Workshop ARPA Piemonte – 7 febbraio 2018, Torino

Attività di studio e monitoraggio del'ambiente periglaciale e del permafrost nelle Alpi piemontesi

La criosfera sotterranea delle alpi orientali, strumento paleoclimatico e di monitoraggio del cambiamento climatico

Renato R. Colucci

Department of Earth System Sciences and Environmental Technologies

ISMAR-CNR Trieste (Italy)

Commissione Grotte E. Boegan (SAG-CAI, Trieste)

The periglacial environment – **Ice Caves**

Ice Caves

What is an ice cave?

Alpine ice caves are natural caves formed in bedrock, containing perennial accumulations of water in its solid phase

(*Perşoiu and Onac, 2012*)

Because one of their main characteristics is to have ground ice older than 2 years, many authors are prone to consider ice caves as *sporadic permafrost phenomena*

(*e.g. Holmlund et al., 2005; French, 2007; Kern et al., 2011)*

The periglacial environment – **Ice Caves**

Ice Caves

As part of the cryosphere, such ice masses are linked to the climate, but they do also exist in different kinds of environments, often at an altitude with an outside mean annual air temperature (MAAT) well above 0 °C

(e.g. Holmlund et al., 2005; Obleitner and Spötl,2011)

→ The accumulation of cold air into a cave during the winter seems to represent the main reason for the development and preservation of cold conditions leading to a progressive accumulation of ice

(Ford and Williams, 1989; Luetscher and Jeannin, 2004).

The periglacial environment – **Ice Caves**

Ice Caves

Ice forms through different mechanisms like recrystallization of snow, refreezing of percolating water, or with much less contribution, sublimation and deposition of cave-air vapor

(Luetscher and Jeannin, 2004).

The periglacial environment – **Ice Caves**

Ice Caves

Depending on their morphology, ice caves generally are described taking in account the relationships between ice formation and cave-air dynamics

classification

The periglacial environment – **Ice Caves**

Ice Caves

Depending on their morphology, ice caves generally are described taking in account the relationships between ice formation and cave-air dynamics

classification

The periglacial environment – **Ice Caves**

Ice Caves

Static (SIC) and Dynamic (DIC)

SIC → quite simple air circulation system, where cold air is trapped owing to its higher density within a single entrance cave

(Thury, 1861; Luetscher and Jeannin, 2004)

DIC → are related to the so-called **chimney effect (Balch effect)**, in which multiple entrances at different elevations produce a more complicated air flow system that forces air convection and is strictly dependent on seasonal effects (Thury, 1861; Balch, 1900)

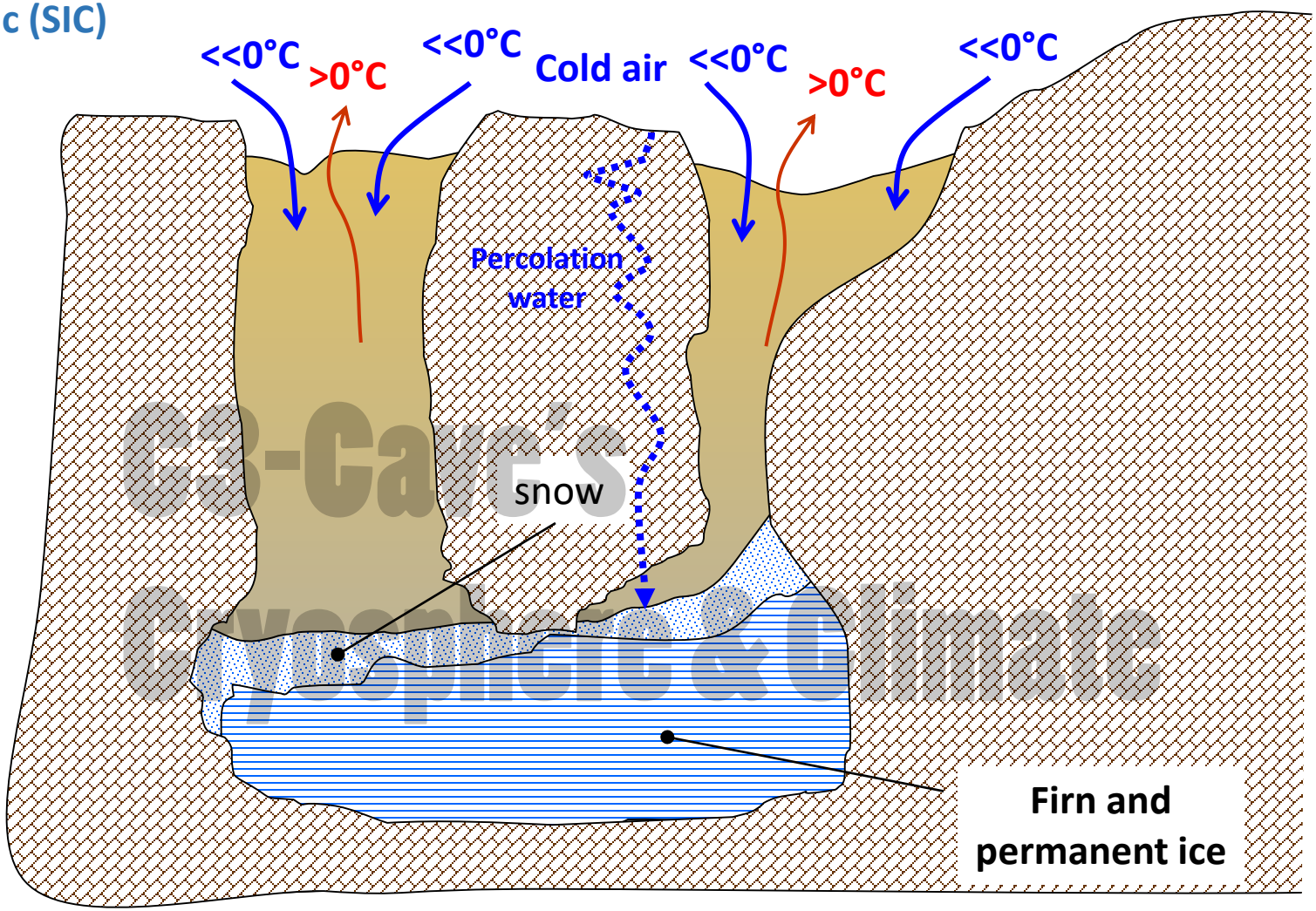
(Thury, 1861; Balch, 1900)

The periglacial environment – **Ice Caves**

WINTER

Ice Caves

Static (SIC)



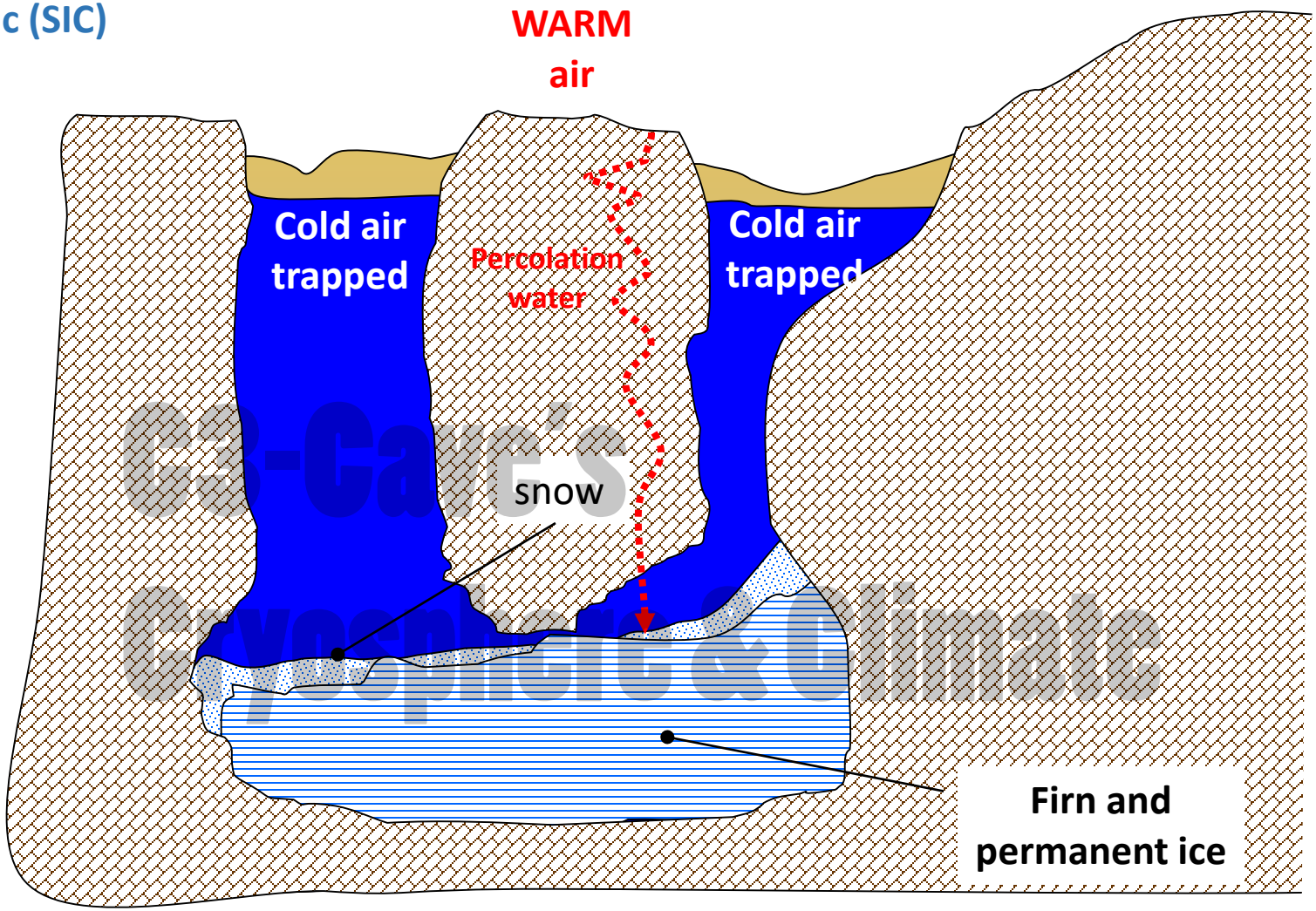
C3-Caves Cryosphere & Climate

The periglacial environment – **Ice Caves**

SUMMER

Ice Caves

Static (SIC)

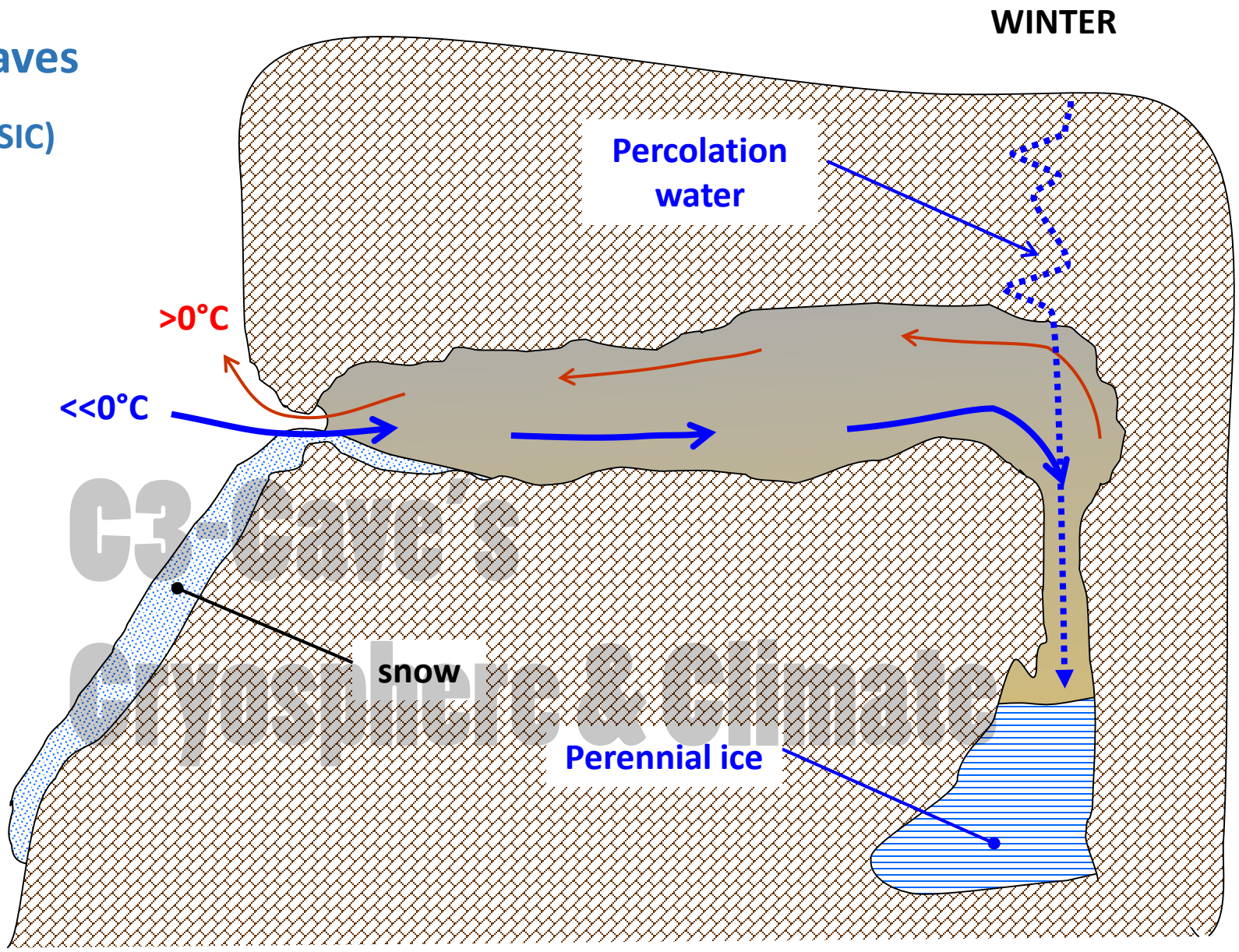


c3-Cave's
Cryosphere & Climate

The periglacial environment – Ice Caves

Ice Caves

Static (SIC)

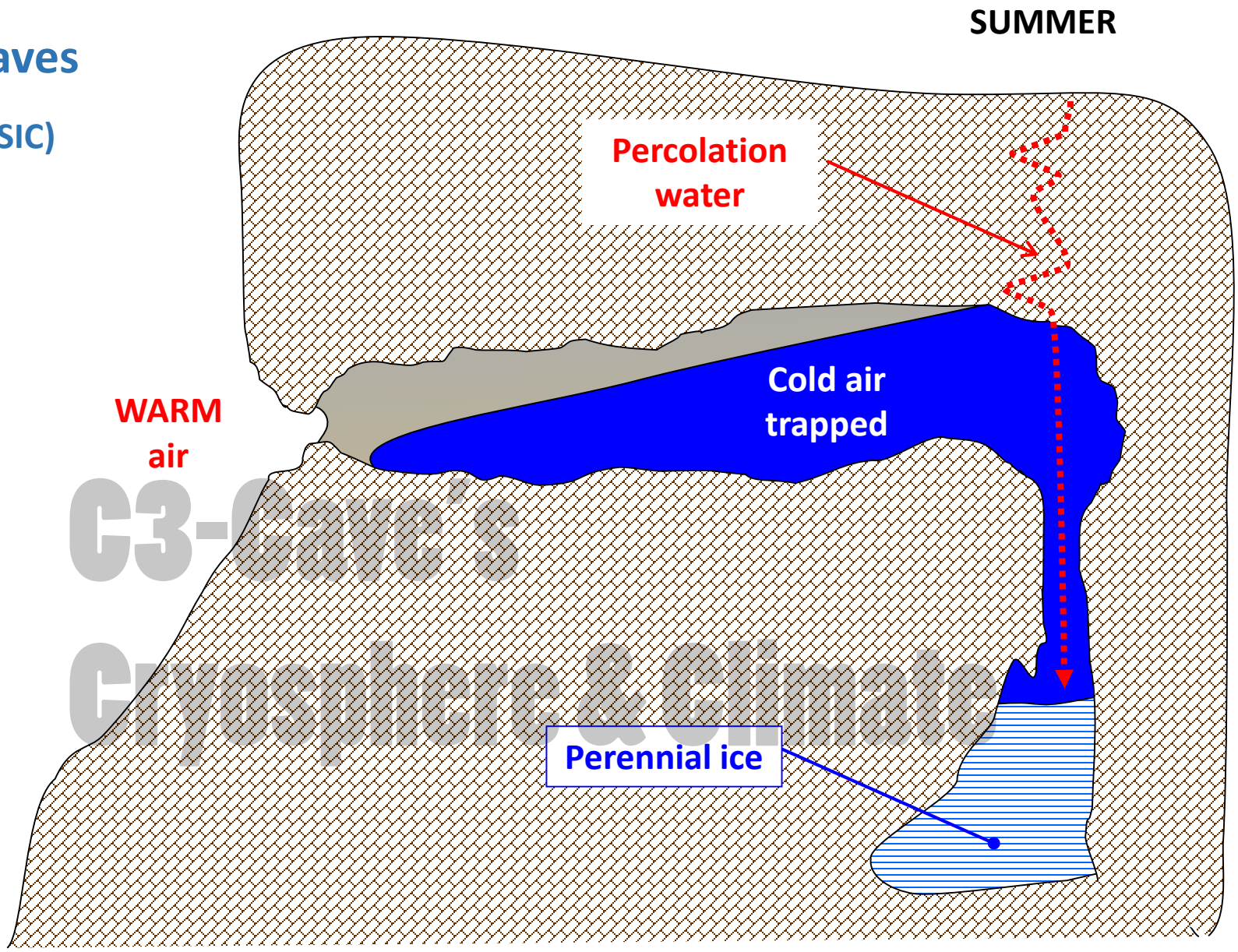


C3 Cave's Cryosphere & Climate

The periglacial environment – **Ice Caves**

Ice Caves

Static (SIC)

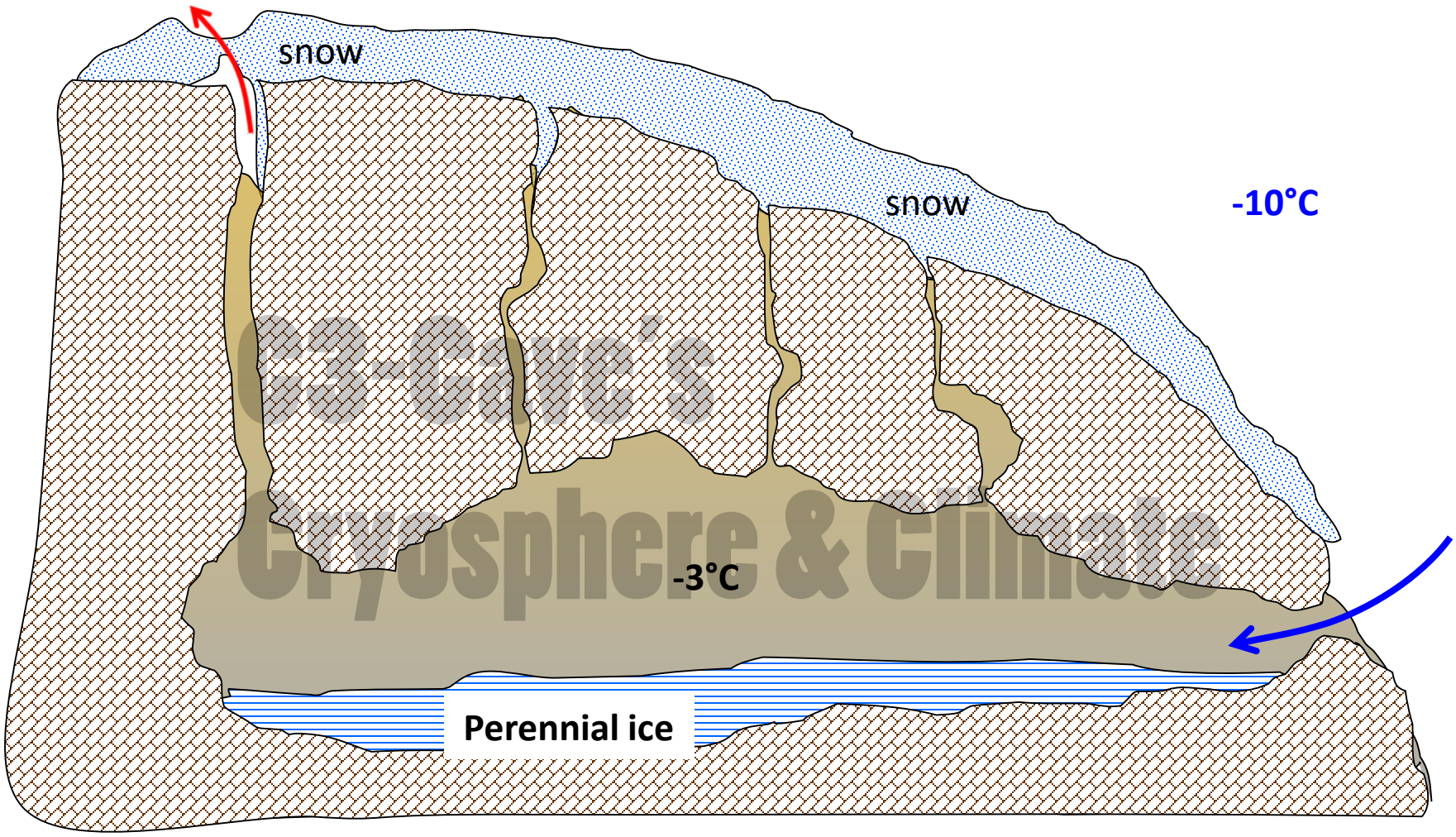


C3-Cave's Cryosphere & Climate

The periglacial environment – **Ice Caves**

Ice Caves

Dynamic (DIC)

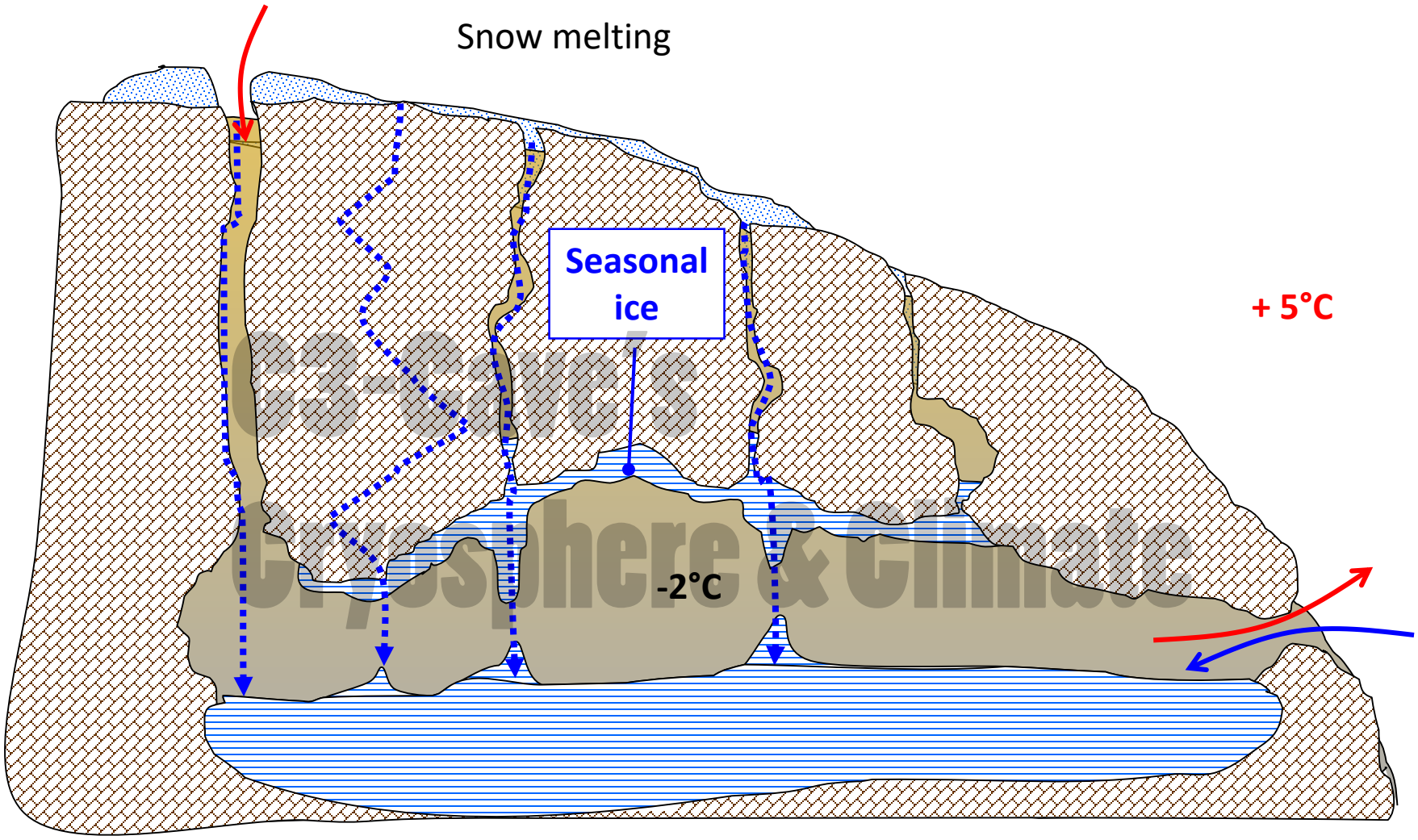


The periglacial environment – **Ice Caves**

SPRING

Ice Caves

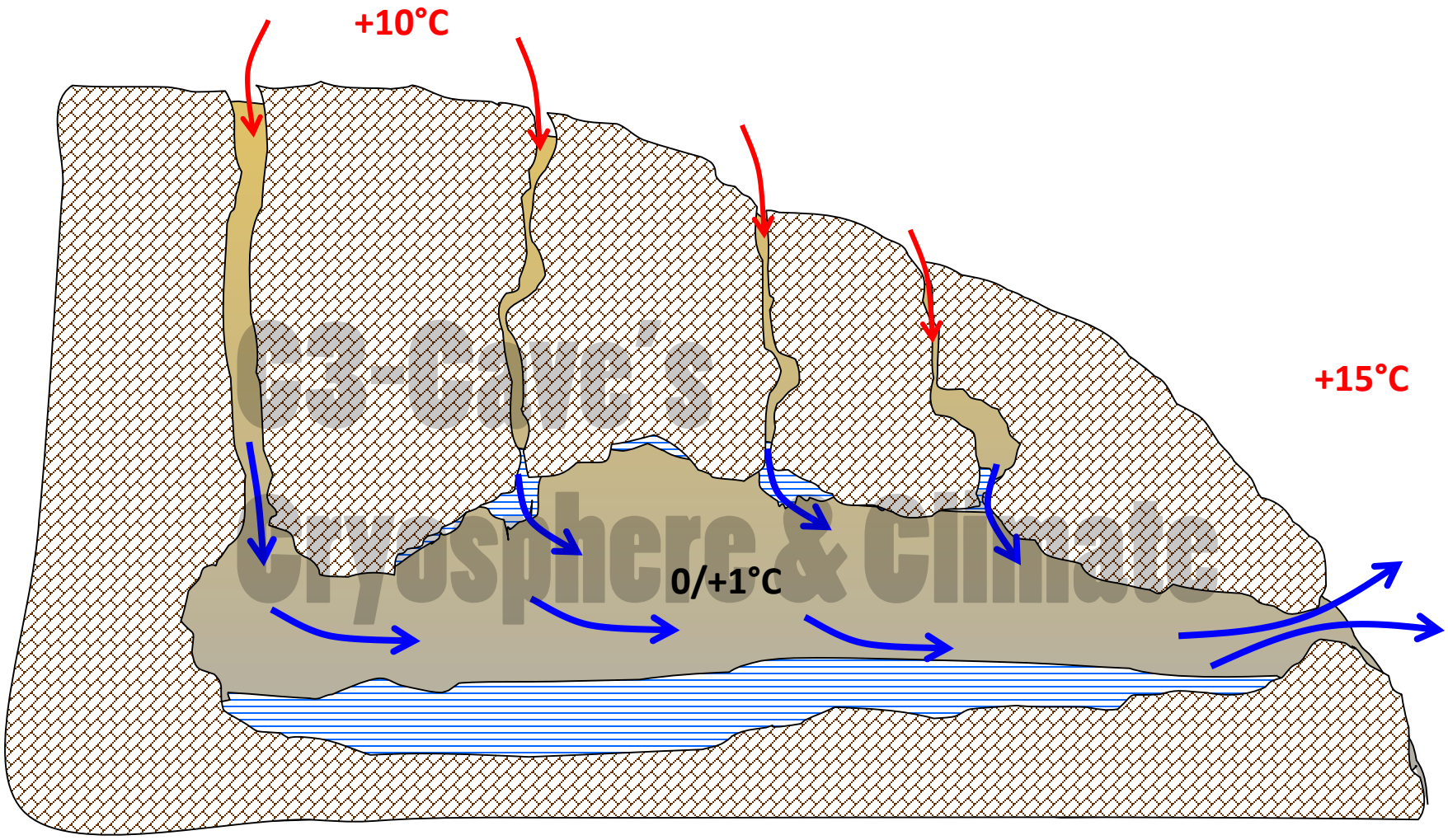
Dynamic (DIC)



The periglacial environment – **Ice Caves**

Ice Caves

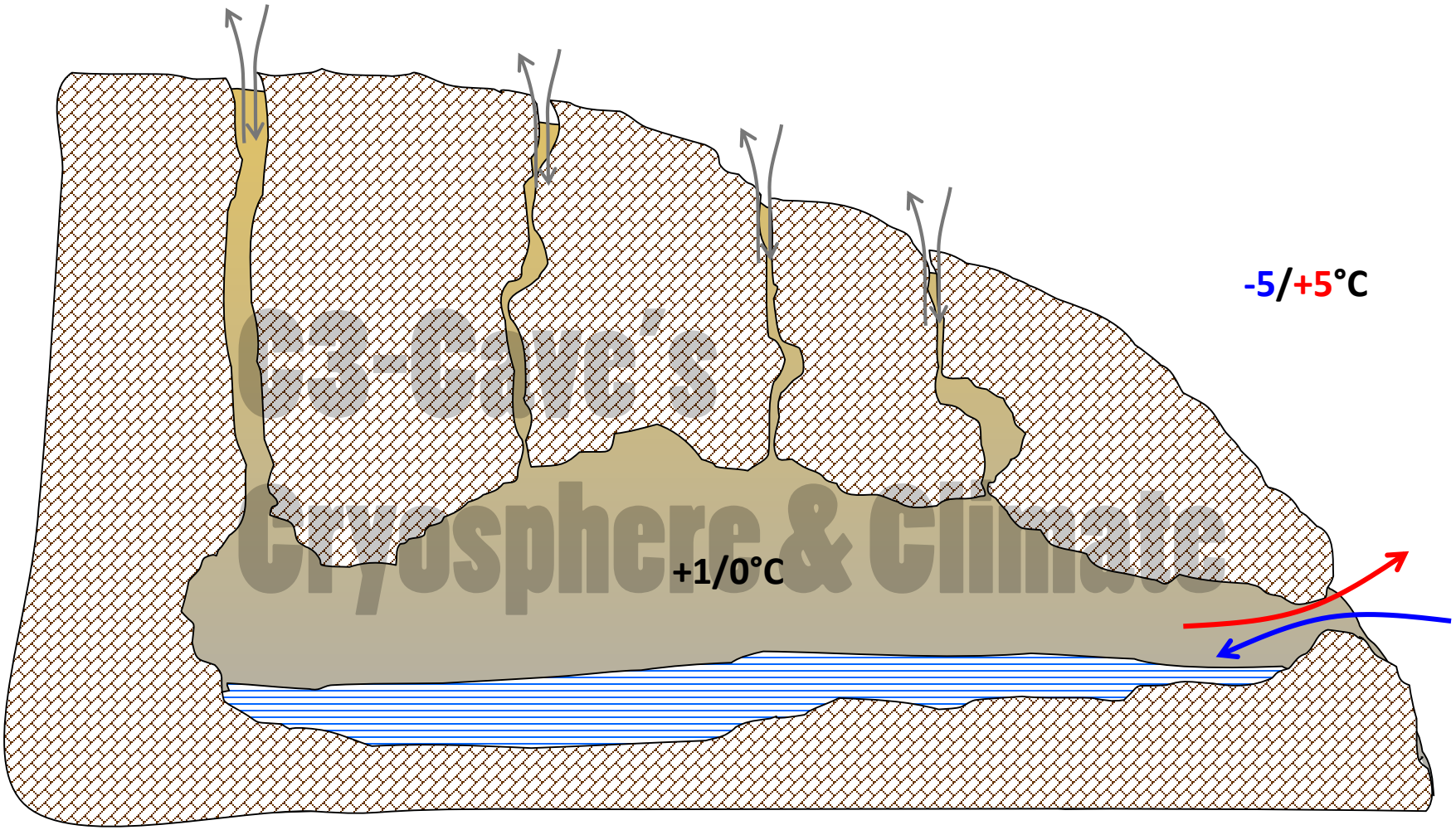
Dynamic (DIC)



The periglacial environment – **Ice Caves**

Ice Caves

Dynamic (DIC)



C3 Cave's Cryosphere & Climate