



Radka Piro · Aksana Rashetska

The Sky



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What you will find in this book

In the coming pages you will learn all about the sky—the sky you see every day. Do you think you already know all about it? Maybe not! Look closer and you'll see how remarkable it is. The sky is forever changing. It has hosted some thrilling events—humanity's first attempts at flight, some successful, some less so; feats of acrobatics and endurance by flying creatures; human space travel; weather both terrible and enchanting—telling many great stories along the way. Nothing compares to the sky!



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Browse these pages and let yourself be borne upwards. Read gradually from start to finish or jump to chapters that interest you most. Do the experiments. And don't forget to look up from the book at the sky from time to time!

Earth's cover

The atmosphere

We can think of the atmosphere as Earth's protective cover. It is a mixture of gases that protects us from the perils of radiation from space, keeps us warm, and allows us to breathe. Earth is the only planet known to support life—all thanks to its atmosphere.

KÁRMÁN LINE

It is generally agreed that space begins at a distance of 62 miles above Earth's surface.

The sky presents us with various spectacles: it can be bright blue with white clouds, a sorrowful gray, or a black expanse dotted with stars. We look at the sky through Earth's atmosphere and beyond that into space.

Exosphere

The outermost layer of the atmosphere, it is extremely cold. Because it gradually blends into space, opinions differ on where it ends.

Thermosphere

As its name suggests ("thermo-" means "heat"), this layer is very hot. Its temperature may exceed 3632°F! Even so, if you were in the thermosphere, you would feel cold, because there aren't enough gas particles to get the heat to you.

Mesosphere

The atmosphere's middle layer has enough gas molecules to create friction to set falling meteors alight, but not so many that you would be able to breathe freely. It is also very cold, with average temperatures of -120°.

Stratosphere

This very dry layer contains the **OZONE LAYER**, which absorbs harmful ultraviolet radiation from the Sun. Without this protection, life on Earth as we know it would not be possible.

Troposphere

This layer of the atmosphere—which begins at the Earth's surface—embraces our planet. It contains all the air plants need for photosynthesis and animals need to breathe, as well as almost all of the water vapor. It is here that processes occur that we refer to as weather.

International Space Station

aurora

satellites

Kármán line

flaming meteoroids

Wow, we're so high!

weather balloons

airplanes

living creatures

clouds

620 mi

310 mi

62 mi

50 mi

31 mi

7.5 mi

Clouds

Look at those fluffy clouds in the sky! Clouds are faithful guides. From above, they keep an eye on everything that moves. Where do they come from, and what do they tell us about the weather?



Where do they come from?

Clouds form thanks to the **WATER CYCLE**. As the Sun warms Earth's surface, water evaporates, then rises as water vapor. The water vapor cools at high altitudes, where it forms clouds by gathering around tiny dust particles in the air.

All the things clouds are

BEAUTIES OF THE NIGHT

They are known as noctilucent clouds. Composed of ice crystals, they are higher in the sky than other clouds. The crystals reflect light from the Sun, making the clouds glow.



IF I DON'T HOLD ON, I'LL FLY AWAY

Some clouds don't like to be alone in the vast sky: they need something to hold on to, such as the top of a mountain. They are called orographic clouds.

What is falling from them?



Rain

As you know, clouds are made up of water droplets. When these become large and heavy, the sky can no longer hold them, and they fall to the ground as rain.

Snow

Snowflakes form around a piece of dust or a speck of pollen. Surprisingly, they are made of ice. They are soft because they are made of tiny crystals.

Hail

Hailstones are frozen pellets that form when water droplets are swept up into cold storm clouds, freeze, gather more water, rise, and freeze. They can be pea- to grapefruit-sized.



DRAWING IN THE SKY

Airplanes often leave behind a contrail, which is basically an artificial cloud. Heated air from the plane's engine cools quickly, forming a line of "cloud."



NOTHING TO SEE

When a cloud forms almost at ground level, it becomes mist or fog.



OUR CLOUDS AREN'T ALONE IN THE UNIVERSE!

Other planets, including Jupiter, have clouds, too. However, they differ from ours in appearance.

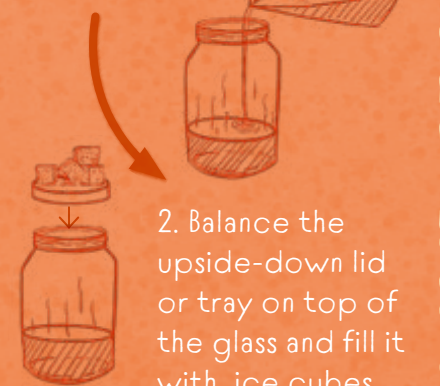
MAKE YOUR OWN CLOUD

You will need: a few ice cubes, a glass, a metal lid (or a small tray), hot water.



CAUTION! Do not use boiling water, which could cause the glass to crack.

1. Pour hot water into the glass.



2. Balance the upside-down lid or tray on top of the glass and fill it with ice cubes.

3. Watch water vapor form a cloud inside the glass. Remove the lid and watch the cloud escape from the glass.



TIP! Ask your parents to spray a little hairspray into the glass. This will make the cloud even more distinct.

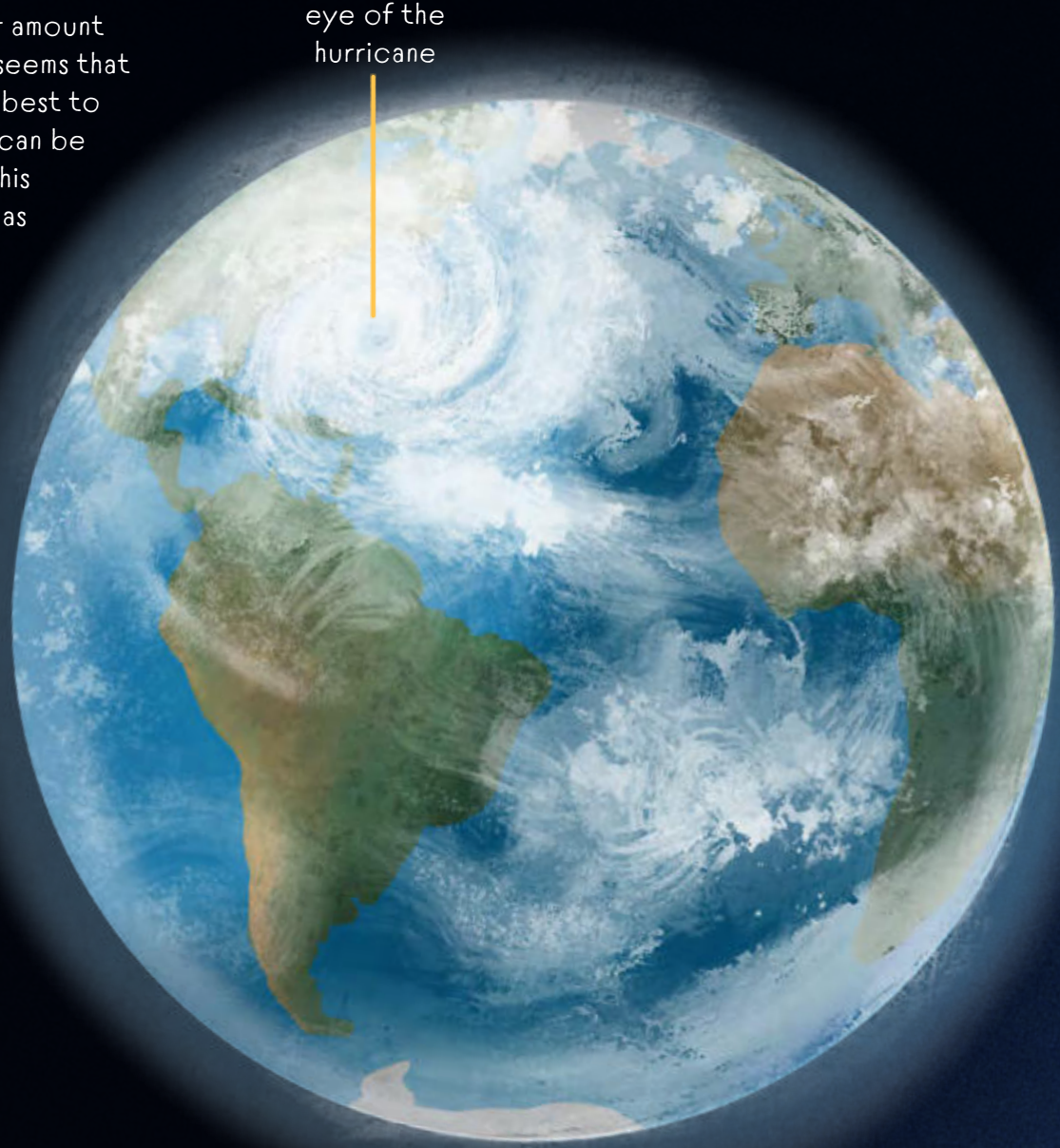
What makes them?

Have you ever thought that a cloud looks solid enough to stand on? A cloud may look like a white, fluffy blanket, but it is composed of water droplets or ice crystals, and can't hold your weight. The droplets reflect sunlight, making the cloud look white.



Extreme weather

The weather gives us a fair amount of trouble. Sometimes it seems that the heavens open. Then it is best to get out of the way. Winds can be incredibly strong. Add to this other inconveniences, such as persistent rainfall and the resulting floods. . . .



Tropical cyclones

Cyclones, typhoons, hurricanes—different names for powerful storms that take the form of a giant vortex. These monsters measure several hundred miles across, making them easy to see from space.

WHAT: A massive storm in the form of a vortex. Tropical cyclones cause terrible damage while serving an important function: they move heat from the equator to the poles, helping to maintain the planet’s climate.

WHERE: most commonly in equatorial regions

SIZE: typically around 300 mi in width, but can grow to more than 1000 mi

DURATION: several days or even weeks

PREDICTABILITY: Scientists can usually predict the path of hurricanes, but not the intensity.

WIND SPEED: This is rated on the **SAFFIR-SIMPSON SCALE**.

Tornadoes

Tornadoes begin inconspicuously and unpredictably and reach great speeds. These narrow columns of rotating air reach from the heavens to the ground. They dance across the landscape, sometimes causing enormous damage.

WHAT: a column of air in rapid rotation formed during a storm or hurricane

WHERE: on every continent except Antarctica. Most common in the USA, in a location referred to as “Tornado Alley.”

SIZE: from several yards to more than a mile across

DURATION: from a few seconds to several hours, but most commonly between 5 and 10 minutes. On average they travel 5 miles but may be yards or more than 200 miles.

PREDICTABILITY: We get only a few minutes’ notice of a tornado threat. Although tornadoes cannot be predicted, meteorologists monitor high-risk situations and places so as to ensure a timely reaction.

WIND SPEED: This is rated on the **ENHANCED FUJITA SCALE**.



A **WATERSPOUT** is a tornado over a body of water. It sucks water into itself.

DUST DEVILS are lively, coltish whirlwinds, smaller and less destructive than tornadoes.

ENHANCED FUJITA SCALE		EF-0	EF-1	EF-2	EF-3	EF-4	EF-5
		65-85	86-110	111-135	136-165	166-200	200 or higher
SAFFIR-SIMPSON SCALE		1	2	3	4	5	
		74-95	96-110	111-129	130-156	157 or higher	
<div><div></div><div>020406080100120140160180200220mph</div></div>							

Rulers of the skies

People in the past were fascinated by the power of storms and strange goings-on in the sky. It was widely believed that creatures who controlled the weather roamed the skies. It was also important not to anger the deities in the sky. Their names and characteristics depended on the sky-watchers' civilization.

The ancient Greeks believed that powerful gods oversaw the lives of humans from Mount Olympus. **ZEUS**, king of the gods, controlled the weather.

Many indigenous peoples of North America tell stories about a storm-bringing **THUNDERBIRD**. Bolts of lightning come from its beak, while claps of thunder come from the flapping of its mighty wings.

In Germanic legend, **THOR**, the god associated with lightning, is one of the most powerful. He unleashed storms using his hammer, Mjölnir.

Winged creatures

We find flying creatures in the stories of almost every culture of the world. Such creatures in myths and legends show that the idea of flight has always attracted humankind.

BABA YAGA **SLAVIC MYTHOLOGY**

Baba Yaga is a wicked old woman who flies in a mortar.

GRIFFIN **GREEK MYTHOLOGY**

The griffin is a creature from Greek and Persian mythology that is half-eagle, half-lion.

DRAGON

ASIAN, AZTEC, AND EUROPEAN MYTHOLOGY

The dragon is a large reptile, sometimes winged.

ROC

ARABIAN MYTHOLOGY

In Arabian mythology, the roc is a huge bird that can carry a human or an elephant.

Humans in the sky

The days when flight was only a dream are long gone. Today's skies burst with activity. Vehicles can deliver us to the heavens in a trice, and there are many air sports.



CAUTION!
Extremely dangerous!

BASE JUMPING

In this high-risk sport, people jump from high places, often wearing special clothing, and deploy a parachute to land.



PARACHUTING

This is jumping from an airplane, with a parachute to slow your fall.



PARAGLIDING

The pilot steers his paraglider on currents of air.



HANG GLIDING

Pilots launch from hills and can soar for hours.

UP TO THE SKIES

Hot-air balloons and airships are **LIGHTER-THAN-AIR** vehicles. They are filled with either gas or heated air, both of which are lighter than the surrounding air.

HOT-AIR BALLOON

How does such a balloon reach the skies? The secret is in warm air. A hot-air balloon has a propane burner that creates a flame to heat the air inside the balloon's envelope. This warmed air is lighter than the cold air around it, causing the balloon to rise.



Us in the balloon



Granny and Grandpa

A flight in a balloon is a great experience! Let's take a quick photo as a memento. Say cheese . . . *click!* The first ever aerial photograph, taken in 1858, was from a balloon. Even people with no real interest in flying could now see the world from on high.

Hi there!



TOO EXPENSIVE!



WHY (NOT) BY AIRSHIP?

Airships are easier to steer than balloons. Whereas a balloon simply drifts, an airship takes us exactly where we wish to go. Why don't we see more airships in the skies? The high cost of building and operating them is the main reason, as well as safety concerns. Some engineers continue to work to solve these problems.

Flying machines

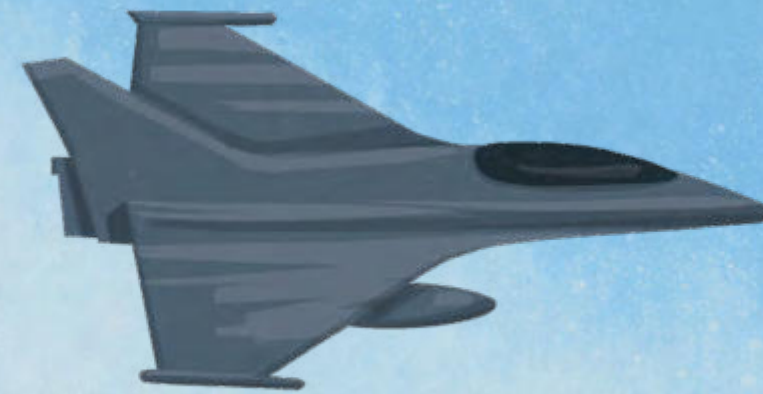
Aircraft come in different shapes and sizes and are used for a variety of purposes.



An **UNMANNED AIRCRAFT** is piloted remotely.



A **CONVERTIPLANE** is capable of vertical take-off and landing, like a helicopter.

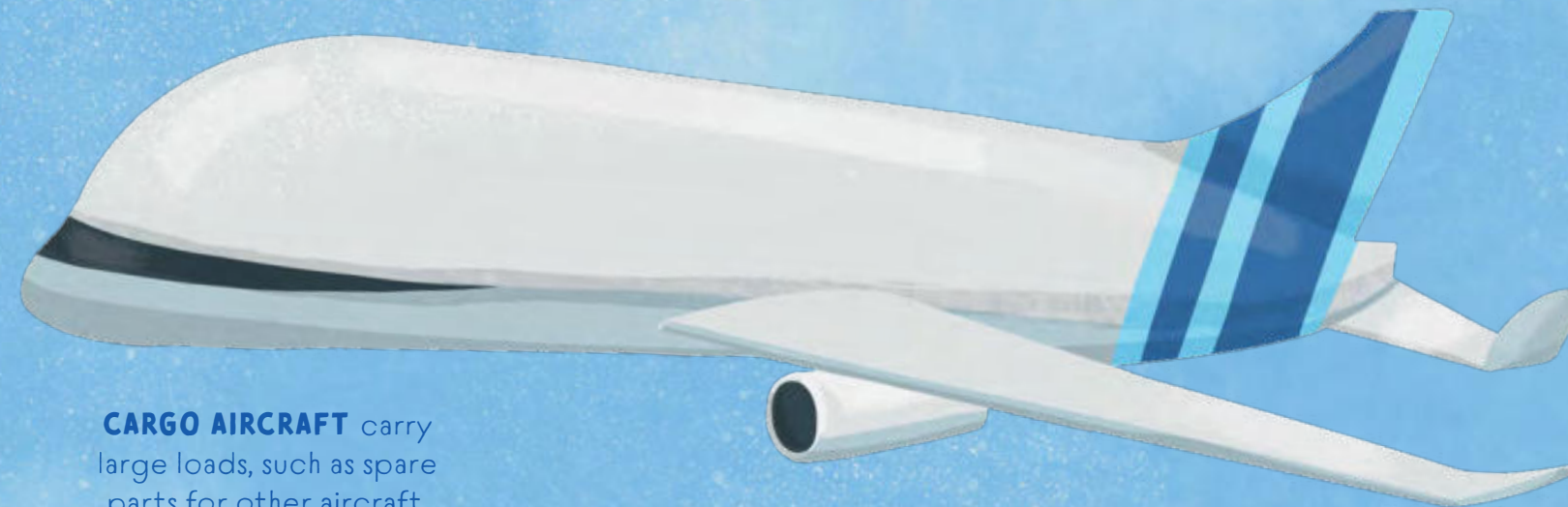


A **FIGHTER JET** is a military aircraft designed to attack enemy aircraft.



A **RESCUE HELICOPTER** rescues people in distress in hard-to-access terrain.

STEALTH AIRCRAFT cannot be detected by radar, unlike other airplanes.



CARGO AIRCRAFT carry large loads, such as spare parts for other aircraft.



A **GLIDER** doesn't have an engine. It uses air currents to fly.



A **FIRE-SERVICE HELICOPTER** carries water for fighting fires.



A **SEAPLANE** can land on and take off from water.

An **AIRLINER** transports passengers.



A view like no other

Is your neck aching? If it is, it is hardly surprising: we have spent a lot of time looking up at the sky. Let us now change things around and enjoy a view of the ground from on high. An aerial view is something special. . . .



The Solar System

Together with Earth, the planets that you can see in the night sky form what we call the Solar System. Its center point is the sun that shines over our heads during the day. The largest bodies that orbit the Sun are the planets.

MIGHTY SUN

The gravitational force of the Sun holds together the entire Solar System!

TINY MERCURY

AVERAGE TEMPERATURE: 333°F
DAY LENGTH: 1,408 hours
EXPECTED COLOR OF DAYTIME SKY: black

THE MOON

OUR EARTH

AVERAGE TEMPERATURE: 59°F
DAY LENGTH: 24 hours
COLOR OF DAYTIME SKY: blue

SUPER-HOT VENUS

AVERAGE TEMPERATURE: 867°F
DAY LENGTH: 5,832 hours
EXPECTED COLOR OF DAYTIME SKY: yellow-orange

GIANT JUPITER

AVERAGE TEMPERATURE: -166°F
DAY LENGTH: 10 hours
EXPECTED COLOR OF DAYTIME SKY: pale blue

RINGED SATURN

AVERAGE TEMPERATURE: -220°F
DAY LENGTH: 11 hours
EXPECTED COLOR OF DAYTIME SKY: yellow

FREEZING URANUS

AVERAGE TEMPERATURE: -320°F
DAY LENGTH: 17 hours
EXPECTED COLOR OF DAYTIME SKY: deep blue

DISTANT NEPTUNE


AVERAGE TEMPERATURE: -330°F
DAY LENGTH: 16 hours
EXPECTED COLOR OF DAYTIME SKY: bright blue

The sky above the planets

Our sky is unique. Other planets have what we might call a sky, but theirs look quite different from Earth's. They are of a different color, and some have storms that last hundreds of years, or clouds that rain acid or diamonds. Their view of the stars, too, is different from Earth's.

Rocky planets and gas giants

The planets are neatly divided into two groups according to type. The first four—Mercury, Venus, Earth, and Mars—are the so-called **TERRESTRIAL** or rocky planets. They are located closest to the Sun, and their surface is firm enough to walk on. The remaining four—Jupiter, Uranus, Saturn, and Neptune—are called **GAS GIANTS** because they don't have hard surfaces and are mostly made up of various gases, such as helium and hydrogen. A nice walk on their swirling gas surface would be out of the question!



This book is about the sky. But what exactly is the sky? The answer may seem obvious, but it is difficult to explain. The words “sky” and “heavens” have many meanings, and loom large in our stories and our daily lives. The sky was here before we were, and space was here before our planet, so when did the sky become the sky? Let’s set out to explore the sky, from all angles, some real, some imaginary.

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