Level of cloud development

Useful concepts (Section 2.2.1)

Height, altitude, vertical extent (Section 2.2.1.1)

- Height: Vertical distance from the point of observation on the Earth's surface to the point being measured.
- Altitude: Vertical distance from mean sea level to the point being measured.
- Height/Altitude of cloud base: For surface observations, height of the cloud base above ground level; for aircraft observations, altitude of the cloud base above mean sea level.
- Vertical extent: Vertical distance from a cloud's base to its top.

Levels (Section 2.2.1.2)

Clouds are generally encountered over a range of altitudes varying from sea level to the top of the troposphere (the tropopause). The troposphere can be vertically divided into three levels, formerly known as "étages": high, middle and low. Each level is defined by the range of heights at which clouds of certain genera occur most frequently. The levels overlap and their limits vary with latitude

Approximate heights of each level, and the genera occurring in each.

Level	*Genera*	*Polar region*	*Temperate region*	*Tropical region*
High	Cirrus Cirrocumulus Cirrostratus	3 – 8 km (10 000 – 25 000 ft)	5 – 13 km (16 500 – 45 000 ft)	6 –18 km (20 000 – 60 000 ft)
Middle	Altocumulus Altostratus Nimbostratus	2 – 4km (6 500 – 13 000 ft)	2 – 7 km (6 500 – 23 000 ft)	2 – 8 km (6 500 – 25 000 ft)
Low	Stratus Stratocumulus Cumulus Cumulonimbus	From the Earth's surface to 2 km (0 – 6 500ft)	From the Earth's surface to 2 km (0 – 6 500ft)	From the Earth's surface to 2 km (0 – 6 500ft)

Most clouds are generally encountered over a range of altitudes varying from: -

- Sea-level to the level of the tropopause.
- The altitude of the tropopause varies in time and space.
- The tops of cloud are therefore higher in the tropics than at middle and high latitudes.

The levels in which six of the genera are found are as follows:

a) Cirrus, Cirrocumulus and Cirrostratus for the high levels (high-level clouds)
b) Altocumulus for the middle level (middle-level clouds)
c) Stratocumulus and Stratus for the low levels (low-level clouds)

With regard to the other four genera, the following remarks may be made:

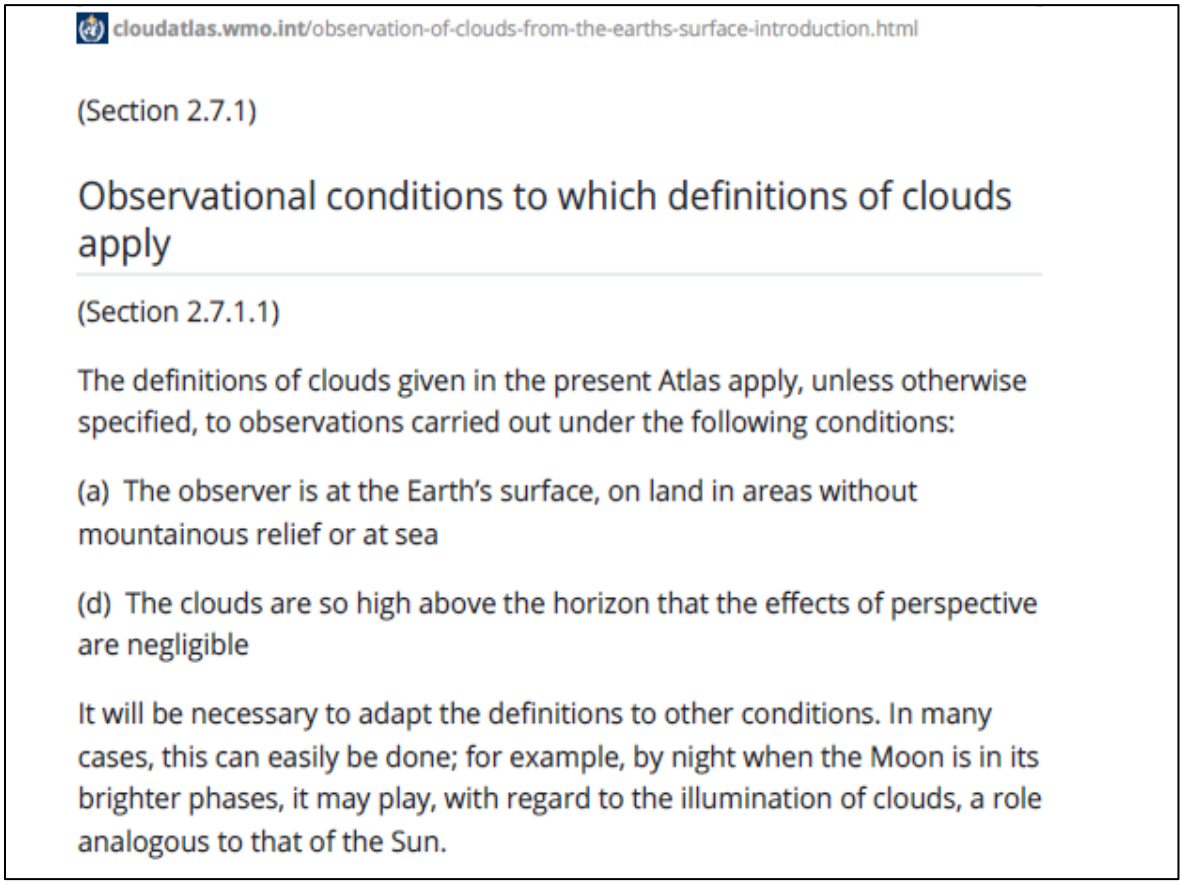
a) Altostratus is usually found in the middle levels, but it often extends to higher levels.
b) Nimbostratus is almost invariably found in the middle stage, but it usually extends both downwards into the low level and upwards into the upper level.
c) Cumulus and Cumulonimbus usually have their bases in the low level, but their vertical extent is often so great that their tops may reach into the middle and high levels.

When the height of a particular cloud is known, the concept of levels may be of some help to the observer in identifying it. Its genus can be determined, by making a choice from among the genera normally encountered in the level corresponding to its height.

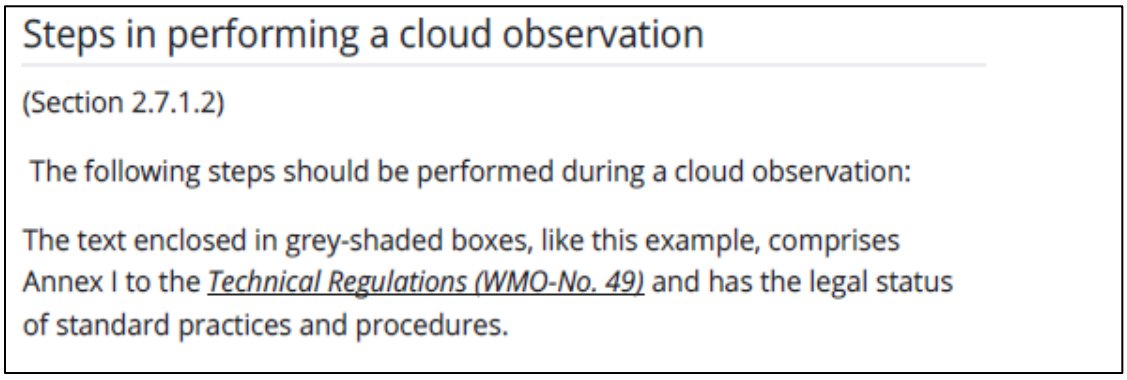
The observer can also obtain a rough idea of the height of low clouds by comparing their apparent speed of movement with the surface wind. A great apparent speed with light or moderate surface winds suggests a lower cloud base than small apparent speeds with strong surface winds.

At weather offices where upper air observations are made, a fairly accurate estimation of the height of clouds is possible when the ascent data is studied.

Observational conditions to which definitions of clouds apply



Steps in performing a cloud observation



Steps in performing a cloud observation

cloudatlas.wmo.int/identifying-clouds.html

(Section 2.7.2)
When identifying clouds, observers must:

Wear sunglasses

1. Ideally, by day, wear polarized (prescription) sunglasses, preferably those with opaque side wings to shut out light from the sides, especially when viewing high cloud. If the polarized lenses make an insignificant difference to how you see the sky, it is likely the lenses are not properly oriented.

Polarized lenses minimize the dazzling effect of bright sunshine and protect your eyes from ultraviolet radiation. They also reveal the presence of cirriform cloud when very thin, such as Cirrostratus nebulosus, by creating greater contrast between cirriform clouds and the blue sky, and when the clouds are veiled by haze.

Conduct night observation

2. At night, perform the observation from as dark a place as possible, well away from lights. Let your eyes adjust to the darkness – this will take at least 5 minutes. Night vision works best when using peripheral vision; moving your head from side to side will reveal more detail than a fixed gaze.

Maintain a continuous watch

In particular, observe the sky during sunrise and sunset. The systematic changes in colour of clouds in these transition periods may confirm or bring to your attention the presence of multiple cloud layers.

Observe the whole sky

4. Observe the sky in its entirety, including the complete horizon:

Watch out for varying appearances

5. Be aware that clouds of the same genera, species and varieties may appear differently in different meteorological situations. For example, cumuliform clouds during an outbreak of cold polar air may look different to cumuliform clouds during an incursion of unstable tropical air. During the cold outbreak, the clouds appear sharper in outline, broader and with little vertical extent; they are less sharp, more turreted and of great vertical extent in tropical air.

Other factors such as vertical wind shear can affect the appearance of clouds. A few examples are:

- Cumulonimbus capillatus incus tops are often asymmetrical (spread downstream), but are occasionally symmetrical (spread out in all directions) when there is minimal wind shear at the cloud top.
- Cirrus uncinus usually has a trail (falling ice crystals) falling below and behind the top of the tuft (head) as the wind speed usually increases (positive shear) with height from the trail to the tuft (head). When there is no difference in wind speed (nil shear) with height through this layer, the trail appears to fall directly beneath the tuft (head). When the wind speed decreases (negative shear) with height through this layer, the trail falls below and ahead of the tuft (head). The positive and negative sheared Cirrus uncinus are mirror images of each other, although even an experienced observer may see them as being completely different.

Observation of clouds from mountain stations

(Section 2.7.7)
When a mountain station is at a level lower than the base of the clouds, the procedure for observing clouds is the same as at low-level stations. Mountainous country often provides clear vertical reference points, so information about cloud height or altitude can often be quite accurate. When clouds are observed below the station level, they should be indicated separately. A description should be given of the upper surface of these clouds, including features such as a flat or undulated surface, or the presence of towering cumuliform clouds above the top of the layer. When estimating the cloud amount, locations where mountains protrude through a patch, sheet or layer should also be considered as covered with clouds.

The text enclosed in grey-shaded boxes, like this example, comprises Annex I to the *Technical Regulations (WMO-No. 49)* and has the legal status of standard practices and procedures.