None, media[1], social networks[2]	Media[1], social networks[2], lay pubs	Media[1], social networks[2], lay pubs	Media[1], scholarly pubs, lay pubs, social networks[2]	Media[1], scholarly pubs, lay pubs, social networks[2]	Media[1], scholarly pubs, lay pubs, social networks[2]
Salience	None to some	Yes	Yes	Yes	Yes	Yes
Approach to weather / climate problems	Reliance on media[1], social networks[2], providers	Reliance on intuition, providers, media[1], social networks[2]	Reliance on intuition, providers, media[1], social networks[2]	Reliance on knowledge, advice of sr. practitioners, media[1]	Reliance on knowledge, experience, advice of colleagues/sr. practitioners, media[1]	Reliance on knowledge, experience, advice of colleagues, media[1]

1 – Media refers to TV/radio and electronic (e.g., Internet weather web sites)

2 – Social networks refer to formal, informal, and electronic (e.g., Facebook, Twitter)

User & Provider Identification Table (Background)

- User categories partially derived from public health and sociology literature, which uses the terms “lay”, “expert”, and “practitioner”, and also discusses the interactions between the two groups (e.g., McClean and Shaw, 2005; Turner, 2007).
- The term “salience” is used here with a slightly different definition than that of Stewart (2009). Here, it means an interest in the weather, whether it be for its own sake, or because of the line of work that the user is in.

Where would GA pilots fit in this table?

- The author has argued that GA pilots are likely "lay experts" since much of their weather and climate knowledge is experientially based
- However, FAA standards require various types of weather training and an acceptable level of proficiency on knowledge and practical exams
- An underlying assumption in the table is that advancing the users' weather and climate knowledge will alter their choice(s) of weather/climate information, and the approach they take to weather/climate problems in their profession.

How do pilots acquire the necessary knowledge?

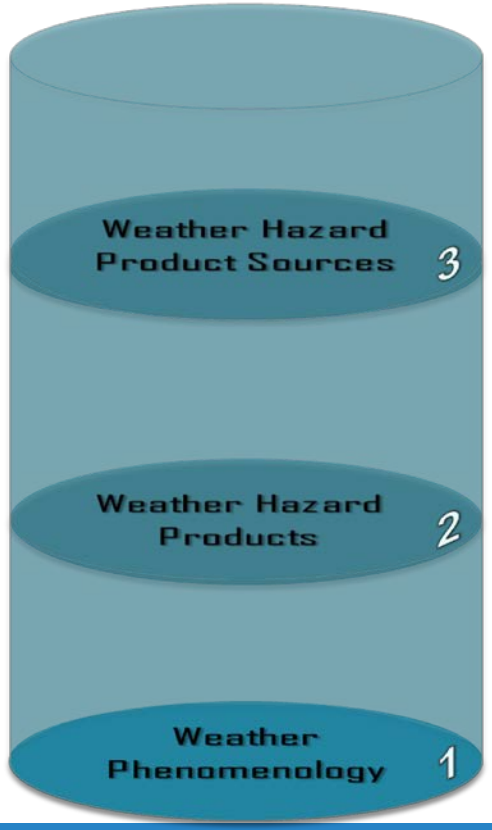
Aviation Weather guidance is spread over multiple Advisory Circulars and Handbooks

Difficult to track content for consistency

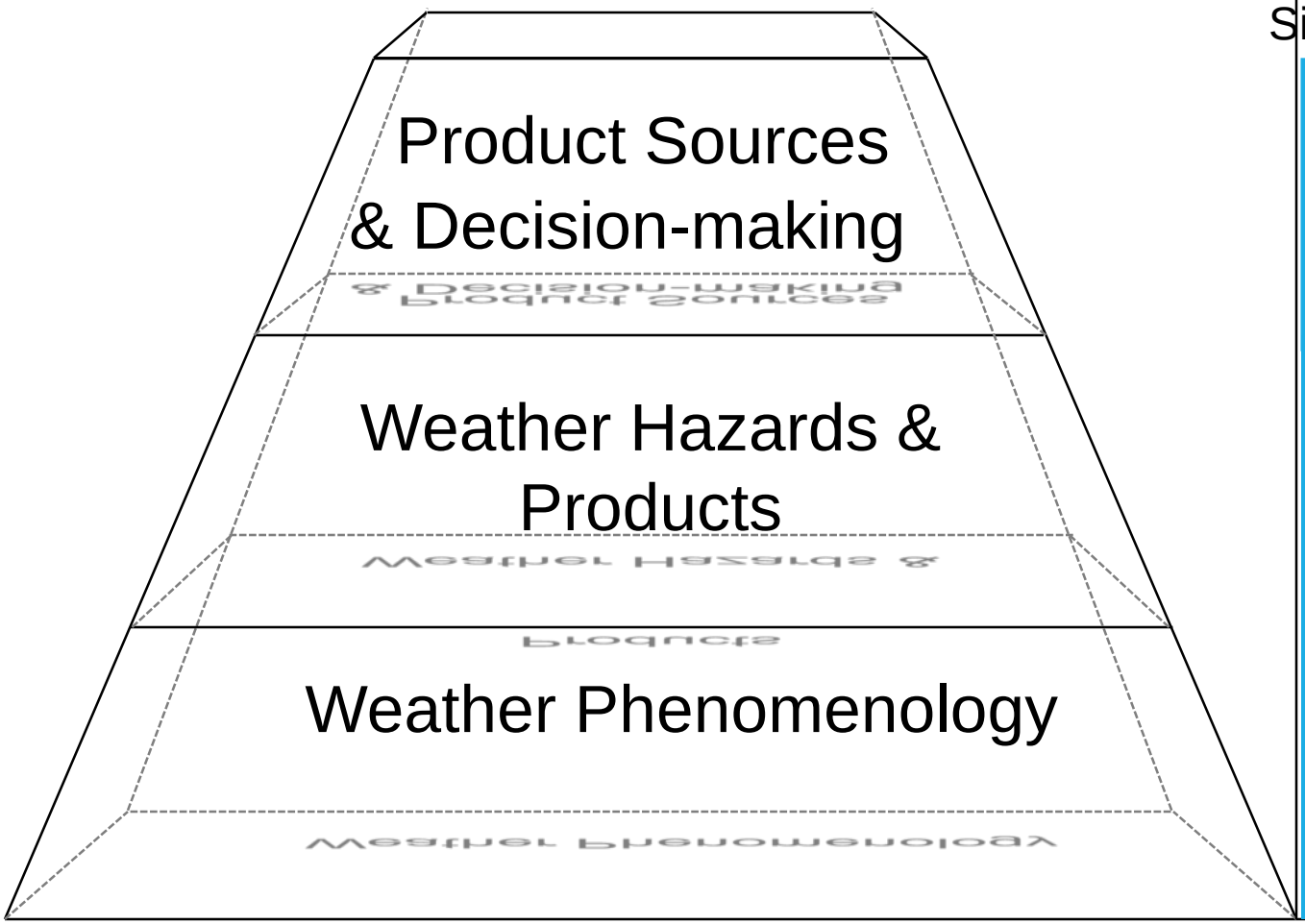
Examples

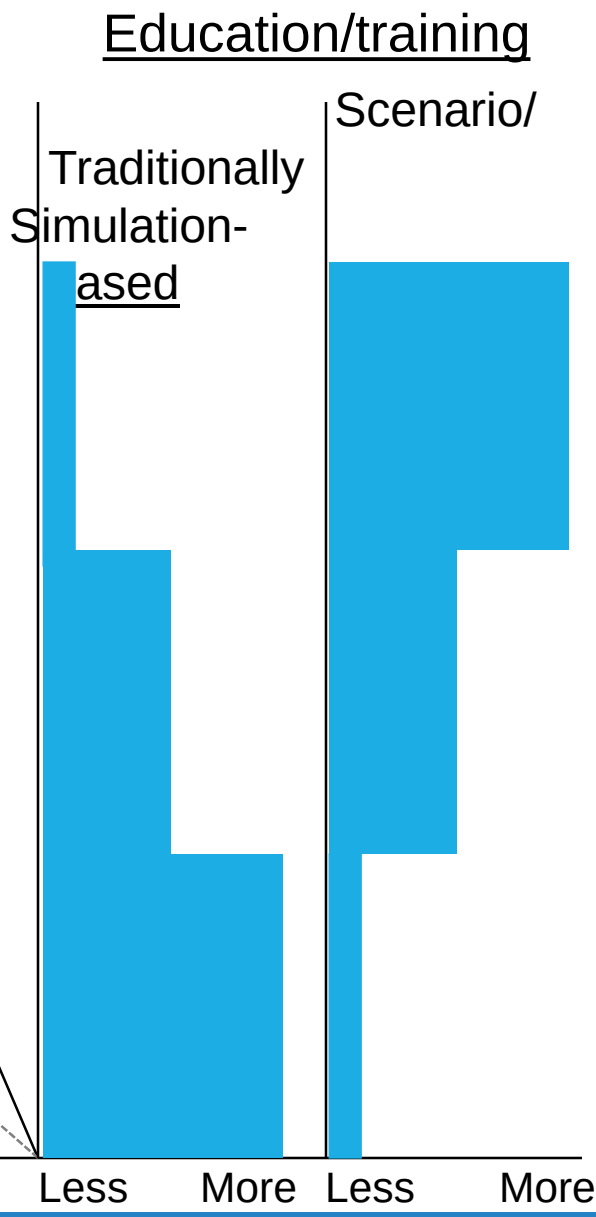
- AC 00-06B Aviation Weather
- AC 00-24B Thunderstorms
- AC 00-30C Clear Air Turbulence Avoidance
- AC 00-45G Aviation Weather Services
- AC 00-54 Pilot Windshear Guide
- AC 00-57 Hazardous Mountain Winds
- AC 00-63A Use of Cockpit Displays of Wx and Aero. Info.
- AC 91-74B Pilot Guide: Flight In Icing Conditions
- FAA-H 8083 25B Pilot Handbook of Aeronautical Knowledge
- FAR/AIM Fed. Avn. Regs. / Aeronautical Info. Manual

- Generally speaking, these documents fall into three broad categories:
  - Phenomenology (concepts and theory)
  - Hazards and Products (to include product interpretation)
  - Product sources
- In 2011, we proposed a building-block approach to the organization of this knowledge (right)
- Since then, we've examined the proper proportioning of knowledge in these three layers
- Taxonomy version 1.0 is a result of collaboration between Meteorologists, Certificated Flight Instructors, and Human Factors Psychologists



Taxonomy version 1.0





Taxonomy version 1.0 – top-level view

WP	Weather Phenomenology	Number of Topics
1000	Basic meteorological knowledge	14
1100	Knowledge of how meteorological phenomena affect flight performance	14
1200	Knowledge of aviation meteorological hazards	8
		36
WHP	**Weather Hazard Products**	**Number of Topics**
2000	Knowledge of official weather hazard products	27*
2100	Knowledge of how to use different products during different flight phases	8
		35
WHPS	**Weather Hazard Product Sources**	**Number of Topics**
3000	Knowledge of approved product sources	7
3100	Knowledge of differences between vendor products	1**
3200	Knowledge of how/when to use different product sources during different flight phases	5
		13

* Includes aviation-weather-specific and general meteorological products

** Under development

1200	Knowledge of aviation meteorological hazards
1201	IMC
1201-a	VFR into IMC
1201-b	Flight conditions associated with common cloud types
1201-c	Special clouds that indicate especially hazardous flight conditions (lenticular, billow, mammatus)
1201-d	Flight conditions associated with fog and mist
1201-e	Definitions of LIFR, IFR, MVFR and VFR
1202	Turbulence
1202-a	Locations favorable for Clear Air Turbulence
1202-b	Locations favorable for Low Level Turbulence
1202-c	Locations favorable for Convectively Induced Turbulence
1202-d	Locations favorable for Mountain Wave Turbulence
1203	Volcanic Ash
1203-a	Warning signs of entering VA cloud
1203-b	Best course of action for exiting VA cloud
1204	Thunderstorms
1204-a	Wind shear as related to thunderstorm severity
1205	Lightning
1206	Icing
1206-a	Induction versus structural icing
1206-b	Definition of light, moderate, severe icing
1206-c	Impact of super-cooled large droplets (SLDs)
1207	Regions within mid-latitude cyclones most favorable for aviation hazards
1207-a	Potential aviation hazards associated with surface fronts
1208	Non Thunderstorm Wind shear

Taxonomy version 1.0: detailed view of 1200-level topics

Recommendations and Suggestions

- Vet Taxonomy Version 1.0 in the community to obtain feedback, suggestions, additions/subtractions, etc.
- Use Taxonomy Version 1.0 to examine FAA pilot weather guidance documents to determine proportionality of topics across the three tiers
- Use Taxonomy Version 1.0 to examine FAA weather training guidance for air traffic controllers and dispatchers to determine proportionality of topics across the three tiers
- Use Taxonomy to develop traceable education and training protocols for particularly challenging aviation weather problems (e.g., VFR into IMC)
  - Taxonomy may help us determine what type of education and training is most appropriate

Questions?

References

Lanicci, J.M., 2016: The importance of the Provider-User Relationship as part of an undergraduate meteorology capstone course. *25th Symposium on Education* (American Meteorological Society), 10-14 January 2016, New Orleans, LA.

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Stewart, A.E., 2009: Minding the weather: The measurement of weather salience. *Bull. Amer. Meteor. Soc.*, 90, 1833-1841.

Turner, S., 2007: Expertise, scientification, and the authority of science. *The Blackwell Encyclopedia of Sociology 1st edn*. Boston: Blackwell, 1541-43. (Available online at http://www.sociologyencyclopedia.com/.)

User & Provider Identification Table (Background)

- Note that the right three columns deal with the sophistication of the Provider.
  - It's important for Providers to get an understanding of where they fit in here, in addition to evaluating their User.
- Using this convention, it is possible to identify users of weather and climate information who are also providers (e.g., air traffic controllers, flight dispatchers)