Air Masses


Continental
arctic cA
(winter only),
Continental
polar cP
(all year)
Maritime
polar mP
Maritime
polar mP
Maritime
tropical mT
Continental
tropical cT
(summer only)
Maritime
tropical mT
North American Air Mass Source Regions

Air Masses

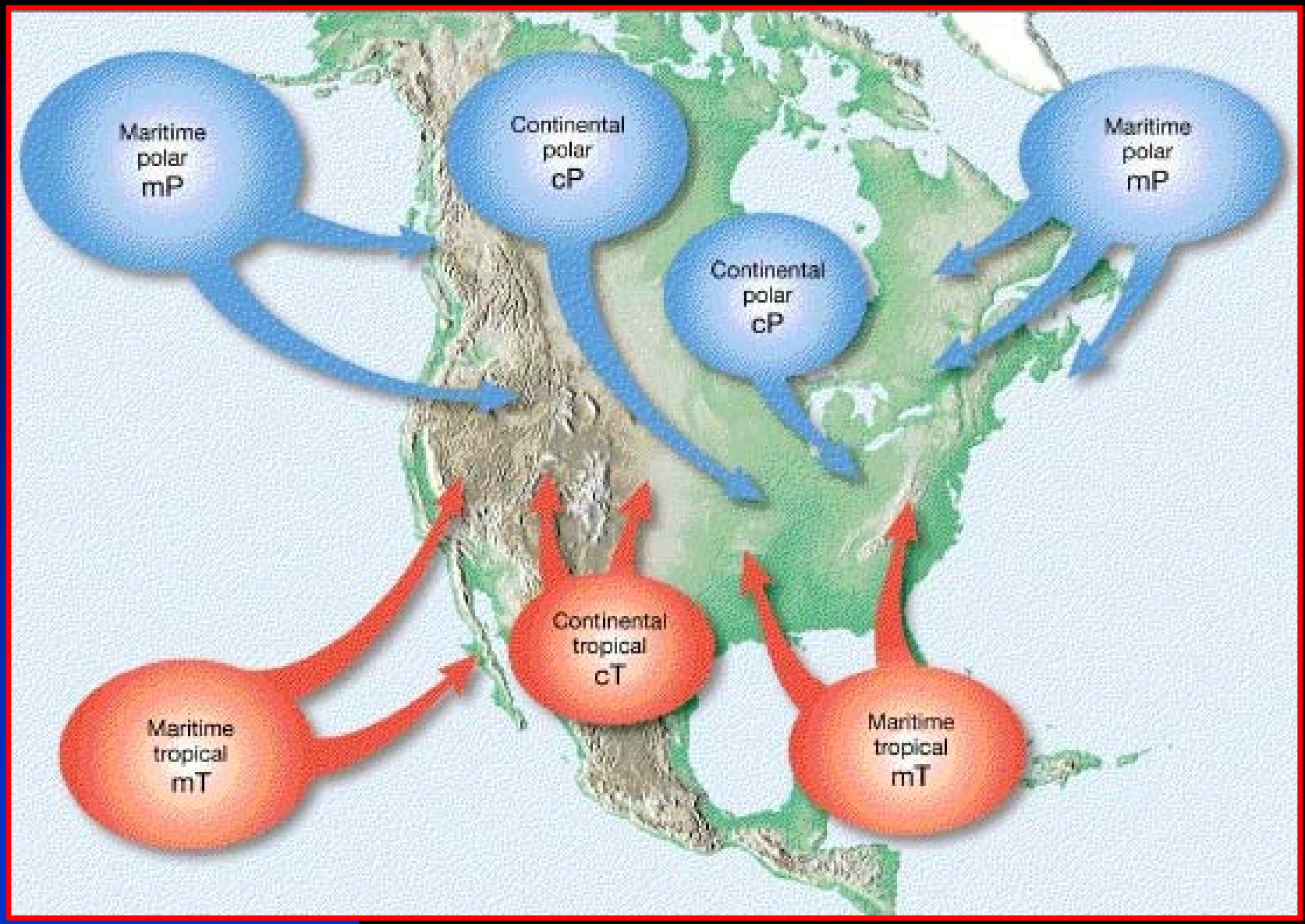
- In the middle latitudes, most weather patterns are the result of the movements of large bodies of air, called air masses.
- An **air mass** is a large body of air, usually 1600 kilometers or more across and perhaps several kilometers thick, which is characterized by homogeneous physical properties (in particular, temperature and moisture content) at any given altitude.
- A region under the influence of an air mass will probably experience generally constant weather conditions, a situation referred to as **air mass weather**.

Air Mass Source Regions

- Areas in which air masses originate are called **air mass source regions.**
- An ideal source region must meet two criteria:
  - First, it must be an extensive and physically uniform area.
  - The second criterion is that the area is characterized by a general stagnation of atmospheric circulation so that air will stay over the region long enough to come to some measure of equilibrium with the surface.
- The classification of an air mass depends on:
  - (1) the latitude of the source region, and
  - (2) the nature of the surface in the area of origin—ocean or continent.

Abbreviations for Air Mass Source Regions

- Air masses are identified by two-letter codes.
- With reference to latitude (temperature), air masses are placed into one of three categories:
  - **polar** (**P**),
  - **arctic** (**A**), and
  - **tropical** (**T**).
- A lowercase letter (**m**, for **maritime**, or **c** for **continental**) is placed in front of the uppercase letter to designate the nature of the surfaces and the humidity characteristics of the air mass.
- Using this classification, the following air masses are identified:
  - cA, cP, cT, mT, and mP.
- Note that there is not a mA source region.

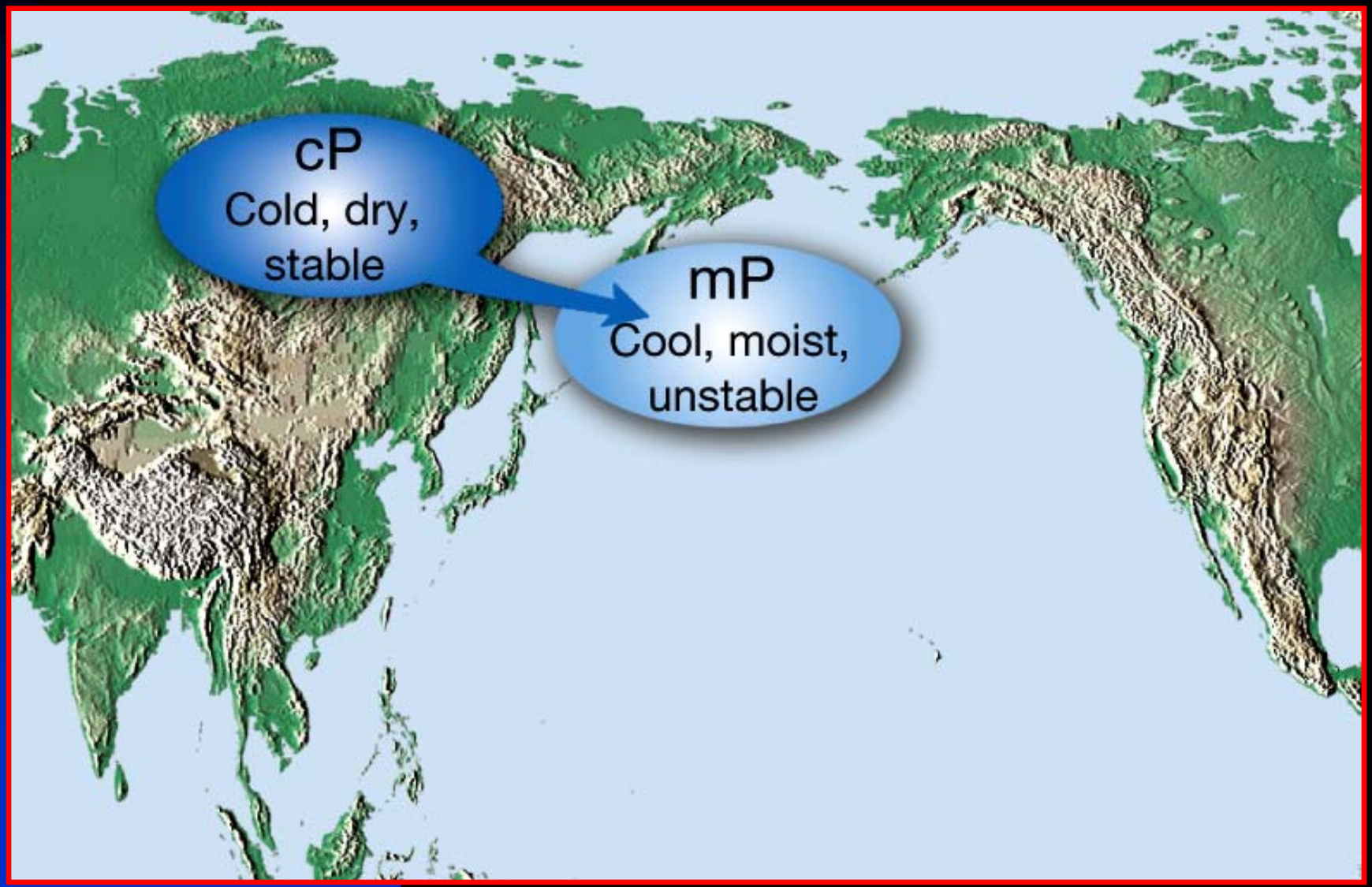

Maritime
polar
mP
Continental
polar
cP
Continental
polar
cP
Maritime
polar
mP
Continental
tropical
cT
Maritime
tropical
mT
Maritime
tropical
mT

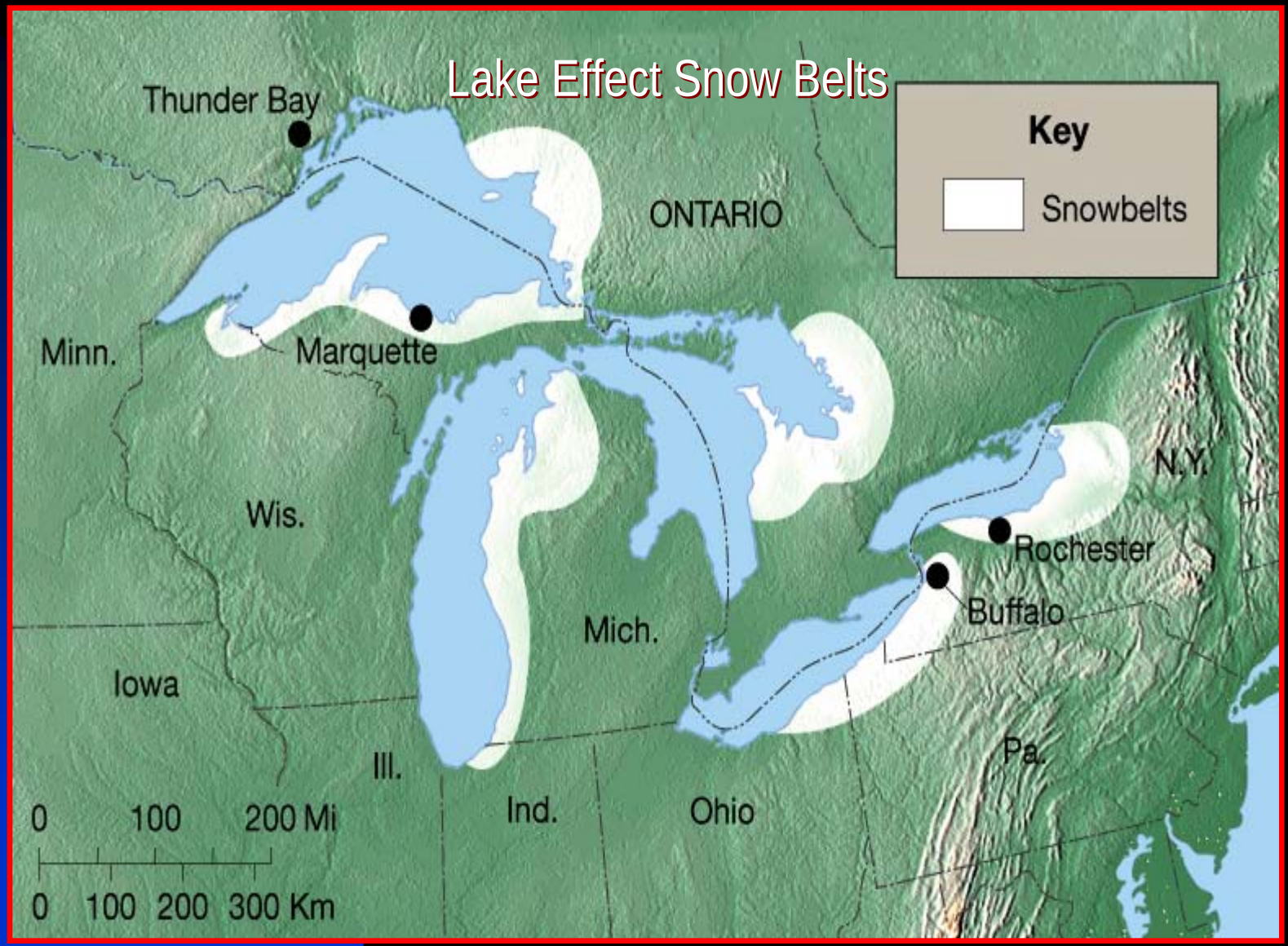
Air Mass Modifications

- Once an air mass moves from its source region, it not only modifies the weather of the area it is traveling over, but it is also gradually modified by the surface over which it is moving.
- Modifications can result from:
  - temperature differences between an air mass and the surface,
  - vertical movements induced by cyclones and anticyclones, or
  - topography.

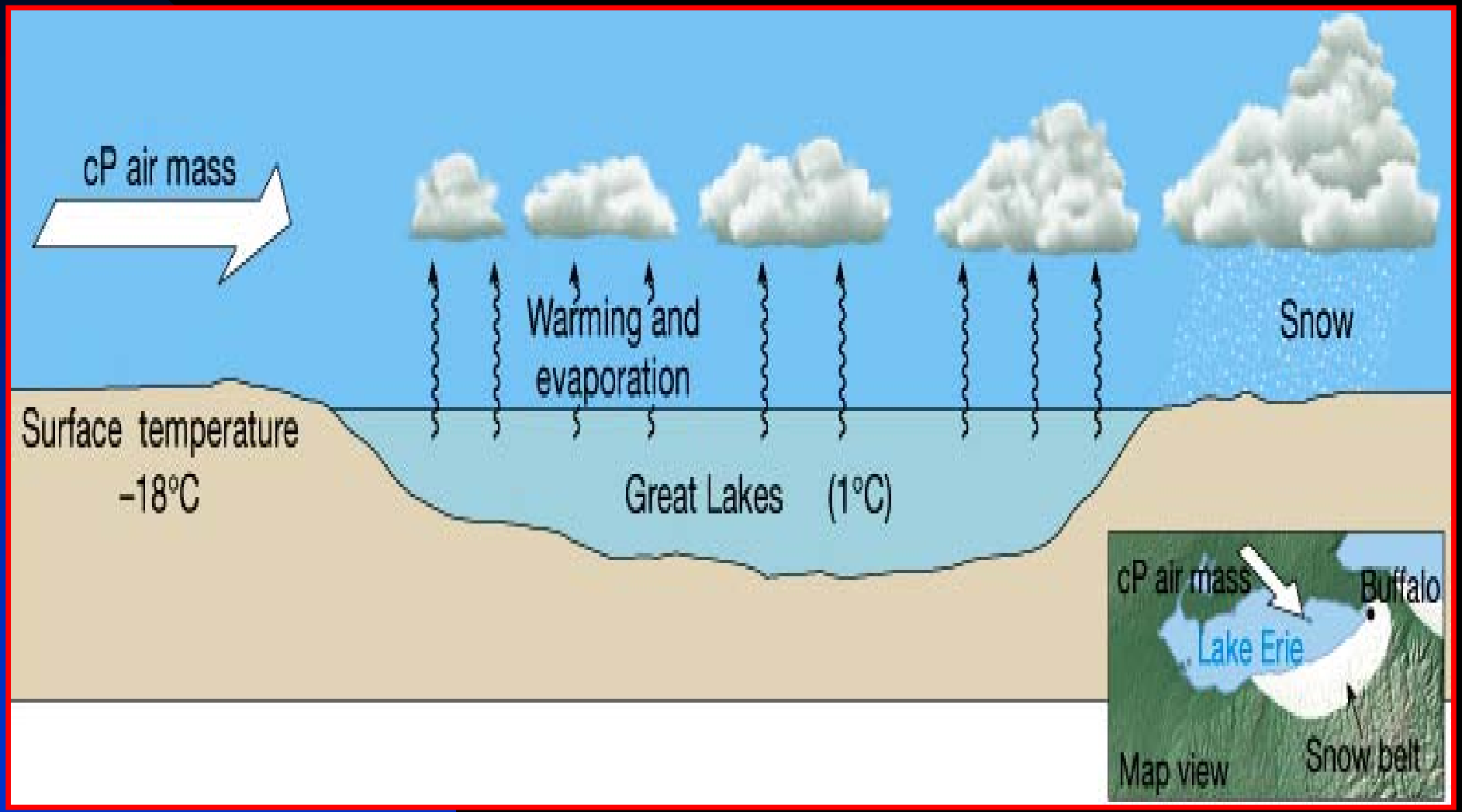
cP and cA Air Masses

- The day-to-day weather we experience depends on the temperature, stability, and moisture content of the air mass we are experiencing.
- **Continental polar** (cP) and **continental arctic** (cA) air masses are, as their classification implies, cold and dry.
- Although cP air masses are not, as a rule, associated with heavy precipitation, those that cross the Great Lakes during late autumn and winter sometimes bring **lake-effect snows** to the leeward shores.


cP
Cold, dry,
stable
mP
Cool, moist,
unstable


Lake Effect Snow Belts
Key
Snowbelts
Thunder Bay
ONTARIO
Minn.
Marquette
Wis.
Mich.
N.Y.
Rochester
Buffalo
Iowa
Ill.
Ind.
Ohio
Pa.
0 100 200 Mi
0 100 200 300 Km

Formation of Lake Effect Snows



mP Air Masses

- **Maritime polar** air masses (mP) form over oceans at high latitudes and are cool to cold and humid.
- The weather associated with an invasion of mP air from the Atlantic into an area east of the Appalachians and north of Cape Hatteras is known as a **nor'easter**.

mT Air Masses

- **Maritime tropical** (mT) air masses affecting North America most often originate over the warm waters of the Gulf of Mexico, the Caribbean Sea, or the adjacent western Atlantic Ocean.
- As expected, mT air masses are warm to hot and they are humid.
- During winter, when cP air dominates the central and eastern United States, mT air only occasionally enters this part of the country.
- However, during the summer, mT air masses from the Gulf, Caribbean, and adjacent Atlantic cover a much wider area of the continent and are present for a greater period.
- The mT air masses from the Gulf-Caribbean-Atlantic source region are also the source of much (if not most) of the precipitation received in the eastern two-thirds of the United States.

Air Masses and Rainfall

- **Isohyets**, lines drawn on a map that connect places having equal rainfall, illustrate the greatest rainfall in the Gulf region and a decrease in precipitation with increasing distance from the mT source region.
- Hot and dry **continental tropical** (cT) air is produced only in the summer in northern interior Mexico and adjacent parts of the arid southwestern United States.

Table 8–1 Weather characteristics of North American air masses

Air Mass	Source Region	Temperature and Moisture Characteristics in Source Region	Stability in Source Region	Associated Weather
cA	Arctic basin and Greenland ice cap	Bitterly cold and very dry in winter	Stable	Cold waves in winter
cP	Interior Canada and Alaska	Very cold and dry in winter	Stable entire year	a. Cold waves in winter b. Modified to cPk in winter over Great Lakes bringing "lake-effect" snow to leeward shores
mP	North Pacific	Mild (cool) and humid entire year	Unstable in winter Stable in summer	a. Low clouds and showers in winter b. Heavy orographic precipitation on windward side of western mountains in winter c. Low stratus and fog along coast in summer; modified to cP inland
mP	Northwestern Atlantic	Cold and humid in winter Cool and humid in summer	Unstable in winter Stable in summer	a. Occasional "nor'easter" in winter b. Occasional periods of clear, cool weather in summer
cT	Northern interior Mexico and southwestern U.S. (summer only)	Hot and dry	Unstable	a. Hot, dry, and cloudless, rarely influencing areas outside source region b. Occasional drought to southern Great Plains
mT	Gulf of Mexico, Caribbean Sea, western Atlantic	Warm and humid entire year	Unstable entire year	a. In winter it usually becomes mTw moving northward and brings occasional widespread precipitation or advection fog b. In summer, hot and humid conditions, frequent cumulus development and showers or thunderstorms
mT	Subtropical Pacific	Warm and humid entire year	Stable entire year	a. In winter it brings fog, drizzle, and occasional moderate precipitation to N.W. Mexico and S.W. United States b. In summer this air mass occasionally reaches the western United States and is a source of moisture for infrequent convectional thunderstorms.

Key Terminology

Air mass

Air mass source region

Lake effect snow

Nor'easter

Isohyets

Air Mass Source Region Types:

cA, cP, cT, mT, and mP