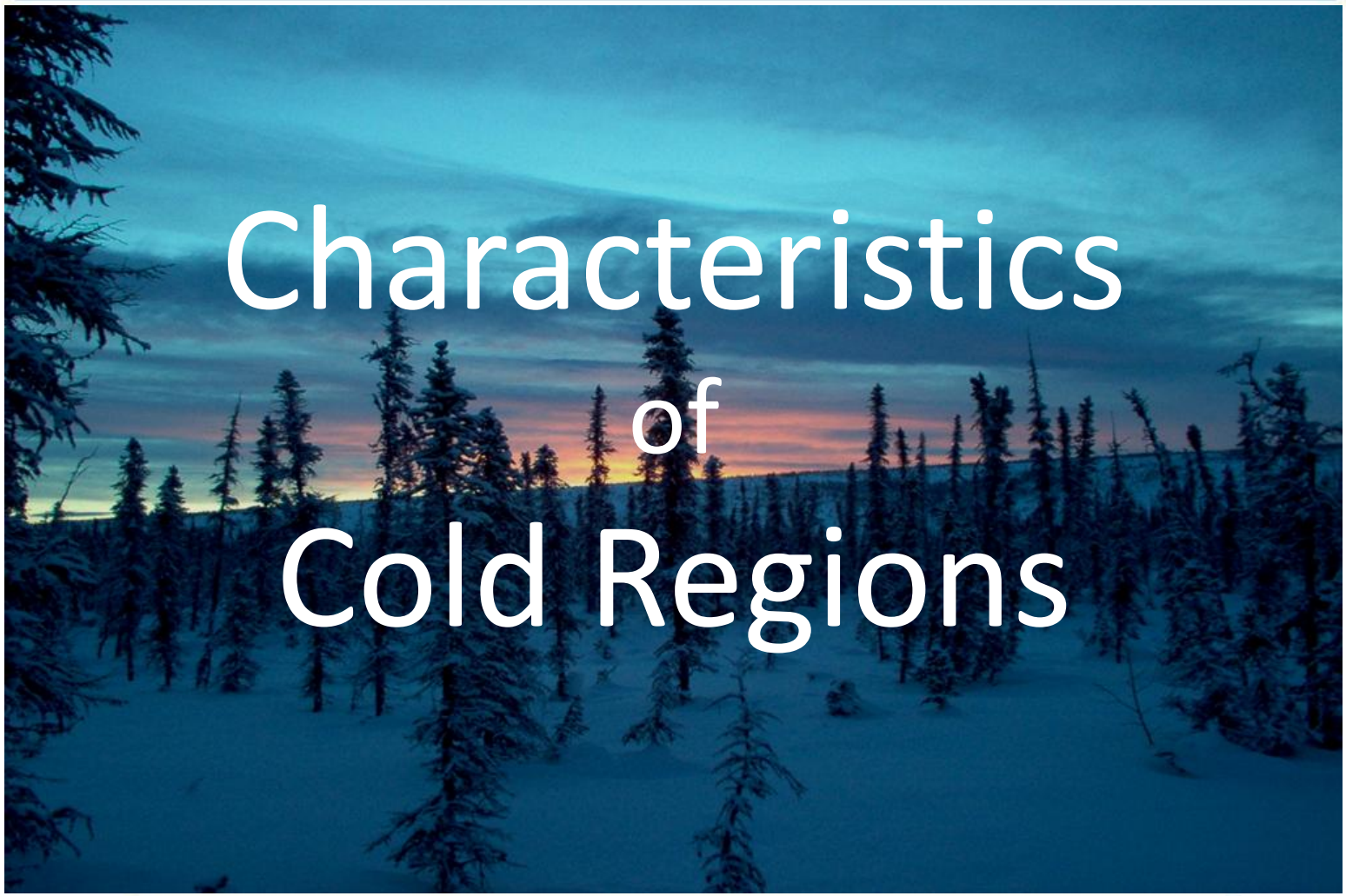
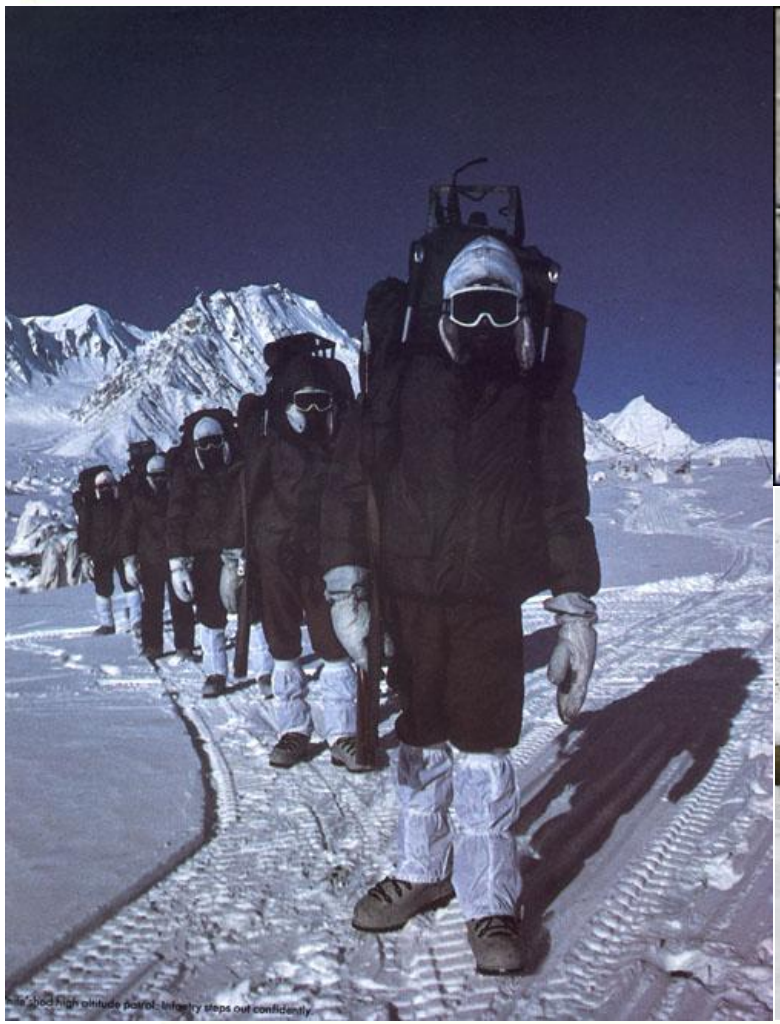


Characteristics of Cold Regions

Terminal Learning Objective

- **Action: Analyze terrain in cold regions**
- **Condition: Given a specified route or location on the ground or on a map in a cold region, and a map sheet of the route/location.**
- **Standard: Analyze the route or location in terms of the five military aspects of terrain and determine how each aspect affects the mission/training.**



AP

© AR

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Terrain Analysis: OAKOC

Observation and Fields of Fire

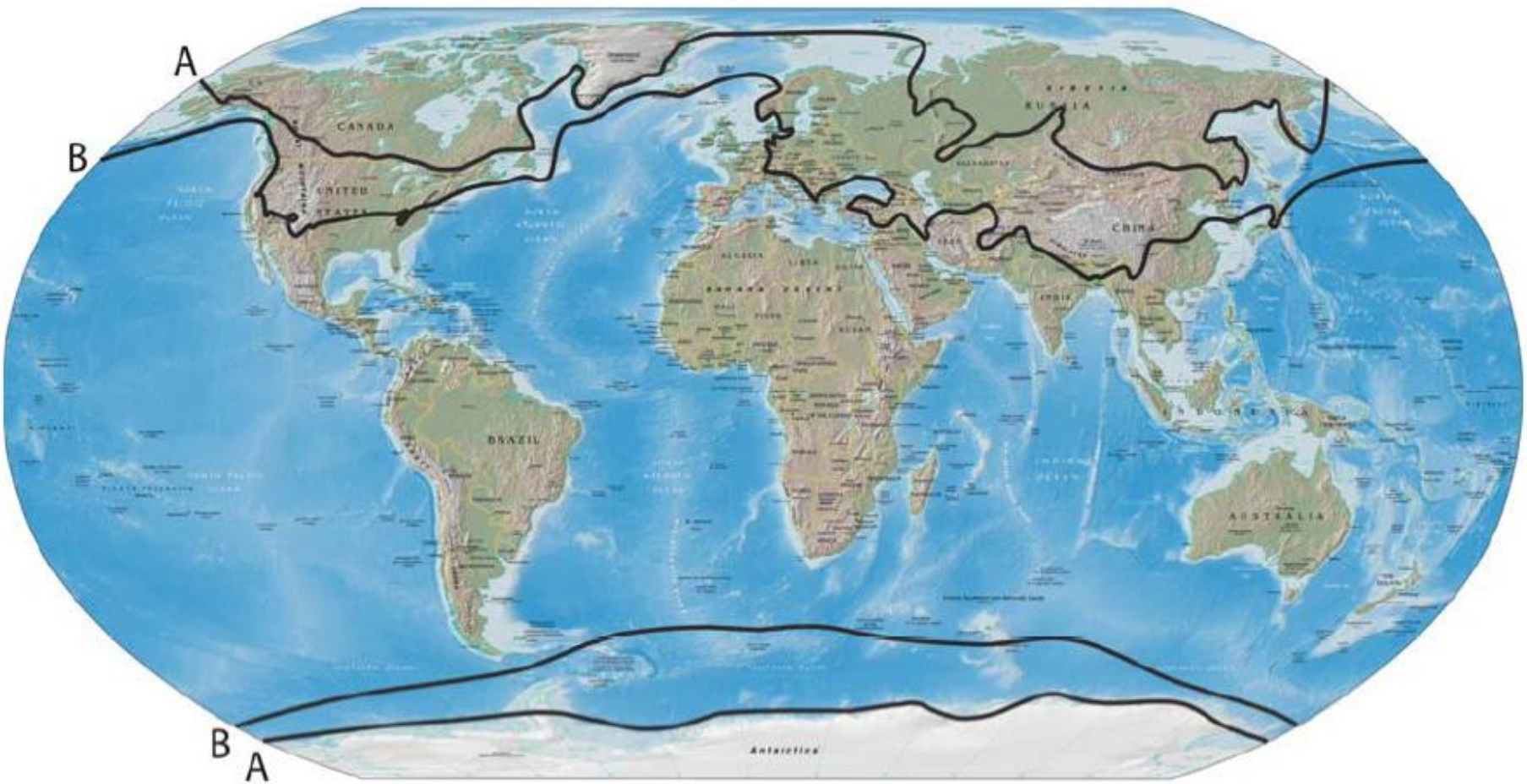
Avenues of Approach

Key Terrain

Obstacles

Cover and Concealment

Cold Regions of the World



Army Categories of Cold
ATTP 3-97.11 Cold Regions Operations Jan 11

Wet Cold +39 to +20 Often accompanied by wet snow/rain. Freeze thaw cycles near constant. Clothing can stay wet for long periods.

Dry Cold +19 to -4 Snow is light and dry. Freeze thaw periods not as frequent. Lower humidity.

Intense Cold -5 to -25 Snow is light and dry. Ground frozen until spring. Human performance begins to degrade. Equipment failure increases.

Extreme Cold -25 to -40 Human performance seriously degraded; survival and comfort take over. Equipment must be constantly checked

Hazardous Cold below -40 Units must scrutinize all operations and limit to the absolutely necessary ie. Lifesupport

Sub Regions

Arctic

Sub-Arctic

Temperate

Mountainous

Arctic

Cold winds / little moisture

Dry climate

Extremely high winds not uncommon

Summer temperature range of 44-51ºF; record high of 79ºF

Winter temperature range of -19 - -26ºF; record low of -54ºF

Snow cover 9 months per year

Arctic

Sub-Arctic

Strong winds

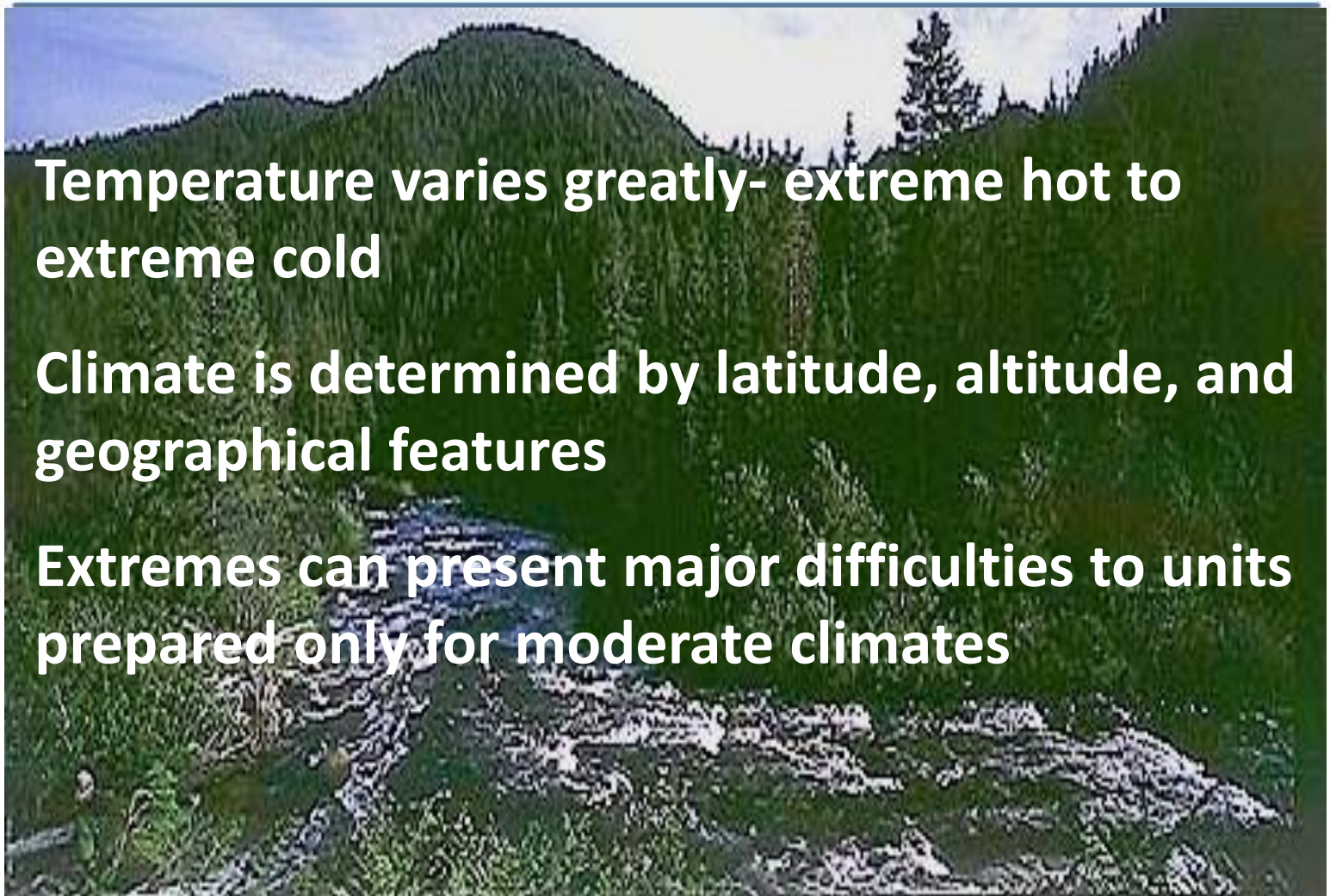
Summer temperature range of 66-73ºF; record high of 96ºF

Winter temperature range of -15 - -19ºF; record low of -81ºF

Snow cover 6-8 months per year

Sub-Arctic

Temperate



Temperature varies greatly- extreme hot to extreme cold

Climate is determined by latitude, altitude, and geographical features

Extremes can present major difficulties to units prepared only for moderate climates

Mountainous Terrain

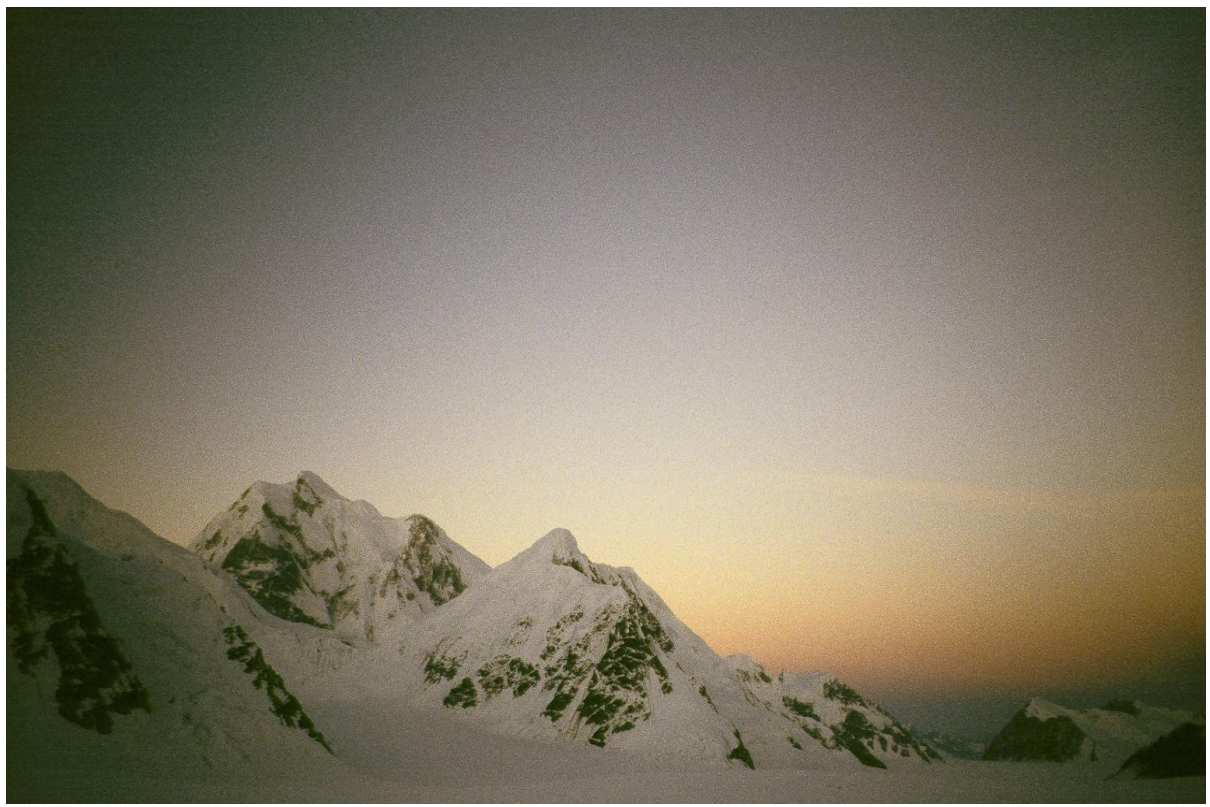
Compounds the difficulties of fighting in cold regions

Weather is difficult to predict

Presents obstacles to ground and air operations

Re-supply and casualty evacuation are often not possible by air or vehicle

Best terrain for small, self-supported units



Terrain Characteristics

Boreal Forests

Tundra

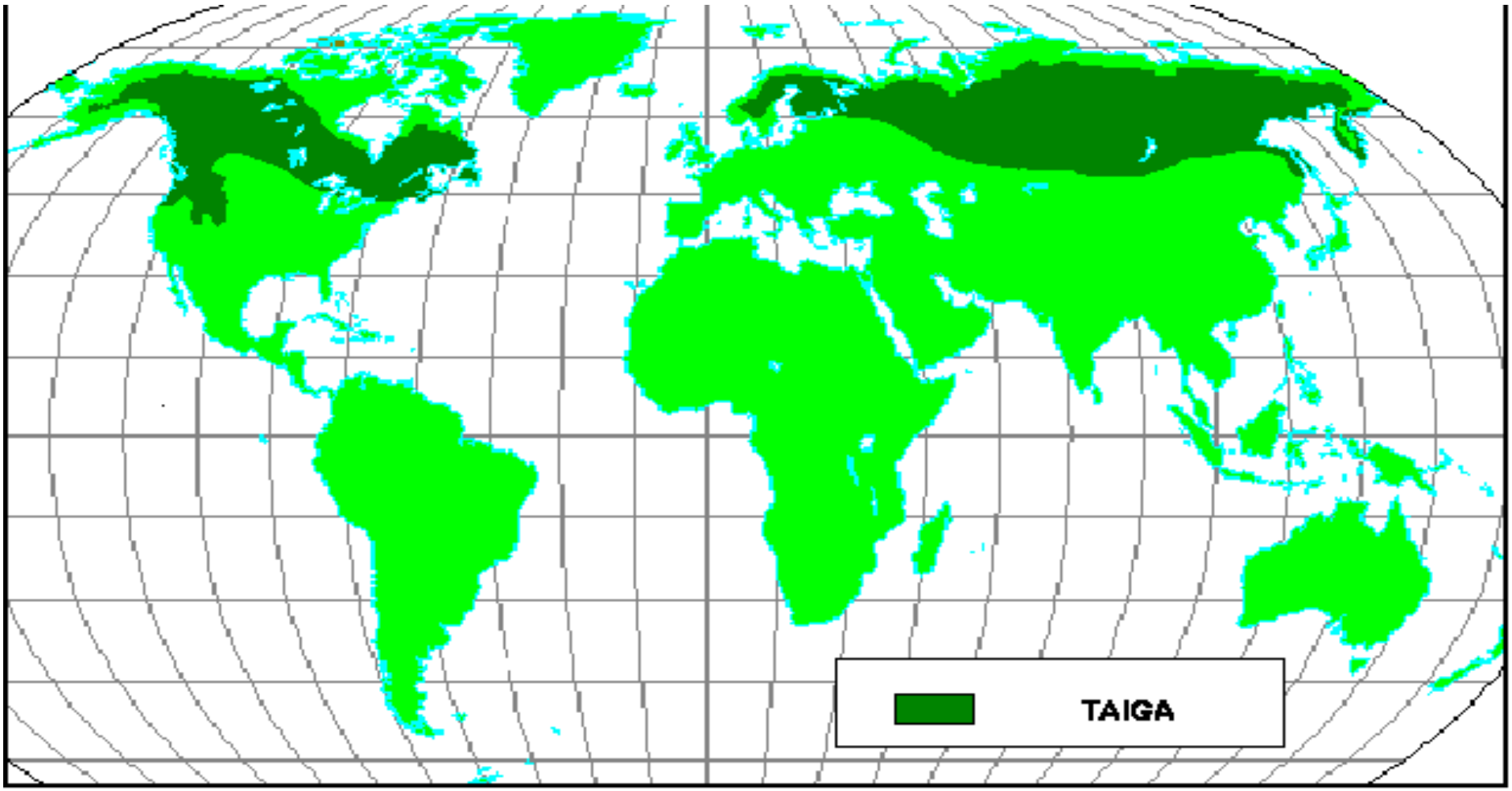
Permafrost

Muskeg

Glaciers and Ice Caps

Rivers

Boreal Forests



Tundra

Common in Arctic

Normally covered in tussocks

Difficult to move through in summer

Tundra

Tundra

Permafrost

Permanently frozen ground

Ground temperature 32°F or less for 2 or more years

Continuous in the Arctic

Discontinuous in Subarctic and further south

Temperate regions free from permafrost

Permafrost (cont')

Thickness varies from a few feet to over 1000 feet

Tundra keeps permafrost from thawing

Frozen ground prevents drainage

Fighting positions difficult to dig

Muskeg

Ground soft and spongy

Many standing pools of water

Very difficult to drive through in summer

Can trap vehicles requiring massive recovery effort

Muskeg

Muskeg

Muskeg

Glaciers and Ice Caps

Covers 10% of Earth's surface

Alaska has 2% of the Earth's glaciers

Often the easiest and safest means of travel in the mountains, but specialized training is required for negotiating

Glaciers and Ice Caps

Rivers

Majority of Arctic and Sub-Arctic rivers are glacier fed

Can be good transportation routes after freeze up

Freeze from banks inward; Thaw opposite

Thickest ice is generally by banks and slow flow areas

Rivers

Rivers

Overflow Ice

Can form at any water source when two conditions are met:

- Temperatures are below freezing
- Water underneath a frozen layer of ice is under pressure

Can build many layers creating obstacles along roads

Can create conditions where water continues to flow despite the temperature which creates a significant obstacle and hazard to dismounted movement

Can be a light film of water or several feet deep

Overflow Ice

Summary

- **Action: Analyze terrain in cold regions**
- **Condition: Given a specified route or location on the ground or on a map in a cold region, and a map sheet of the route/location.**
- **Standard: Analyze the route or location in terms of the five military aspects of terrain and determine how each aspect affects the mission/training.**

Weather

Terminal Learning Objective

Action: Analyze weather of cold regions

Condition: Given a training mission that involves a specified route or location on the ground or a map in a cold region, a map sheet of the route/location, a current weather forecast for the general area, altimeter and/or barometer (if available) and any other pertinent weather information or data.

Standard: Analyze the weather for the route/location in terms of visibility, survivability and mobility and determine how each of these aspects affects the training/mission.

Forces that create weather:

Sun, air movement, earth's rotation, oceans and land masses, cold fronts and warm fronts

<u>Weather depends upon:</u>

Air temperature, humidity, air pressure, how air is being moved and if the air is being lifted or not

<u>You should observe:</u>

Clouds, air pressure, wind direction/speed, temperature and humidity to help predict weather

Some tools that you can use are thermometer, barometer/altimeter and wind meter.

The Sun

The major force behind the weather

Does not heat the earth evenly; at the equator it heats the earth's surface with greater intensity than it does at the poles

Uneven heating results in air movement; temperature variations are ultimately responsible for all weather

Air Movement

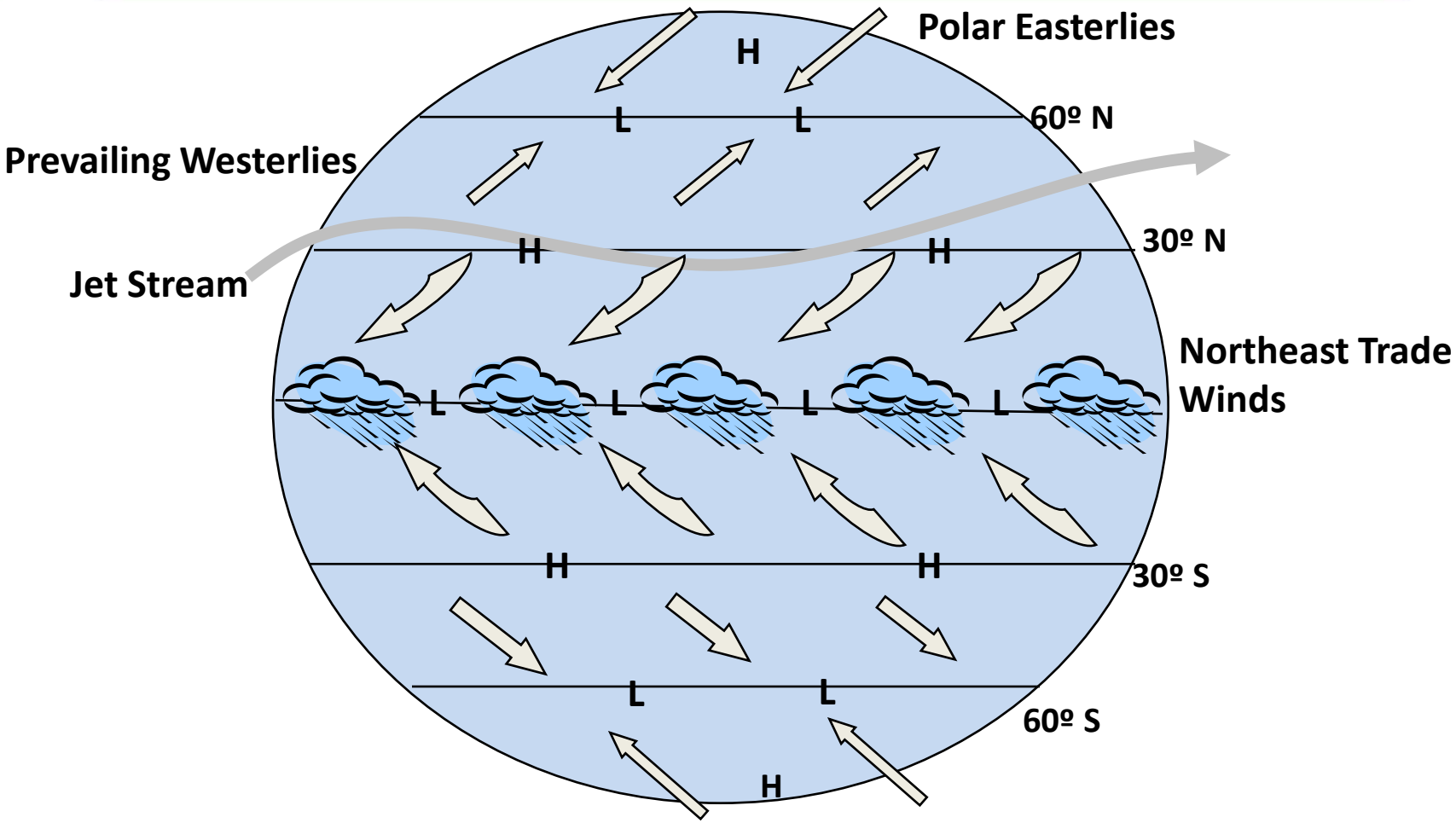
Air pressure is the weight of the atmosphere at any given place.

Air that is cooled, sinks and is dense (heavier) air – therefore the air pressure is high.

Air that is heated is less dense and rises – therefore the air pressure is low.

The higher in altitude you go, the lower the air pressure will be.

Earth's Rotation



Oceans and Land Masses

Maritime Zones:

- influenced by large bodies of water
- moderate to heavy precipitation is typical (deep snow pack)
- cool, wet summers and moderate, wet winters
- freeze thaw cycles more common in winter

Continental Zones:

- inland areas; influenced by large land mass
- moderate to light precipitation is typical (shallow snow pack)
- hot summers, very cold winters
- freeze thaw cycles are rare in winter

Fronts

Warm Front: warm air mass moves into and over a slower or stationary cold air mass; warm air is less dense and therefore moves up and over the cold air mass

Cold Front: cold air mass overtakes a slower or stationary warm air mass; cold air forces the warm air up

Occluded Front: Combination of warm front and cold front characteristics; occurs frequently over land

Stationary Front: no significant air movement is occurring

Cloud Formations

Convective Lifting: Sun's heat radiating off the earth's surface causing air currents (thermals) to rise straight up and lift air to point of saturation.

Frontal Lifting: A front is formed when two air masses of different moisture content and temperature collide. Air masses will not mix, so the warmer air will lift until it reaches its saturation point. Produces majority of precipitation.

Cyclonic Lifting: An area of low pressure pulls air into its center from all over in a counterclockwise direction. When air reaches the center of low pressure, it has nowhere to go but up. Air continues to lift until it reaches the saturation point.

Cloud Formation (cont)

Orographic Lifting: **This happens when an air mass is pushed up an over a mass of higher ground such as a mountain. This is typical along coast regions with mountains. As the air mass moves up the mountain range, the moisture is released quickly and typically produces heavy precipitation. This is evident in the Cascade Range of the Pacific Northwest.**

Cloud Types

Low Level

Mid Level

High Level

Vertical-Development Clouds

Less Common Clouds

Low-Level Clouds: **Either Cumulus or Stratus; mostly composed of water; two of the precipitating low level clouds are Nimbostratus clouds and Stratocumulus clouds**

Cumulus Clouds:
Low Level; Fair Weather

Stratus Clouds, Low Level: Fair Weather, Light Precipitation

Nimbostratus Clouds: Low Level

Statocumulus Clouds: Low Level

Mid-Level Clouds: Middle clouds generally indicate fair weather, especially if they are rising over time. These clouds have the prefix ‘alto’. Deteriorating weather is indicated by lowering middle clouds though these storms are usually hours away.

Altocumulus Clouds: Mid Level

Altostratus Clouds: Mid Level

High-Level Clouds: These clouds are in the upper reaches of the troposphere and indicate moisture aloft and that precipitation is 24-36 hours away. Cirrus and Cirrostratus are the most common. The only indicators of these clouds may be a halo or ring around the moon or sun.

Cirrus Clouds: High Level

Cirrostratus Clouds: High Level

Vertical Development Cloud Formations

- **<u>Fair Weather Cumulus:</u> resemble floating cotton balls with a short lifespan**

- **<u>Cumulonimbus:</u> generally in the shape of anvils. Produce the majority of thunderstorms.**

Cumulonimbus Clouds: Thunderhead

Less Common Cloud Formations

<u>Orographic or Lenticular Clouds:</u> **Look similar to contact lenses. Indicate poor weather in the near future.**

<u>Contrails:</u> **Exhaust from jets creates clouds in the upper atmosphere; evaporate quickly in fair weather; contrails that takes longer than 2 hours to evaporate indicate impending bad weather**

Lenticular Clouds

Lenticular Clouds

Weather Prediction

Some of the indicators that weather conditions will change/deteriorate significantly in the near future are:

- **lenticular cloud formation**
- **cirrus clouds or halo around sun or moon (24-36 hours)**
- **thunderheads (cumulonimbus)**
- **thickening, lowering clouds**
- **falling barometer - decreasing barometric pressure**
- **general warming temperatures**
- **marked wind increases or direction shifts**
- **contrails that do not dissipate after 2 hours**

Weather Hazards and Phenomena

Wind Chill Chart

WIND SPEED	AIR TEMPERATURE IN FAHRENHEIT																
	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95

WIND SPEED BASED ON MEASURES AT 33 FEET HEIGHT. IF WIND SPEED MEASURED AT GROUND LEVEL, MULTIPLY BY 1.5 TO OBTAIN WIND SPEED AT 33 FEET IN HEIGHT AND THEN UTILIZE CHART.

Ice Fog

Temperatures are -30º F or colder; heat or vapor source present and still air conditions

Obscures vision and target recognition

Hinders movement

Leaves signature when weapons are fired or vehicles are operated

Numerous supplementary positions are needed for weapons

Can be used to conceal your movement

Blizzard

High winds

Blowing snow

Reduced visibility

Usually lasts 24 hours or less

Whiteout

Loss of Depth Perception

Units Should Stop and Wait Condition out

Temperature Inversion

Cold air settles in low areas; warm air settles on top of cold

Can be 20°F difference

Bivouac site selection

Looming

Optical illusion that causes objects to appear closer than they actually are; causes problems with range estimation

Normally occurs in extreme cold or hot dry air

Chinook Winds

These are warm, dry winds that occur in the lee of high mountain ranges. It is a fairly common wintertime phenomena in the mountainous west and in parts of Alaska. These winds develop in well-defined areas and can be quite strong.

Aurora Borealis

Caused by Charged Particles Produced by the Sun

Occur All Year

Aurora Borealis Activity Can Adversely Effect AM and satellite communications but may enhance FM communications

In Southern Hemisphere Called Aurora Australis

Aurora Borealis

Summary

Action: Analyze weather of cold regions

Condition: Given a training mission that involves a specified route or location on the ground or a map in a cold region, a map sheet of the route/location, a current weather forecast for the general area, altimeter and/or barometer (if available) and any other pertinent weather information or data.

Standard: Analyze the weather for the route/location in terms of visibility, survivability and mobility and determine how each of these aspects affects the training mission.