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科学探索丛书

EARTH SCIENCE

地球科学

Weather and Climate

天气与气候

REBECCA L. JOHNSON (美) 著

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Introduction 4

引言

Spiral in the Sky

空气中的旋涡

Chapter 1 6

第一章

The Restless Air

永不平静的空气

Chapter 2 12

第二章

Water, Water Everywhere

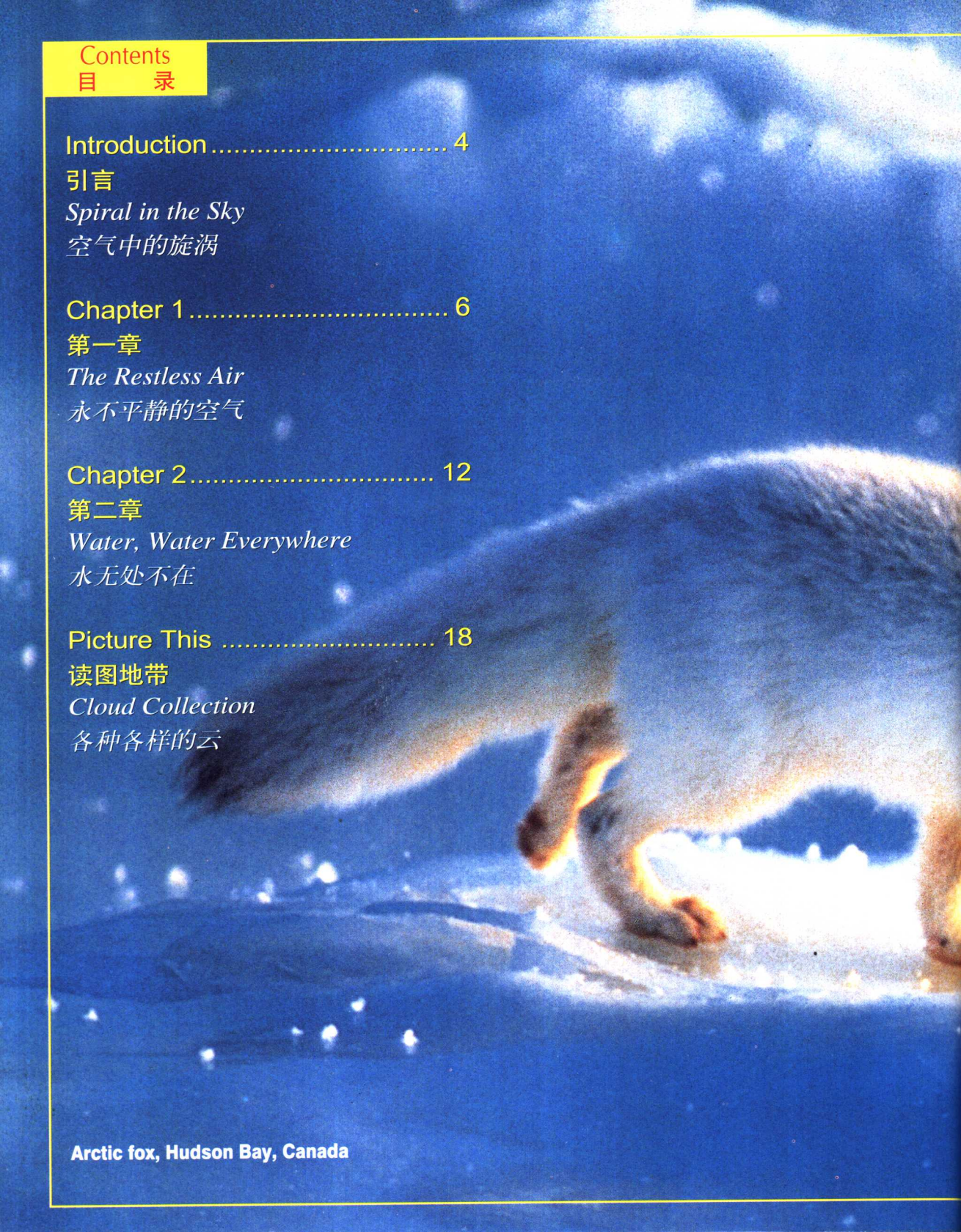
水无处不在

Picture This 18

读图地带

Cloud Collection

各种各样的云





Chapter 3..... 20

第三章

Cloudy with a Chance of Rain...

多云，可能有雨……

Thinking Like a Scientist..... 27

像科学家一样思考

Hands-on Science 28

亲身实践

Building a Barometer

制作气压计

Science Notebook 30

科学备忘录

Index..... 31

索引

Introduction ·
引言

Spiral in the Sky

空气中的旋涡

On October 21, 1998, masses¹ of clouds began to swirl² above the Caribbean Sea³. During the next few days, the clouds gradually⁴ formed an enormous⁵ spiral hundreds of kilometers across—and Hurricane Mitch⁶ was born.

On October 29, Hurricane Mitch came ashore⁷ in Honduras⁸. Winds shrieking⁹ along at 250 kilometers an hour (155 mph) ripped apart¹⁰ houses, tore boats from their docks¹¹, and stripped¹² trees of their leaves. The storm drenched¹³ the land with rain—as much as 64 centimeters (25 inches) in a single¹⁴ day. In neighboring countries, roads, bridges, and buildings washed away. Banana, coffee, and citrus¹⁵ crops disappeared¹⁶. The heavy rains triggered¹⁷ mudslides¹⁸ that roared¹⁹ down mountainsides and buried²⁰ entire²¹ villages in black mud.



Hurricane Mitch, one of the deadliest hurricanes of the past century, left at least 11,000 people dead. Thousands more were missing and millions lost their homes. Billions of dollars' worth of damage²² occurred²³ throughout Central America.

No matter what form weather takes—from a warm, sunny, beautiful day to a raging²⁴ hurricane—it affects each of us. In this book you will take a closer look at weather. So get set to become weatherwise²⁵.

1. mass	<i>n.</i>	(聚成一体的)团	14. single	<i>adj.</i>	一个的
2. swirl	<i>v.</i>	旋转; 打转	15. citrus	<i>n.</i>	柑橘属果树
3. Caribbean Sea		加勒比海	16. disappear	<i>v.</i>	消失
4. gradually	<i>adv.</i>	逐渐地	17. trigger	<i>v.</i>	引起; 促使
5. enormous	<i>adj.</i>	巨大的	18. mudslide	<i>n.</i>	泥石流
6. Hurricane Mitch		米奇飓风	19. roar	<i>v.</i>	呼啸
7. ashore	<i>adv.</i>	上岸; 上陆地	20. bury	<i>v.</i>	埋葬; 掩埋
8. Honduras		洪都拉斯	21. entire	<i>adj.</i>	全部的; 整个的
9. shriek	<i>v.</i>	尖啸	22. damage	<i>n.</i>	损失
10. rip apart		把……弄得凌乱不堪; 使裂开	23. occur	<i>v.</i>	发生
11. dock	<i>n.</i>	码头; 船坞	24. raging	<i>adj.</i>	狂暴的; 凶猛的
12. strip	<i>v.</i>	剥去; 除去	25. weatherwise	<i>adj.</i>	善于预测天气的
13. drench	<i>v.</i>	使湿透; 浸湿	26. whirl	<i>v.</i>	旋转

Hurricane Mitch whirls²⁶ over the Caribbean in October 1998.

The Restless Air

永不平静的空气

*Your alarm¹ goes off². A new day begins. What will you wear?
What will you do? Your answers depend on the weather.*

- | | | |
|--|-------------|-----------|
| 1. alarm | <i>n.</i> | (闹钟的)闹铃 |
| 2. go off | | 发出响声 |
| 3. colorful | <i>adj.</i> | 多彩的 |
| 4. Washington State
International Kite Festival | | 华盛顿州国际风筝节 |

Colorful³ kites fill the sky at the Washington State International Kite Festival⁴.

Weather affects our lives in many different ways. For many people, knowing what the weather will do in an hour, a day, or a week is important. Airline pilots¹ know how fast and from what direction² winds are blowing before they take off³ and land. People who fish are aware of⁴ storms brewing⁵ out at sea. Farmers wait for dry weather to start harvesting their crops.

You probably talk about the weather at least once every day. Just what is weather? In simple terms, weather is what is happening in the air around you.

Earth is surrounded⁶ by a blanket⁷ of air called the atmosphere⁸, which extends⁹ some 1,000 kilometers (625 miles) or so from the planet¹⁰'s surface¹¹. However, weather—clouds, storms, wind, rain, and snow—occurs only in the troposphere¹², the very lowest part of the atmosphere.

1. pilot	<i>n.</i>	飞行员	9. extend	<i>v.</i>	延伸
2. direction	<i>n.</i>	方向	10. planet	<i>n.</i>	行星(此处指地球)
3. take off		起飞	11. surface	<i>n.</i>	表面
4. be aware of		意识到, 知道	12. troposphere	<i>n.</i>	对流层
5. brew	<i>v.</i>	(风暴等)酝酿; 即将发生	13. stratosphere	<i>n.</i>	平流层
6. surround	<i>v.</i>	围绕; 环绕	14. mesosphere	<i>n.</i>	中间层
7. blanket	<i>n.</i>	覆盖层; 似毯子的东西	15. thermosphere	<i>n.</i>	热层
8. atmosphere	<i>n.</i>	大气层	16. exosphere	<i>n.</i>	外逸层

Earth's Atmosphere

Exosphere¹⁶

Thermosphere¹⁵

Mesosphere¹⁴

Stratosphere¹³

Troposphere

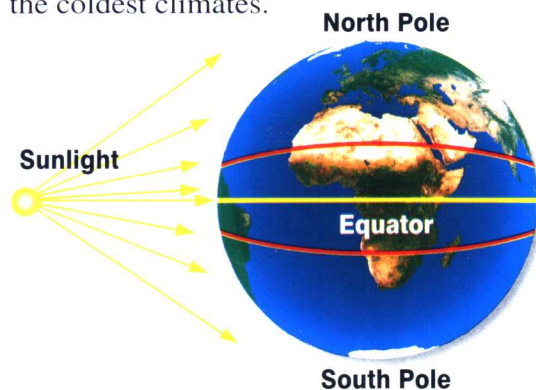
Weather or Climate?

Weather is powered¹ by the sun heating Earth. This heat energy² is responsible for³ creating different climates in different places on Earth. While weather changes from day to day, climate is a region⁴'s general pattern⁵ of weather over a long period of time.

Why is the climate at the North Pole⁶ so different from the climate of an island near the Equator⁷? The most important reason is the difference in the intensity⁸ of sunlight these two places receive.

How would you describe the climate where you live?

Because Earth's surface is curved⁹, the sun's rays¹⁰ strike¹¹ different parts of Earth at different angles¹². The rays strike Earth more directly—and more intensely¹³—near the Equator than at the Poles. So places near the Equator, often called the tropics¹⁴, have the warmest climates. Those near the Poles have the coldest climates.



1. power	v.	给……提供动力	13. intensely	adv.	强烈地
2. heat energy		热能	14. tropics	n.	热带地区
3. be responsible for		对……负有责任	15. mild	adj.	(天气等)温暖的; 暖和的
4. region	n.	地区; 地带	16. Winnipeg		温尼伯
5. pattern	n.	型; 模式	17. Manitoba		马尼托巴省
6. North Pole		北极	18. roughly	adv.	大体上; 大约
7. Equator	n.	(地球)赤道	19. ocean current		洋流
8. intensity	n.	强度	20. Gulf Stream		湾流
9. curved	adj.	弯曲的; 曲线形的	21. inland	adj.	内陆的
10. ray	n.	光线	22. height above sea level		海拔高度
11. strike	v.	到达	23. spot	n.	地点
12. angle	n.	角度			

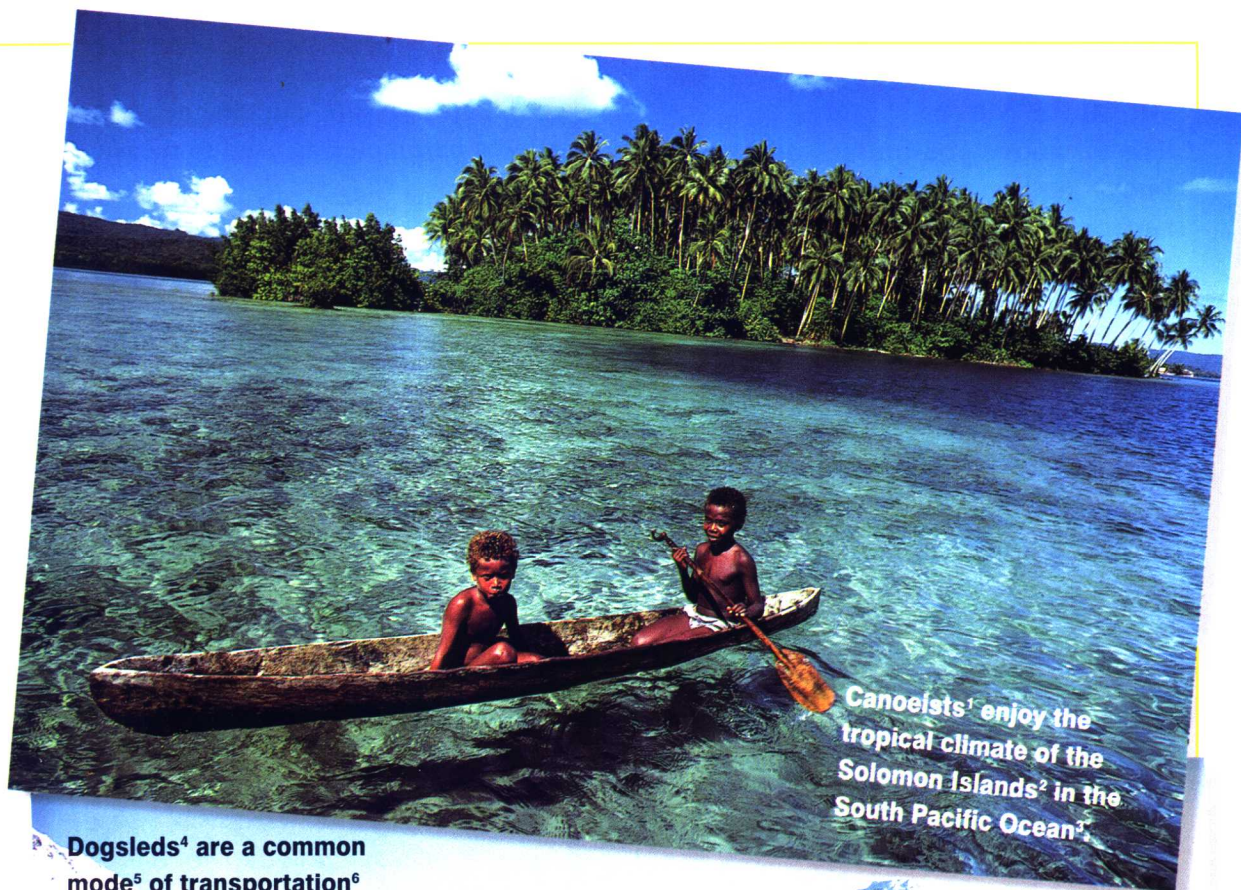
Interesting Questions

Q: London, England, has a milder¹⁵ climate than Winnipeg¹⁶, Manitoba¹⁷, Canada. But these two cities are roughly¹⁸ the same distance from the North Pole. What's the deal?

A: Even though London is as far north as Winnipeg, London is on an island warmed by a mild ocean current¹⁹, called the Gulf Stream²⁰. Places close to the ocean or some other large body of water usually have a milder climate than places far inland²¹.

Q: How does height above sea level²² affect climate?

A: Usually the higher you go, the cooler the climate. A spot²³ near the top of a tall mountain has a cooler climate than one near the mountain's base.



Canoeists¹ enjoy the tropical climate of the Solomon Islands² in the South Pacific Ocean³.

Dogsleds⁴ are a common mode⁵ of transportation⁶ in the polar climate⁷ of Greenland⁸.



- | | | |
|------------------------|-----------|--------|
| 1. canoeist | <i>n.</i> | 划独木舟的人 |
| 2. Solomon Islands | | 所罗门群岛 |
| 3. South Pacific Ocean | | 南太平洋 |
| 4. dogsled | <i>n.</i> | 狗拖的雪橇 |
| 5. mode | <i>n.</i> | 方式 |
| 6. transportation | <i>n.</i> | 运输 |
| 7. polar climate | | 极地气候 |
| 8. Greenland | | 格陵兰岛 |

Air on the Move

The air above you presses down on your body—and on everything else on Earth's surface. This is called air pressure¹. However, the air doesn't always push down with exactly² the same amount³ of force. In other

words, air pressure can change. A device⁴ called a barometer⁵ is used to measure⁶ air pressure.

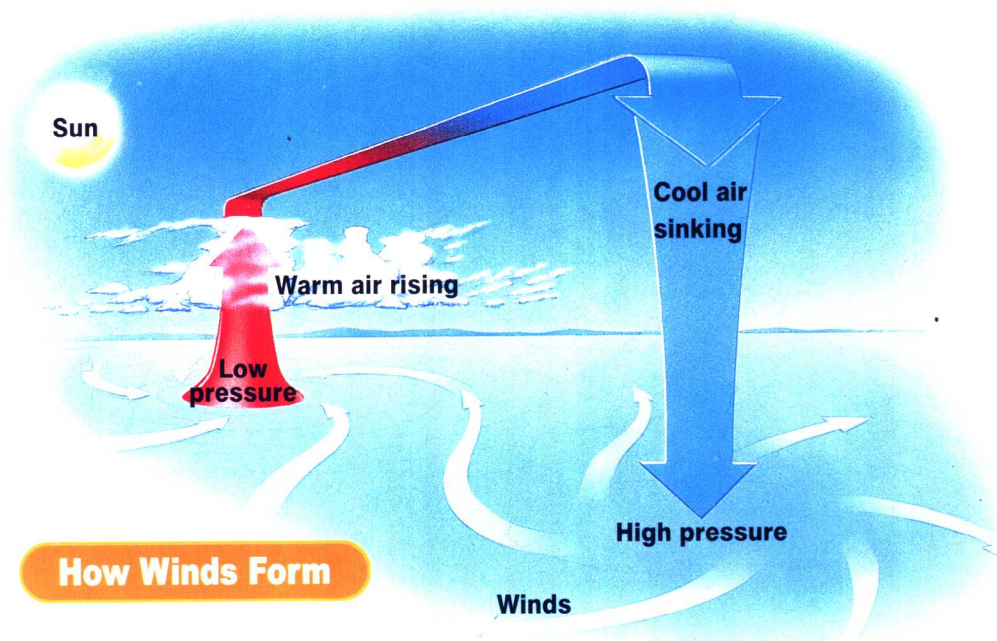
Warm air is less dense⁷ than cool air. This means that particles⁸ of warm air are farther apart than particles of cool air. So in the same amount of space, warm air weighs less than cool air. Warm air tends to⁹ rise, and cool air tends to sink¹⁰.

This dog knows which way the wind blows.



The sun's rays heat Earth's surface, but some parts of the surface heat up more than others. Above these hotter spots, the air becomes warmer.

- | | | |
|-----------------|------|---------|
| 1. air pressure | | 气压 |
| 2. exactly | adv. | 精确地；确切地 |
| 3. amount | n. | 数量 |
| 4. device | n. | 装置 |
| 5. barometer | n. | 气压计 |
| 6. measure | v. | 测量 |
| 7. dense | adj. | 密度大的 |
| 8. particle | n. | 微粒；颗粒 |
| 9. tend to | | 有……之势 |
| 10. sink | v. | 下沉 |



When a mass of warm air rises, there is less air pushing down on that area of Earth's surface. The rising air creates¹ an area of low pressure beneath² it. In contrast³, when air cools, it gets heavier and sinks. Wherever air is sinking toward Earth's surface, an area of high pressure is produced.

Changes in air pressure lead to changes in the weather. Air always moves from an area of higher pressure to an area of lower pressure. This movement of air from one place to another creates wind. The larger the pressure difference between two areas, the

faster the air will move and the harder the wind will blow.

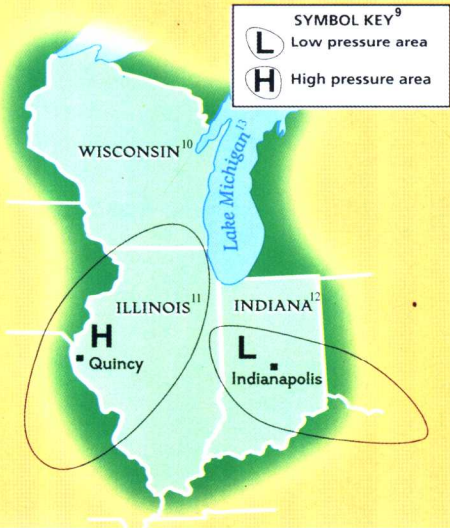
1. create	v.	产生
2. beneath	prep.	在……底下
3. in contrast		相反
4. predict	v.	预报; 预测
5. forecast	v.	预报; 预测
6. Quincy		昆西
7. Indianapolis		印第安纳波利斯
8. hint	n.	提示; 暗示
9. symbol key		符号图例
10. Wisconsin		威斯康星州
11. Illinois		伊利诺伊州
12. Indiana		印第安纳州
13. Lake Michigan		密歇根湖

Thinking Like a Scientist: Predicting⁴

Weather scientists use information about high and low pressure areas to forecast⁵, or predict, how winds will blow. You can make the same kind of prediction.

On the map shown here, notice there are two pressure areas, one high and one low. Based on what you've learned about air pressure and wind direction, predict how the wind will blow. Will it go from the city of Quincy⁶ toward Indianapolis⁷? Or from Indianapolis toward Quincy? Explain.

HINT⁸: Remember that air always moves from an area of high pressure to an area of low pressure.



Water, Water Everywhere

水无处不在



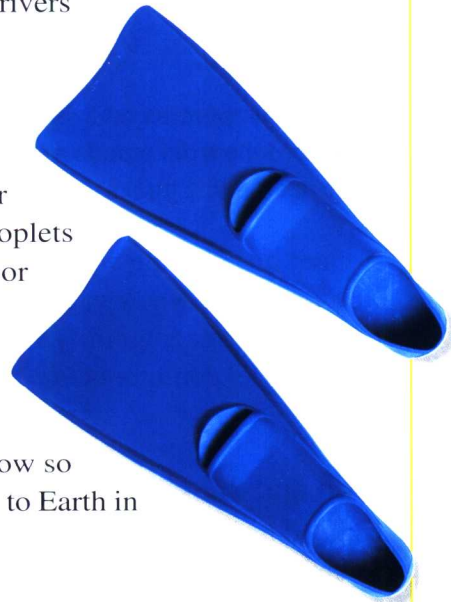
After a swim you stretch out¹ in the sunshine to catch some rays. Soon your wet skin is dry. Where did the water go?

When sunlight heats water droplets² on your skin, the droplets turn into invisible³ water vapor⁴ that rises into the air. This process⁵ of turning liquid⁶ water into water vapor is called evaporation⁷.

Millions of liters⁸ of water evaporate from oceans, lakes, and rivers every day. Just how much moisture⁹ air holds—the air's humidity¹⁰—depends on the temperature¹¹ and other factors¹².

When warm air rises, it starts to cool. As air cools, the water vapor it contains condenses¹³, or changes back into tiny¹⁴ droplets of liquid water. If rising air becomes cold quickly, the vapor condenses and freezes to form ice crystals¹⁵. This condensation of water vapor in the air creates clouds.

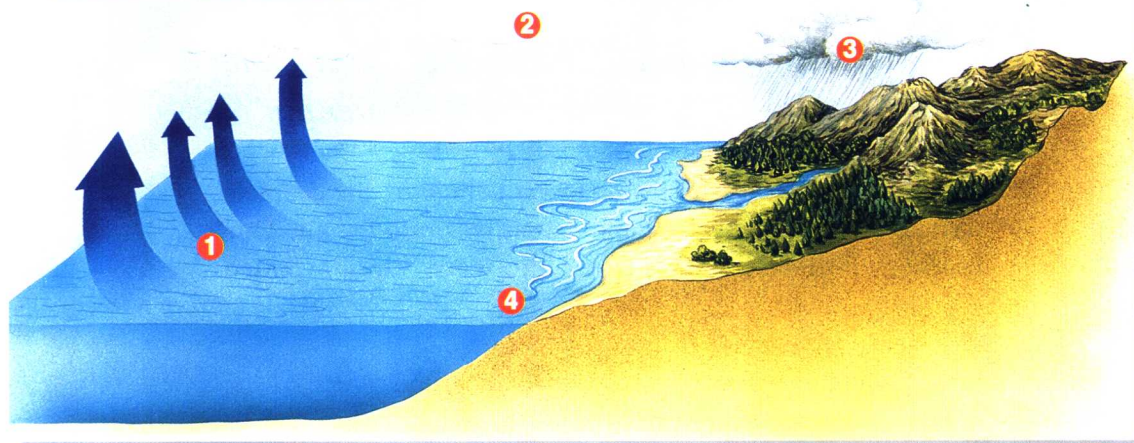
As the air in clouds swirls around, the droplets or ice crystals bump into each other and join together. Eventually¹⁶ they grow so large and heavy that they fall as rain or snow. Water returning to Earth in this way is known as precipitation¹⁷.



1. stretch out		伸展着身子躺	10. humidity	<i>n.</i>	湿度
2. droplet	<i>n.</i>	小滴	11. temperature	<i>n.</i>	温度
3. invisible	<i>adj.</i>	看不见的	12. factor	<i>n.</i>	因素
4. vapor	<i>n.</i>	水蒸气	13. condense	<i>v.</i>	凝结, 冷凝
5. process	<i>n.</i>	过程	14. tiny	<i>adj.</i>	极小的, 微小的
6. liquid	<i>adj.</i>	液体的, 液态的	15. ice crystal		冰晶(体)
7. evaporation	<i>n.</i>	蒸发	16. eventually	<i>adv.</i>	最后, 最终
8. liter	<i>n.</i>	升	17. precipitation	<i>n.</i>	降水
9. moisture	<i>n.</i>	湿气, 水分			

Swimmers in a wave pool await the next wave.

The Water Cycle



- ① Water evaporates and rises as water vapor. ② Water vapor condenses to form clouds. ③ Water falls from clouds as rain or snow. ④ Water returns to rivers, lakes, and oceans, and the cycle begins again.**

Sooner or later, the water evaporates, rises into the air as water vapor, and eventually condenses once again. This never-ending water cycle¹ continues every day around the world.

Rain and Snow

Created by energy from the sun, great swirls of high and low pressure move around Earth. Wherever a mass of warm, moist² air meets a mass of cooler, drier air, a boundary³ called a front⁴ is formed.

You've probably heard weather forecasters talk about fronts. A cold front occurs when a cold air mass pushes under a warm air mass, forcing the warm air to rise. A warm front occurs when a warm air mass meets and glides⁵ up over a cold air mass. A stationary⁶ front occurs where warm and cold air masses

meet, but neither one moves.

Clouds typically⁷ form in areas of low pressure and along fronts. These clouds can bring gentle⁸ showers⁹ or severe¹⁰ storms. Thunderstorms¹¹ are violent¹² weather events. They can spring up quickly and bring heavy rain, lightning, thunder, and high winds. Some thunderstorms form on hot days when moist air close to the ground heats up and

1. water cycle		水文循环
2. moist	<i>adj.</i>	潮湿的
3. boundary	<i>n.</i>	界限
4. front	<i>n.</i>	(气压的)锋
5. glide	<i>v.</i>	滑行; 滑移
6. stationary	<i>adj.</i>	静止的; 停滞的
7. typically	<i>adv.</i>	一般地; 通常
8. gentle	<i>adj.</i>	和缓的
9. shower	<i>n.</i>	阵雨
10. severe	<i>adj.</i>	猛烈的; 强的
11. thunderstorm	<i>n.</i>	雷暴
12. violent	<i>adj.</i>	猛烈的; 强烈的

risers quickly through the troposphere. As water vapor in the rising air quickly condenses, towering¹ thunderclouds² develop.

Clouds created along low pressure areas and fronts in winter can bring snow. Snowflakes³ form inside clouds when tiny ice crystals collide⁴ and stick⁵ together. If the air is cold enough, the flakes fall without melting.

Add strong winds to falling snow, and you've got the ingredients⁶ for a blizzard⁷. Winds can pile up⁸ the snow into drifts⁹ deep enough to bury cars and block roads.

- | | | |
|-----------------|-------------|----------------|
| 1. towering | <i>adj.</i> | 激烈的 |
| 2. thundercloud | <i>n.</i> | 雷雨云 |
| 3. snowflake | <i>n.</i> | 雪花; 雪片 |
| 4. collide | <i>v.</i> | 碰撞 |
| 5. stick | <i>v.</i> | 粘住; 紧靠 |
| 6. ingredient | <i>n.</i> | 成分; 组成部分 |
| 7. blizzard | <i>n.</i> | 暴风雪 |
| 8. pile up | | (把……)堆积起来 |
| 9. drift | <i>n.</i> | 吹积物 |
| 10. flatten | <i>v.</i> | 变平 |
| 11. complex | <i>adj.</i> | 复杂的 |
| 12. delicate | <i>adj.</i> | 精美的 |
| 13. identical | <i>adj.</i> | (完全)相同的; 一模一样的 |
| 14. Dane County | | 戴恩县 |

Did you ever

wonder...

... if each snowflake makes a pattern truly different from any other snowflake?

Snowflakes are formed when tiny, flattened¹⁰ crystals of ice join into complex¹¹, delicate¹², six-sided shapes. People have been studying and photographing snowflakes for many years. No one has found two identical¹³ snowflakes yet.



Blowing snow from a blizzard in Dane County¹⁴, Wisconsin, buried this car.

