Lesson: “How can we predict when it's going to storm?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! Have you ever experienced one of these? Not just rain, but wind, lightning, thunder. It's a thunderstorm. These are exciting. Maybe even a little scary, right? Now imagine flying on an airplane during a thunderstorm with lightning out the window. The plane is shaking. Now, luckily, this rarely happens, and that's because pilots do everything they can to avoid thunderstorms. They've got a good lookout from up there. They can spot bad weather up ahead. So if a storm cloud is in the way, it's usually possible to fly around it, or sometimes even climb higher and fly over it. That is precisely what this guy tried to do on July 26, 1959. His name was Lieutenant Colonel William Rankin. And what I'm about to tell you is a completely true story. William Rankin was flying from Massachusetts to South Carolina, USA. He'd been told to expect thunderstorms. But this was a jet fighter plane, capable of flying higher than any ordinary plane. So he figured that if he did run into a bad thunderstorm—no problem, he could just fly over it. Just a few minutes before he was about to reach his destination, he saw this huge, puffy cloud in front of him. He'd seen clouds like this many times before. Now, to someone who didn't know better, you might even think the cloud looked inviting and friendly. But William Rankin knew that its looks are deceiving. This was no friendly cloud. It was a very certain type. And he knew this was a kind of storm cloud that he should avoid at all costs. It was enormous, extending nearly nine miles up into the sky. This cloud was taller than the tallest mountain on Earth. Still, he

figured he could fly over it, which should have been fine, unless—well, unless something really terrible happened, like his engine stalled, and the plane stopped flying, or something. And that's exactly what happened. While directly over the top of this cloud, he heard a loud bump and a rumble from the engine. The engine had stopped. A warning light was flashing. OK, stay calm, he thought. He'd practiced for this kind of problem. All he had to do was pull a lever, and then the backup engine would come on. But as he pulled it—crack—the lever broke off in his hand. There was no backup power. He was going to have to eject, or parachute, out of his plane, and let the plane crash. He jumped from the plane, falling, falling out of the sky. But as if things couldn't get any worse, he looked down and saw that he was still right over the top of the cloud. William Rankin was about to become the first human being ever to fall through a storm cloud with nothing to protect him. As he entered the cloud, his skin turned red and frostbitten from the severe cold. High above the Earth, temperatures are incredibly cold: minus 58 degrees. That's as cold as winter in Antarctica. His parachute opened up, which gave him a moment of relief, but only a moment. Just then, a huge bolt of lightning flashed behind his parachute. Lightning was now striking all around him. The thunder was so loud, it made his entire body rumble. Ten minutes had now gone by. During a normal skydive, by now, he should have parachuted safely to the ground. But he was still up in the cloud. And worse, now he was being pelted by huge drops of frozen rain—what's called hail. Some of it was the size of golf balls. Each piece of hail was hitting him. It was like being punched. He was getting bruised badly. He couldn't wait to be out of this cloud. But just as soon as he'd fallen a little bit farther, a strong, upwards-breezing wind would push him back up into the cloud, and hail would beat him up even more. He was getting beaten up by a cloud. Finally, after what seemed to him like forever, he reached the bottom of the cloud and fell safely to the ground, where he landed in a forest. He was alive. It felt like a miracle. He looked at his watch. It read 6:40 PM. Not only had he just become the first

person to go directly through a storm cloud, but because of the violent, upward-blowing winds, he'd been stuck inside the storm cloud for 40 minutes. Looking back up at the sky, this is what William Rankin would have seen. He'd fallen through a type of storm cloud called a cumulonimbus cloud. They're puffy and enormously tall. They even look kind of friendly and fun. But even though William Rankin's experience of falling through a cumulonimbus cloud was incredibly rare, these clouds themselves are actually not that rare. In fact, they're one of the two most common kinds of storm clouds. And chances are that they sometimes form near where you live. What about you? What's the worst storm you ever experienced? Have you ever experienced a thunderstorm coming toward you before it arrives? What clues would you look for to know if a storm was coming your way?

ACTIVITY INTRODUCTION VIDEO 1

In this activity, you're going to make a “Storm Spotter's Guide,” a little book that will help you figure out when storms are heading your way. You'll notice that this book has a lot of blanks in it. We'll be filling those in together over the course of this mystery. By the time you're finished today, you'll be able to spot storms before they're raining down on you. Here's what you do, step by step.

ACTIVITY PART 1 STEP 1

Get your supplies. When you're done with this step, click the arrow on the right.

ACTIVITY PART 1 STEP 2

Flip over your paper and fold it in half like this so that the words are on the outside. Make sure to line up the corners and the edges before you fold, and then run your fingernail along the fold to make a good crease.

ACTIVITY PART 1 STEP 3

Unfold the paper. Then fold it like this with the words on the outside. Make sure to line up the corners and edges again before folding, and use your fingernail to make a good crease.

ACTIVITY PART 1 STEP 4

Fold the top layer so that the edge meets the crease. Then flip the paper over and do it again.

ACTIVITY PART 1 STEP 5

Unfold the paper, like this. Hold it and cut along the fold where the gray meets the white. Stop cutting when you reach the black line.

ACTIVITY PART 1 STEP 6

Fold the flaps in opposite directions, like this.

ACTIVITY PART 1 STEP 7

Fold it up, like this. You may need to crease the edges to help it stay closed. Then, write your name and date on the front cover. Now, your book's done. In the next video, you'll start filling out the book. But for now, just set it aside until you need it.

EXPLORATION VIDEO 2

How do you tell when a storm is coming? The first big clue is to know your clouds. Not all clouds are storm clouds, like these here. These are a type of cloud that doesn't cause any bad weather. You've probably seen lots of these before—they're the classic clouds, the kind most people think of if you ask them to picture a cloud. These clouds kind of look like piles of fluff or cotton. In fact, that's what they're named after. Scientists call these clouds cumulus clouds, from the Latin word meaning *a pile of something*, like a pile of fluff. Fluffy cumulus clouds are usually spaced apart from each other somewhat. So when you see them, there's always some blue sky around them. When you look up and see a sky that looks like this, this is what we call a partly cloudy day—no bad weather here. Cumulus clouds are good weather clouds, so go ahead and turn to page 1 of your booklet. Write the name of this cloud at the top, and under that, write a word that will remind you what the cloud looks like. We wrote, “fluffy.” Then draw an example of a fluffy cumulus cloud in the box. You don't have to draw anything fancy, just draw the shape. I'll pause the video now so that you can do that. Press play when you're ready to continue. Now that you've drawn a cumulus cloud, let's look at a second kind of cloud. This kind of cloud isn't very fluffy like cotton. In fact, it's more long and flat. It's spread out. Here's another example. You see how these clouds stretch across the sky? When one of these clouds is overhead, when you're underneath one, they can block out the whole sky and look like this. The whole sky just looks

whitish or light gray. You see no blue sky at all. This is what you'll hear people call an overcast sky, meaning the sky is completely covered by cloud. But just because these kind of clouds block out the sun, that doesn't mean it's going to storm. These aren't storm clouds, they're just long, flat, spread out clouds that block your view of the blue sky. These clouds are called stratus, from the Latin word for *spread out*. They're almost like a blanket of clouds that's come over you. So let's put them in your book. In the booklet, turn the page over to page 3. Be careful—you don't want page 2; you want page 3. Write the cloud name at the top of the page, and under that, write a word that will remind you what this cloud looks like. We wrote, "spread out." Then draw a picture of this cloud in the box. I'll pause the video now. Just press play to continue. OK, so now we know about fluffy cumulus clouds and spread out stratus clouds. Those are the two fair weather clouds. But what about bad weather clouds, storm clouds? Well, once you know about the fair weather clouds, you actually have started to learn something about the storm clouds. Let me explain. Remember the storm cloud from the story of William Rankin? That was called a cumulonimbus cloud. There, you see that word cumulo again, just like in the cumulus-type of cloud. Remember what cumulus means: it means a pile, like a pile of fluff. Well, cumulonimbus clouds have that in common with cumulus clouds. They're both fluffy-looking clouds. In fact, a cumulonimbus cloud starts out as an ordinary-looking cumulus cloud. Let me show you what I mean. Here's a sped-up video of some fluffy cumulus clouds. But now, watch this for a little while. Just watch what happens; I'll let you see. Whoa, you see that happening? It got way taller, right? If you see a puffy white cloud that starts to look tall and towering like this one, it's become a cumulonimbus storm cloud, the kind like William Rankin fell through. The end of that word, nimbus, comes from the Latin word for *storm*. So cumulonimbus clouds are good clouds that have turned into bad clouds. They start as harmless cumulus clouds, and they turn into stormy cumulonimbus. Here are some more photos of cumulonimbus

clouds. Notice that the shape of the top can differ somewhat—they're not all exactly the same. But no matter what shape the tops are, cumulonimbus clouds are always very tall. If a cumulonimbus cloud is going to pass over your town, it could be pretty serious. From the story of William Rankin, you've already seen some of the traits of cumulonimbus storms. They produce strong winds, heavy rains, lightning, and thunder, and sometimes they even produce frozen rain or hail, which can be big enough to smash car windows. Luckily, even though cumulonimbus storms are really bad, they don't last a long time. Most cumulonimbus storms are less than an hour long. OK, so let's draw one in your book. Turn to page 2, next to where you drew the cumulus cloud. What you want to do is write “cumulo” in front of nimbus to make cumulonimbus. Underneath, write some words that will remind you what this cloud looks like. Then draw a picture of a cumulonimbus cloud. I'll pause now so you can do this. So now you've drawn a cumulonimbus cloud in your book, but do you remember, I mentioned there's another type of storm cloud? You see, just like cumulus clouds can go bad, becoming cumulonimbus clouds, well, stratus clouds have their own way of becoming storm clouds too. This is a normal spread out stratus cloud. There's no storm here, right? But if you see stratus clouds getting thicker and darker like this, that's a sign that it's becoming a storm cloud. The reason it's getting darker is because more and more water droplets are building up inside the cloud, which makes it harder for sunlight to shine through from the other side. Once enough water builds up inside that cloud, the water starts to fall down, and the cloud begins to rain. Here's another picture of the same type of cloud. So this type of cloud is called stratonimbus, meaning, “a spread out raincloud.” You see the lines of rain falling from the cloud? That's actually rain you can see there. So now you know both types of storm clouds. Notice how different they look from each other, even though they're both storm clouds. Stratonimbus clouds come from spread out stratus clouds. So they're still very long and flat, like a blanket across the sky. And

cumulonimbus clouds come from cumulus clouds, so they're still very puffy, just a lot taller than an ordinary cumulus. But maybe the most important difference between these two storm clouds is how they behave. A cumulonimbus cloud is a powerful storm, but the cloud itself is tall, not wide. So that means that when one of these passes over where you live, even though the storm is bad, it doesn't last very long. If one of these storms passes over you, you definitely want to run inside to stay safe, but there's a good chance that in less than 20 minutes, the storm will pass. It might even be sunny outside again, and you'll be able to go back to life as usual. Stratonimbus clouds are the opposite. The clouds are like wide blankets across the sky. So that means that the rain might last all day long. These aren't very powerful storms like a cumulonimbus. There's no lightning, there's no hail—it just rains. You'll be stuck inside most of the day if one of these passes overhead. Now that you understand both storm clouds, let's add stratonimbus to your book. Turn to page 4, next to where you drew the stratus clouds. Write “strato” in front of nimbus to make stratonimbus. And underneath, write some words that remind you what this cloud looks like. Then draw a picture of the stratonimbus clouds, and also be sure to shade it in dark to remind yourself that these clouds turn dark gray. This video will end now. Go to the next video when you're ready to move on.

EXPLORATION VIDEO 3

So now you know four kinds of clouds to look for—cumulus, cumulonimbus, stratus, and stratonimbus. If you see cumulus clouds or stratus clouds in the skies, no worries. There's no storm coming. But if you see cumulonimbus or stratonimbus, those are bad news. You also know that you should watch for changes. Cumulus clouds can turn into cumulonimbus clouds. So if you see a cumulus cloud start growing tall and towering, watch out. Or if you see stratus clouds start to get thick and dark, turning into stratonimbus clouds, that's also bad news. So it

seems like it should be pretty easy to know whether a storm is coming now, right? Just use your book and look for the clouds. But say that one day you go outside and you see one of these up in the sky. Oh, you recognize that shape! It's a tall cumulonimbus storm cloud, a bad thunderstorm is on its way. So you go inside, you wait for the storm to pass, but you wait and wait and nothing happens. No storm comes. What's going on? When you go outside to check, that's when you realize the cloud moved in a different direction. See, you assumed that it was coming toward you, but, in fact, it was off in the distance and blowing toward some other town. So knowing which clouds create storms, that's only the first clue to being able to predict storms. You also have to know which direction the wind is blowing. Now, luckily, there's a pretty easy way to figure this out. A long time ago, people discovered an interesting pattern with the wind based on where you live. Winds always tend to blow a certain direction, like this. Isn't that cool? So for example, people living here in Southern Mexico, they realized that almost anytime there's wind, for them it blows from east to west. Sometimes there's exceptions, you know, like one day it might blow from north to south. But almost always, if you're in southern Mexico, it blows from east to west. Have you ever noticed which direction the wind blows where you live? Have a look at this world map, where people have recorded the wind directions. Figure out where you live and which way the wind usually blows there. That will tell you which way to look to see what clouds are coming your way.

ACTIVITY INTRODUCTION VIDEO 2

Your book is done. Now you're going to do an activity that lets you practice using your book to figure out if a storm is coming your way. To do this, you'll need your completed “Storm Spotter's Guide,” a copy of the three “Will It Storm” handouts, and a partner. I'll pause while you find a partner and your teacher gives each person their handouts. Just press play to continue. OK,

here's how this activity will work. I'm going to show you a few different pictures of the sky. You and your partner will look at each picture and use your “Storm Spotter's Guide” to decode the clouds. For each picture, you'll have to decide what clouds are in the sky and whether or not they're storm clouds. You'll also want to check the direction the wind is blowing to figure out if the clouds are coming your way. To do this, look at the arrow that will be in each picture. Is the wind blowing towards you, like this arrow shows? Or is the wind blowing directly away from you? Or is it even blowing some other direction? Unless the wind is blowing the storm clouds toward you, you might not have to worry about them at all. Now, after each photo, you'll discuss what you think with your class before moving on to the next photo. OK, let's get started!

FOLLOW VISUAL ACTIVITY ON WEBSITE - NO NARRATION