OXFORD *Secondary* ATLAS *for South Africa*

for Grades 7–12

NEW EDITION

CAPS

OXFORD *Secondary* ATLAS *for South Africa*

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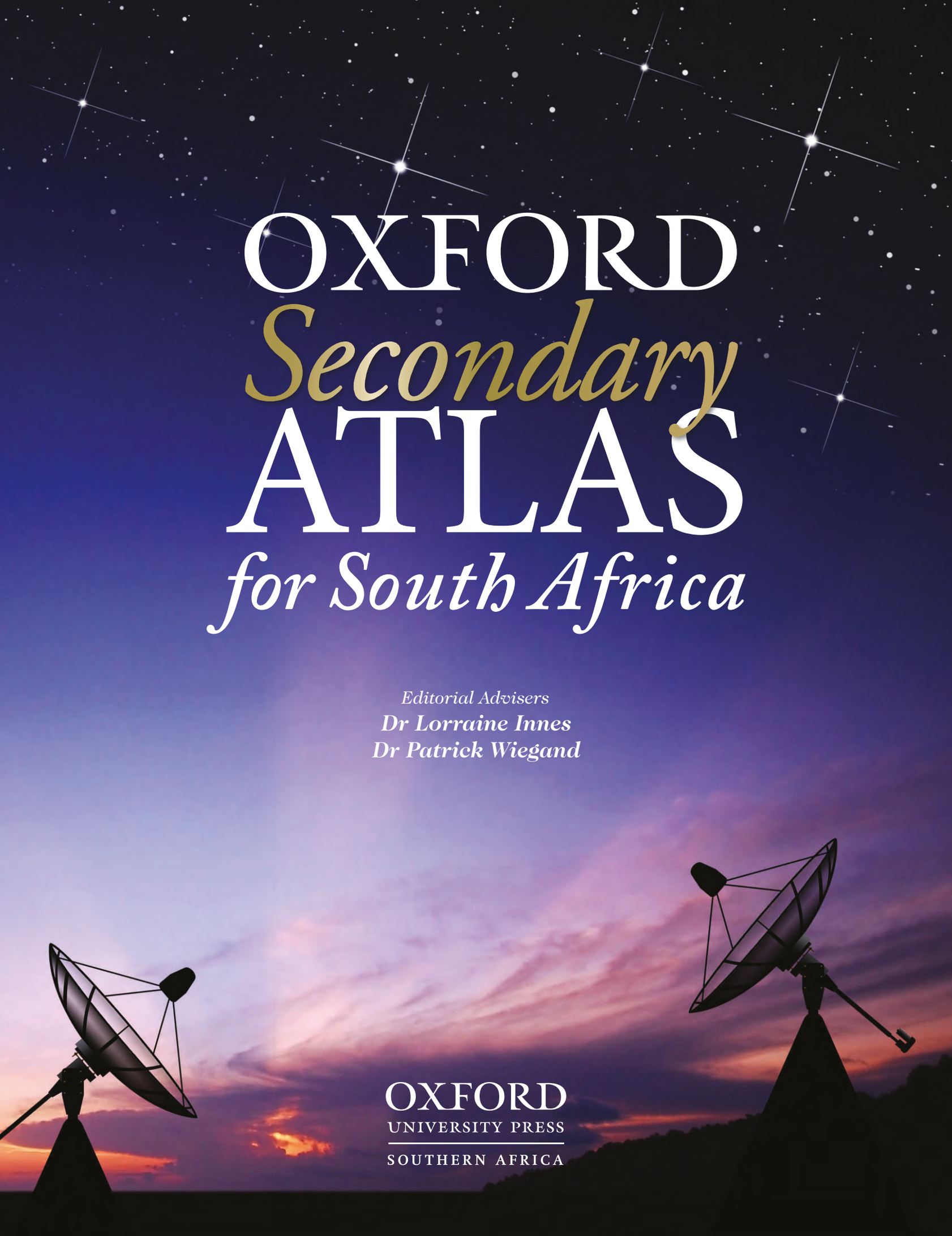

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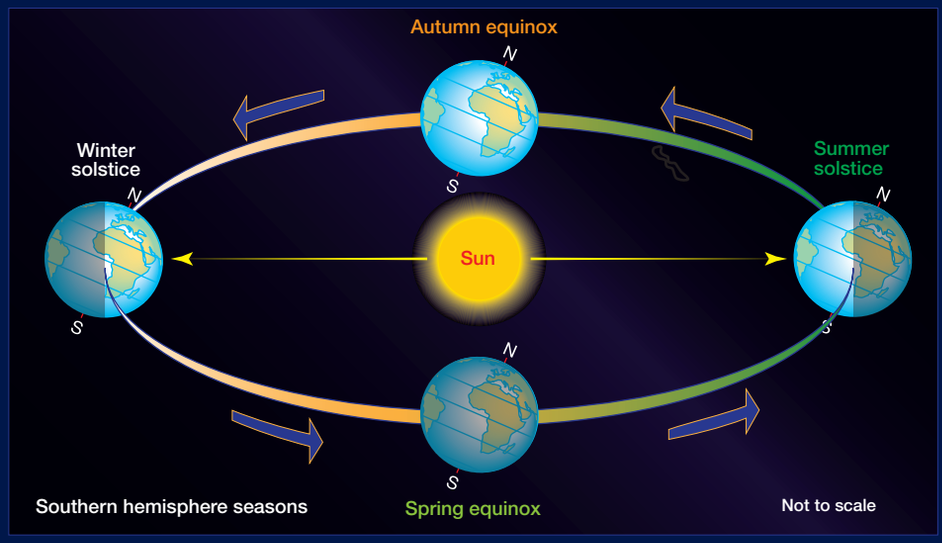
4 Latitude: global atmospheric circulation

Revolution and inclination of the axis cause the seasons

The hemisphere receiving the most direct sunlight for the greater number of hours experiences summer, while the hemisphere receiving the least direct sunlight for shorter hours experiences winter.

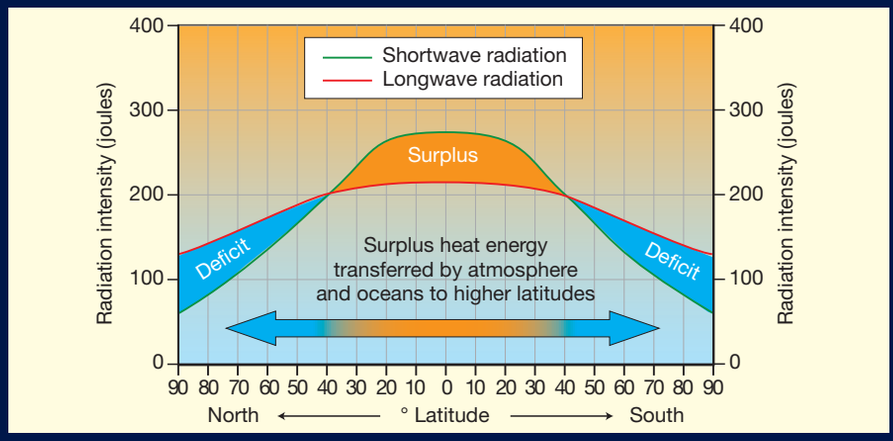
- **Solstices:** In the southern hemisphere, the summer solstice occurs on 21 December each year when the Sun's direct rays fall on the Tropic of Capricorn at 23,5°S. The winter solstice in the southern hemisphere occurs on 21 June when the Sun's direct rays fall on the Tropic of Cancer at 23,5°N.
- **Equinoxes:** Equinoxes happen when the Sun's rays shine directly over the Equator and the circle of illumination corresponds with the day/night line. Everywhere on Earth experiences equal length of day and night. This is known as an equinox.



Revolution and the seasons

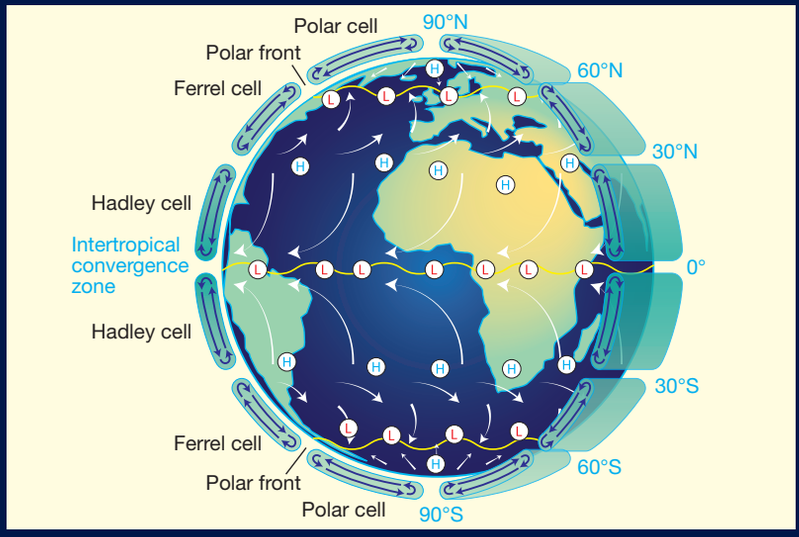
Angle of insolation

The Earth's axis is inclined at an angle of 23,5° from vertical. If Earth's axis was perpendicular to its orbit, the Sun's direct rays would only ever shine on the Equator. Due to the inclination of the axis, the perpendicular rays of the Sun fall between 23,5°N and 23,5°S as Earth revolves around the Sun. The differences in the number of hours of insolation (incoming solar radiation) and the angles at which the Sun's rays strike the Earth are important causes of global climate differences.



The energy balance graph shows latitudes receiving and losing energy.

Global circulation of the atmosphere



Tri-cellular global atmospheric circulation model (during the equinoxes). The Intertropical Convergence Zone (ITCZ) moves to correspond with the position of maximum insolation, causing the positions of the circulation cells to move with the seasons.

The Sun's direct rays shine only between the tropics. This excess of insolation energy is circulated in the seas and atmosphere to the temperate and polar zones to establish an energy balance.

The tri-cellular global atmospheric circulation model illustrates vertical and horizontal air movements in three tubular shaped cells in each hemisphere.

- **Ferrel cells** transfer temperate air towards the polar regions.
- **Hadley cells** transfer tropical energy towards the temperate zones.
- **Polar cells** are driven by the high pressure resulting from extreme cold over the Poles. This drives surface air towards the temperate regions. Uplift and upper air mixing occur along the polar front.

Longitude and time

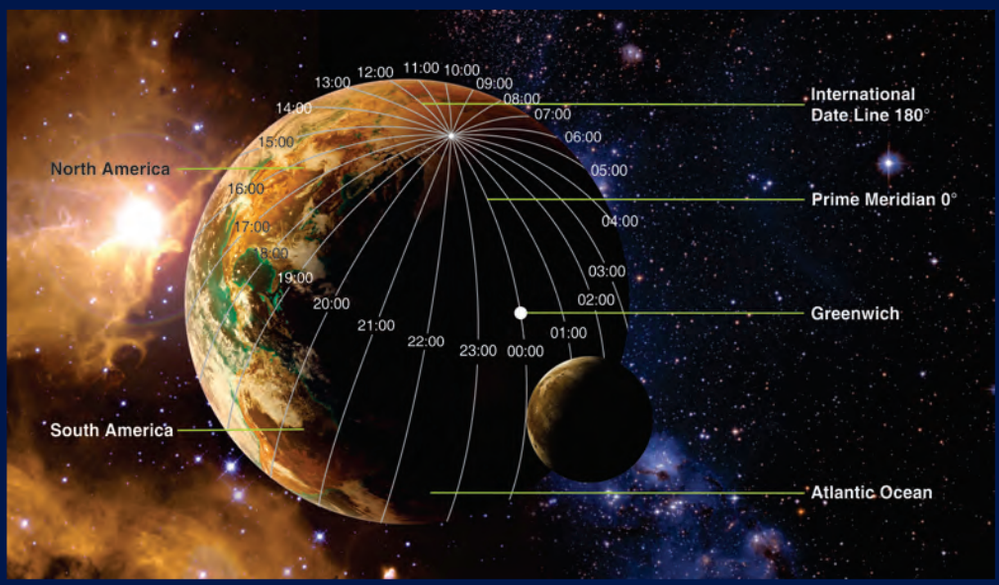
Earth completes a rotation through 360° once every 24 hours. This means that it rotates through 15° every hour. This in turn has resulted in the division of the globe into 24 standard time zones centred on lines of longitude at 15° intervals.

True north

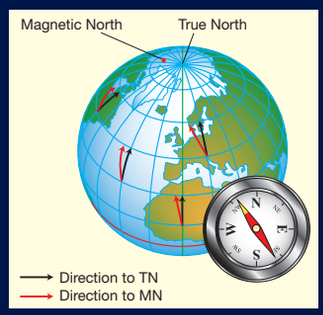
Every line of longitude is a true north line because it is drawn from the North Pole to the South Pole. Any line drawn parallel to a line of longitude or perpendicular (at a right angle) to a line of latitude is also a true north line.

Magnetic north

The needle of a magnetic compass is attracted to the magnetic north pole created by Earth's magnetic field which moves slightly all the time. The angle between a line pointing to true north (TN) and a line pointing to magnetic north (MN) is the angle of magnetic declination. This angle is shown on maps so that people can orientate maps correctly. Nowadays, many people use GPS to navigate; few still rely on a magnetic compass to find their way.



Rotation and time



True north and magnetic north

Describe direction

Direction describes the relative position from one place to another. Direction is given using words such as north or south, west or east or in combinations of these words.

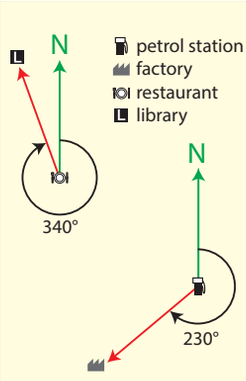
Greenwich Mean Time (GMT)

At the International Meridian Conference in 1884, it was agreed that the line of longitude through the Royal Observatory at Greenwich in London would be the starting line for counting degrees of longitude. This line divides the western hemisphere from the eastern hemisphere. Another name for a line of longitude is a meridian.

Earth orbits the Sun on an elliptical not spherical orbit. This causes the length of each day to vary by a few seconds. The average or mean time for each day of the solar year is calculated and used as Greenwich Mean Time. Earth rotates from west to east. Any place to the west of Greenwich will be behind GMT. Any place to the east of Greenwich will be ahead of GMT.

Central African Time (CAT)

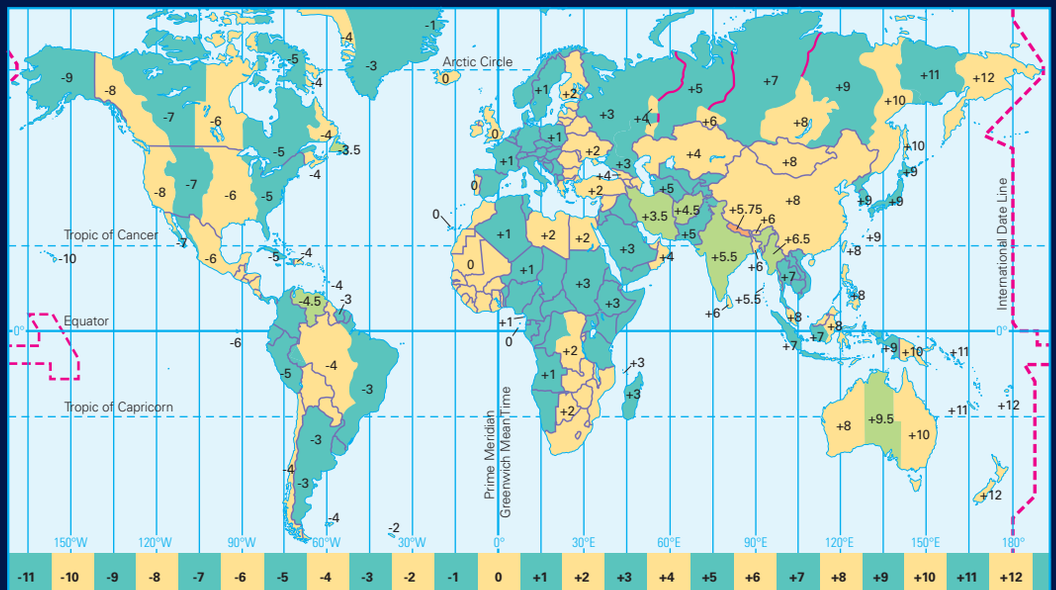
The Central African Time Zone is one of the 24 standard time zones around the globe. The central meridian in the CAT zone is 30°E which is two hours ahead of the Greenwich Meridian. In our country we also use the 30°E meridian. Here it is known as South African Standard Time (SAST).



Measure bearing

Bearing measures the relative position from one place to another. It is given as the angle, between a true north line and a line joining the two places. The angle is measured from the true north line in a clockwise direction. It can be anywhere between 0° and 360°.

Measuring bearing clockwise from north



World time zones