

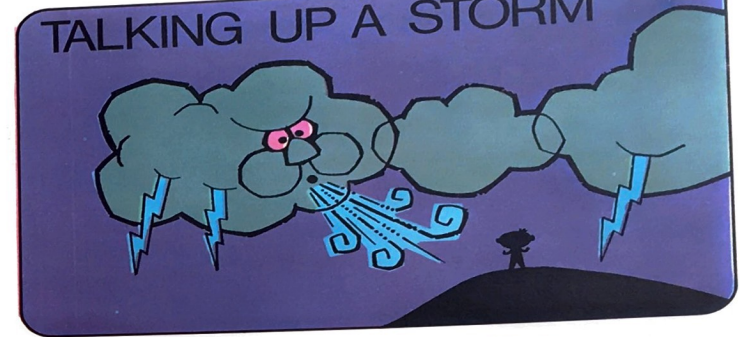
WEATHER

SULLIVAN TOPIC SERIES

# TALKING UP A STORM



# TALKING UP A STORM



By Lex Hames  
Art By Louis Besser

A Sullivan Associates Program from Behavioral Research Laboratories

## A Sullivan Associates Reader

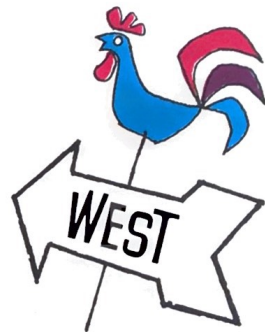
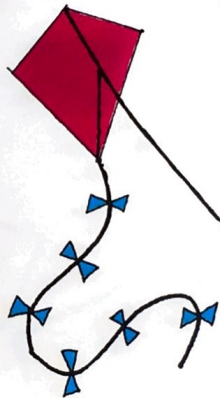
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The wind blows east,



the wind blows west,



the wind,  
you know,

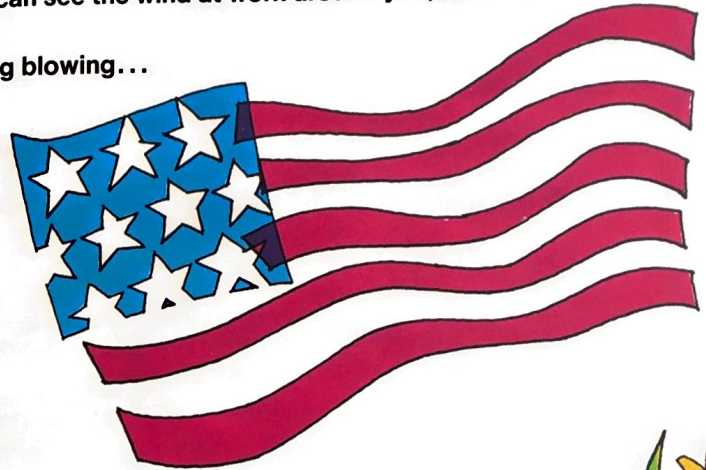


does seldom rest.



You can see the wind at work around you, all the time.

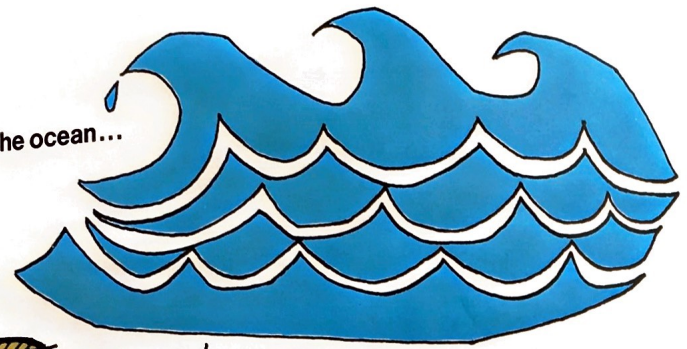
A flag blowing...



tall grass that is being pushed close to the ground...



waves on the ocean...



leaves skipping along the ground...



smoke drifting across the sky instead of going straight up...

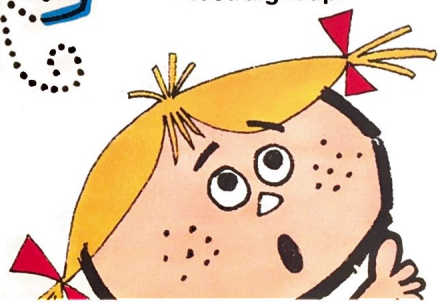


THEY'RE ALL CAUSED BY WIND!



But sometimes, even when you don't feel the wind or see it at work, it's still there!

Next time you're outside, lick your finger and hold it straight up.



Now what?

Does your finger feel cool?

It sure does.



If your finger feels cool, that's because of the wind hitting it. If you can't feel any wind on your face, but your finger feels cool when you lick it and hold it up – that shows there is a very small wind.

**NEXT...**

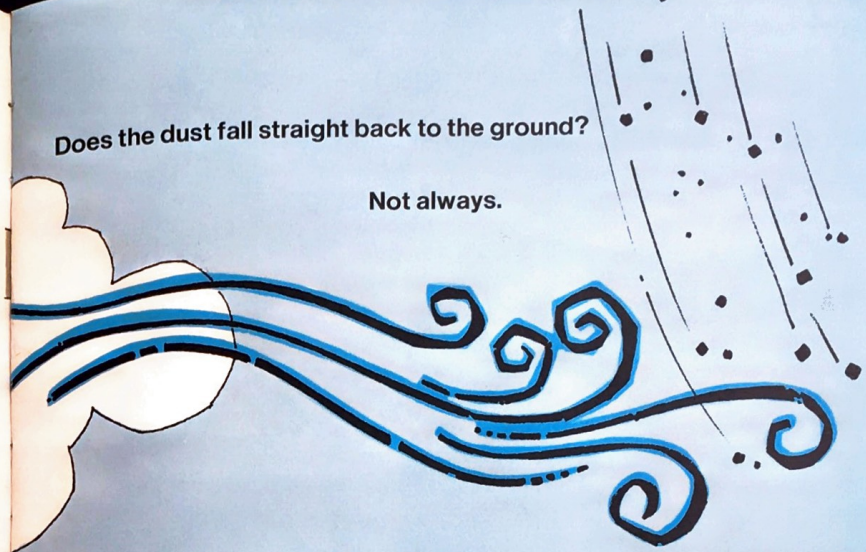
Throw some dust up in the air!



**WHEE!**

Does the dust fall straight back to the ground?

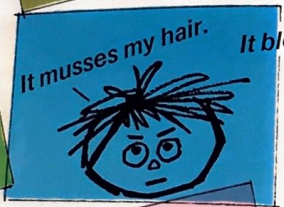
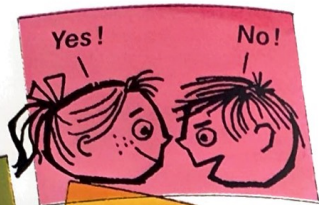
Not always.



If the dust falls sideways, that shows there is at least some wind, blowing the dust particles\* around.

\* Particles are very tiny bits of something.

Do you like the wind?



Sometimes we love the wind, and sometimes we hate it.  
But what *is* it?

Wind is just moving air.



All right, already!  
So what is air?

Well, air is made up of things called molecules. You might say molecules are the bits and pieces from which air is made, just as bricks are the bits and pieces from which a brick house is made. There are several kinds of air molecules, but they're all very tiny.



Are air molecules this big?

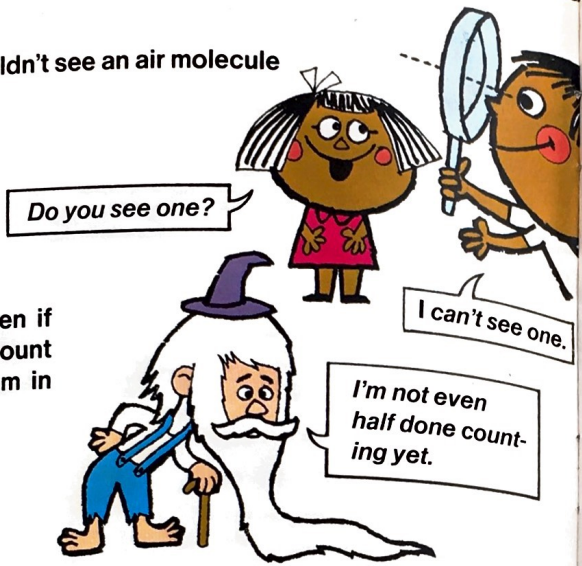
No—much smaller than that. You couldn't see an air molecule no matter how hard you tried.

And there are lots of them, too. Even if you could see them, you couldn't count all the air molecules in a single room in your whole lifetime!

**SO...**

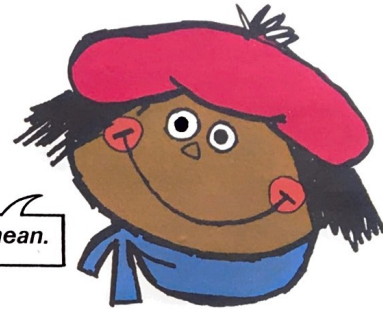
When you feel the wind against your face—

it's just all those little air molecules running into you!



*But why is wind?*

Do you mean why do those little air molecules move around so much, running into you, and trees, and grass, and everything else?



*That's just what I mean.*

You've asked a good question.



*Of course.*

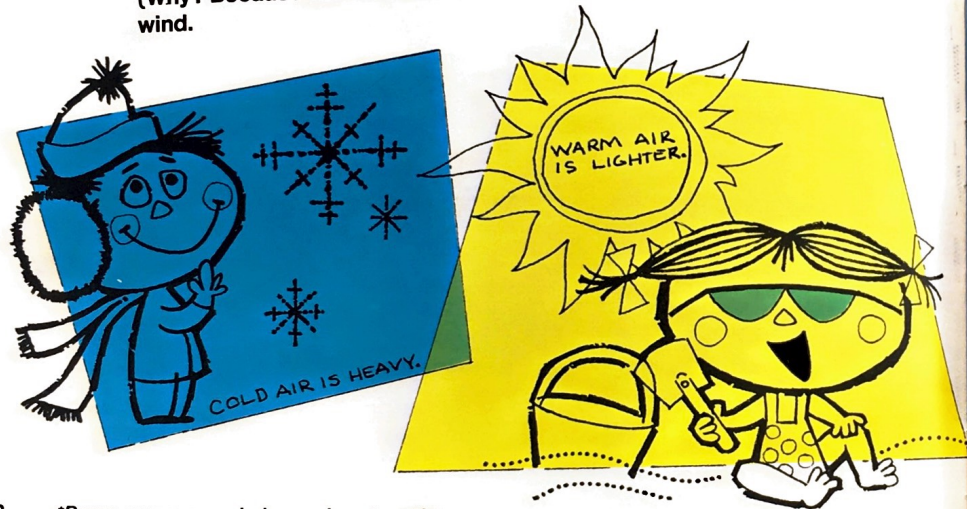


Well, you should know that some air is heavier than other air.

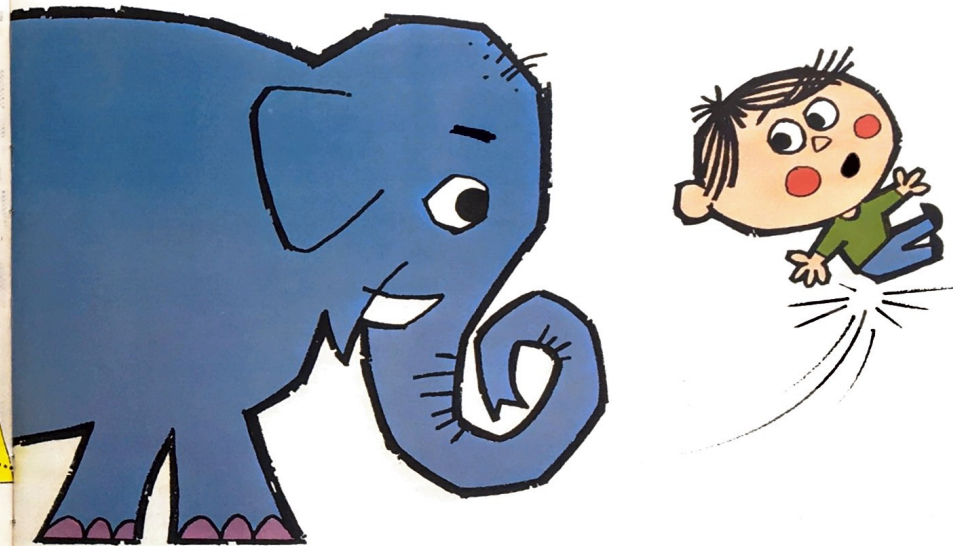
### HEAVIER?

That's right, cold air is heavier than hot air. A scientist would say that cold air is heavier because it is denser\* than hot air. In other words, a bucket of cold air has more air molecules in it than a bucket of hot air.

When cold air pushes against hot air, the hot air moves. (Why? Because the cold air is heavier.) This movement is the wind.



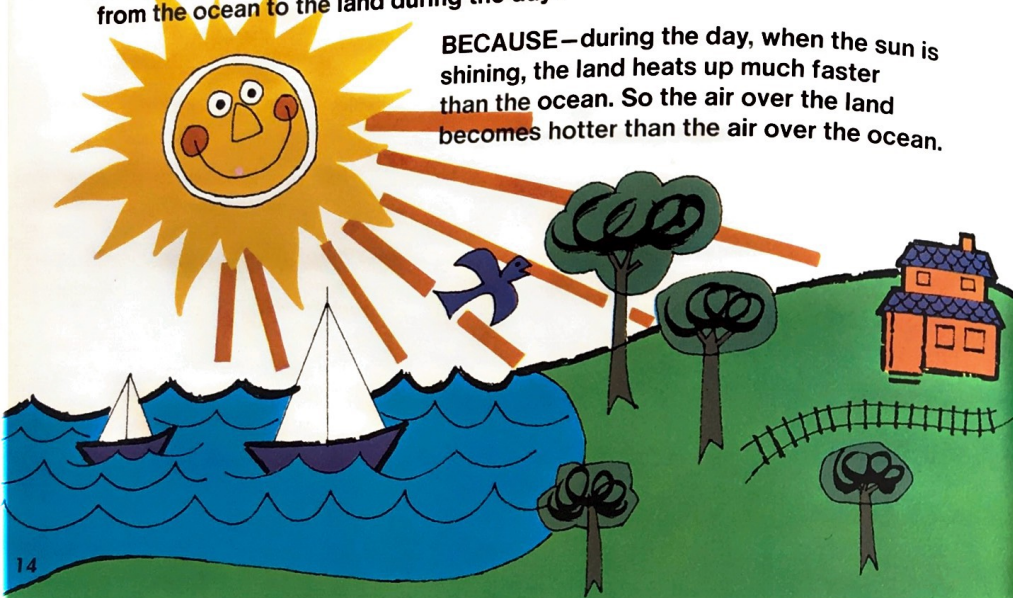
Suppose an elephant came along and gave you a push. Would you have to move? Of course you would! Why? Because you'd have no choice—he's heavier!



Cold air acts rather like the elephant we just saw. The cold, heavy air pushes the light, hot air around, and that makes wind.

Can you guess why the wind always seems to be blowing from the ocean to the land during the day?

**BECAUSE**—during the day, when the sun is shining, the land heats up much faster than the ocean. So the air over the land becomes hotter than the air over the ocean.



Now can you guess what is going to happen? Right—the cold, heavy air from the ocean pushes the hot, light air up and out of the way—

and gives us a nice, cool sea breeze!



It's time now that you meet the wind's closest companions\* . . . STORMS!  
Although the wind often goes around without storms, you never, never meet a storm without the wind. Here comes a storm now.

Storm by day,

storm by night,



the storm blows hard with all its might!

\*A companion is someone you spend time with.

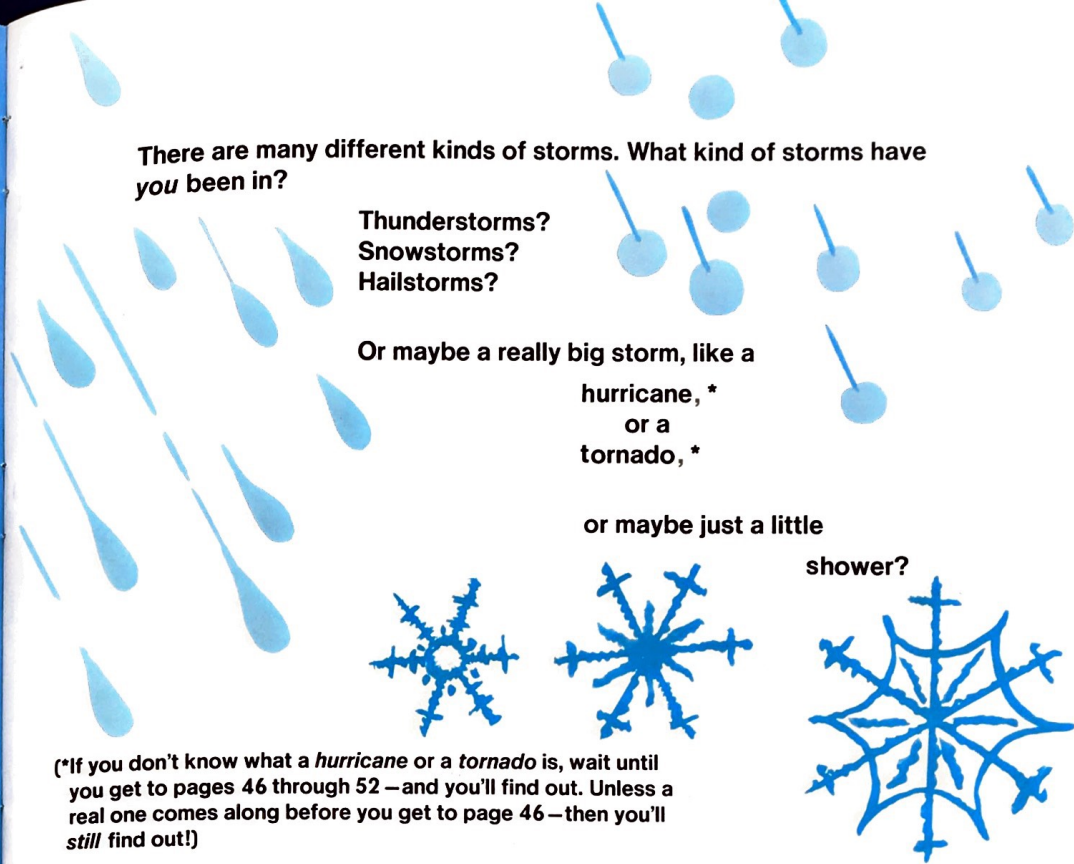
There are many different kinds of storms. What kind of storms have you been in?

Thunderstorms?  
Snowstorms?  
Hailstorms?

Or maybe a really big storm, like a  
hurricane,\*  
or a  
tornado,\*

or maybe just a little

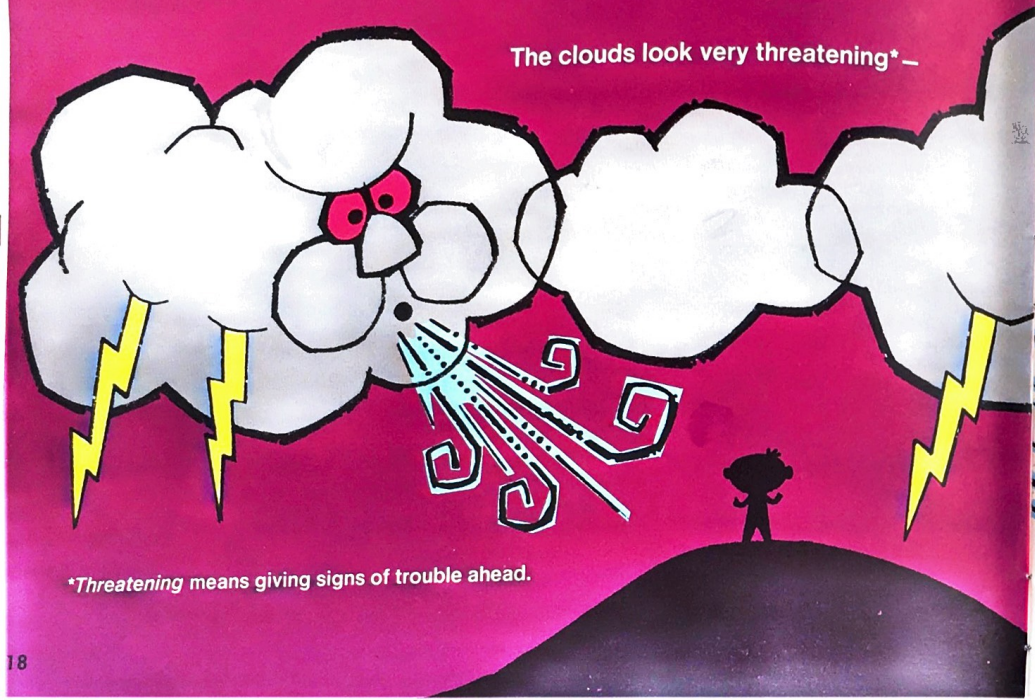
shower?



(\*If you don't know what a *hurricane* or a *tornado* is, wait until you get to pages 46 through 52 – and you'll find out. Unless a real one comes along before you get to page 46 – then you'll still find out!)

Imagine that you are in a big storm, a truly huge thunderstorm.  
What's it like?  
There are huge gray clouds overhead, piled up like mountains of  
cotton.

The clouds look very threatening\*—



\*Threatening means giving signs of trouble ahead.

The rain is coming down, and down, and down!

The rain is coming down in buckets!

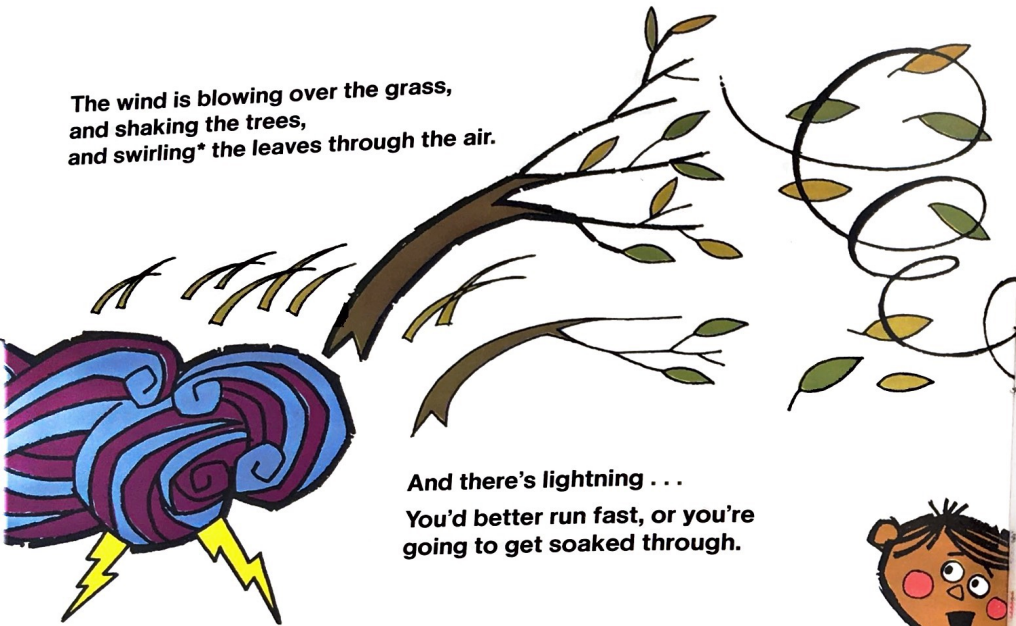
(That's an old saying—pretty weird, don't you think?  
You'd need thousands of buckets to hold a storm.)

The wind is howling . . .

HOWL! WHOOSH!



The wind is blowing over the grass,  
and shaking the trees,  
and swirling\* the leaves through the air.



And there's lightning . . .  
You'd better run fast, or you're  
going to get soaked through.



Of course, maybe you *like* to get wet.

You didn't run home fast enough, did you?



No!

You got pretty wet, didn't you?

Yes!



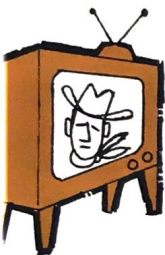
How did you ever  
get so wet?

Want a mud pie?



\*Swirling means moving around—spinning sometimes one way, some-  
times another.

Now that you are home, and warm and dry again,  
you're probably wondering . . .



**WHAT CAUSES A STORM LIKE THAT.**

Well, to understand what causes storms, you must first understand  
a few things about . . .



To understand clouds, you must learn about something called water vapor.



*Is that like water?*

It is, in a way. If water becomes hot enough, it will turn into water vapor.  
Have you ever watched your mother boiling water on the stove?



*What are you doing?*



*I'm watching  
the water boil!*

You may have thought that as the water boiled,  
the amount of water in the pot became less. If  
you thought that, you were right!

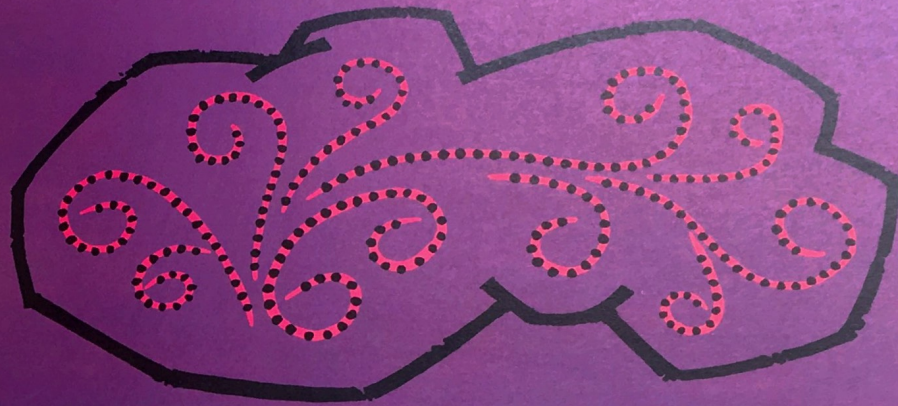


*Hey! I was right.*

If your mother had kept the water on a hot burner long enough, in time *all* of it would have disappeared. Why? Because as the water boiled, it was turning into *water vapor*—and the water vapor was going into the air. Next time she says, “Oh, dear, all the water has boiled away,” tell her it has turned into water vapor. Unless you live in a very dry place, like a desert, the air around you probably has a lot of water vapor in it—



But you can't see water vapor. It's invisible.\*



But even though you can't see it, water vapor is very important.

\*Invisible means you can't see it.

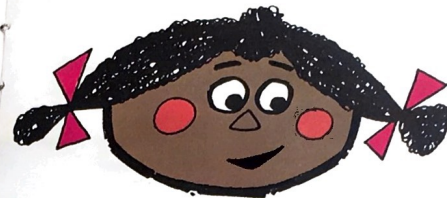
When air with water vapor in it cools, the water vapor cools, too. (And do you remember that if water gets hot enough, it will turn into water vapor?) If the water vapor gets cool enough, it will turn back into water. But of course, this doesn't mean there's suddenly a big lake up in the sky.



The water vapor turns into many tiny drops of water. When there are enough of these drops together, they make...



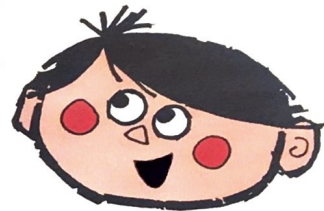
**A CLOUD!**



*That's all a cloud is?  
Just tiny drops of water?*

That's right.

*So the way to make a cloud is to cool air. That cools the water vapor, too. And if the water vapor is cooled enough, it will turn into many tiny water droplets\*—and you'll have a cloud!*



That's right again.

\*A droplet is a very small drop.



*I have a question. How do you cool air?*



*I'm going to make my own clouds from now on!*

That's a very good question. There are several ways to cool air. But the most common way is to lift it—to make it go up. As air goes upwards, it cools off.

*So when air is forced up, it gets cooler—and that cools the water vapor, and that makes clouds.*



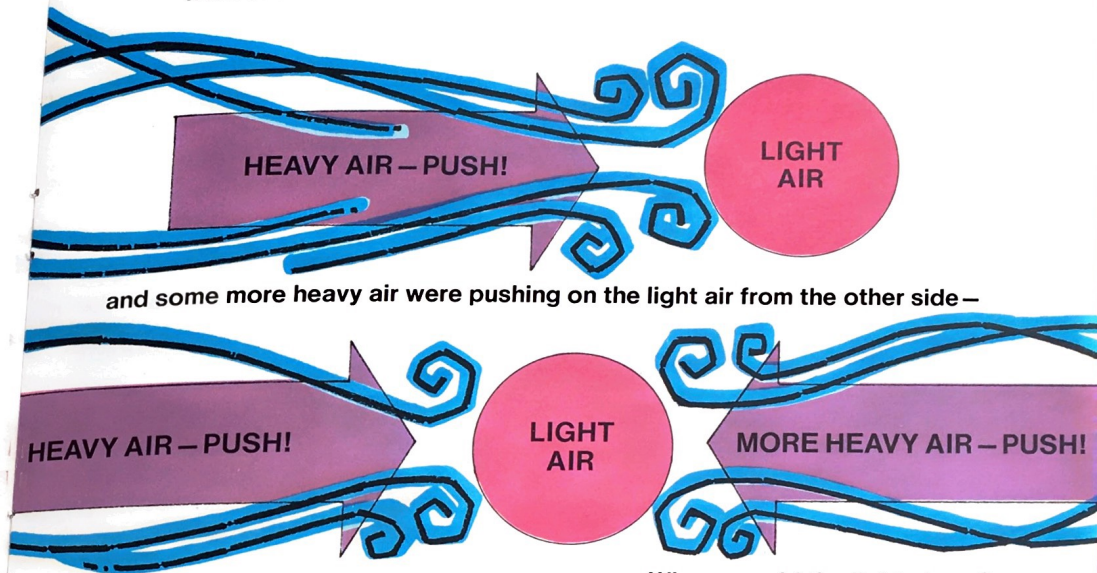
*But what makes air go up?*

You can guess, can't you? It's our old friend. He's finally getting back into the act.



Yes. It's the WIND! Wind makes air go up.

Remember that cold, heavy air pushes light, hot air, and that makes wind? Well, suppose some heavy air were pushing on some light air from one side—



and some more heavy air were pushing on the light air from the other side—

Where would the light air go?

UP! The light air could only go up!

*They got me!*

*Thanks, pal.*

LIGHT AIR

*We got rid of him.*

HEAVY AIR

MORE HEAVY AIR

It would go up just like toothpaste squeezed out of a tube.



*And when the air went up, it would cool off—and maybe form clouds.*



Right!  
Now you're getting it.

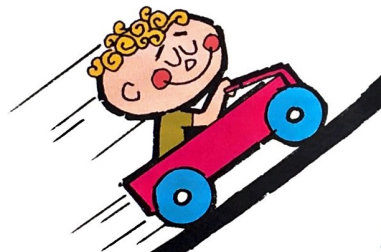
Have you ever noticed those big, fluffy clouds which sit on top of mountains, looking as if they are about to roll down into the valley?



Think of a wagon for a moment. If you give it a really big push . . .



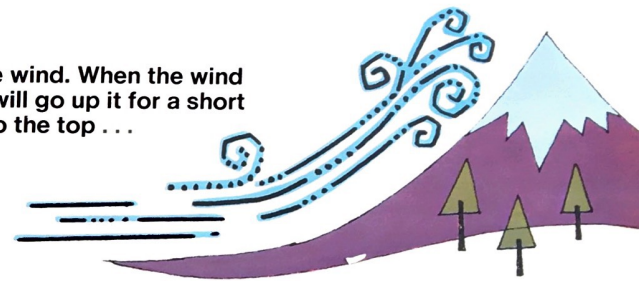
and the wagon comes to a hill . . .



it will roll a little way up the hill, then slide back down again.



Imagine the wagon is the wind. When the wind comes to a mountain, it will go up it for a short way, maybe all the way to the top . . .



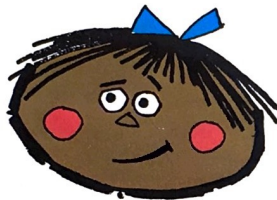
and then the air will cool off (remember how air cools when it rises) and form a cloud or two.



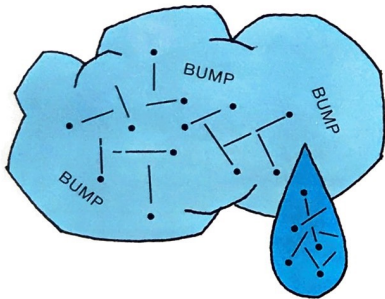
And clouds cause some storms!

Why, that's right. (How did he know?) Clouds do cause some storms.

Like rain?



Clouds cause rain. If enough tiny rain droplets form in a cloud, they start getting crowded. And they start bumping into each other—like people in a subway.



When two tiny droplets bump into each other, they form a bigger drop. The droplets keep bumping into each other, joining together, and getting bigger. It takes a lot of tiny droplets to form one good-sized drop of water.

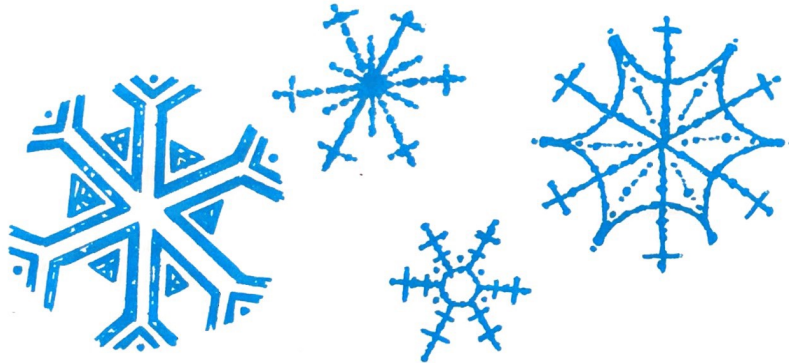
And when the drops get too big for the wind to hold up in the air any more, they fall to the ground as . . .

RAIN!



IT'S RAINING, IT'S POURING, THE OLD MAN IS SNORING...

If a cloud becomes cold enough, sometimes the tiny water droplets will freeze into ice. (Just as water in a freezer turns into ice cubes.) But the drops don't turn into ice cubes, they turn into ice crystals,\* that look like this –



Don't you think they are beautiful? There are more kinds of ice crystals than you can imagine. And every one of them is different. How do we know? This is what scientists tell us.

\*Ice crystals are pieces of clear ice which form many different shapes. Remember those little air molecules you learned about earlier? Well, crystals are made up of water molecules.

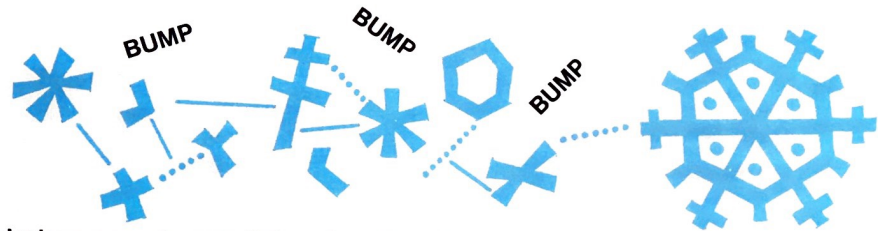
You couldn't actually see an ice crystal with your bare eyes. You would need a microscope.\*



When there are many of these ice crystals, they bump into each other and join together.

And when enough ice crystals join together, they become a . . .

**SNOWFLAKE!**



And when enough snowflakes form in a cloud,

they fall to the ground as . . .



\*A microscope looks like this. It makes things look larger than they are, so that when you look through a microscope at something very tiny, you can see it better.

# SNOW!

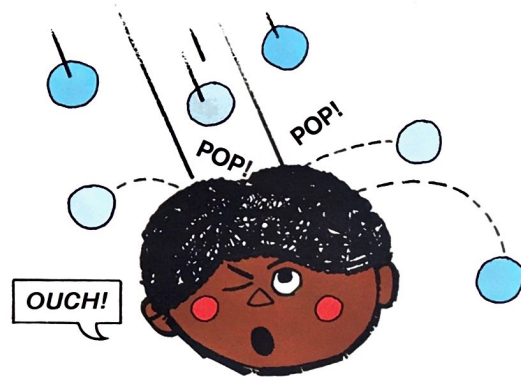
It's snowing!



Sometimes, when a cloud gets cold, the water droplets may freeze into tiny balls instead of into crystals.

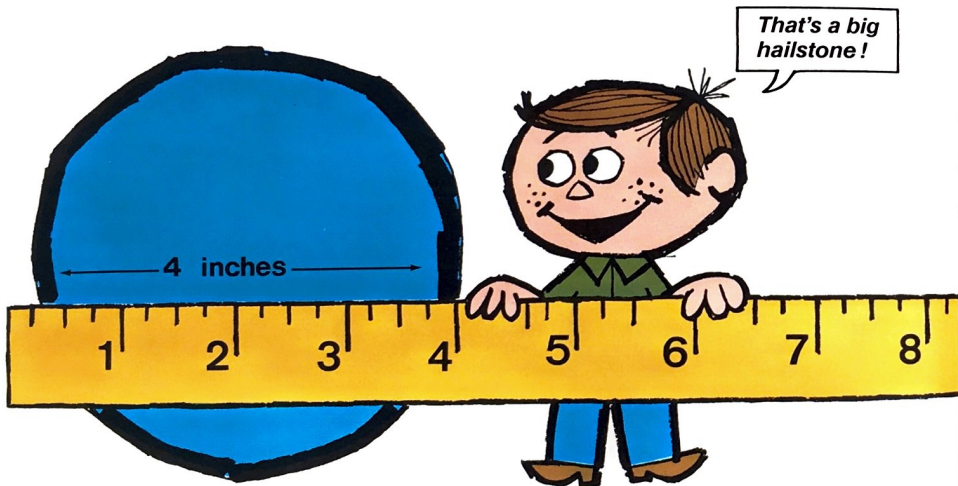


When water droplets that aren't frozen bump into ice balls, they freeze on the ice balls—so the ice balls keep getting bigger and bigger. When the ice balls get big enough, they fall to earth.



Then we call them hailstones, and we say it's hailing.

Did you know that hailstones can actually get *this* big?



Now you can see how the wind, and clouds, and storms all fit together.

Air is made of many tiny molecules—



*which are too small for me to see!*

Wind is just moving air—



*it's all those air molecules hitting my face.*

Air usually has water vapor in it—



*which I can't see, either!*

Sometimes the wind makes air go up—



And when air goes up, it cools off. If it cools off enough, the water vapor turns back into water droplets. And the water droplets form—

clouds!

And from clouds come—



rain—

and snow—

and hail.

I'm wet!

It dented my car!



You probably think you have seen some big rainstorms—



*You better believe I have! Why, I remember just last month, it rained for three days and three nights, and water was running down all the streets, and we were sailing boats in the streets, and Margie's lawn began to wash away, and . . .*





Yes, that sounds like quite a rainstorm. But a storm like that is *nothing* compared to some rainstorms.



What? That was the biggest storm I've ever seen! That was the biggest storm ever . . .

OK, OK, but suppose that you lived in India, a country on the other side of the world from the United States. In some parts of India, rainfall is measured by the *foot!* (Not this kind of foot); → *this* kind.



From January until June, India is very dry. Then one day in June, the direction of the wind completely changes—the monsoon winds have come to India! And the monsoon winds bring rain, and rain, and more rain. You wouldn't believe how it rains.

Well, it couldn't rain more than it did in that storm I was telling you about.



Oh yes, it could! There is one town in India that gets more than thirty-six feet of rain a year!

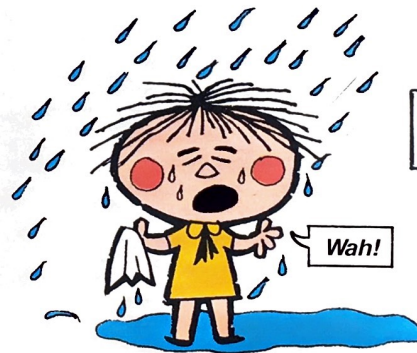


OK. That is bigger than my storm.

That's a lot of rain.



And India is not the only place in the world that has a great amount of rainfall. The world's record—for the most rainfall in the shortest time—was set in 1911, in the country of Panama.\* Two and a half inches of rain fell in only *three* minutes! Just think of that! Imagine how wet you would have become in *that* rainstorm!



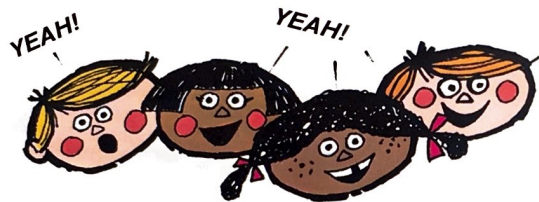
\*Panama is south of the United States, in Central America.



Oh.



Would you like to hear some more about storms—about some really big, powerful storms?



All right. How about a hurricane?



Hurricanes are the biggest storms of all. They can be many miles wide, and they have very strong winds that sometimes blow up to two hundred miles an hour. (That is about three times as fast as you ever go in your family car!)

Hurricanes are one of the most destructive\* forces in nature. Hurricanes start over the ocean, and when they blow in to land, then . . . watch out!

HURRICANE!



Hurricanes blow trees over—

hurricanes knock down telephone poles.

\*Destructive means breaking things up, destroying things, causing things to be hurt in some way. *Destructive* comes from the word *destroy*.

Hurricanes smash houses—



hurricanes roll cars around—



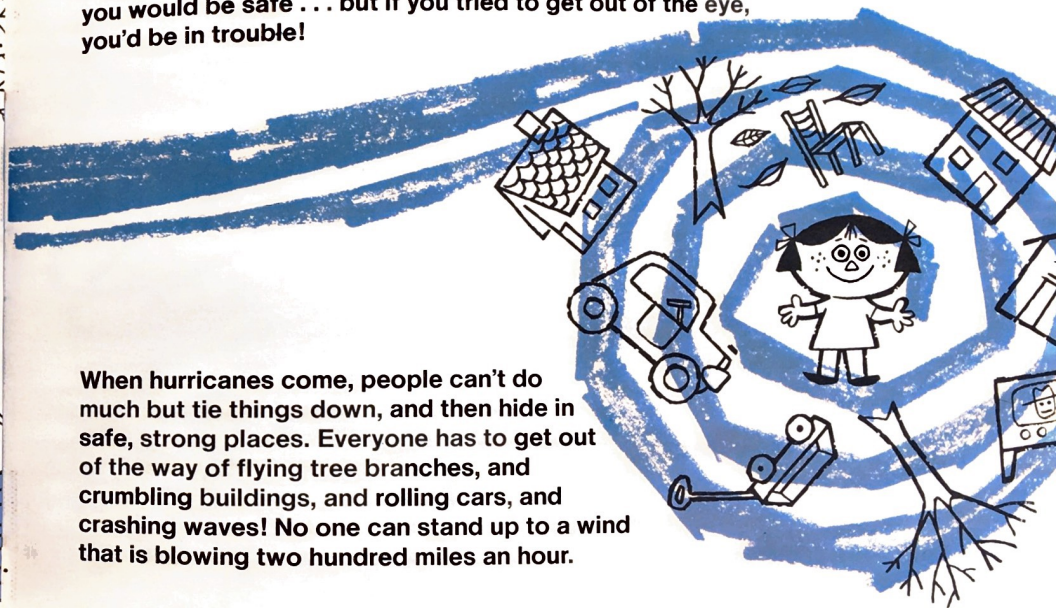
hurricanes wash huge crashing waves up on the beach houses and docks—



and do a lot more harm.

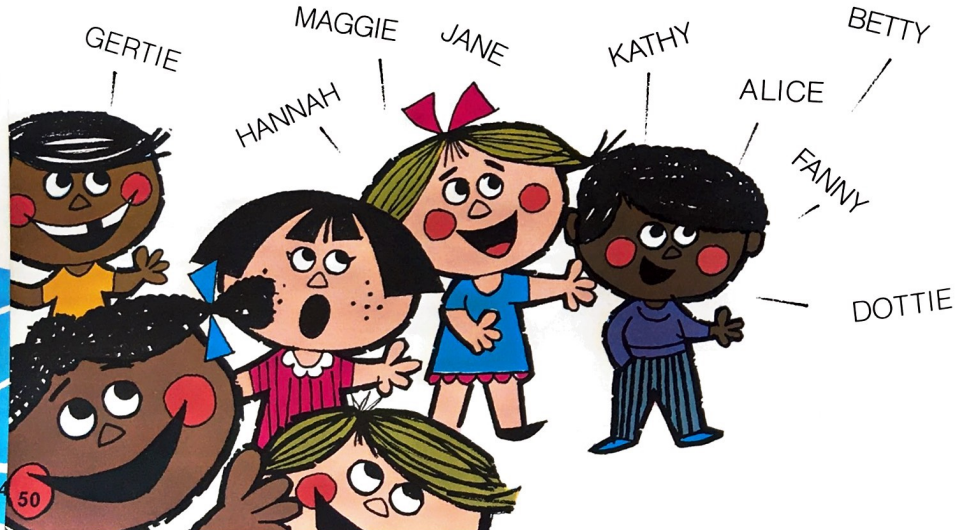
The winds in a hurricane go round and round, like water in a whirlpool. And this brings us to an odd fact about a hurricane: In the very middle of the hurricane is a place called “the eye of the storm.” And in the eye it is quite calm, there is no wind—even though the wind is howling and tearing on every side of the eye! So if you were in the eye of a hurricane, you would be safe . . . but if you tried to get out of the eye, you’d be in trouble!

When hurricanes come, people can’t do much but tie things down, and then hide in safe, strong places. Everyone has to get out of the way of flying tree branches, and crumbling buildings, and rolling cars, and crashing waves! No one can stand up to a wind that is blowing two hundred miles an hour.



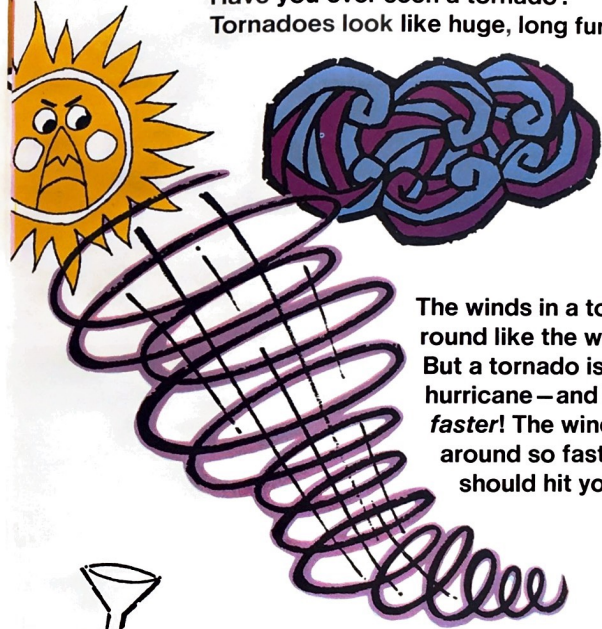
About ten hurricanes hit the United States every year. Each storm is given a name. And what do you think the storms are named after? . . . girls! The first hurricane of the year is given a girl's name beginning with the letter "A," the year's second hurricane is given a girl's name starting with the letter "B," and so on.

What name would *you* like to give a hurricane? Perhaps you have a very destructive little sister, named Susie, who breaks up all your things. If so, you probably think Hurricane Susie is a good name.



Hurricanes aren't the only storms in the United States that cause trouble.

Have you ever seen a tornado?  
Tornadoes look like huge, long funnels\* in the sky—



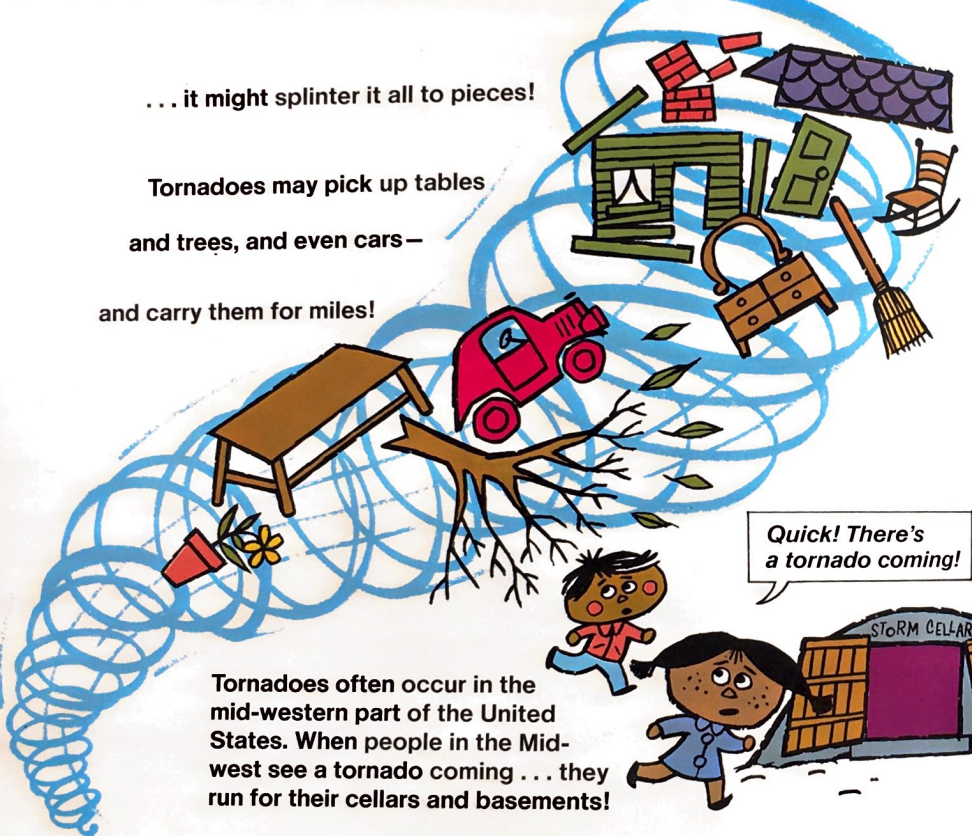
The winds in a tornado go round and round like the winds in a hurricane. But a tornado is much smaller than a hurricane—and its winds are even *faster!* The wind in a tornado goes around so fast, that if a tornado should hit your house . . .



\* Here is a *funnel*. We say that things with this shape are funnel shaped. Perhaps you've seen one in your kitchen.

... it might splinter it all to pieces!

Tornadoes may pick up tables  
and trees, and even cars —  
and carry them for miles!



Tornadoes often occur in the mid-western part of the United States. When people in the Mid-west see a tornado coming ... they run for their cellars and basements!

Rainstorms can be destructive, too. If too much rain falls, then there is too much water for the rivers and creeks to hold — and the water spills over the banks! We then have a *flood*! Water runs over streets, and lawns, and playgrounds! It pours into living rooms and bedrooms and basements! Mud washes over everything! In really great floods, people may have to sit on top of their houses, and rescue teams go from house to house in boats.

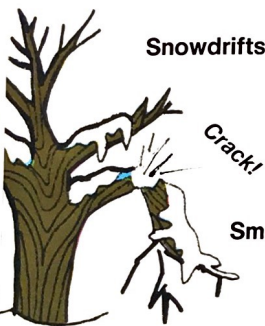
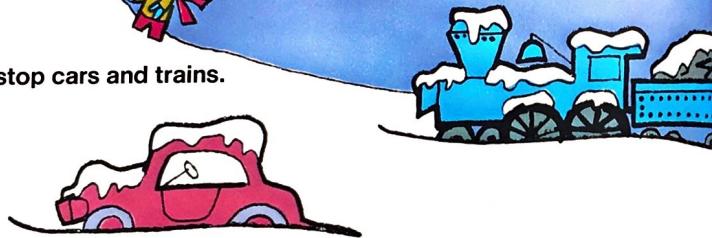


(It looks more fun than it really is. Imagine how you'd feel to find all your toys and clothes, and the things you like, spoiled by the water.)

Snowstorms can also cause trouble. In the mountains, snowstorms sometimes make snowdrifts *fifty* feet high! (A snowdrift is a mound of piled-up snow.)

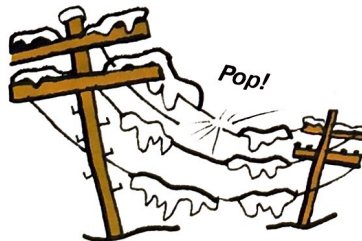


Snowdrifts can stop cars and trains.



Smaller snowdrifts can break tree branches—

and telephone wires.

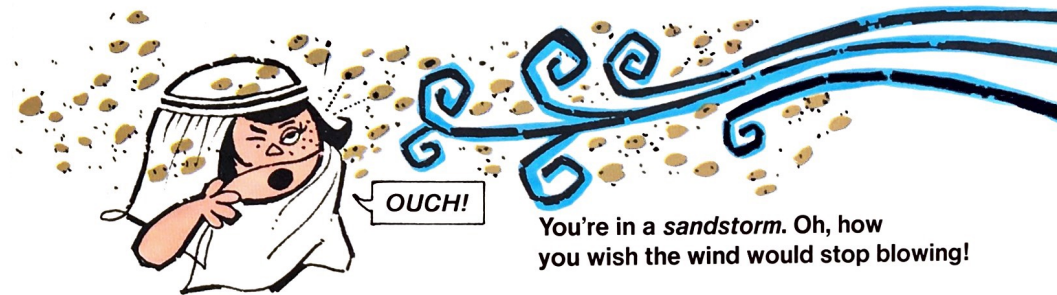


That's enough of snow. Let's have some heat.

Imagine that you are riding a camel across a desert. All you can see for miles and miles is sand, and sand, and more sand.



Suddenly, the wind begins to blow. It's blowing very hard. The wind is blowing the sand against your face! The sand stings and hurts! You pull a scarf across your face but you can still feel the stinging sand.



You're in a *sandstorm*. Oh, how you wish the wind would stop blowing!

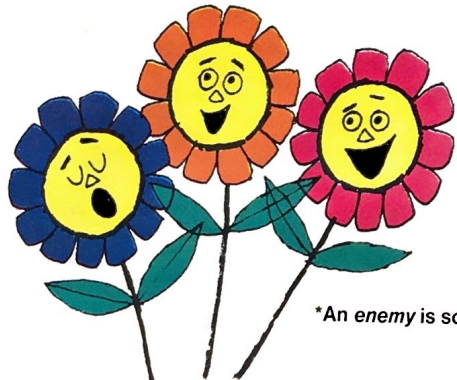
You can see that sometimes storms and wind can be our enemies.\*  
But many times they are our friends, too . . .

Wind can cool you off.



Boy! Nothing like a cool breeze after a baseball game.

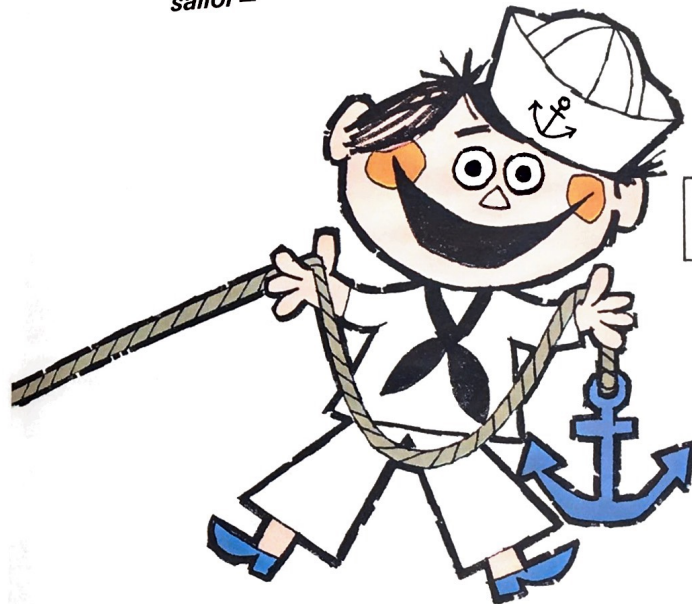
And storms bring rain to make plants grow.



APRIL SHOWERS  
BRING MAY FLOWERS!

\*An enemy is someone who works against you.

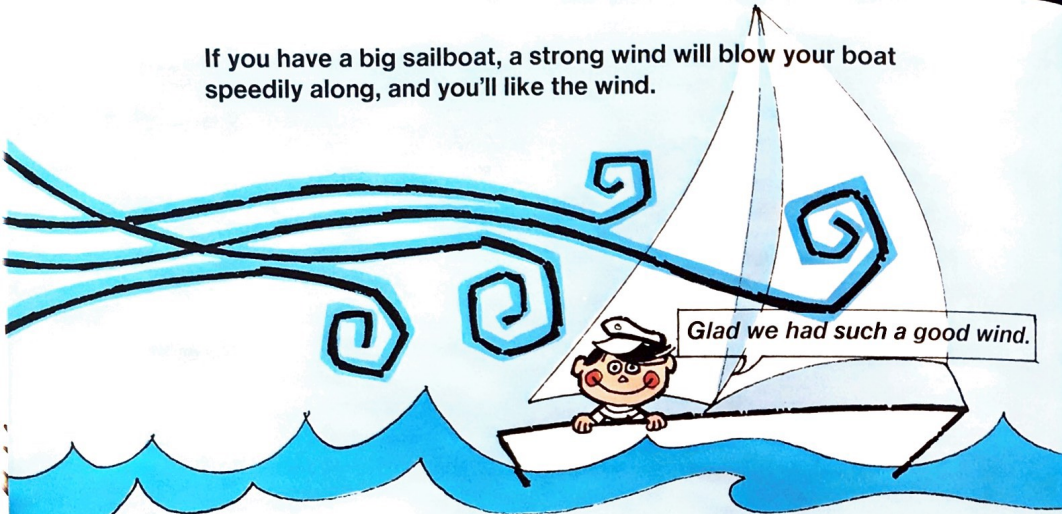
Sometimes the wind may be your friend, while it is an enemy to someone else. Or vice versa.\* For instance, suppose you are a sailor—



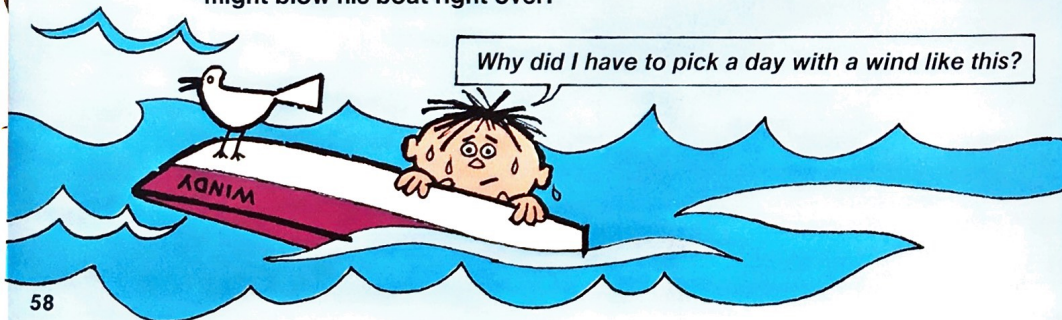
Wow! I've never been a sailor before!

\*Vice versa is a Latin word which we use sometimes when we want to say "the other way around." In this case, it would mean, "sometimes the wind may be your enemy, while it is a friend to someone else."

If you have a big sailboat, a strong wind will blow your boat speedily along, and you'll like the wind.



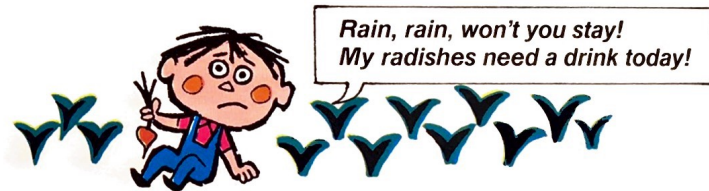
But suppose another sailor has a *small* sailboat. A strong wind might blow his boat right over!



And it is the same with rain. A heavy fall of rain might not be a friend to you, but it might be a friend to someone else. Suppose you are a farmer who grows hay, and you want to cut your hay today.



But the man who lives next door grows radishes.



Too bad it can't just rain on your neighbor's radishes and let the sun shine on your hay—so everyone could be happy. But that's the weather for you!



Whew!

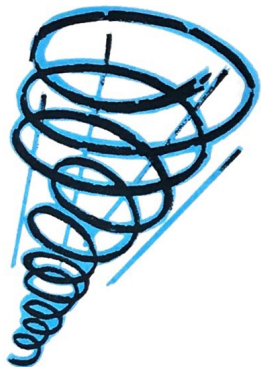
I've been blown over . . .



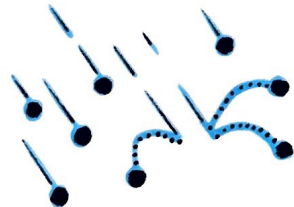
I've been snowed on . . .



I've been swept up in a tornado . . .

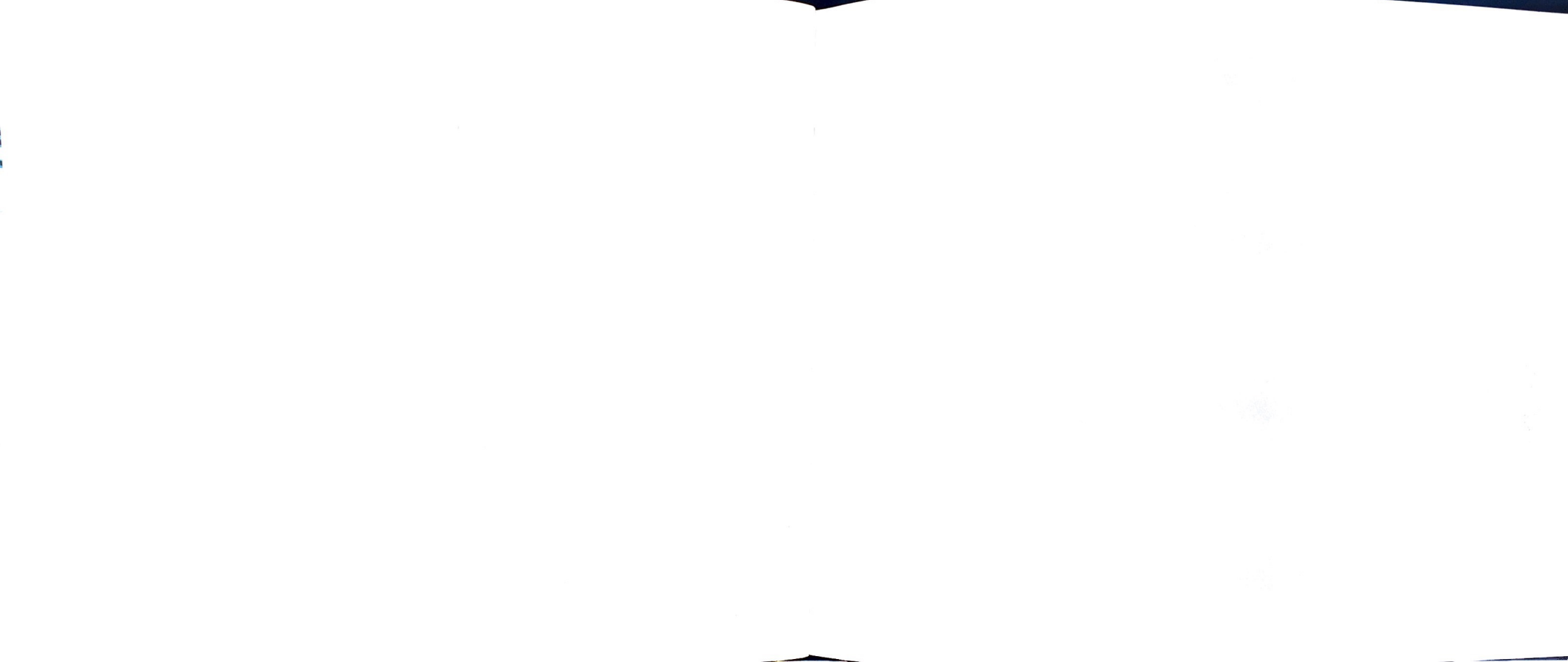


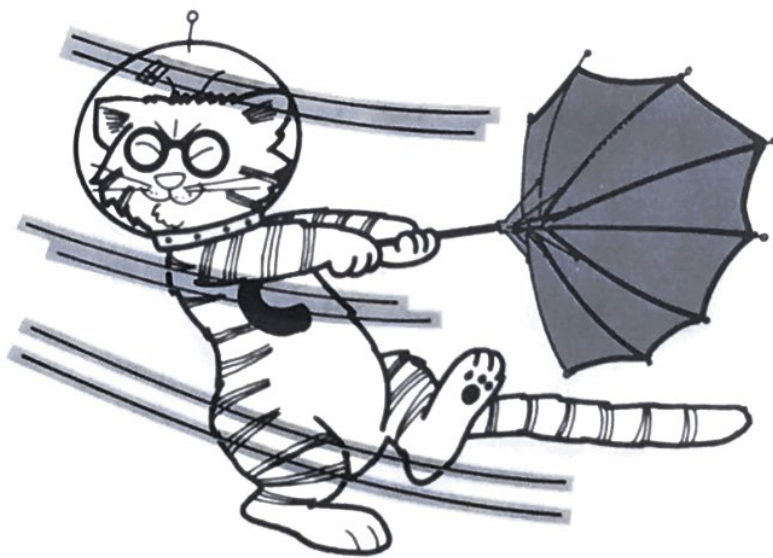
and a hailstone almost dented my space helmet.



Now it looks as if there's a thunderstorm coming . . . I'd better run.  
The things I go through to bring you these topic readers!







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