IN THE KNOW Latitude, Longitude, Night and Day

Simon Collis

Accurate and reliable background information to underpin your geography lessons

Introduction

Learning to tell the time is an early primary skill; understanding how time works through night and day and across different places around the globe is a more complex but equally essential geographical skill. Where do you start with teaching about longitude, latitude and how the position of Earth in space affects time? The information here will give you a solid background for teaching about time and place and tackling the sorts of questions that may be raised in class.

Earth in space

Everything is spinning! The sun is constantly rotating on its axis, taking 25 days to complete one full rotation at its Equator. Earth is also constantly rotating. It rotates on its axis, making one full rotation every 24 hours, and it rotates (orbits) around the sun, making one full rotation around the sun every 364.25 days. The moon rotates on its own axis, making one full rotation every 27 days, and it orbits Earth, making one full rotation around Earth every 27.322 days. Figure 1 shows these rotations.

It is Earth's rotation that gives us night and day, and its orbit around the sun that gives us seasonal change.

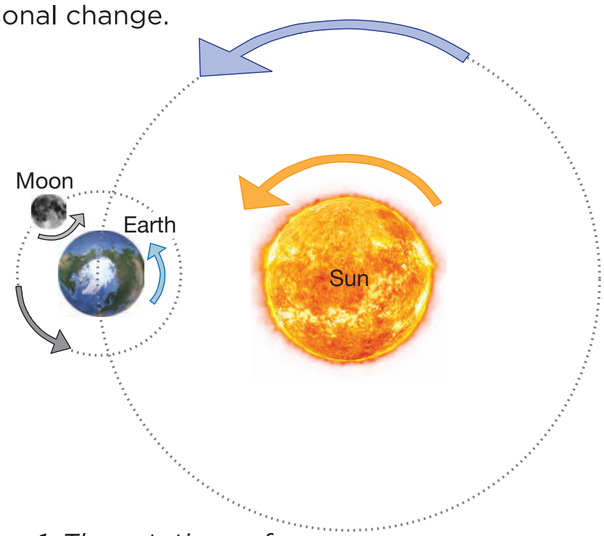

Figure 1: The rotations of Earth, the sun and the moon.

Night and day

As Earth rotates on its axis, there is a constant cycle between night and day. Half of Earth faces the sun and experiences the light and heat from the sun's rays; the other half is in darkness. As we experience daytime, people on the opposite half of Earth are experiencing night.

This also helps to explain sunrise and sunset. Sunrise occurs in the east and sunset in the west because Earth spins to the east. Earth rotates until the sun can be glimpsed over the horizon. As a location rotates towards the sun's rays to the east, the sun appears to rise; as the location continues to rotate round and away from the sun towards night, the last glimpse of the sun is seen to the west where the sun appears to go down. At sunrise and sunset, the sun is lower in the sky. This means sunlight has to pass through a thicker layer of the atmosphere. Small particles, including dust and water vapour, within the atmosphere help to absorb and scatter blue and violet light, allowing red, orange and yellow light to pass more easily, giving us sunrises and sunsets in shades of these colours (Figure 2).

Seasons

As Earth orbits the sun, the tilt of Earth on its axis leans one half of Earth further towards, or further away from, the sun (Figure 3). The top half, above the Equator, is the Northern Hemisphere

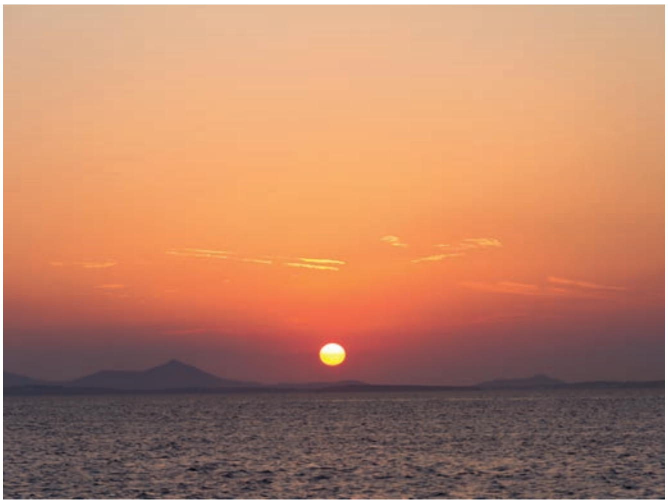

Figure 2: The red, orange and yellow light of sunrise and sunset.
Photos: Sunrise © kcxd (left) and Sunset © Tim Ove (right).

and the bottom half, below the Equator, is the Southern Hemisphere. The hemisphere tilted towards the sun receives greater warmth for longer periods during one day, and the hemisphere tilted away from the sun receives less warmth for shorter periods of time during one day.

There is less obvious seasonal change around the Equator because the Equator is more consistently tilted towards the sun all year round. The boundaries of the equatorial area are marked by the Tropic of Cancer to the north and the Tropic of Capricorn to the south. These lines mark the northernmost and southernmost points where the sun is directly overhead at the June and December solstices. This means that outside these areas, there is a greater variation between the seasons.

The polar regions experience the most differences in daylight and warmth, as the effect of their tilt is much more pronounced. It is the tilt towards the sun that creates near constant daylight, known as the Midnight Sun, during the peak of summer, and near constant darkness during the winter when almost no daylight reaches the pole. The boundaries of the polar regions are marked by the Arctic and Antarctic Circles.

Latitude and longitude

Now that satellite navigation is easily accessible, often in the palm of your hand, navigating our way around the globe is simple. Underpinning satellite navigation is the system of latitude and longitude, developed and refined over centuries by scientists, mathematicians and astronomers. Latitude and longitude enable us to pinpoint every place on Earth in relation to the Equator

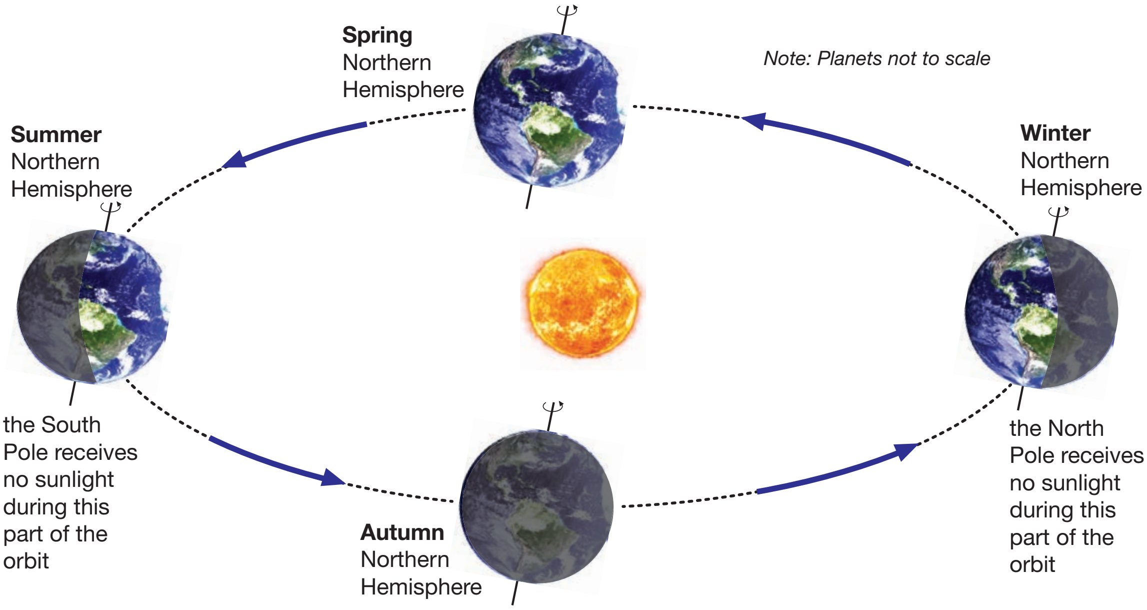

Figure 3: The tilt of Earth on its axis leans one half of Earth further towards, or further away from, the sun.

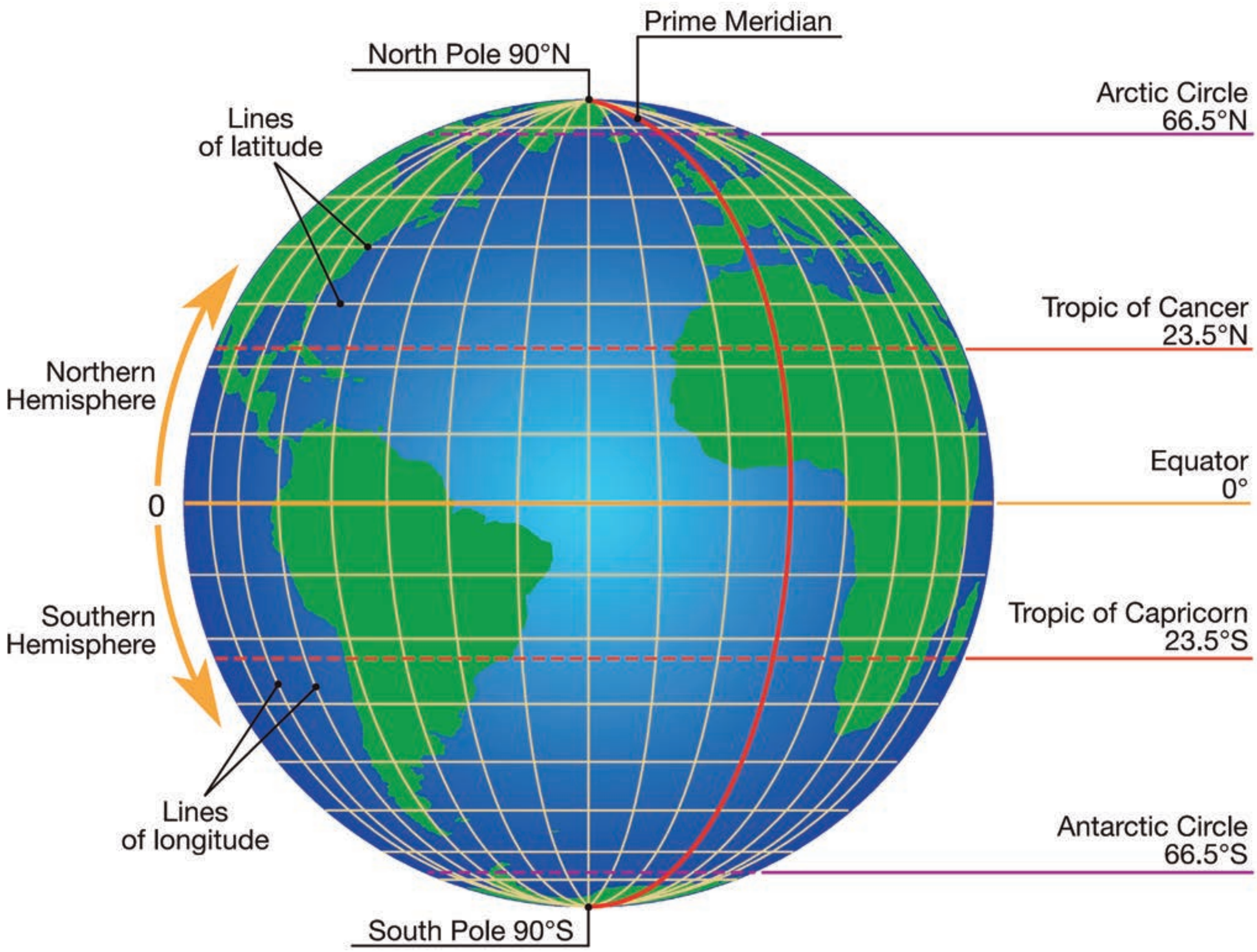

Figure 4: Latitude and longitude enable us to pinpoint every place on Earth in relation to the Equator and the Greenwich Meridian.

and the Greenwich Meridian (Figure 4), and using latitude and longitude gives us a common language to describe the location of places and find our way without reference to vague or subjective landmarks.

Latitude

Latitude describes locations in terms of how far north or south they are from the Equator, which divides Earth into the Northern and Southern Hemispheres. Lines of latitude are a series of imaginary horizontal lines circling Earth, all running parallel to the Equator. They are longest at the Equator, decreasing in length as they get nearer to the Poles. Latitude is measured in degrees, from 90°N (the North Pole) to 90°S (the South Pole). There are five major lines of latitude: the Equator at 0°, the Tropics of Cancer (23.5°N) and Capricorn (23.5°S) and the Arctic (66.56°N) and Antarctic (66.56°S) Circles.

FACT The distance measured by 1° of latitude is approximately 113km.

Longitude

Lines of longitude are a series of imaginary vertical lines, all equal in length, that run from the North to the South Pole. They divide Earth into segments, much like an orange. Longitude gives our position east or west of the Prime Meridian. Longitude is measured in degrees, from 180°E to 180°W. On the opposite side of Earth to the Prime Meridian is the International Date Line, which divides one calendar day from the next. It roughly follows 180° longitude through the Pacific Ocean (deviating around several island groups).

Earth is divided into 24 standard meridians, at intervals of roughly 15° longitude, starting with the Prime Meridian. These meridians are the centre of 24 standard time zones (although some of these follow political boundaries). Time zones are determined by the rotation of Earth around the sun and are designed to ensure the maximum amount of daylight for the inhabitants of the zone. By standardising methods of time-keeping they also facilitate travel between zones.

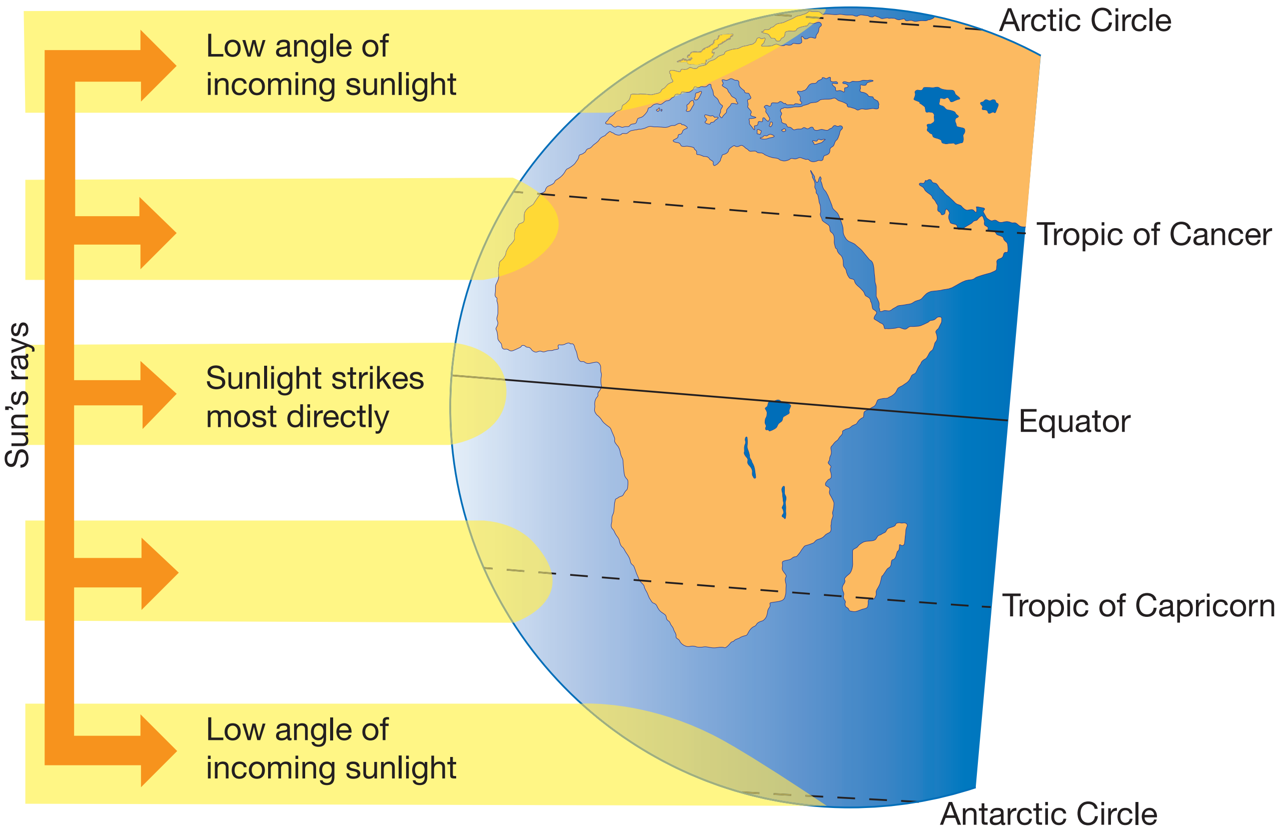

Figure 5: The hottest climates are near the Equator, where the sun's rays are most concentrated, and cooler towards the Poles, where the sun's rays are less concentrated as they are spread over a larger area.

Latitude and climate

Climate is an average of weather conditions in a place over a 30-year period. Climate is affected by latitude, distance from the Equator, altitude and terrain. Climates are hottest near the Equator, where the sun's rays are most concentrated, and coolest towards the poles, where the sun's rays are less concentrated as they are spread over a larger area (Figure 5). Areas of the world with similar climates can be mapped as climate zones (Figure 6).

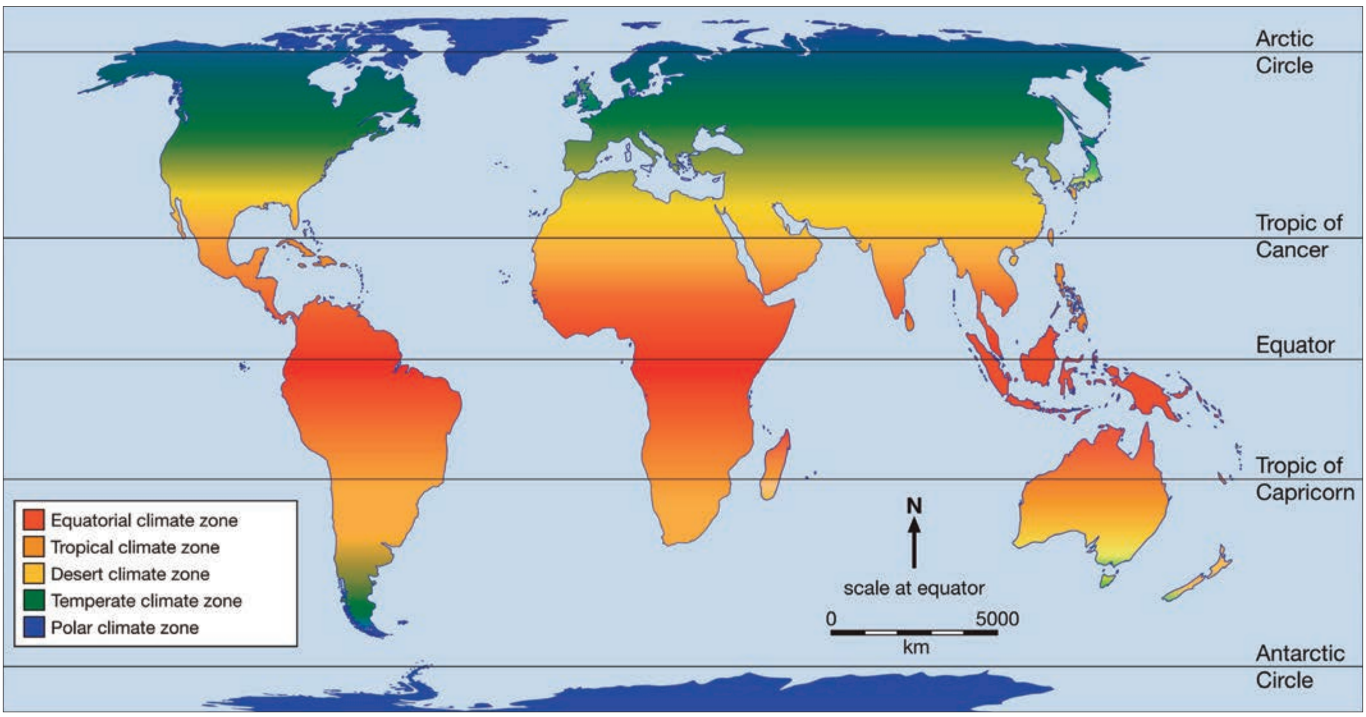

Figure 6: Areas of the world with similar climates can be mapped as climate zones.

Glossary

Arctic Circle – a line around Earth at latitude 66.56°N. Within the Arctic Circle, the sun is above the horizon for 24 hours during the summer solstice in June (a day lasting 24 consecutive hours) and below the horizon during the winter solstice in December (a night lasting 24 consecutive hours).

Antarctic Circle – a line around Earth at latitude 66.56°S. Within the Antarctic Circle, the sun is above the horizon for 24 hours during the summer solstice in December (a day lasting 24 consecutive hours) and below the horizon during the winter solstice in June (a night lasting 24 consecutive hours).

Climate – an average of weather conditions in a place over a 30-year period. This could include an average of precipitation, temperature, humidity etc. Climate is affected by latitude, distance from the Equator, altitude and terrain.

Equator – a line that divides Earth into the Northern and Southern Hemispheres and is equidistant from the North and South Poles.

Hemisphere – half of Earth, usually divided into the Northern or Southern Hemisphere by the Equator, or Eastern and Western hemispheres by a line that runs through the poles.

Latitude – the distance of a place north or south of the Equator, ranging from 90°N to 90°S. This is measured in degrees and minutes, e.g. 53°23'N, or in decimal degrees, e.g. 53.4°N. Lines of latitude, or parallels, run as circles east-west in parallel to the Equator.

Longitude – the distance of a place east or west of the Prime Meridian, ranging from 180°E to 180°W. This is measured in degrees and minutes, e.g. 1°28'W, or in decimal degrees, e.g. 1.5°W. Lines of longitude and latitude can be combined to indicate an exact location.

Meridian – a line of constant longitude that passes through a given place on the surface of Earth and the poles.

Prime Meridian – the meridian at which longitude is 0°, from which we measure other longitudes in an easterly or westerly direction. The Prime Meridian used by GPS is 102m from the Royal Observatory in Greenwich.

Tropic of Cancer – a line around Earth at 23°26' north of the Equator. This marks the northern boundary of the tropics; at the June solstice, this is the northernmost point that the sun is directly overhead.

Tropic of Capricorn – a line around Earth at 23°26' south of the Equator. This marks the southern boundary of the tropics; at the December solstice, this is the southernmost point that the sun is directly overhead.

Further ideas, links and resources to support your teaching of longitude and latitude can be found at: **www.geography.org.uk/investigating-longitude-latitude-and-daylight-at-key-stage-1-2**

Geographical Association

ISBN 978-1-84377-438-9.
Published by The Geographical Association, 160 Solly Street, Sheffield S1 4BF.
Company number 07139068.
Website: www.geography.org.uk.
The Geographical Association is a registered charity: no 1135148.