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B.A. PART - 1 (PHYSICAL GEOGRAPHY : PAPER - 1)

TOPIC : AIR MASSES

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Although the troposphere is a continuous body of mixed gases that surrounds the planet, it is by no means a uniform blanket of air. Instead, it is composed of many large parcels of air that are distinct from one another. Such large parcels are referred to as air masses.

CHARACTERISTICS AIR MASSES

To be recognized as a distinct air mass, a parcel of air must meet three requirements:

- It must be large. A typical air mass is more than 1600 kilometers (1000 miles) across and several kilometers deep (from Earth's surface to the top of the air mass).
- It must have uniform properties in the horizontal dimension. This means that at any given altitude in the air mass, its physical characteristics:- primarily temperature, humidity, and stability; are relatively homogeneous.
- It must travel as a unit. It must be distinct from the surrounding air, and when it moves it must retain its original characteristics and not be torn apart by differences in airflow.

ORIGIN OF AIR MASSES

- An air mass develops its characteristics when it stagnates or remains over a uniform land or sea surface long enough to acquire the temperature/humidity/stability characteristics of the surface below.
- This stagnation needs to last for only a few days if the underlying surface has prominent temperature and moisture characteristics. Stable air is more likely to remain stagnant for a few days than unstable air, so regions with anticyclonic (high pressure) conditions commonly form air masses.

SOURCE REGIONS OF AIR MASSES

The formation of air masses is usually associated with what are called source regions: regions of Earth's surface that are particularly well suited to generate air masses. Such regions must be extensive, physically uniform, and associated with air that is stationary or anticyclonic.

- Ideal source regions are – ocean surfaces and extensive flat land areas that have a uniform covering of snow, forest, or desert.
- Air masses rarely form over the irregular terrain of mountain ranges.

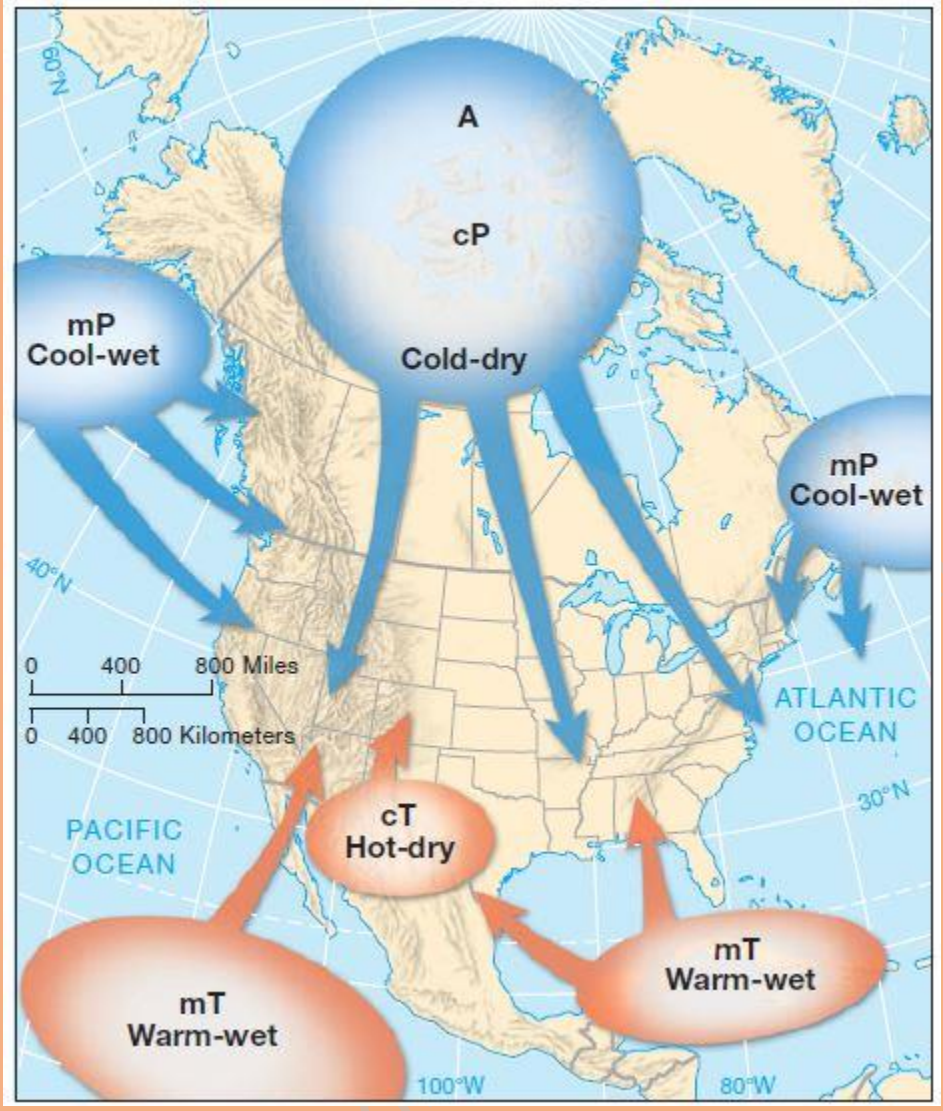


Image portrays the principal recognized source regions for air masses that affect North America. Warm air masses can form in any season over the waters of the southern North Atlantic, the Gulf of Mexico/Caribbean Sea, and the southern North Pacific, and in summer, they can form over the deserts of the southwestern United States and northwestern Mexico. Cold air masses develop over the northern portions of the Atlantic and Pacific Oceans and over the snow-covered lands of north-central Canada.

It may well be that the concept of source regions is of more theoretical value than actual value. A broader view, one subscribed to by many atmospheric scientists,

holds that air masses can originate almost anywhere in the low or high latitudes but rarely in the midlatitudes due to the prevailing westerlies where persistent wind would prevent air mass formation.

CLASSIFICATION OF AIR MASSES

Air masses are classified on the basis of source region. The latitude of the source region correlates directly with the temperature of the air mass, and the nature of the surface strongly influences the humidity content of the air mass. Thus,

- A low-latitude air mass is warm or hot
- A high-latitude one is cool or cold.

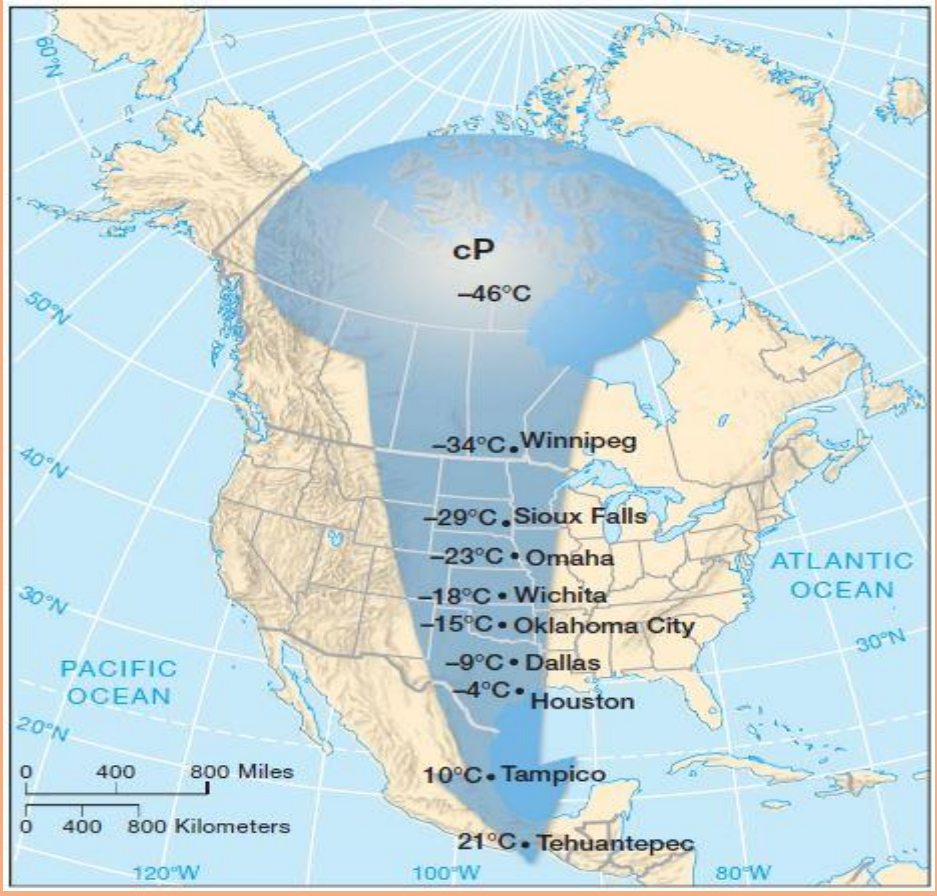
If the air mass develops over a continental surface, it is likely to be dry; if it originates over an ocean, it is usually moist. A one- or two-letter code is generally used to identify air masses. Although some authorities recognize other categories, the basic classification is sixfold are as follows:-

Type	Code	Source Regions	Source Region Properties
Arctic/Antarctic	A	Antarctica, Arctic Ocean and fringes, and Greenland	Very cold, very dry, very stable
Continental polar	cP	High-latitude plains of Eurasia and North America	Cold, dry, very stable
Maritime polar	mP	Oceans in vicinity of 50°–60° N and S latitude	Cold, moist, relatively unstable
Continental tropical	cT	Low-latitude deserts	Hot, very dry, unstable
Maritime tropical	mT	Tropical and subtropical oceans	Warm, moist, of variable stability
Equatorial	E	Oceans near the equator	Warm, very moist, unstable

MOVEMENT AND MODIFICATION OF AIR MASSES

Some air masses remain in their source region for long periods, even indefinitely. In such cases, the weather associated with the air mass persists with little variation. Our interest, however, is in masses that leave their source region and move into other regions, particularly into the midlatitudes. When an air mass departs from its source region, its structure begins to change. This change is due in part to thermal modification (warming or cooling from below), in part to dynamic modification (uplift, subsidence, convergence, turbulence), and perhaps also in part to addition or subtraction of moisture.

Once it leaves its source area, an air mass modifies the weather of the regions into which it moves: it takes source-region characteristics into other regions.



A midwinter outburst of continental polar (cP) air from northern Canada sweeps down across the central part of North America. With a source-region temperature of −46°C (−50°F) around Great Slave Lake, the air mass has warmed to −34°C (−30°F) by the time it reaches Winnipeg, Manitoba, and it continues to warm as it moves southward. Throughout its southward course, the air mass becomes warmer, but it also brings some of the coldest weather that each of these places will receive all winter. Thus, the air mass is modified, but it also modifies the weather in all regions it passes through. Temperature, of course, is only one of the characteristics modified by a moving air mass. There are also modifications in humidity and stability.

North American Air Masses

The North American continent is a prominent area of air mass interaction. The lack of mountains trending east to west permits polar air to sweep southward and tropical air to flow northward unhindered by terrain, particularly over the eastern two-thirds of the continent. In the western part of the continent, though, air masses moving off the Pacific are impeded by the prominent north– south trending mountain ranges.

Continental polar (cP) – Air masses develop in central and northern Canada, and Arctic (A) air masses originate farther north and so are colder and drier than cP air masses – both are dominant features in winter with their cold, dry, stable nature. Maritime polar (mP) air from the Pacific in winter can bring cloudiness and heavy precipitation to the mountainous west coastal regions. In summer, cool Pacific mP air produces fog and low stratus clouds along the coast. North Atlantic mP air masses are also cool, moist, and unstable, but except for occasional incursions into the mid-Atlantic coastal region, Atlantic mP air does not affect North America because the prevailing circulation of the atmosphere is westerly.

Maritime tropical (mT) air from the Atlantic/Caribbean/ Gulf of Mexico is warm, moist, and unstable. It strongly influences weather and climate east of the Rockies in the United States, southern Canada, and much of Mexico, serving as the principal precipitation source in this broad region. It is more prevalent in summer than in winter, bringing periods of uncomfortable humid heat. Pacific mT air originates over water in areas of anticyclonic subsidence, and so it tends to be cooler, drier, and more stable than Atlantic mT air; it is felt only in the southwestern United States and northwestern Mexico, where it may produce coastal fog and moderate orographic rainfall where forced to ascend mountain slopes. It is also the source of some summer rains in the southwestern interior.

Continental tropical (cT) air is relatively unimportant in North America because its source region is not extensive. In summer, hot, very dry, unstable cT air surges into the southern Great Plains area on occasion, bringing heat waves and dry conditions.

Equatorial (E) air affects North America only in association with hurricanes. It is similar to mT air except that E air provides an even more copious source of rain than does mT air because of high humidity and instability.

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