

multi-age format
WONDERS *of* CREATION

THE NEW

WEATHER

MICHAEL OARD

BOOK

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How to use this book: *The New Weather Book* has been updated and developed with three skill levels in mind. These can be utilized for the classroom, independent study, or homeschool setting and also be customized per the abilities of the student.

It is recommended that every reader examine the text on the white background, as this is the basic skill level information related to the material. More proficient students and those with increased interest in the subject matter can then proceed to the more advanced concept levels. Additionally, the most advanced readers, after having read through all levels of the material, can use the upper-level material as a springboard for independent research and other educational assignments (research papers, oral reports, presentations, imaginative projects, etc.).

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The basic level is presented for younger readers and includes the various Safety Tips segments indicated by this icon: 
Level 2
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Level 3
This upper level incorporates more advanced concepts and theories related to all subject matter included in the text, as well as unique information that will inspire additional research or learning about advancements in meteorology or specific weather-related activities.

Whether using the material as a unit study, part of a curriculum, simply a book of interest, or even a reference book for other materials, *The New Weather Book* will engage students with amazing visuals and facilitate learning through helpful charts and diagrams where needed. As always, whether discussing weather facts, history, or its many interesting features, God's place as Creator is honored within this informative study.

01

God Created

There are days when the sun shines from a cloudless sky and warm breezes cause the leaves to flutter. Other days are gray, cloudy, and rainy. What we decide to do for the day often depends upon the weather. If it is cold and dreary on Saturday, we play inside. A heavy snow inspires us to build a snow fort. The weather also determines how we dress for the day.

Weather affects your moods. A gentle breeze and sunny skies make you cheerful. Have you noticed the bright smiles a sunny day brings, especially after bad weather? But when the wind whistles around the corners of your home or howls down your chimney, you feel anxious.

Weather affects our decisions. It determines what we wear to school. Businessmen listen to the weather report so they can plan work more effectively. If your father is a cement contractor, he needs to know if it is too cold, or too wet, to pour his cement. Airports need to know weather conditions so they can advise pilots.



atmosphere	latitudes
axis	nitrogen
carbon dioxide	oxygen
climate	tide

Level 1 | Level 2 | Level 3

Jesus the Creator

The Bible tells us in John 1:10 that Jesus created everything: *“He was in the world, and the world was made through him, yet the world did not know him.”* The Apostle Paul says in the first chapter of the Book of Colossians that He created the atmosphere and the weather: *“For by him all things were created, in heaven and on earth, visible and invisible, whether thrones or dominions or rulers or authorities—all things were created through him and for him.”* (Colossians 1:16).

God used His infinite wisdom to create this earth. From the smallest to the largest features of creation, He displays His intelligence, love, and careful attention to detail. Our world was specially created with design and purpose. In many other ways, Jesus made sure that this world would be a good home for us. For those who choose to listen, all creation shouts of His wondrous works and His love: *“For his invisible attributes, namely, his eternal power and divine nature, have been clearly perceived, ever since the creation of the world, [a] in the things that have been made. So they are without excuse.”* (Romans 1:20).

When we know more about God’s order in creation, we can predict the number of hours of daylight, the seasons, and the weather. His order is seen as the sun rises and sets, marking each day. Seasons have come and gone since creation. Life-sustaining rain and snow regularly water the world around us. Weather is part of the system God uses to preserve and nourish His plants and animals. In this way He makes the planet liveable for humans. It is only because God gave us an ordered planet that we can predict the weather.



Why Dangerous Weather?

Sometimes the harmony we have come to expect in nature appears out of whack. A terrible storm destroys homes and crops. Hail pelts a field of grain and destroys a farmer’s crops and income within minutes. A sudden tornado crushes a mobile home. A winter blizzard ties up traffic and breaks electrical lines, causing power outages.

Have you ever wondered why God, who is so good, allows His creation to be briefly interrupted by short periods of dangerous weather? We find the answer in the Old Testament Book of Genesis. There is another principle at work in our world. It is called the sin principle. God, in the beginning declared His creation “very good.” It was perfect. There was no death or sickness. The lion and the lamb were friends. Instead of the lion eating the lamb, he ate plants. Best of all, the weather was lovely everywhere. There was perfect order and harmony.

Chapter 3 of the Book of Genesis then tells how this all changed. Adam and Even were given a choice. With a little help from Satan, they disobeyed God’s only command — to not eat the fruit from “the tree of the knowledge of good and evil” (Genesis 2:17). You may wonder why God gave them any command at all. For them to be best friends with God, Adam and Even needed to be free. You would not want a best friend who was forced to love you. It’s difficult to have a loving relationship with someone who has no choice. God gave Adam and Eve the freedom to choose, but they wanted it all. They thought they would be like God. They chose to know both good and evil. They couldn’t have it both ways because God is all good. They had to leave paradise.

The world they entered as a result of their choices was very different. They came to know evil. Animals ate each other, people died, and sometimes the weather went crazy. As the Bible says, death entered the world. Now we have good and evil living side by side. We cannot judge Adam and Eve too harshly. We very likely would have done the same thing.

God's laws are all good. If we choose to love and obey His commands, we will experience the harmony, love, and joy a good relationship with Him brings. We will also enjoy good relationships with other people. That is what God desires for us.

So we see that the world changed because of Adam and Eve's choices. As a result, we sometimes experience dangerous storms and other difficulties. But God showed us His mercy by offering us forgiveness through a Savior, Jesus. He also gave us minds so we can learn about the laws governing the weather and to predict storms.



The Anthropic Principle

God's created the universe and world just right to sustain life on earth. This is called the anthropic principle and is powerful evidence for God's existence and love for us.

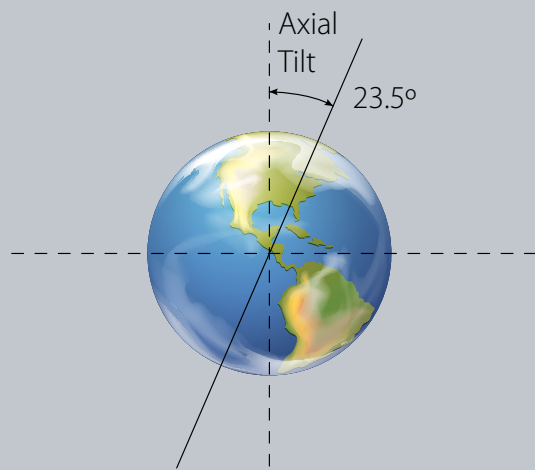
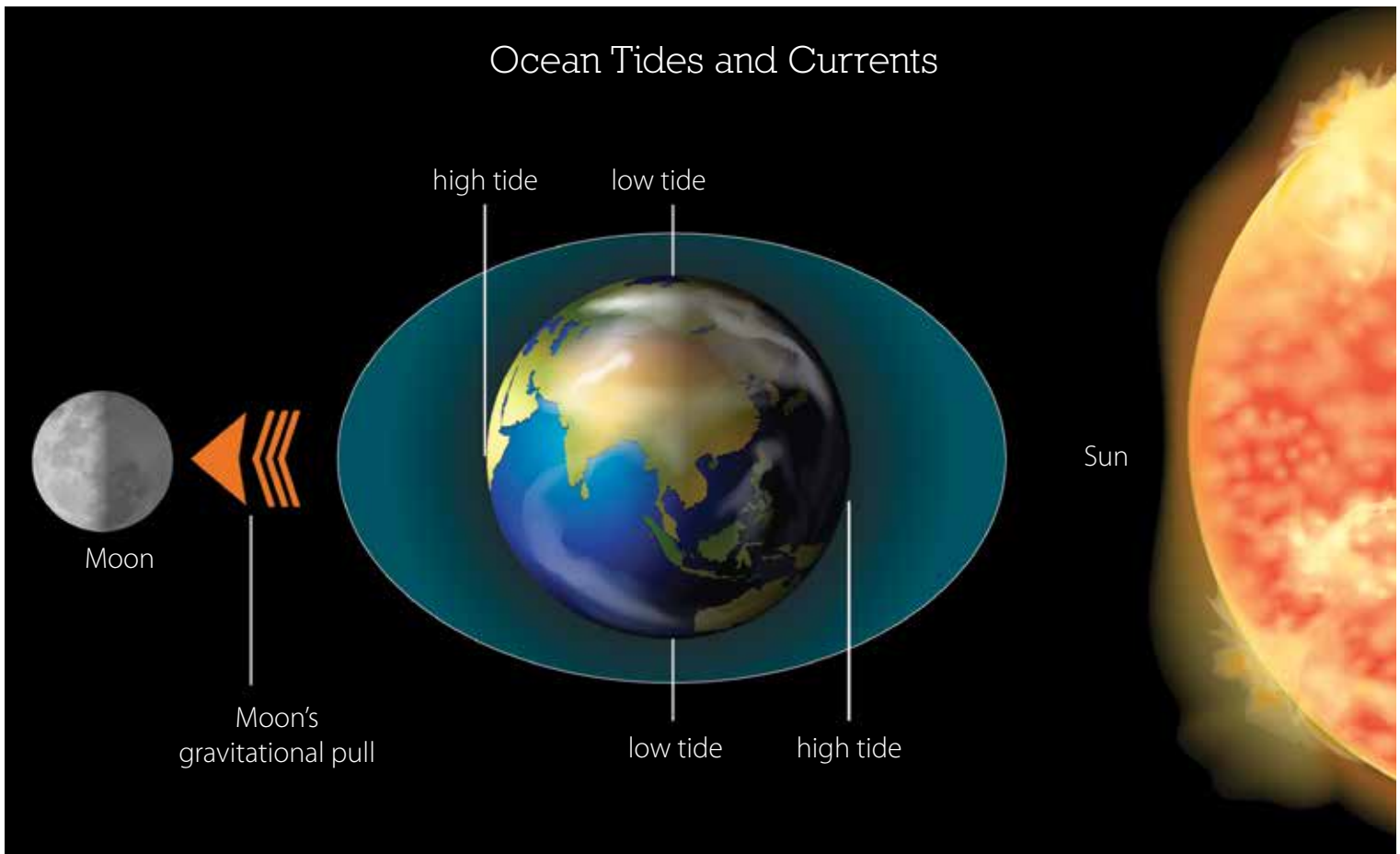
God placed the moon 240,000 miles (384,000 km) away from the earth — exactly the right distance to cause small tides in the ocean. If the moon were a little closer, it would cause severe tides and flooding. If the moon were only 50,000 miles (80,000 km) away instead of 240,000 miles, the tides would cover most of the continents — twice a day! If the moon were farther away, much of the ocean would become heavily polluted. Tides mix the ocean water. The mixing helps to keep the oceans fresh by exposing more of the water to sunlight and by dispersing pollution. The amount of water in the ocean is important as well, because the oceans are large enough to dilute the pollution.

Did you know that the sun is 400 times the size of the moon, and its distance is 400 times the distance of the moon from the earth? That is why the sun and moon, the greater and lesser lights of Genesis 1:16, look the same size in the sky. This amazing fact also accounts for solar and lunar eclipses.

The earth spins on its axis at just the right speed — once around every day. If it spun slower, the light side would be too hot for life, and the dark side would be too cold. If the earth spun any faster, it would cause fierce winds to blow.

If the tilt of the earth's axis (23.5°) were smaller, the higher latitudes would be too cold, and an ice age would develop. If the tilt were greater, surface temperatures would fluctuate wildly, more so than today, making the climate more unstable. The tilt gives us our seasons. Summers are long enough for us to grow food. Winter provides a period of dormancy needed for many plants.

Ocean Tides and Currents



God placed just the right amount of water vapor and carbon dioxide in the atmosphere. Our ocean is the right size to maintain the proper balance of water vapor in the atmosphere. These gases cause the earth to act like a giant greenhouse. If there were much less of these gasses, the earth would be too cold. Although these invisible gases make up about 0.1 percent of the atmosphere, they cause the earth to be about 60°F (33°C) warmer. If there were much more of these gases, the earth would be too hot.

God put exactly the right amount of oxygen in the atmosphere. The atmosphere is composed of about 21 percent oxygen, 78 percent nitrogen, 0.9 percent argon, and about 0.1 percent water vapor and carbon dioxide. If there were more oxygen, the processes in our bodies would react too fast. More oxygen would cause fires to burn too quickly. Forest fires would rage completely out of control. If there were less oxygen in our atmosphere, processes in our bodies would operate too slowly.

The atmosphere's thickness protects us from the 20 million meteors that hit the earth each day at speeds averaging 10 miles/sec (16 km/sec). The vast majority burn up before they reach the ground. The atmosphere also absorbs practically all the harmful cosmic rays that bombard the top of the atmosphere.

God even made the earth just the right size for gravity to hold earth's water and the atmosphere in place.

02

What Causes Earth's Weather



Weather is the momentary condition of the air. Besides temperature and precipitation, it includes wind direction and wind speed, visibility, the amount of water vapor, air pressure, cloud conditions, and air quality. Precipitation is moisture that falls from the sky in the form of rain, freezing rain, snow, hail, or drizzle. Air quality is determined by how much dust, haze, or pollution is in the air.

The weather also depends on the latitude and how close to the ocean you are. Summer temperatures are cooler in northern Europe than in southern Europe. During winter in the Northern Hemisphere, it is usually very cold in Saskatchewan, Canada, while in Texas the weather is mild. It makes a difference whether you live in Seattle, Washington, close to the ocean, or in Bismarck, North Dakota, far from the ocean at the same latitude. Seattle is kept mild by a flow of air from off the Pacific Ocean.



- arid
- barometer
- condensation
- dew point
- Doppler radar
- equator
- low-pressure system
- ice cap
- meteorologist
- precipitation
- weather balloon

Level 1 | Level 2 | Level 3



The Weather “Engine”

The sun is the ultimate cause of weather because of the differences in heating on the earth. This is why the sun with its differences in heating is called the weather engine. As sunlight enters the atmosphere, its rays are either absorbed by the air or reflected back to space from the white clouds. Sunlight that makes it to the ground is both absorbed and reflected. Most of the reflected light goes back into space. The sunlight absorbed at the earth’s surface heats the ground. As the surface warms, it heats the atmosphere above it.

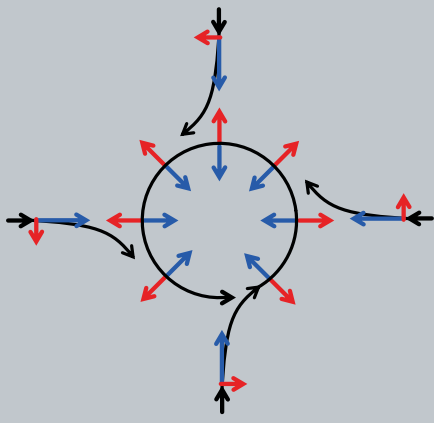
The ground and atmosphere continually lose heat by infrared radiation (invisible rays that cool the land at night). Many of these infrared rays are absorbed by the atmosphere, but those

that escape into space cause the cooling. Clouds act like a blanket to keep the earth warmer at night. They absorb most of the infrared radiation and redirect some of it back to the ground. As a result, the ground and air below the clouds do not cool off much at night.

The infrared radiation cools the earth at night. When the sun comes up, the sunshine warms the ground and air. This is why the air cools at night and warms during the day. If the days are long and the nights short during summer, more heat is gained by sunshine than is lost by infrared radiation in a 24-hour period. So temperatures warm as summer approaches. It works the opposite in winter. The shorter days and longer nights result in more loss

of heat in a 24-hour period. As winter comes, temperatures become colder.

The difference between daytime sunshine and nighttime infrared cooling also causes temperature differences between the tropics and polar latitudes. These temperature differences cause air pressure changes, which push the earth’s winds. Air blows from high pressure to low pressure. For example, the air inside a tire is at a higher pressure than the atmosphere. There are more air molecules per cubic inch or cubic centimeter in the tire than in the atmosphere. So when you loosen the valve, the air flows out of the tire. It works the same way in the atmosphere.



A low-pressure system over Iceland spins counterclockwise due to balance between the Coriolis force and the pressure gradient force.

The Coriolis Force

Because of the earth spinning on its axis, air flow in the atmosphere is more complicated. The spin causes air to move to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. This deflecting force on the air is called the Coriolis force. As air blows from high to low pressure, the Coriolis force causes air to circulate in a spiral around a low-pressure center. The air spirals counterclockwise around a low center in the Northern Hemisphere and clockwise in the Southern Hemisphere. Because the air is spiraling toward the center of the low, it is forced upward, forming clouds and precipitation. Practically all precipitation is formed from upward-moving air.

The Coriolis force in the Northern Hemisphere is like a disk rotating counterclockwise. Pretend you are at the center of the disk. If you throw a ball toward a target on the edge of the disk, the ball will miss to the right. It will appear that the ball was deflected to the right. What really happened was that as the ball reached the edge, the disk rotated to the left underneath the ball. It works the same in the atmosphere as the earth rotates.

