Six clouds you should know about and what they can reveal about the weather

By Hannah Christensen, The Conversation on 09.22.19
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Image 1. Lightning and rain from collapsing cumulonimbus clouds in late afternoon over the city of Tucson, Arizona. Photo from: Wild Horizons/UIG via Getty Images

Modern weather forecasts rely on complex computer simulators. These simulators use all the physics equations that describe the atmosphere, including the movement of air, the sun's warmth, and the formation of clouds and rain.

There have been incremental improvements in forecasts over time. This means that modern five-day weather forecasts are as skillful as three-day forecasts were 20 years ago.

But you don't need a supercomputer to predict how the weather above your head is likely to change over the next few hours. This has been known across cultures for millennia. By keeping an eye on the skies above you, and knowing a little about how clouds form, you can predict whether rain is on the way.

And a little understanding of the physics behind cloud formation highlights the complexity of the atmosphere. It also sheds some light on why predicting the weather beyond a few days is such a challenging problem.

So here are six clouds to keep an eye out for, and how they can help you understand the weather.

Cumulus

Clouds form when air cools to the dew point, the temperature at which the air can no longer hold all its water vapor. At this temperature, water vapor condenses to form droplets of liquid water. We observe these droplets as a cloud. For this process to happen, we require air to be forced to rise in the atmosphere, or for moist air to come into contact with a cold surface.

On a sunny day, the sun's radiation heats the land, which in turn heats the air just above it. This warmed air rises by convection and forms cumulus. These "fair weather" clouds look like cotton wool. If you look at a sky filled with cumulus, you may notice they have flat bases, which all lie at the same level. At this height, air from ground level has cooled to the dew point. Cumulus clouds do not generally rain. If you see them, you're in for fine weather.

Cumulonimbus

While small cumulus do not rain, if you notice cumulus getting larger and extending higher into the atmosphere, it's a sign that intense rain is on the way. This is common in the summer, with morning cumulus developing into deep cumulonimbus (thunderstorm) clouds in the afternoon.

Near the ground, cumulonimbus are well defined. Higher up they start to look wispy at the edges. This transition indicates that the cloud is no longer made of water droplets, but ice crystals. When gusts of wind blow water droplets outside the cloud, they rapidly evaporate in the drier environment, giving water clouds a very sharp edge. On the other hand, ice crystals carried outside the cloud do not quickly evaporate, giving a wispy appearance.

Cumulonimbus are often flat-topped. Within the cumulonimbus, warm air rises by convection. In doing so, it gradually cools until it is the same temperature as the surrounding atmosphere. At this level, the air is no longer buoyant so cannot rise further. Instead it spreads out, forming a characteristic anvil shape.

Cirrus

Cirrus form very high in the atmosphere. They are wispy, being composed entirely of ice crystals falling through the atmosphere. If cirrus are carried horizontally by winds moving at different speeds, they take a characteristic hooked shape. Only at very high altitudes or latitudes do cirrus produce rain at ground level.

But sometimes you may notice that cirrus begins to cover more of the sky, and gets lower and thicker. This is a good indication that a warm front is approaching. In a warm front, a warm and a cold air mass meet. The lighter warm air is forced to rise over the cold air mass. This leads to cloud formation. The lowering clouds indicate that the front is drawing near, giving a period of rain in the next 12 hours.

Stratus

Stratus is a low

continuous cloud sheet covering the sky. Stratus forms by gently rising air, or by a mild wind bringing moist air over a cold land or sea surface. A stratus cloud is thin. So while conditions may feel gloomy, rain is unlikely, and at most will be a light drizzle. Stratus is identical to fog. If you've ever been walking in the mountains on a foggy day, you've been walking in the clouds.

Lenticular

Our final two cloud types will not help you predict the coming weather, but they do give a glimpse of the extraordinarily complicated motions of the atmosphere. Smooth, lens-shaped lenticular clouds form as air is blown up and over a mountain range.

Once past the mountain, the air sinks back to its previous level. As it sinks, it warms and the cloud evaporates. But it can overshoot, in which case the air mass bobs back up, allowing another lenticular cloud to form. This can lead to a string of clouds, extending some way beyond the mountain range. The interaction of wind with mountains and other surface features is one of the many details that have to be represented in computer simulators to get accurate predictions of the weather.

Kelvin-Helmholtz

And lastly, my personal favorite, the Kelvin-Helmholtz cloud, resembles a breaking ocean wave. When air masses at different heights move horizontally with different speeds, the situation

becomes unstable. The boundary between the air masses begins to ripple, eventually forming larger waves.

Kelvin-Helmholtz clouds are rare. The only time I spotted one was over Jutland, western Denmark. They're rare because we can only see this process taking place in the atmosphere if the lower air mass contains a cloud. The cloud can then trace out the breaking waves, revealing the intricacy of the otherwise invisible motions above our heads.

Quiz

1 Which paragraph from the article BEST supports the conclusion that clouds can help predict incoming weather?

(A) Near the ground, cumulonimbus are well defined. Higher up they start to look wispy at the edges. This transition indicates that the cloud is no longer made of water droplets, but ice crystals. When gusts of wind blow water droplets outside the cloud, they rapidly evaporate in the drier environment, giving water clouds a very sharp edge. On the other hand, ice crystals carried outside the cloud do not quickly evaporate, giving a wispy appearance.

(B) But sometimes you may notice that cirrus begins to cover more of the sky, and gets lower and thicker. This is a good indication that a warm front is approaching. In a warm front, a warm and a cold air mass meet. The lighter warm air is forced to rise over the cold air mass. This leads to cloud formation. The lowering clouds indicate that the front is drawing near, giving a period of rain in the next 12 hours.

(C) Once past the mountain, the air sinks back to its previous level. As it sinks, it warms and the cloud evaporates. But it can overshoot, in which case the air mass bobs back up, allowing another lenticular cloud to form. This can lead to a string of clouds, extending some way beyond the mountain range. The interaction of wind with mountains and other surface features is one of the many details that have to be represented in computer simulators to get accurate predictions of the weather.

(D) Kelvin-Helmholtz clouds are rare. The only time I spotted one was over Jutland, western Denmark. They're rare because we can only see this process taking place in the atmosphere if the lower air mass contains a cloud. The cloud can then trace out the breaking waves, revealing the intricacy of the otherwise invisible motions above our heads.

2 Read the following conclusion.

Shifts in cloud formations often lead to changes in the weather.

Which sentence from the article provides the BEST support for the statement above?

(A) If you look at a sky filled with cumulus, you may notice they have flat bases, which all lie at the same level.

(B) This is common in the summer, with morning cumulus developing into deep cumulonimbus (thunderstorm) clouds in the afternoon.

(C) Stratus forms by gently rising air, or by a mild wind bringing moist air over a cold land or sea surface.

(D) When air masses at different heights move horizontally with different speeds, the situation becomes unstable.

3 How are cumulonimbus clouds different from cirrus clouds?

(A) Cumulonimbus clouds help scientists predict the weather, but cirrus clouds do not.

(B) Cumulonimbus clouds produce only a drizzle of rain, while cirrus clouds can produce heavy rains.

(C) Cumulonimbus clouds are wispy because they are made of ice crystals, but cirrus clouds are not.

(D) Cumulonimbus clouds have an anvil shape, while cirrus clouds can be shaped like hooks.

4 What does the author do to build understanding of the different types of clouds?

(A) The author explains how different types of clouds form and what they can tell us about the weather.

(B) The author describes what the different types of clouds look like and whether they form high or low in the sky.

(C) The author explains how different types of clouds form and how they respond in varying air temperatures.

(D) The author describes what the different types of clouds look like and when we can expect to see them.