Cloud types for observers

Reading the sky

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Introduction

Clouds are continually changing and appear in an infinite variety of forms. It is possible, however, to define a limited number of characteristic forms observed all over the world into which clouds can be broadly grouped. The World Meteorological Organization (WMO) has drawn up a classification of these characteristic forms to enable an observer to report the types of cloud present. This publication illustrates and explains the classifications.

Classification is based on 10 main groups of clouds. These are divided into three levels — low, medium and high — according to that part of the atmosphere in which they are usually found. A code figure designated C_L, C_M or C_H is used to describe the clouds of each level. The divisions are shown in the table below. When there is more than one type of cloud of any level present, an order of priority has been arranged by WMO to determine which code figure should be used.

In this publication a separate section is devoted to the clouds of each level. At the beginning of each section a pictorial guide shows the priority of coding.

The descriptions and photographs which follow are given in the same order as the code figures in the pictorial guide. To find the correct code figure from the pictorial guides, start at whichever circle is applicable at the top of the page and follow the solid line from description to description as long as all the criteria are applicable. If a description is reached which is not applicable, return to the previous description and take the pecked line to a picture square. The correct code figure will be found in the top right-hand corner of the picture square.

Distinguishing features connected with the 10 main groups of clouds are listed at the end of this publication. Observers may find this a useful guide when considering which clouds may be present, or when eliminating improbable clouds, especially during darkness. In some meteorological messages, clouds are identified according to the 10 main groups. A code figure, designated C, is used. All references to C code figures in this publication are printed in red.

In the United Kingdom the height of the cloud base is reported in feet.

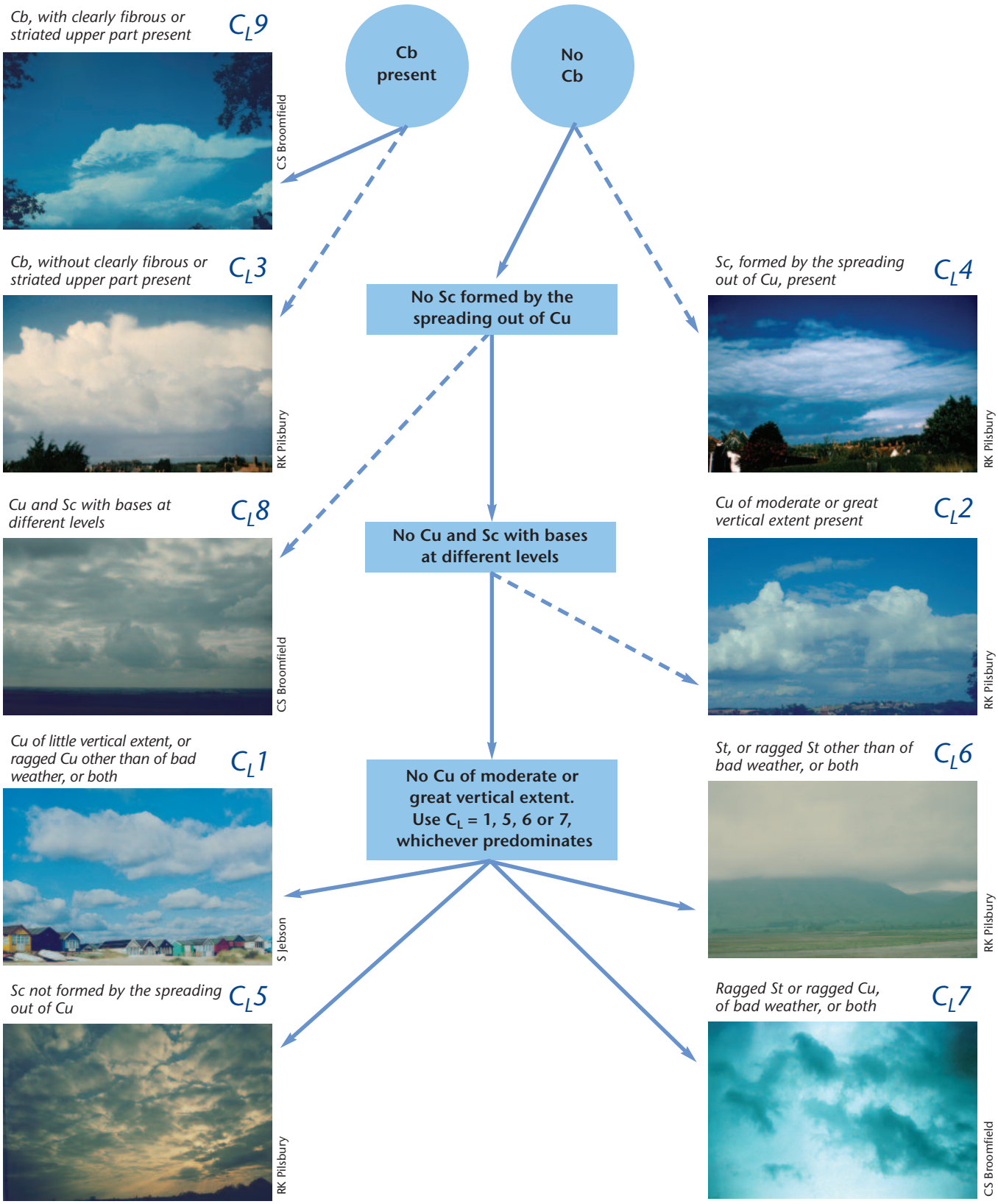
Cloud classification

Level	Designation	Type	Abbreviation	C code
High clouds (base usually 20,000 ft or above, over British Isles)	C_H	Cirrus	Ci	0
		Cirrocumulus	Cc	1
		Cirrostratus	Cs	2
Medium clouds (base usually between 6,500 and 20,000 ft over British Isles, although Ns may lower to near the Earth's surface)	C_M	Altocumulus	Ac	3
		Altostratus	As	4
		Nimbostratus	Ns	5
Low clouds (base usually below 6,500 ft over British Isles)	C_L	Stratocumulus	Sc	6
		Stratus	St	7
		Cumulus	Cu	8
		Cumulonimbus	Cb	9

Pictorial guide C_L: Sc-St-Cu-Cb

To find the correct code figure below, start at whichever circle is applicable and then follow the solid line from description to description, so long as all criteria are met.

If a description is reached which is not applicable, return to the previous description and follow the pecked line.



C_L9 Cumulonimbus with anvil

(Cloud Group C9)

The characteristic shape of these clouds can only be seen as a whole when viewed from a distance (top photograph). The tops of these massive clouds show a fibrous or striated structure that frequently resembles an anvil (facing page, top left), plume, or huge mass of hair (facing page, bottom left). They may occur as an isolated cloud or an extensive wall (facing page, 3rd row right). Squalls, hail and/or thunder often accompany them.

Underneath the base, which is often very dark, pannus clouds C_L7 frequently form and, in storms, these may be only a few hundred feet above the Earth's surface. The pannus clouds may merge to form a continuous layer. There may be ragged cumulus (bottom photograph) or a dense horizontal roll at the shower's edge. Mamma may form, especially on the underside of the projecting anvil (facing page, 2nd row left), and may appear particularly prominent when the sun is low in the sky. Virga may often be seen. Dense cirrus, altocumulus, altostratus, stratocumulus, cumulus and stratus may also be present.

If the cumulonimbus passes nearly, or directly, overhead the characteristic top can be lost to view. An observer, seeing only the underside, may therefore confuse it with nimbostratus if a watch has not been kept on the sky, but by convention, the cloud is reported as cumulonimbus if accompanied by lightning, thunder, hail or other precipitation of a showery nature.

C_L=9 is used when it is impossible to differentiate between C_L3 and C_L9.

Cumulonimbus most frequently develop from large cumulus C_L2; sometimes they develop from altocumulus castellanus C_M8, then the base is unusually high; they may be embedded in altostratus or nimbostratus; and/or they may disintegrate into dense cirrus C_H3.

PH Jeffries

Strait of Gibraltar
Base of stratocumulus in foreground about 1,800 ft

RD Whyman

Bracknell

RD Whyman

Bracknell
Cloud base 1,000–1,200 ft

C_L3 Cumulonimbus without anvil (Cloud Group C9)

K Woodley

Newton Breda

CS Broomfield

RK Pilsbury

Totland IOW Cloud base 1,800 ft

PJB Nye

Dishforth

Crown copyright

Bracknell
Cloud base about 3,000 ft

The clouds of C_L3 are generally at an intermediate stage representing a further development of C_L2 but not yet reaching the stage of C_L9.

The clear-cut outlines and cauliflower tops of C_L2 have at least partially disappeared, but no part of the cloud top has acquired a fibrous appearance or any anvil development. The protuberances tend to form a whitish mass without striations.

Showers or thunderstorms may occur. Cumulus, stratocumulus or stratus may also be present.

New cloud domes may be produced which make the cumulonimbus assume, temporarily, the appearance of towering cumulus C_L2, but it should still be called cumulonimbus and reported as C_L3. The occurrence of lightning, thunder or hail sometimes provides the only indication of the presence of a cumulonimbus. If, in this case, it is not possible to decide whether the cloud is C_L3 or C_L9, the coding is, by convention, $C_L=9$.

C_L4 Stratocumulus from spreading out of cumulus

(Cloud Group C6)

This type of stratocumulus most often forms when the upper part of cumulus clouds, that had been gaining height and are no longer able to do so, begin to spread out horizontally. The cumulus generally widen towards the level at which they spread out. Sometimes the cumulus growth is resumed, at least in some places, above the stratocumulus. Ragged mamma often appear on the underside of the stratocumulus (see inset to middle photograph). The individual mamma elements are short-lived and do not appear as prominent as those shown in the second row photograph on page 36.

Another form of C_L4 often occurs in the evening when the sun's heat decreases and, in consequence, cumulus clouds flatten and assume the appearance of patches of stratocumulus. This is depicted in the bottom group of photographs which were taken over a period of about 20 minutes. Cirrus and cirrostratus also appear in these photographs.

RK Pilsbury

SG Cornford

jfp Galvin

RAF Cranwell

RK Pilsbury

Cirrostratus and cirrus can also be seen

C_L8 Cumulus and stratocumulus at different heights (Cloud Groups C6 and C8)

CS Broomfield (Crown copyright)

Cumulus base 2,000 ft. Stratocumulus base 3,000 ft

RK Pilsbury

Totland IOW
Stratocumulus and cumulus

CS Broomfield (Crown copyright)

Cumulus base 2,500 ft. Stratocumulus base 6,500 ft

The code figure C_L=8 is used for cumulus and stratocumulus, other than the stratocumulus formed from the spreading out of cumulus C_L=4, that have their bases at different heights.

Usually the cumulus forms beneath patches or a sheet of stratocumulus and may even thrust its way into or through the stratocumulus (bottom photograph). Unlike some C_L4 the cumulus of C_L8 does not widen upwards towards the stratocumulus layer. A thinned or even cleared area may surround the cumulus column.

Less frequently the cumulus appears above the stratocumulus.

The captions to the top and bottom photographs show the estimated height of the cloud base at the time each picture was taken.

C_L2 Cumulus of moderate or strong vertical development (Cloud Group C8)

These clouds are a development of C_L1. Their outline is usually clear cut, with horizontal bases and cauliflower-shaped tops (top photograph), although in fresh winds some raggedness may occur. Sunlit parts are mostly brilliant white while bases are relatively dark. The clouds are sometimes arranged in lines, called cloud streets, nearly parallel to the wind direction (small pictures, top right). They may also form with tall towers (small pictures, top left) that may be tilted by the wind.

When well developed these clouds may sometimes give showers and in the tropics there may be abundant rainfall.

Small cumulus C_L1 and stratocumulus C_L5 may also be present, all having their bases at the same level. Well-developed cumulus clouds may be accompanied by dense cirrus, C_H2 or C_H3, and altocumulus, formed from the spreading out of cumulus C_M6.

Over land, cumulus clouds usually disperse in the late afternoon or early evening. Over the oceans, maximum cumulus activity seems to occur in the late hours of the night.

As there is little change in the temperature of the sea beneath them, the height of the base of cumulus in the ocean trade wind belts is remarkably uniform at around 2,000 ft.

RK Pilsbury

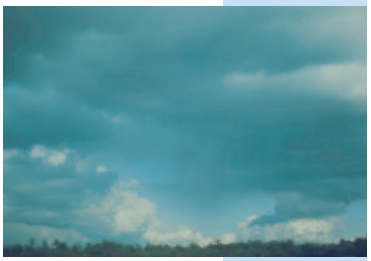
Christchurch Bay
Cumulus base 3,000 ft

RK Pilsbury

Cumulus mediocris

RK Pilsbury

Christchurch Bay
Cumulus base 2,500 ft



Crown copyright

Bracknell
Cumulus base 3,000 ft with virga

RD Whyman

Cumulus congestus

Geo Anderson

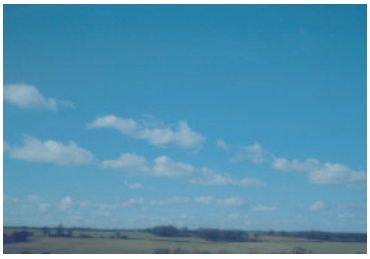
Large cumulus

C_L1 Small cumulus

(Cloud Group C8)

CS Broomfield

Base 1,200 ft



CS Broomfield

Odiham, Hants. Base 2,000 ft

CS Broomfield

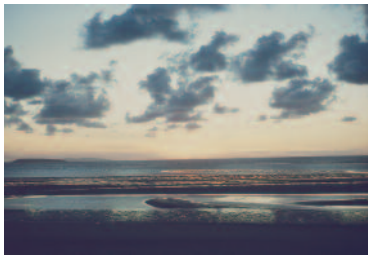
Fareham, Hants
Base 3,000 ft

RK Pilsbury

Base 2,000 ft

C S Broomfield

West Meon, Hants



WG Pendleton

Penmaen
Cumulus fractus

Cumulus formation is often preceded by hazy spots out of which the clouds evolve (top left). The clouds in their early stages of formation are depicted in the photograph at top right. When completely formed, the clouds have clear-cut horizontal bases and rounded tops (centre photographs). In this stage they are called 'fair weather' cumulus. In the photograph at bottom left the clouds have been frayed by a fairly strong, turbulent wind.

Over land, on clear mornings, cumulus may form as the sun rapidly heats the ground, or may result from the transformation of stratus C_L6. Near coasts, cumulus may form over the land by day in a sea-breeze and over the sea during the night in a land-breeze.

Cumulus in the last stages of dissipation (bottom right) is also coded as C_L=1.

If at least one of the cumulus clouds present in the sky shows moderate or strong vertical development, the code C_L=2 is used.

C_L5 Stratocumulus not from the spreading of cumulus (Cloud Group C6)

Stratocumulus occurs in patches or layers, composed of rounded masses or rolls, at one or more levels. The clouds are grey or whitish and almost always have dark parts. Most of the regularly arranged small elements, when more than 30° above the horizon, have an apparent width of more than three fingers at arm's length.

When in the form of dark rolls (top photograph) the edges often merge together to form a continuous layer.

Sometimes the elements lie in parallel bands (middle photograph). Due to perspective these may appear to converge towards the horizon.

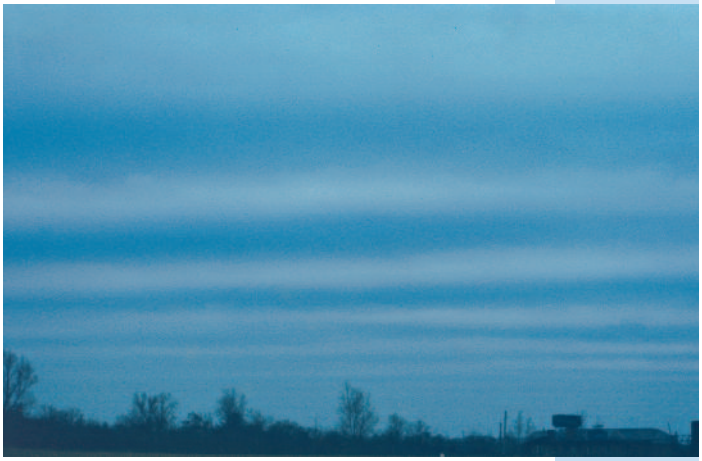
Sometimes the cloud is not very dense and gaps may appear between the elements (bottom photograph).

In the tropics especially, stratocumulus may occur as a large, single roll cloud. It may also occur in the shape of lenses or almonds, although this is fairly rare. One particular species, called stratocumulus castellanus, has cumulus-like turrets rising from a common horizontal base (bottom, inset). The turrets may develop into large cumulus, when the coding becomes C_L=2 C=8, or even cumulonimbus.

Stratus C_L6 C=7 may lift to become stratocumulus C_L5 C=6. Stratocumulus often forms beneath nimbostratus C_M2 C=5.

JFP Galvin

Oslofjord
Stratocumulus stratiformis



Crown copyright

Aldergrove
Stratocumulus stratiformis

RM Blackall

JFP Galvin

C_L7 Stratus fractus and cumulus fractus of bad weather (Cloud Group C7)

CS Broomfield

Pannus (dark) 600 ft beneath nimbostratus (light grey) 2,000 ft

Crown copyright

Kingswood
Stratus fractus

CS Broomfield

Cumulus fractus 1,500 ft beneath altostratus 8,000 ft

These ragged shreds of low cloud always appear in association with other clouds. They often form beneath lowering altostratus or nimbostratus, during precipitation and for a short time before and after. They also occur beneath cumulonimbus and precipitating cumulus.

Collectively they are known as pannus or 'scud'. Frequently these clouds become increasingly numerous and merge into a more or less continuous layer, sometimes completely obscuring the sky above. They appear dark or grey against the lighter grey of the cloud above and generally move quickly across the sky, changing shape rapidly.

C_L6 Stratus

(Cloud Group C7)

Stratus most commonly occurs as a single, grey, fairly uniform, featureless layer of low cloud. Occasionally it can be dark or even threatening, although at most it can only produce weak precipitation. This feature makes it fairly easy to distinguish from nimbostratus, which nearly always produces rain, snow or ice pellets.

However, precipitation falling from a higher cloud through a dark, uniform layer of stratus may cause the observer some confusion. Stratus, when forming or dissipating, may appear as ragged shreds called stratus fractus. When occurring alone these shreds appear grey when viewed towards the sun and white when viewed away from it. They may also appear beneath a continuous layer of stratus. These shreds, unlike those of C_L7, are not accompanied by precipitation. Fog will often lift into a layer of stratus by an increase in wind or a rise in temperature. Stratus is sometimes comparatively thin and the disc of the sun or moon may be seen with a clear outline (photograph, bottom right).

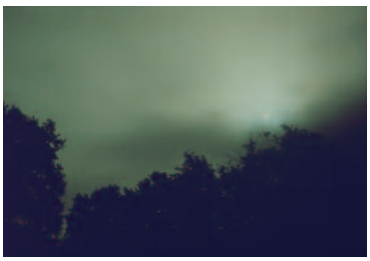
The top photograph shows a patch of stratus almost resting on the headland 462 ft above mean sea level. In the second photograph the top of an 180 ft office block is lost to view in low stratus on an overcast foggy morning. Patches beneath a main layer are seen in the third row left. Third row right shows stratus, in a hilly region, base less than 50 ft above ground, that has drifted in from the sea. A layer of stratus in the process of dissipation is shown at bottom left. The base of the cloud in this photograph was estimated to be 900 ft.

RK Pilsbury

West Wight

CS Broomfield

Bracknell



F Norton

CS Broomfield

Isle of Man

CS Broomfield (Crown copyright)

Bracknell

RK Pilsbury

Pictorial guide C_M: Ac-As-Ns

To find the correct code figure below, start at whichever circle is applicable and then follow the solid line from description to description, so long as all criteria are met.

If a description is reached which is not applicable, return to the previous description and follow the pecked line.

No Ac

Ac present

Sky not chaotic

No turreted Ac and no Ac in tufts

No As and no Ns

No Ac formed by the spreading out of Cu or Cb

Ac not invading the sky

Ac not changing much nor in the shape of almonds and lenses

Ac at single level use C_M = 3 or 7 whichever predominates

Semi transparent As C_M1

SG Cornford

Opaque As, or Ns C_M2

SG Cornford

Ac, formed by the spreading out of Cu or Cb, present C_M6

RK Pilsbury

Ac invading the sky C_M5

RK Pilsbury

Ac at two or more levels C_M7

RK Pilsbury

Semi-transparent Ac predominant C_M3

Steve Jebson

Chaotic sky C_M9

Crown copyright

Turreted Ac or AC in tufts present C_M8

Matthew Clark

As or Ns also present C_M7

SG Cornford

Ac continually changing in appearanceor in the shape of almonds or leaves C_M4

Crown copyright

Opaque Ac predominant C_M7

RK Pilsbury

C_M2 Thick altostratus or nimbostratus

(Cloud Groups C4 and C5)

Altostratus C_M2 is denser and of a darker grey or bluish-grey than altostratus C_M1 from which it may develop. The greater part is sufficiently dense to completely mask the sun or moon. Ragged shreds of pannus clouds C_L7 may form at a considerable distance below the altostratus. Later, with a thickening of the altostratus and a lowering of its base, this distance is greatly reduced. Pannus can be seen in the three photographs on this page.

With further thickening of altostratus and lowering of its base, the cloud may eventually become thick enough to mask the sun throughout. At this stage it is called nimbostratus. The C_M code remains C_M=2 but the C code changes to **C=5**, continuously falling rain or snow gives it a diffuse appearance. Pannus clouds, generally moving fast and changing shape rapidly, frequently occur beneath its base. These clouds appear dark or grey against the lighter background of the cloud above. During heavy precipitation the pannus may disappear.

If pannus clouds merge into a continuous layer obscuring the cloud above, the coding C_M=2 should be replaced by a / and the pannus coded as C_L=7 **C=7**.

In the tropics, particularly during short lulls in the rainfall, nimbostratus may break into several different cloud layers which rapidly merge again. The clouds then often show a very livid colour with variations in brightness.

RK Pilsbury

Base of nimbostratus estimated at 6,000–8,000 ft with pannus at 800 ft

CS Broomfield

Nimbostratus with stratus fractus

RK Pilsbury

Nimbostratus with pannus, base 800 ft, below

C_M1 Thin altostratus

(Cloud Group C4)

CS Broomfield

Cloud base 10,000 ft

SG Cornford

Altostratus 15,000 ft with stratocumulus, bases 3,000 ft and 5,000 ft, beneath

RK Pilsbury

Altostratus showing broad parallel bands

Thin altostratus usually evolves from the gradual thickening of a veil of cirrostratus. It nearly always appears as a layer of great horizontal extent.

It is of a greyish or bluish colour, never white, and the greater part is always translucent enough to reveal the sun (or moon) as through ground glass. The ground-glass effect can be seen in the three photographs on this page. Objects on the ground do not cast shadows, and halo phenomena are never seen. Pannus clouds C_L7 may occur.

In their initial stages of formation the pannus clouds are small and well separated and usually occur at a considerable distance below the altostratus. Sometimes, especially in the tropics, altostratus may form from the spreading out of the middle or upper part of a cumulonimbus.

C_M9 Altocumulus of a chaotic sky

(Cloud Group C3)

Altocumulus of a chaotic sky generally occurs at several levels. The sky is characterised by its heavy, stagnant appearance. There are more or less broken cloud sheets of poorly defined clouds of all transitional forms from rather low, thick altocumulus, to high, thin altostratus. There is generally a mixture of low-level and high-level clouds also present in this type of sky.

In the top photograph the estimated base of the lowest cloud is 7,000 ft. There are confused higher layers up to the sheet of altostratus at 15,000 ft. A prominent turret of altocumulus castellanus can be seen in the centre of the photograph.

In the middle photograph ragged altocumulus and altostratus can be seen in several ill-defined layers, the lowest appearing grey in the light of the setting sun. The layers range in height from about 8,000 ft to 18,000 ft. Virga can be seen trailing beneath some of the clouds.

The bottom picture shows poorly defined patches of altocumulus and stratocumulus beneath extensive layers of altostratus and altocumulus.

CS Broomfield

CS Broomfield

RK Pilsbury

C_M8 Altocumulus with tufts or sproutings

(Cloud Group C3)

RK Pilsbury

Altocumulus floccus with virga, base 15,000 ft

DMG Buchanan

London Heathrow Airport
Altocumulus castellanus, base 7,000 ft

RN Hughes

Great Gaddeston, Herts
Altocumulus castellanus, base about 15,000 ft

Two species of altocumulus are coded under C_M8.

Altocumulus floccus clouds, as depicted in the top photograph, occur as white or grey scattered tufts with rounded and slightly bulging upper parts. These clouds resemble very small ragged cumulus and are often accompanied by fibrous trails of virga from their bases.

Altocumulus castellanus is pictured in the other two photographs. This species has sproutings in the form of small towers or battlements and the cumiliform appearance is more marked than in altocumulus floccus. The cloud elements have a common base and appear to be arranged in lines. These characteristics are evident when the cloud is seen from the side.

Altocumulus castellanus may develop into large cumulus C_L2 or sometimes cumulonimbus C_L3 or 9. Altocumulus floccus sometimes results from the dissipation of the base of altocumulus castellanus, and may itself dissipate, leaving behind very white trails of cirrus.

Both these types are associated with developing thundery conditions over a wide area as opposed to thunderstorms arising from locally generated cumulonimbus clouds.

C_M7 Altocumulus with altostratus or nimbostratus

(Other than chaotic sky)

(Cloud Group C3 if altocumulus predominates, C4 if altostratus predominates, C5 if nimbostratus predominates)

When altocumulus occurs together with altostratus or nimbostratus, C_M is coded as 7 (unless C_M=9 applies.)

The clouds may occur as a single or a multiple layer, showing partly the characteristics of altocumulus, partly those of altostratus or nimbostratus. This sky results from transformation processes by which altocumulus changes locally and acquires the appearance of altostratus or nimbostratus.

Altocumulus and altostratus at the same level are depicted in the top photograph. In the middle photograph they occur at more than one level.

Code figure C_M=7 is also used to report altocumulus in two or more layers, or thick altocumulus in a single layer. Then code figures C_M=6, 5 and 4 take precedence over C_M=7. Descriptions of these other types of sky of C_M7 are given on page 22.

RK Pilsbury

Bracknell
Cloud base 12,000 ft

SG Cornford

Isle of Skye
Cloud base between 10,000 and 15,000 ft

CS Broomfield

C_M6 Altocumulus from the spreading out of cumulus (Cloud Group C3)

RK Pilsbury

Totland, IOW

RK Pilsbury

Cumulus base 3,000 ft, altocumulus base about 10,500 ft, cirrostratus about 25,000 ft

F Norton

Shinfield Park, Reading

F Norton

Shinfield Park, Reading

F Norton

Shinfield Park, Reading

RK Pilsbury

On some occasions the upward growth of cumulus cloud on reaching medium cloud levels is arrested. The top of the cumulus cloud then spreads out to form altocumulus C_M6. The top photograph shows the early stages of this type of formation. The photograph beneath was taken of the same cloud some time later when the spread of the altocumulus had become much more extensive. Cirrostratus is also seen above the altocumulus and cumulus.

Another example of this type of altocumulus development is seen at the bottom of the page (top line and bottom left).

Occasionally, after a temporary spreading out, upward growth is resumed in places so that the altocumulus appears on the side of the cumulus. This renewed upward growth can be seen in the photograph at bottom right. Altocumulus C_M6 can also occur on the side of cumulonimbus.

Because of the way in which it is formed, C_M6 occurs in patches. These are fairly thick at first and their under surface may appear rippled. Later these patches thin out and break into separate elements. Altocumulus never has the fibrous structure, silky sheen or whiteness of the anvil of cumulonimbus.

C_M5 Altocumulus progressively invading the sky

(Cloud Group C3)

The altocumulus clouds of C_M5 gradually spread from one part of the horizon, often passing overhead, and may eventually reach the opposite horizon. These clouds generally thicken, and usually appear thickest, in the direction from which they first appeared. The advancing edge may consist of small cloudlets, often in the process of dissipation, which may cover a large expanse of the sky. The clouds often lie in parallel bands and may be in one or more layers. The coding $C_M=5$ is no longer applicable once the clouds stretch from horizon to horizon, or when the forward edge no longer progresses.

If, during its progress across the sky, parts of the altocumulus change to altostratus or nimbostratus, the coding becomes $C_M=7$ instead of $C_M=5$.

The middle photograph was taken a short time after the top photograph and together they illustrate the spread of altocumulus with time.

CS Broomfield

Bracknell
Base 9,000 ft

CS Broomfield

Bracknell
Base 9,000 ft

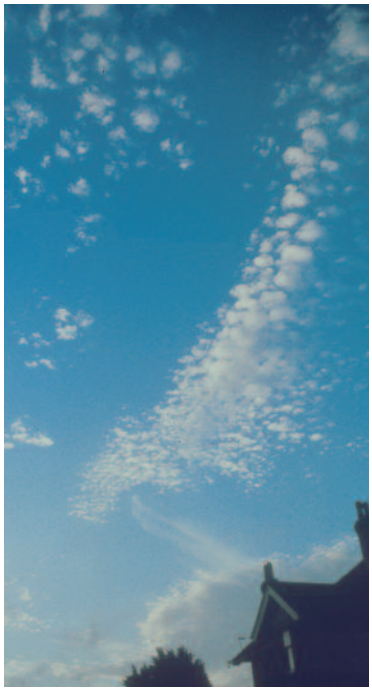
RK Pilsbury

Totland, IOW
Altocumulus stratiformis

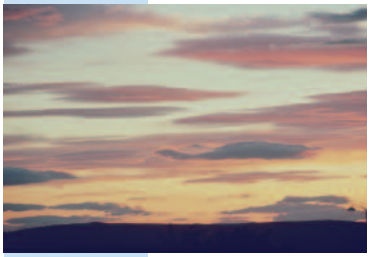
C_M4 Altocumulus continually changing shape — lenticular altocumulus (Cloud Group C3)

RK Pilsbury

Totland IOW



RK Pilsbury



RK Pilsbury

Aberdeen at sunset

PH Jeffries

Southern Spain

JA Walton

Aberdeen

Crown copyright

Cerrig-y-Drudion

The irregularly arranged elements of altocumulus of specification C_M=4 are continuously changing in shape. They often appear to be dissolving in some places and forming in others. This can be seen by comparing the two top photographs which were taken within five minutes of each other. These clouds are usually thin and do not progressively invade the sky. They often resemble a net or honeycomb.

The altocumulus of C_M4 often forms in patches in the shape of almonds or lenses and is then called altocumulus lenticularis. These formations are caused by wave motions in the atmosphere and are frequently seen in mountainous or hilly areas. They are often called wave clouds. They may be triggered by hills only a few hundred metres high and may extend downwind for over 100 km. The cloud elements form at the windward edge of the cloud and are carried to the downwind edge where they evaporate. The cloud as a whole is usually stationary or slow moving. These clouds often have very smooth outlines and show definite shading. At sea they are likely to be seen only to landward. They may appear well distributed over the sky (middle left —stratocumulus is also present), or as a single element (middle right), and can resemble a pile of plates when the elements appear one on top of the other.

C_M7 Altocumulus at more than one level

(Cloud Group C3)

Besides being used to specify altocumulus together with altostratus or nimbostratus (page 18) the code figure C_M=7 is used to describe patches, sheets, or layers of altocumulus at two or more levels.

These patches, sheets, or layers may be of either generally thin altocumulus, although thick enough in places to mask the sun or moon completely, or altocumulus which is thick throughout.

The elements of this altocumulus do not change continually, nor do the clouds progressively invade the sky.

In the top photograph the lower grey layer was estimated to be at 8,000 ft and the higher white layer at 12,000 ft. In the middle photograph the layers were estimated to be at 10,000 ft and 15,000 ft. The bottom photograph was taken when the sun was low in the sky and the difference in colouring shows the two layers quite distinctly. The base of the dark-grey layer was estimated to be at 8,000 ft and the upper white layer at 15,000 ft.

Note: Further specifications for C_M=7 are given on page 24.

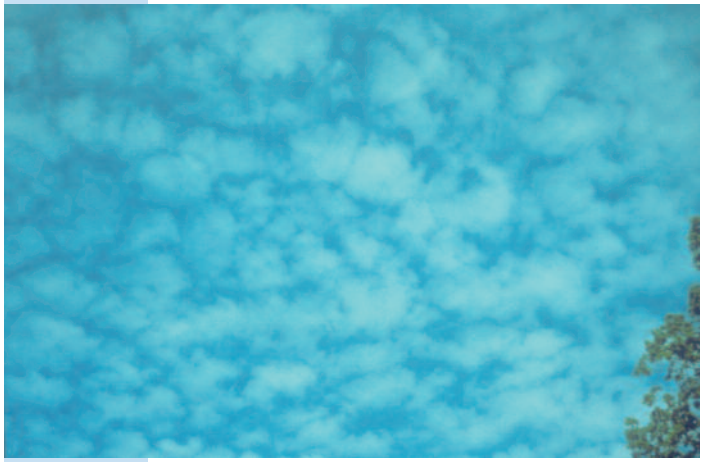
CS Broomfield

CS Broomfield

CS Broomfield

C_M3 Semi-transparent altocumulus

(Cloud Group C3)



CS Broomfield

CS Broomfield

Base 12,000 ft

S Jebson

The coding C_M=3 is used to report altocumulus at a single level, the greater part of which is sufficiently transparent to reveal the position of the sun or moon.

The clouds do not progressively invade the sky, and the individual elements change very little.

The regularly arranged elements, as pictured in the top and middle photographs, usually have an apparent width of between one and three fingers at arm's length, when 30° or more above the horizon. In the middle photograph an aircraft condensation trail high above the altocumulus can also be seen.

These thin altocumulus clouds usually produce a corona.

C_M7 Thick altocumulus in a single layer

(Cloud Group C3)

In addition to the specifications on pages 18 and 22, C_M=7 is also used when there are patches, sheets or a layer of predominantly thick altocumulus at a single level. The elements of this altocumulus do not change continually, nor does the cloud progressively invade the sky. Most of the regularly arranged elements, as shown in the middle and bottom photographs, have an apparent width of between one and three fingers at arm's length, when 30° or more above the horizon. Even if the elements appear smaller than this, the cloud is still classified altocumulus if it shows shading. In the top photograph the cloud elements are irregular in shape.

RK Pilsbury

Base 8,000 ft

CS Broomfield

Base 9,000 ft

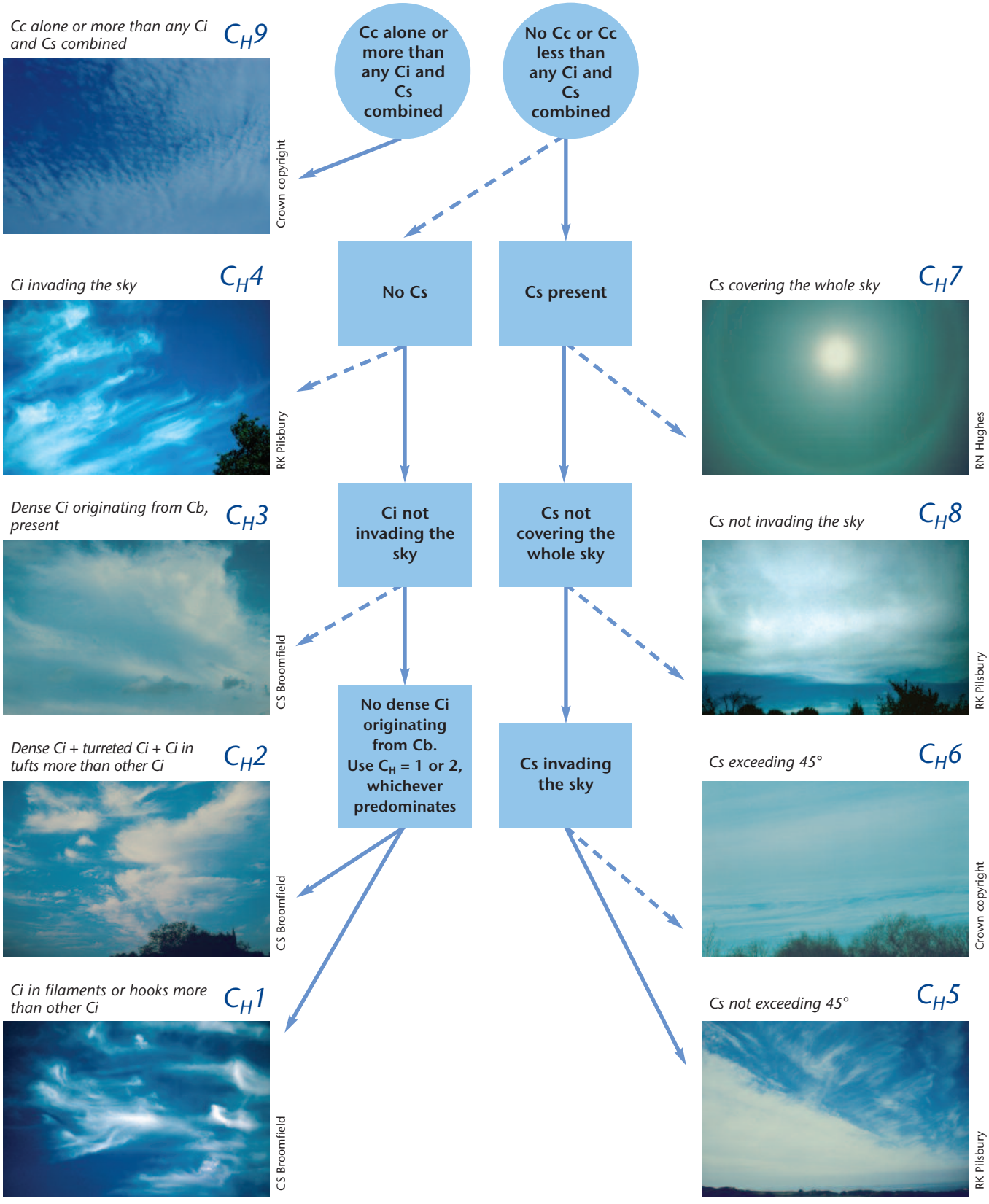
JFP Galvin

Altocumulus stratiformis

Pictorial C_H: Ci-Cc-Cs

To find the correct code figure below, start at whichever circle is applicable and then follow the solid line from description to description, so long as all criteria are met.

If a description is reached which is not applicable, return to the previous description and follow the pecked line.



C_H9 Cirrocumulus

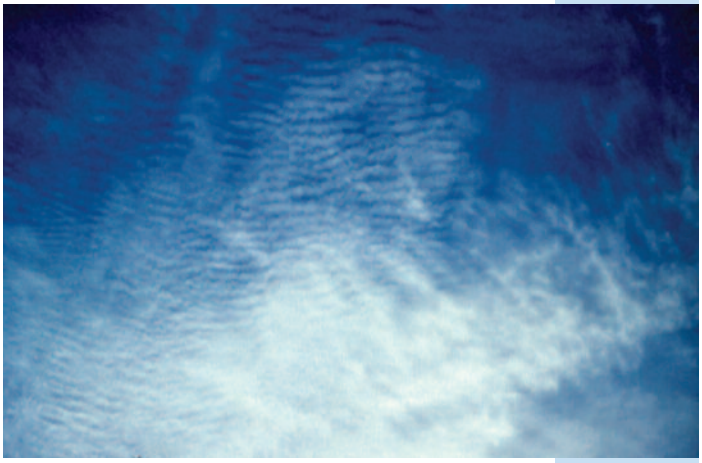
(Cloud Group C1)

Real cirrocumulus is uncommon.

The cloud is composed of very small elements, most of which have an apparent width of less than the little finger held at arm's length. The elements never show shading. They are often arranged in ripples resembling those left by the ebb tide in the sand on the seashore. The cloud elements and clear spaces may also be arranged in a manner suggesting a net or a honeycomb (top photograph). The regular pattern of 'waves' and small gaps may resemble the skin of a mackerel, thus giving rise to the popular name 'mackerel sky'. (This name is also occasionally given to high altocumulus clouds.) In hilly regions the cloud may appear in more or less isolated patches which are almond-shaped and very white throughout.

The cloud is frequently associated with cirrus or cirrostratus but code figure C_H=9 should only be used when the cirrocumulus predominates.

The clouds shown in the photographs had estimated bases of 20,000 ft or above.



F Norton

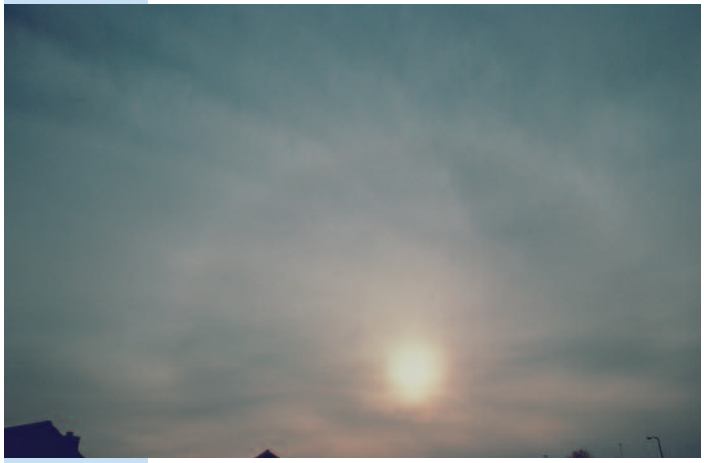
RK Pilsbury

RK Pilsbury

Cirrocumulus stratiformis

C_H7 Cirrostratus covering the whole sky

(Cloud Group C2)



RK Pilsbury

RK Pilsbury

The cirrostratus in this example is thin and featureless

CS Broomfield

Halo not detectable. Any variations in the thickness of the cirrostratus are noticeable when the sun is low in the sky

Code figure C_H=7 is only used when a veil of cirrostratus covers the entire sky. Although it may be relatively dense, the veil is sometimes so thin that it is barely visible. It may be distinguished from altostratus by its thinness, which allows shadows to be cast when the sun is not low in the sky, and that it often displays halo phenomena.

If the sun is bright it may be difficult to see a halo around it, but by covering the sun with the hand it is usually possible to see any halo quite well. The distance between the top of the thumb and the little finger spread wide apart at arm's length is almost as wide as the radius of the small (22°) halo. (Haloes are often spoken of in weather lore as foreshadowing storms, but they are too common to be reliable signs of impending stormy weather.)

It is sometimes difficult to discern cirrostratus through haze. Cirrostratus differs from haze, in that haze is opalescent or has a dirty yellowish to brownish colour.

If there are any gaps in the veil of cirrostratus through which the blue of the sky can be distinguished, the coding for C_H should be 8.

Cirrus at different levels, and cirrocumulus, may also be present.

C_H8 Cirrostratus neither progressively invading the sky nor entirely covering it (Cloud Group C2)

The sky corresponding to C_H8 is characterised by the presence of a veil of cirrostratus which is not (or no longer) invading the sky progressively and which does not completely cover it; the edge of the veil may be clear-cut or frayed.

The code figure C_H=8 is also used when cirrostratus occurs in patches whether they increase in amount or not.

Cirrus and cirrocumulus may also be present, but should not predominate over the cirrostratus.

CS Broomfield

Cirrostratus not increasing. The photograph on the right was taken 90 minutes after the photograph on the left

RK Pilsbury

Patch of cirrostratus

C_H5 Cirrostratus increasing but below 45° elevation (Cloud Group C2)

CS Broomfield

Bracknell
Cirrostratus

Cirrostratus invading the sky progressively but with its continuous part still less than 45° above the horizon is the main characteristic of C_H5. There may be cirrus, frequently seen in bands, filaments, tufts, or resembling fish skeletons, ahead of the cirrostratus. The cirrus may have developed from C_H4. (When such cirrus predominates over the cirrostratus at the same level the C code is **0**.) Cirrostratus near the horizon may be mistaken for altostratus, but the slowness with which it seems to move or change its appearance characterises cirrostratus. It is whitish throughout and differs from haze which has a dirty yellowish to brownish colour.

C_H6 Cirrostratus increasing and above 45°elevation (Cloud Group C2)

RK Pilsbury

Totland, IOW
C_H5 (left) developing into C_H6 (right)

If the cirrostratus of C_H5 continues to invade the sky so that it is continuous to more than 45° above the horizon, without covering the whole sky, the coding becomes C_H=6. The cirrostratus generally grows denser as a whole as it progresses, still often preceded by cirrus as described under C_H5.

The photograph on the right was taken 30 minutes after the photograph on the left. In the earlier picture, contrails can be seen crossing the sky. In the later photograph, the trails have either mainly dispersed or have become obscured by the thickening cirrostratus. Small cumulus clouds can be seen in both photographs.

Cirrostratus not completely covering the sky may be straight-edged and clear-cut as in C_H5 (top). More often, however, it shows an irregular border as depicted in C_H6 (left).

C_H4 Cirrus progressively invading the sky

(Cloud Group C0)

The cirrus clouds of C_H4 are the same species of cirrus as those of C_H1 (page 33), but with the important difference that as C_H4 they progressively invade the sky. They generally become denser as a whole. They usually seem to fuse together in the direction of the horizon from which they first appeared and the forward edge moves towards the opposite part of the horizon. The clouds occur most frequently in the form of strands trailing from a small hook or tuft, and less frequently in the form of straight or irregularly curved filaments.

Cirrostratus should not be present, otherwise the coding would be C_H=5 or 6 as the case may be.

The cirrus clouds shown in the photographs on this page were steadily invading the sky and had an estimated base of 20,000–25,000 ft.

RK Pilsbury

Totland, IOW
Cirrus uncinus

RK Pilsbury

Cirrus fibratus

RK Pilsbury

Totland, IOW
Cirrus uncinus

C_H3 Dense cirrus from cumulonimbus

(Cloud Group C0)

JFP Galvin

Wokingham, Berks
Cirrus spissatus

M Kidds

Reading, Berks

RK Pilsbury

Over the English Channel

The code figure C_H=3 is used only when the observer is reasonably certain that at least one of the dense cirrus clouds in the sky originated from the upper part of a cumulonimbus. It may be possible to see this development if a watch can be kept on the sky (middle photograph). Such cirrus clouds frequently have hairy or frayed edges and are often in the form of an anvil. These clouds are sufficiently thick to veil the sun, obscure its outline or even hide it. In winter this form of cirrus can occur well below 20,000 ft.

Other cirrus clouds may also be present.

C_H2 Dense cirrus

(Cloud Group C0)

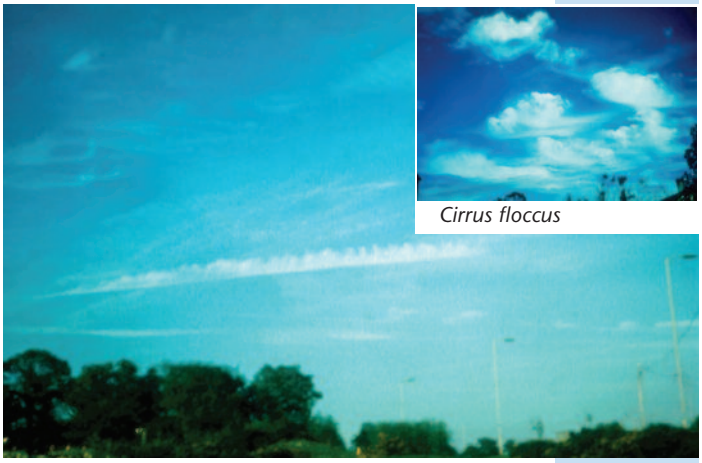
The cirrus of this specification frequently occurs in entangled sheaves (top photograph), or in patches thick enough to appear grey when viewed towards the sun (bottom photograph). It does not usually increase in amount.

Cirrus of C_H2 may also occur in narrow bands with sproutings like turrets or battlements (centre) and is then called cirrus castellanus. Another species takes the form of cirrus in small tufts, the lower part often being more or less ragged (centre inset). This species is known as cirrus floccus.

Cirrus of code figure C_H=1 may also be present, but should not predominate.

If any of the cirrus has originated from the upper part of a cumulonimbus the coding for C_H should be 3. Sometimes the cirrus of C_H2 develops into thick anvil shapes which could be mistaken for the C_H3 of a decaying cumulonimbus.

RK Pilsbury



F Norton

Cirrus floccus

RD Whyman

Cirrus castellanus 25,000 ft beneath other cirrus at 30,000 ft

WG Pendleton

Llandyrnog, Clwyd
Base 20,000 ft

C_H1 Cirrus in filaments or hooks not progressively invading the sky (Cloud Group C0)

RD Whyman

Cloud height about 30,000 ft

RK Pilsbury

CS Broomfield

The white, delicate, hair-like cirrus clouds of C_H1 occur most often in nearly straight or somewhat curved filaments (top photograph). Sometimes they are shaped like commas topped with a hook or a tuft (middle photograph) and in this form they are popularly called 'mares' tails'. The elements may sometimes be arranged in a manner suggesting a fish skeleton with a spinal column and filaments on either side like ribs. Cirrus may also occur in parallel bands, sometimes broad, which owing to perspective may appear to converge towards the horizon (bottom photograph). The height of the cirrus in the photographs opposite was at least 20,000 ft.

The cirrus of C_H1 does not progressively invade the sky. This type of cloud often occurs with other cirrus clouds, but the high cloud should be coded as C_H=1 only when the combined cover of all filaments, strands and hooks exceeds the cover of all other cirrus clouds.

Special clouds

NACREOUS CLOUDS resemble pale cirrus or lenticular altocumulus and show very marked irisation, the most brilliant colours occurring when the sun is just below the horizon. They are sometimes called 'mother-of-pearl' clouds. They can still be distinguished up to about two hours after sunset as thin grey clouds standing out against the starry sky. In moonlight they may be visible throughout the night. They have been observed mainly from Norway, at altitudes between 21 and 30 km, and Scotland. They are ignored when assessing C_H and C.

NOCTILUCENT CLOUDS resemble thin cirrus, but are usually bluish or silvery, sometimes orange to red, or reddish when on the horizon. They are extremely rare, being most commonly observed on clear midsummer nights between latitudes 55° and 65° N. They become visible at the same time as the brightest stars and appear more brilliant after midnight. Their altitude is between 75 and 90 km. Particles collected by rockets in 1962 provided strong indications that these clouds consist of ice crystals. They are ignored when assessing C_H and C.

CONDENSATION TRAILS (contrails) form in the wake of aircraft when the air is sufficiently cold and humid. They are often short-lived, but, especially when cirrus and cirrostratus are present, they may spread out and persist for several hours. Persistent trails are reported by using the C_H code figure most appropriate; sometimes it is impossible to distinguish between old trails and cloud.

They may produce halo phenomena with exceptionally pure colours. Over the UK they rarely form below 28,000 ft in summer and 20,000 ft in winter. They may cast shadows on thin clouds beneath them. A series of such shadows may be the only indication that there is more than one layer of cloud present.

PF Tomalin

Lyddington, Oakham

RM Blackall

Pershore, Works

S Jebson

Contrails

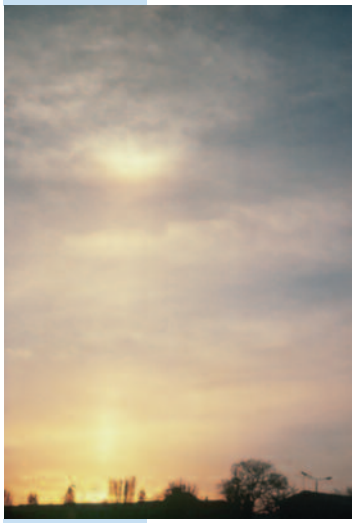
CS Broomfield

Persistent contrails

Optical phenomena and other features

JA Walton

Halo



RW Mason

Sun pillar

HALO PHENOMENA — The small halo of 22° radius centred on the sun or moon is seen most frequently (top photograph). A white horizontal line at the same elevation as the sun is called the parhelic circle and the two bright spots on this are called 'mock suns' (parhelia). Mock suns appear further from the sun when it is higher in the sky. The bright spot above the sun is part of an arc of contact. Pillars of light may appear vertically above or below the sun or moon (second photograph) and are most frequently seen at sunrise or sunset. These, coupled with a portion of the parhelic circle, may form a cross. A large, less bright, halo of 46° radius is sometimes seen, its arcs of contact perhaps showing strong colouration. Rarely other arcs may occur, but usually only part of the display is seen. Halo phenomena are usually associated with Cs, sometimes Ci. (Mock suns or pillars are sometimes seen in Ac.)

J Hallett

CORONA — A brownish ring of small diameter around the moon or sun. In strong daylight it may be easier to detect by observing the sun's reflection in calm water. Outer coloured rings with red outermost sometimes occur. Distorted coronae may sometimes occur when the moon is not full. Most frequently associated with Ac, but sometimes occurs with Cc, Cs, As, Sc, and St.

J Freeman

Irisation

IRISATION — Colours, predominantly green and pink, often with pastel shades, that sometimes appear on Cc, Ac or Sc. The colours may appear as bands nearly parallel to the margins of the clouds, or as a mosaic pattern.

Optical phenomena and other features (continued)

VIRGA — Trails of precipitation (fallstreaks) that do not reach the earth's surface, attached to the underside of a cloud. Mainly associated with Cc (small trails), Ac (pictured), As (may be clearly visible), Ns, Sc (especially at very low temperatures), Cu, and Cb.

RK Pilsbury

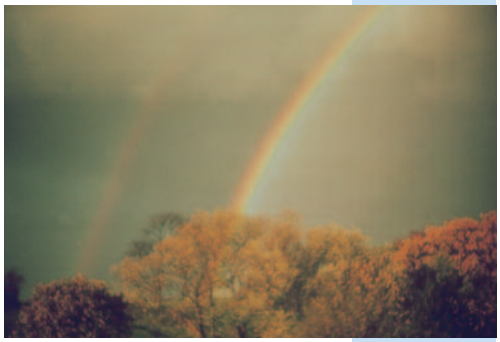
MAMMA — Downdraughts can sometimes cause udder-like protuberances to form on the under surface of Ci, Cc, Ac, As, Sc (irregular and ragged), and Cb (bulbous, pictured). The protuberances may appear prominent when the sun is low in the sky.

PJB Nye

SMOKE — City smoke and industrial pollution causes the sun to look very red at sunrise and sunset and to have an orange tint when high in the sky. From a distance, such pollution may be confused with a bank of cloud on the horizon, but pollution generally appears light-grey or to have a bluish hue.

WS Pike

RAINBOW — Appears on a screen of raindrops when the observer has his back to the sun. A less bright secondary bow, with colour sequence reversed, sometimes occurs, with darker sky between the two. They may be bordered by fainter bows. When produced by the moon the colours are much weaker or are absent. The rainbow indicates Cb or precipitating large Cu.



Crown copyright

Primary and secondary rainbows

Crown copyright

Jersey. Crepuscular rays

CREPUSCULAR RAYS — These take the form of pale blue or white rays diverging from the sun when it is behind Cu or Cb. Sunbeams piercing small gaps in cloud layers (sometimes called 'sun drawing water') and shadows cast by clouds near the horizon at twilight are also called crepuscular rays.

RK Pilsbury

LIGHTNING — Cloud accompanied by lightning is reported as Cb.

Crown copyright

Waterspout

SPOUT — An often violent whirlwind, revealed by the presence of a funnel of cloud beneath Cb, with a 'bush' of matter raised from the earth's surface. The cloud and bush often meet. Spouts occur under newly-formed parts of Cb, not from where the rain is falling. Weak spouts are occasionally seen beneath Cu.

JFP Galvin

VELUM — An accessory cloud of great horizontal extent, close above or attached to the upper part of Cu or Cb which often pierce it. Pictured with C_L9 **C 9**.

Other clouds

Big fires may produce dark clouds similar to large cumulus. Combustion products may be carried by the wind to great distances and occasionally cause a blue appearance of the sun or moon. Real cumulus may also form.

Volcanic eruptions may cause large cumulus-like clouds that may spread out at a high altitude over vast areas. The sky then assumes a peculiar tint which may persist for several weeks.

Very large explosions are usually accompanied by a cloud of smoke or dust above which velum is often seen.

Industrial activities may also produce clouds. Fire clouds, clouds of smoke or dust, clouds from volcanic eruptions, and veils of combustion products are ignored when considering the coding for C_L, C_M, C_H and C. However, real cumulus and cumulonimbus clouds that may result from such events are reported in the usual way.

Appearance of clouds

When the sun is sufficiently high above the horizon, clouds in direct sunlight are white or grey whilst those which receive light from the blue sky are bluish-grey. Some clouds, which are brilliant white in reflected light, show marked contrasts in brilliance when illuminated from behind. The colour of the sun may change as it approaches the horizon and clouds in the vicinity may show a corresponding colouration.

The underside of a cloud may redden when the sun is on the horizon as shown in the picture of stratocumulus (right).

Haze may make distant clouds appear yellow, orange or red. Dust particles introduce a white tinge to the blue of the sky; thus the sky is of a deeper blue when the air has its origins in polar regions.

Satellite view of clouds

This picture was taken from a TIROS-N satellite during the early afternoon of 12 July 1979.

The spiralling pattern of clouds indicates the centre of a depression south of Iceland. Shower clouds of cumulus and cumulonimbus, organised into streets, follow the strong winds on the southern and eastern flanks of the depression. South-west of the depression the cumulus flattens into stratocumulus. The wide band of cloud off north-west districts of the British Isles is associated with a belt of rain, with cloud present at all levels from stratocumulus, altocumulus and altostratus up to cirrus. The cloud over northern France is mostly dense cirrus and thick altocumulus castellanus in association with a low pressure area.

Over the United Kingdom, land heating over the Midlands has caused shallow cumulus to form. Some cirrus and altocumulus are present over southern England associated with the cloud over France. Over Wales, the north of England and the Southern Uplands of Scotland, large cumulus clouds have formed over the higher ground.

Cumulus and cumulonimbus clouds producing showers and thunderstorms have formed over Scandinavia. Interaction between the Baltic Sea and land, heating has produced large cumulus and cumulonimbus along these coasts.

RK Pilsbury

Cumulus from a power station, cirrostratus on horizon

JFP Galvin

Stratocumulus at sunset

University of Dundee

Cloud observations at night

The sky should be watched towards dusk to obtain some guidance on the clouds which are likely to be present after the daylight has gone.

When the sun is just below the horizon the lowest clouds look grey, clouds at medium levels look rose-coloured and those very high appear whitish. As nightfall approaches, medium-level clouds turn grey while cirrus and aircraft condensation trails turn yellow, then pink and finally grey. This colour sequence is reversed at dawn.

After nightfall the sky should be observed from a dark place, well away from lights. The observation should not be made before the observer's eyes are adapted to the darkness.

In moonlight, clouds are visible when the moon is more than a quarter full. All perceptible clouds appear black to grey, except those illuminated by the moon, which present a whitish appearance. Halo phenomena produced by the moon are always white. The colours of rainbows produced by the moon are much weaker than those produced by the sun and sometimes absent.

When the moon is less than one-quarter full there may be difficulty in identifying clouds at large angular distances from the moon. Their existence and approximate amount may be deduced from the blotting out of the stars, although stars near the horizon may be blotted out by haze alone.

The difficulties are, of course, substantially increased if there is no moon at all. Observation of cirrus is then difficult, but if thick and extensive it may be noted by its dimming effect on stars. Cirrostratus causes slight diffusion of light around each star, whose brilliance is at the same time dimmed, but in the absence of moonlight it is almost impossible to differentiate between cirrus and cirrostratus.

The brighter stars and planets are visible through thin veils of cirrus, cirrocumulus and cirrostratus.

Altostratus is generally so dense that the stars are masked. The gradual lowering of a sheet of altostratus may be very difficult to detect, but as the base is rarely quite uniform, as it descends, small contrasts can often be discerned on all but the darkest nights. Nimbostratus usually develops from thickening altostratus. If, on dark nights, doubt exists regarding the choice of designation altostratus or nimbostratus — by convention the cloud is called nimbostratus if rain or snow is reaching the surface. Nimbostratus is usually associated with moderate or strong winds and stratus with a calm or light wind, although this criterion alone must not be used as a basis for distinction.

Fog formed over the sea and driven across the coast by an onshore wind may appear inland as stratus cloud. Its spread across the sky may be very rapid.

The intensity of the darkness is of some assistance in deciding whether the sky is wholly covered or not with dense low cloud. If there is any light at all, variation of contrast may indicate patches of low cloud and medium or high cloud above. Near built-up areas, clouds may often be revealed by illumination from below, especially when snow is lying. Sodium street lighting often casts an orange glow on the base of the cloud. A layer of cloud so illuminated may provide a bright background against which lower fragments stand out in dark relief. Very low cloud may obscure known lights on hills and tall structures. The lights of low-flying aircraft, or when hidden by low cloud the noise of their engines, may give a clue to the cloud present.

Where equipment is available to measure the height of the cloud base, the knowledge of the height of the base is also helpful in identifying the cloud types that may be present.

Distinguishing features of cloud types

Cloud	Appearance of sun or moon	Optical phenomena
Ci	Only dense patches may veil or hide the sun	Halo phenomena may occur, but the halo circle is almost never complete
Cc	Usually transparent enough to show the position of the sun or moon	Corona sometimes, but no halo phenomena. Occasionally irisation on the edges of the cloud, generally within 30° of the sun
Cs	Never thick enough to prevent shadows when the sun is above 30°. The sun's outline will be visible, unless the sun is close to the horizon	Halo phenomena generally produced which may sometimes provide the only indication of thin cirrostratus. Corona sometimes, but no irisation
Ac	May be thin enough to show position of sun or moon, or these may be seen through spaces in the clouds. Sometimes thick enough to hide the sun or moon	Corona or irisation often seen. Ac castellanus and floccus may sometimes show mock suns or a luminous pillar
As	Thinner parts reveal the sun or moon as though through ground glass. Denser parts completely hide sun or moon. No shadows are cast	Corona sometimes, but no halo phenomena
Ns	Sun or moon always blotted out. In daylight the cloud appears as if illuminated from within	None
Sc	Sun, moon, higher clouds or blue sky may be seen through gaps. Thin patches may show position of sun or moon. When dense, sun or moon completely hidden	In extremely cold weather a halo may sometimes occur in virga beneath Sc. When the cloud is not very thick a corona or irisation is sometimes observed
St	Usually so thick that sun or moon completely hidden. When thin, outline of sun or moon clearly visible without ground-glass effect	Corona may be produced when the cloud is very thin
Cu		Rainbow sometimes from precipitation
Cb		Rainbow sometimes. Lightning sometimes

Precipitation	Range of cloud base over British Isles	Cloud
None from Ci	Usually 20,000–40,000 ft	Ci
None from Cc	If — at a non-aviation station — the height cannot reasonably be estimated, the British practice is to use a nominal height of 25,000 ft, and 35,000 ft for any higher cloud	Cc
None from Cs	Cs may thicken to become As	Cs
Although usually none from Ac, very occasionally rain or snow may reach the Earth's surface (usually from altocumulus castellanus)	Usually 6,500–20,000 ft. If — at a non-aviation station — the height cannot reasonably be estimated, the British practice is to use a nominal height of 10,000 ft, and 15,000 ft for any Ac or As above	Ac
When precipitation reaches the ground it is generally continuous rain, snow or ice pellets; the drops are of moderate size. Precipitation seldom reaches the ground if the cloud base is higher than about 10,000 ft	Altostratus may thicken with progressive lowering of the base to become Ns	As
Usually rain, snow or ice pellets, sometimes moderate or heavy	Usually between the surface and 10,000 ft	Ns
Rain, snow, or snow pellets; rarely, then only of weak intensity. Drizzle may occur occasionally when the base of the Sc is low	Usually between 1,000 ft* and 4,500 ft but may often be observed to 6,500 ft	Sc
Only weak falls of drizzle, rain, snow or snow grains, but along coasts and in mountainous areas amounts may be considerable. Precipitation may fall from a higher cloud hidden by St, then dark uniform St closely resembles Ns and may easily be confused with it	Usually between the surface and 2,000 ft but may sometimes be observed to 4,000 ft	St
Cu with strongly sprouting cauliflower tops may, rarely, give showers. In the tropics they may give abundant rainfall	Usually between 1,000 ft* and 5,000 ft, but may sometimes be observed to 6,500 ft. After initial formation, a rise in temperature often leads to a rise in cloud base	Cu
Usually showers or thunderstorms, often with squalls, sometimes with hail. By convention the cloud is called Cb if accompanied by lightning, thunder or hail	Usually between 2,000 ft* and 5,000 ft, but may sometimes lower to near surface, or be as high as 6,500 ft	Cb

*At stations substantially over 500 ft above sea level, the base will often be less

Notes

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