

# Tropics

In the strict sense, the tropics refer to two latitudes  $23^{\circ}27'$  north and south, defined in relation to a fairly stable cosmic factor, that is the inclination of the polar axis in relation to the ecliptic plane. Their names are derived from the signs of the zodiac (tropic of Cancer for the northern hemisphere, tropic of Capricorn for the southern hemisphere). By extension, the parts of the globe that lie between these two parallels are characterised first of all by their climates. But they have also been envisaged in a wider perspective, and sometimes taken as a subject of geographical study.

Two parallels unlike any other

Every day in its daily trajectory, the sun reaches a maximum height above the horizon (it "reaches its zenith") in the middle of the day, or at midday. Along the two tropics, once a year, at the time of the sun's zenith, its rays fall vertically on the ground. To the north and to the south of the tropics the sun never reaches the vertical zenith, while between them the event occurs twice. It is this cosmic phenomenon that defines the tropics as the parallels of latitude along which the sun reaches its vertical zenith at midday one single time in the course of the annual yearly cycle (or in other words in the course of the rotation of the earth around the sun). This cycle has often been described as "the apparent movement of the sun". The sun reaches the vertical zenith on the Equator on March 21st (the spring equinox), then this occurs progressively further north up to June 21st, when it reaches the vertical zenith on the northerly tropic of Cancer; then the vertical zenith shifts gradually south, reaching the Equator on September 21st (autumn equinox). A symmetrical movement takes place between September and March in the southern hemisphere, with the sun reaching the vertical zenith on the tropic of Capricorn on December 22nd.

In relation to terrestrial landmarks, the place where the sun reaches its vertical zenith "shifts" in a return journey between the Equator and the tropics. It can be said that the shift northwards and southwards "stops" on June 21st and December 22nd respectively. These dates are known as "solstices" derived from the Latin sol (sun) and stare (stand).

A climatic zone

The supply of solar energy to the terrestrial atmosphere depends on the duration of the day, and the height of the sun above the horizon. Between the tropics, the supply of solar energy is never low, and the height of the sun is particularly marked. Thus the thermal budgets (the difference between the heat provided by the sun's rays and loss of heat by terrestrial radiation) are positive in an average year in the tropical zone (and indeed even beyond, since it is only around  $38^{\circ}$  latitude north that the budgets become negative). The differences in thermal budgets are the main driving forces of a series of vertical and horizontal movements in the atmosphere. The amplitude of the vertical movements is related to precipitations.

Thus the inter-tropical regions are characterised by generally warm, wet climates. However at least two types of climate should be distinguished:

• Climates where the seasonal contrasts in terms of temperature are very small, and where all months of the year can be considered to be "wet" (rainfall above potential evapotranspiration), even if the amounts of rainfall may vary quite considerably. These climates are more typical of the regions close to the Equator.

• Climates where there is a contrast between a wet season (generally during the summer of the hemisphere considered) and dry season (generally in the winter in the hemisphere considered). There are likewise marked thermal contrasts, with "thermal paroxysms" at the end of the dry season around the "spring" equinox.

The literature (and cartography) relating to the classification of world climates exhibits certain ambiguities: either the first of these two types is referred to as "equatorial climate" and the second as "tropical" sensu stricto; or both types are referred to as "tropical climates", in which case there is a need to state whether they are "tropical climates with no dry season" or to "tropical climates with alternating wet and dry seasons".

Tropical climate zones border to the north and south on the following:

- Climates that remain warm or hot, but with long dry seasons to the west and in the centre of continental masses
- Climates that retain a long, abundant rainy season, but that have a season of marked winter cooling along the easterly coasts of the

continents.

Generally speaking, it can be said that when moving out of the tropics, towards the west and centres of the continents dry areas will be found at fairly low latitudes, and cold areas will be found when moving out of the tropics towards the eastern fringes of continents and at higher latitudes. Thus zones of tropical climate fall within the tropics on the western coasts and in the centre of continents, and often beyond the tropics on the eastern coasts. This dissymmetry has had considerable impact on the history of human settlement.

For a very large part, the summer rains in the tropical areas, and their marked extension northwards towards intermediate latitudes on the east of continental masses, can be attributed to the part played by the summer monsoons. The scale of these trans-equatorial currents, moving from the hemisphere that is in winter to the hemisphere that is in summer, in certain regions of the world and in particular in south-east Asia, has often led to this type of climate being referred to as a "monsoon climate". It is in fact *sensu stricto* a tropical climate as described above; it is true that it is particularly extensive, but it clearly belongs to a climatic type that is found in large areas of the inter-tropical zone across the globe (Durand-Dastès F 1990).

A particular geographical entity?

"The tropics" (the phrase often used to refer to the regions between the two tropics) have, in more explicit manner than other zones across the globe, been considered as possessing a particularly marked "personality", which has led to the development of a "tropical geography". This phrase in fact has two acceptations, that have been rather well defined by Gilles Sautter (Sautter, G. in Durand-Lasserve et al, 1984).

-The first acceptation is based on the fact that academics in the different disciplines, among whom geographers, "give a strong meaning to the word tropical that puts emphasis on the cascade of chain reactions downstream resulting from an indisputable climatic fact, heat in association with seasonal or permanent rainfall. This viewpoint gives a first acceptation to the expression tropical geography. The cascade of effects extends to all aspects of the natural environment and includes implications within human societies".

-For geographers, the adjective tropical also covers a quite different acceptation. Tropical geography is not in this case a way of casting light on things, or a specific approach, it is merely the practice of geographers overall whose preferences, inclinations, affinities or circumstances have led them to work in Africa, Latin America or Asia. They are acquainted with one another, and share a certain number of existential problems."

Practices arising from these two acceptations have led to a form of autonomy for "tropical geography" that is probably more clear-cut than in other areas of study defined from climatic criteria. There has been an institutionalisation, in particular in France. Thus the CEGCET (tropical geography centre) for a long time occupied an important position among the laboratories devoted to geography in CNRS. But other countries and international institutions also have organisations centred on the geography of the tropics.

The relevance of the practices arising from this institutionalisation has been questioned, as well as the very notion of tropical geography. In particular, a certain number of geographers working on zones that include "tropical" regions have focused on socio-economic issues, such as the "third world" or "underdevelopment", that could offer more relevant analysis grids. Active debate on these themes is reflected in geographical journals in the 1980s and 1990s (see for example the account of a debate in "Espace géographique" n°4, 1984).

This debate bears a more or less direct relationship with discussions on overall apprehension of "the tropics". In France they have centred mainly around the work of Pierre Gourou, and the change in perspective introduced by this author, ranging from his very pessimistic view of the "tropical world" in his book "Pays Tropicaux" published in 1947 to a more moderate presentation in his book entitled, significantly, "Terres de bonne espérance. Le monde tropical" (Lands of good hope, the tropical world) published in 1982. Epistemological issues around the subject of the tropical world still today arouse curiosity and debate (Bruneau 2006; Clayton & Bowd, 2006).

# Bibliographie

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