



MINISTÈRE
DES ARMÉES

*Liberté
Égalité
Fraternité*



MEDICAL SUPPORT IN (VERY) COLD CONDITIONS

October 21st 2022



Liverpool Land, East Greenland

Plan

- Cold Conditions ? : 5 W
- Interactions with medical support
- Focus : emergency drugs in cold conditions
- What's next ?



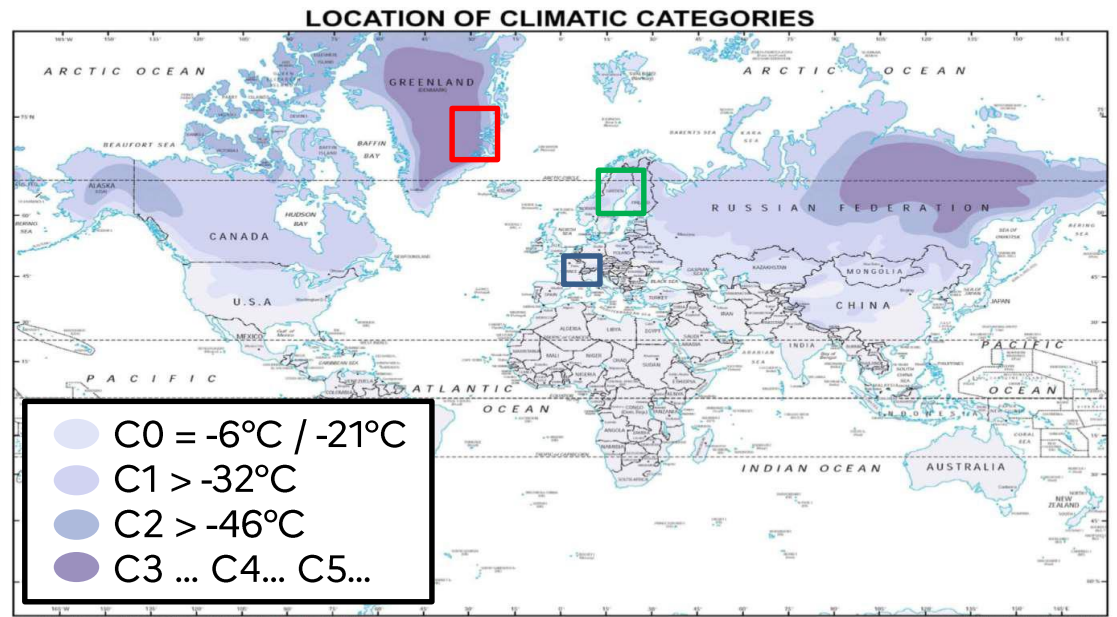
Dômes de Miage

A (brief) 5W

Where?



What?



When?
... the past

Why?
... the future



Who?



MEDICAL SUPPORT IN (VERY) COLD CONDITIONS

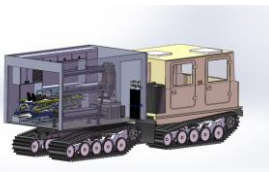
Interactions with medical support



● Drill !



● Innovations and tests



Cold conditions



● Current procedures still valid ?

Tactical Combat Casualty Care under arctic conditions – the GAP
E. Rein et al.
International Journal of Circumpolar Health 2022, 81

● Well documented :

Wilderness Medical Society Clinical Practice Guidelines for the Out-of-Hospital Evaluation and Treatment of Accidental Hypothermia: 2019 Update
Dow, Jennifer et al.
Wilderness & Environmental Medicine, Volume 30, Issue 4, S47 - S69

Wilderness Medical Society Clinical Practice Guidelines for the Prevention and Treatment of Frostbite: 2019 Update
McIntosh, Scott E. et al.
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● More datas needed

British Military freezing cold injuries: a 13-year review.
Heil KM, Oakley EH, Wood AM.
J R Army Med Corps. 2016;162(6):413–418.
Occurrence of freezing cold injuries in the Norwegian Armed Forces between 2004–2021
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Focus : Emergency drugs in cold conditions

2 main questions

- Are emergency drugs affected by cold conditions ?
- Which conditions during arctic / high altitude expeditions ?

Bonus

- Test of a prototype of a warming ampoule holder.

Litterature review and field study



Liverpool Land, East Greenland



Are trauma care drugs affected by cold conditions ?

1. Effect of extreme temperatures on drugs for prehospital ACLS.

-20°C à +70°C 40 h

Johansen et al. (1993)

American Journal of Emergency Medicine

2. Alteration in prehospital drug concentration after thermal exposure.

-6°C à +54°C 14 d

Dustin L et al. (2007)

American Journal of Emergency Medicine

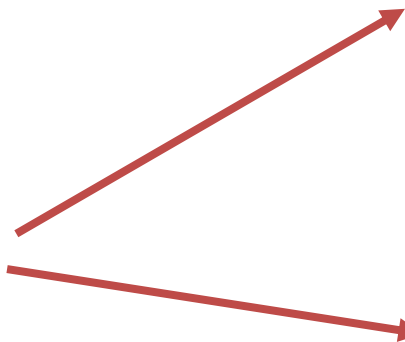
3. Hot and cold drugs : national park service medication stability at the extremes of temperature.

Armenian Patil et al.(2017)

Prehospital emergency care

-20°C à +45°C 28 d

Drug	Study	Cold resistant ?	Freeze / thaw cycle stability ?
Adrenaline	All	Green	Green
Morphine	3	Green	Green
Lidocaïne	1 ; 2	Light Green	Light Red
Naloxone	All	Green	Red
Atropine	All	Green	Red
Fentanyl	3	Red	Red
Celocurine	1	Red	Red
Midazolam	3	Red	Red





Which conditions during arctic / high altitude expeditions ?

Field study : M&M

- 3 military expeditions with medical support
 - *Baffin land, Nunaavut, Canada from 3/05/2017 to 09/06/2017*
 - *Liverpool land, East Greenland from 21/03 to 10/04/2018*
 - *Himalaya, India from 11/04 to 17/06/2018*

- Temperature follow up
 - *Outside conditions*
 - *Inside (tents) conditions*
 - *Ampoule holder : classic (CAH) vs warming (WAH)*



Liverpool Land, East Greenland



MEDICAL SUPPORT IN (VERY) COLD CONDITIONS



Baffin Land, Nuunavut Canada



Which conditions during arctic / high altitude expeditions ?

Expedition	Localisation	Minimal T° (°C)			Freezing time per day (min)			Amplitude T° max	Amplitude T°		
			±			±				±	
Baffin	Out	-4,0	±	7,3	9h30	±	0h38	32	16,0	±	7,4
	In	1,5	±	4,8	2h30	±	0h46		8,2	±	4,3
	WAH	4,6	±	4,5	0h00	±		22	15,7	±	5,4
	CAH	1,6	±	4,9	2h45	±	3h30	17	8,8	±	3,9
Greenland	Out	-15,1	±	5,7	23h50	±	0h30	17,5	10,2	±	5,0
	WAH	-6,7	±	5,8	11h50	±	8h30	41	15,3	±	9,0
	CAH	-10,2	±	6,7	15h26	±	7h45	25,7	18,4	±	5,5
Himalaya	Out	-7,5	±	5,6	13h15	±	3h20	39	24,1	±	8,3
	In		±			±		40,5		±	
	WAH	-0,7	±	4,6	2h00	±	2h36	23	20,2	±	8,0
	CAH	-2,3	±	3,8	7h00	±	3h20	17	12,4	±	4,1

Conclusions :

- Not (always) so cold...
- Wide temperature range
- Prototype is OK for reducing frost time but not always for temperature range



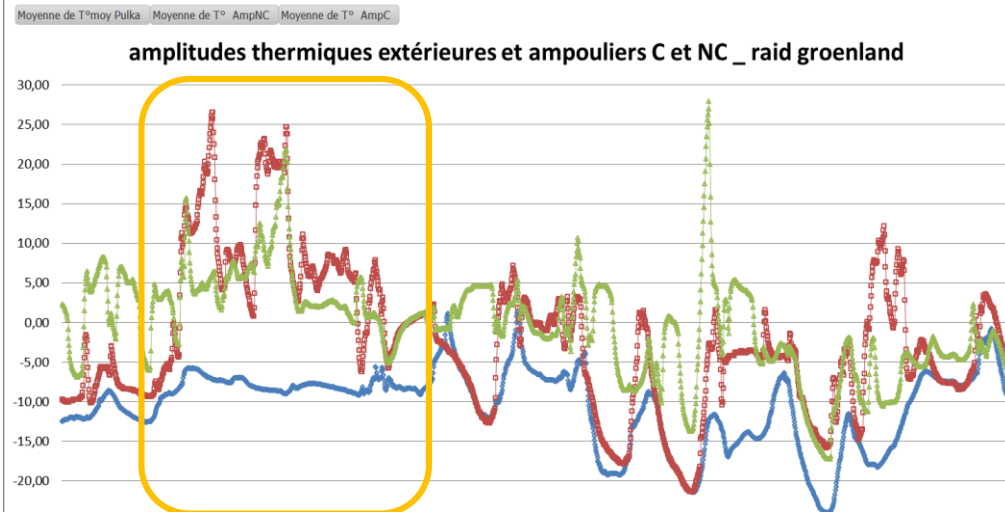
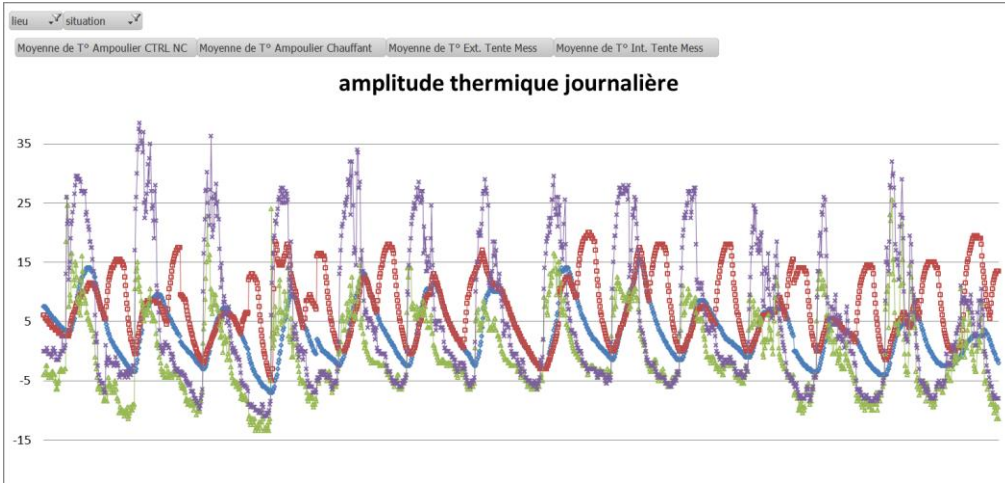
Which conditions during arctic / high altitude expeditions ?

Field study : Results

CAH / WAH / Outside / Inside

Conclusions :

- Wide temperature range
- Difference between expeditions : base camp vs traveling expedition



Liverpool Land, East Greenland



What's next ?

Field study : Discussion

- Field / Study comparison : lot of freeze / thaw cycles = new laboratory tests are needed
- Mild efficiency of the active ampoule holder = a new type is currently under development
- Using the body temperature to store vulnerable drugs ? = a prototype of a specific medical jacket is under development



Liverpool Land, East Greenland

What's next ?

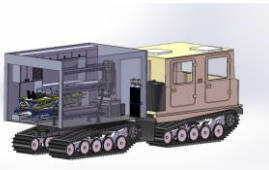


● Drill !

(More) International exercises !



● Innovations and tests



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Questions ?



Near the Top of Mont Blanc

