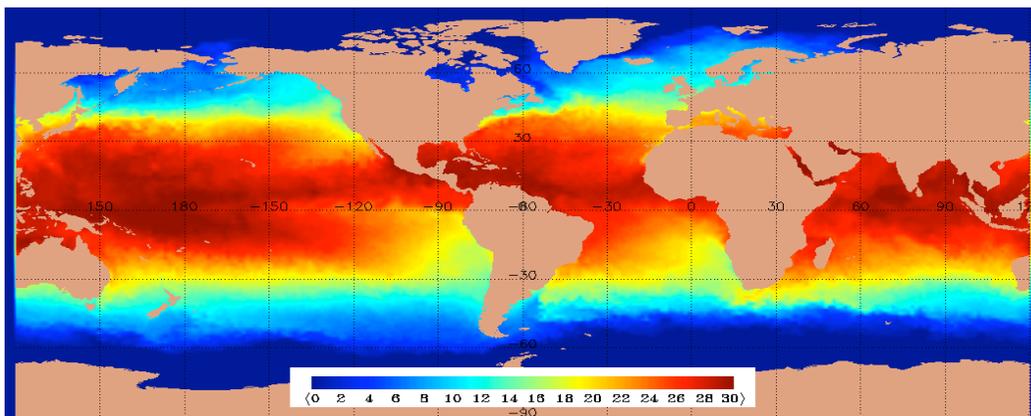


# How Oceans & Mountains Affect Weather & Climate

#	TERM	DEFINITION
1	ATMOSPHERE	The layers of gas that surround the earth. Gases: #1 is Nitrogen, then oxygen Layers: Troposphere- we live here, weather takes place here; Stratosphere – warm, ozone layer is here (protects us from the sun’s ultraviolet rays); Mesosphere - cold, Thermosphere - cold, Exosphere – “outside” atmosphere
2	CLIMATE	The average weather of a place or region over a long period of time
3	LAND BREEZE	The movement of air from the land to the sea that occurs at night. After the sun goes down, the land cools off quicker than the ocean, so air moves from the cooler land to the warmer ocean.
4	LEEWARD SIDE	The side of a mountain that is NOT by the ocean and gets cool, dry air, and therefore has little plant life.
5	OCEAN CURRENT	The stream of water that flows through an ocean. Currents that flow from the equator are warm and bring warm weather. Currents that flow from the poles are cool and bring cool weather.
6	RAIN SHADOW	The effect that a mountain has on the climate of both its sides in which one gets warm temperature & little precipitation while the other gets cool temperature & a lot of precipitation.
7	SEA BREEZE	The movement of air from the sea to the land that occurs during the day. The sun’s heat energy warms the land quicker than the ocean, so air moves from the cooler water to the warmer land.
8	WEATHER	The condition of the air at a certain time and place. (Includes temperature, precipitation, humidity, & air pressure.)
9	WINDWARD SIDE	The side of a mountain that is beside the ocean and gets all the warm, moist air, rainfall and therefore has most of the plant life.

## Thermal Imaging Map of the Earth’s Oceans



According to the thermal imaging map, where is the warmer water located?

Near the equator

Where is the cooler water located?

Near the poles

Why do you think that is? The equator gets more direct sunlight, so it is warmer, while the poles get weaker rays that are more spread out and less concentrated

## More Investigations

Look at the map of the currents below:

1. There are two types, a lighter arrow, and a darker arrow. What do the lighter arrows have in common?

**The arrows that are alike are coming from the same areas on the earth**

What do the darker arrows have in common?

**They come from the polar regions**

2. Why do you think each type is similar?

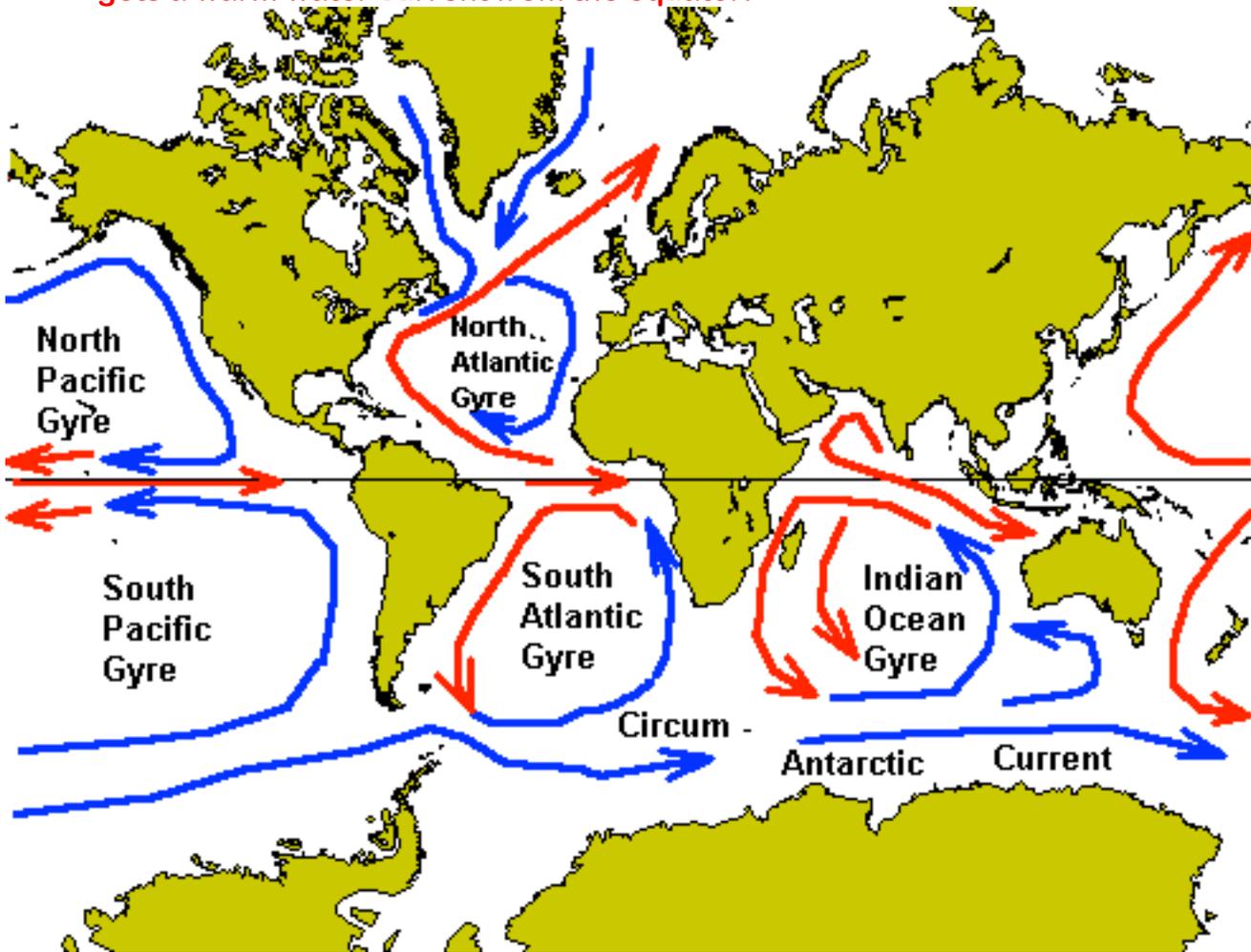
**They come from the equator**

3. What kind of water do you think each type arrow brings to the area in which it is flowing?

**Light arrows bring warm water from the equator/ Dark arrows bring cool water from the polar regions**

4. Find the west coast of the United States. Now find the east coast. How do you think swimming in the oceans in Florida would be different than swimming in the oceans of California?

**The California water would probably be cooler than the Florida water because it receives a cold water current from the north pole, while the Florida coast gets a warm water current from the equator.**



# Rain Shadow

At the top, the condensed air gets so heavy that it turns into precipitation just before crossing over to the other side of the mountain.

Prevailing winds (sea breeze) from the ocean push warm moist air against the mountain & it moves up. As the moist air rises, it begins to get cooler and cooler due to the high altitude. Once it reaches the top, the air will cool enough to condense.

Region of Rain Shadow

Dry Air

Since the air already lost its moisture, the humidity on this side is low & plants get very little water. Different types of plants will grow.

Sea

Windward Side  
(W=Wet/Water side/Warm/Windy)

Leeward Side  
(L=Little water/Land side/Lizard)

## Factors Affecting Climate

THERE ARE MANY DIFFERENT FACTORS THAT AFFECT CLIMATE AROUND THE WORLD. THE MOST IMPORTANT FACTORS ARE:

- **Distance From The Sea**
- **Ocean Currents**
- **Direction of Prevailing Winds**
- **Relief**
- **Proximity To The Equator**
- **The El Nino Phenomenon**
- RECENTLY, IT HAS BEEN ACCEPTED THAT **human activity** IS ALSO AFFECTING CLIMATE.

### **Distance From The Sea**

THE SEA AFFECTS THE CLIMATE OF A PLACE. COASTAL AREAS ARE **COOLER AND WETTER** THAN INLAND AREAS. CLOUDS FORM WHEN WARM AIR FROM INLAND AREAS MEETS COOL AIR FROM THE SEA.

THE CENTER OF CONTINENTS IS SUBJECT TO A **LARGE RANGE OF TEMPERATURES**. IN THE SUMMER, TEMPERATURES CAN BE **VERY HOT AND DRY** AS MOISTURE FROM THE SEA **EVAPORATES** BEFORE IT REACHES THE **CENTER** OF THE CONTINENT.

## **Ocean Currents**

OCEAN CURRENTS CAN INCREASE OR REDUCE **TEMPERATURES**.

THE GULF STREAM IS A WARM OCEAN CURRENT IN THE NORTH ATLANTIC FLOWING FROM THE GULF OF MEXICO, NORTHEAST ALONG THE U.S COAST, AND FROM THERE, TO THE BRITISH ISLES.

THE GULF OF MEXICO HAS HIGHER AIR TEMPERATURES THAN BRITAIN'S, AS IT'S CLOSER TO THE **EQUATOR**. THIS MEANS THAT THE AIR COMING FROM THE GULF OF MEXICO TO BRITAIN IS ALSO **WARM**. HOWEVER, THE AIR IS ALSO QUITE MOIST AS IT TRAVELS OVER THE ATLANTIC OCEAN. THIS IS ONE REASON WHY BRITAIN OFTEN RECEIVES **WET** WEATHER.

THE GULF STREAM KEEPS THE WEST COAST OF EUROPE FREE FROM **ICE** IN THE WINTER AND, IN THE SUMMER **WARMER** THAN OTHER PLACES OF SIMILAR LATITUDE.

## **Direction of Prevailing Winds**

WINDS THAT BLOW FROM THE SEA OFTEN BRING **RAIN** TO THE **COAST** AND **DRY** WEATHER TO **INLAND** AREAS. WINDS THAT BLOW TO BRITAIN FROM WARM INLAND AREAS SUCH AS AFRICA WILL BE **WARM AND DRY**. WINDS THAT BLOW TO BRITAIN FROM INLAND AREAS SUCH AS THE NETHERLANDS WILL BE **COLD AND DRY** IN WINTER. BRITAIN'S PREVAILING WINDS COME FROM A SOUTH, WESTERLY DIRECTION OVER THE ATLANTIC. THE WINDS ARE **COOL** IN THE SUMMER AND **MILD** IN THE WINTER. **CONTINENTAL** WINDS BRING MORE **EXTREME, DRY** WEATHER, WHILE **OCEAN** CURRENTS BRING **MILDER, MOIST** WEATHER. BASED ON THIS, DESCRIBE THE WEATHER OF THE FOLLOWING CITIES IN THE UNITED STATES:

PHOENIX, ARIZONA:

TOPEKA, KANSAS:

SEATTLE, WASHINGTON:

MIAMI, FLORIDA:

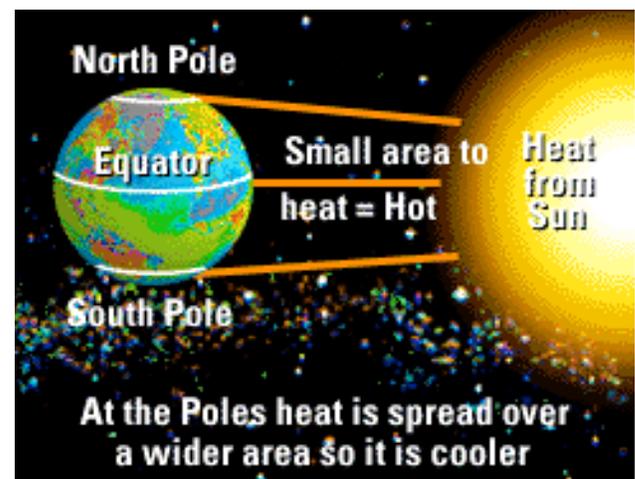
## **Mountains & Altitude**

MOUNTAINS RECEIVE **MORE RAINFALL** THAN LOW-LYING AREAS BECAUSE THE TEMPERATURE ON TOP OF MOUNTAINS IS **LOWER** THAN THE TEMPERATURE AT SEA LEVEL. THAT IS WHY YOU OFTEN SEE **SNOW** ON THE TOP OF MOUNTAINS ALL YEAR ROUND. THE **HIGHER** THE PLACE IS ABOVE SEA LEVEL THE **COLDER** IT WILL BE. THIS HAPPENS BECAUSE AS **ALTITUDE** INCREASES, AIR BECOMES **THINNER** AND IS **LESS** ABLE TO **ABSORB AND RETAIN HEAT**.

## **Proximity To The Equator**

THE PROXIMITY TO THE EQUATOR AFFECTS THE CLIMATE OF A PLACE. THE EQUATOR RECEIVES THE MORE **SUNLIGHT** THAN ANYWHERE ELSE ON EARTH. THIS IS DUE TO ITS POSITION IN RELATION TO THE SUN (SEE RIGHT). THE DIAGRAM SHOWS THAT THE EQUATOR IS HOTTER BECAUSE THE SUN HAS **LESS AREA** TO HEAT. IT IS COOLER AT THE **NORTH AND SOUTH POLES** AS THE SUN HAS **MORE AREA** TO HEAT UP, AND THE **HEAT** IS **SPREAD** OVER A WIDER AREA.

### **THE EARTH'S POSITION IN RELATION TO THE SUN**



## **El Nino**

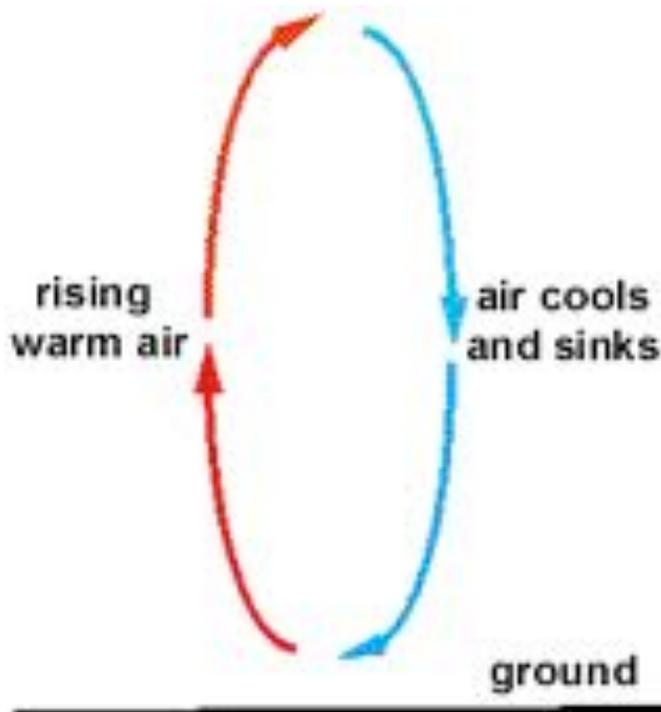
EL NINO, WHICH AFFECTS WIND AND RAINFALL PATTERNS, HAS BEEN BLAMED FOR DROUGHTS AND FLOODS IN COUNTRIES AROUND THE PACIFIC RIM. EL NINO REFERS TO THE IRREGULAR WARMING OF SURFACE WATER IN THE PACIFIC. THE WARMER WATER PUMPS ENERGY AND MOISTURE INTO THE ATMOSPHERE, ALTERING GLOBAL WIND AND RAINFALL PATTERNS. THE PHENOMENON HAS CAUSED TORNADOES IN FLORIDA, SMOG IN INDONESIA, AND FOREST FIRES IN BRAZIL.

## **Human Influence**

THE FACTORS ABOVE AFFECT THE CLIMATE NATURALLY. HOWEVER, WE CANNOT FORGET THE INFLUENCE OF HUMANS ON OUR CLIMATE. WE HAVE BEEN AFFECTING THE CLIMATE SINCE WE APPEARED ON THIS EARTH MILLIONS OF YEARS AGO. IN THOSE TIMES, THE AFFECT ON THE CLIMATE WAS SMALL. TREES WERE CUT DOWN TO PROVIDE WOOD FOR FIRES. TREES TAKE IN CARBON DIOXIDE AND PRODUCE OXYGEN. A REDUCTION IN TREES WILL THEREFORE HAVE INCREASED THE AMOUNT OF CARBON DIOXIDE IN THE ATMOSPHERE.

THE INDUSTRIAL REVOLUTION, STARTING AT THE END OF THE 19TH CENTURY, HAS HAD A HUGE EFFECT ON CLIMATE. THE INVENTION OF THE MOTOR ENGINE AND THE INCREASED BURNING OF FOSSIL FUELS HAVE INCREASED THE AMOUNT OF CARBON DIOXIDE IN THE ATMOSPHERE. THE NUMBER OF TREES BEING CUT DOWN HAS ALSO INCREASED, MEANING THAT THE EXTRA CARBON DIOXIDE PRODUCED CANNOT BE CHANGED INTO OXYGEN.

## **Convections Currents**



CONVECTION CURRENTS ARE AREAS WHERE MATTER MOVES IN A CIRCULAR MOTION DUE TO TEMPERATURE DIFFERENCES. THEY CAN OCCUR IN WATER OR IN THE AIR. WHEN A CONVECTION CURRENT OCCURS IN THE AIR, WIND IS CREATED. HEAT ENERGY FROM THE SUN CAUSES THE EARTH'S CRUST TO HEAT. THE WARMED CRUST IN TURN HEATS THE AIR ABOVE IT CAUSING IT TO RISE. WHEN IT RISES, COOLER AIR TAKES ITS PLACE. AS THE WARM AIR RISES HIGHER AND HIGHER, IT COOLS AGAIN CAUSING IT TO BECOME MORE DENSE AND HEAVY. IT THEN SINKS BACK TO THE EARTH CAUSING THE CYCLE TO REPEAT.

# Land & Sea Breezes

CONVECTION CURRENTS ALSO CAUSE LAND & SEA BREEZES. REMEMBER THAT ARE TRAVELS FROM **COOL** TO **HOT**. (A GREAT TRICK IS TO REMEMBER THE ALPHABET. **C** COMES BEFORE **H**, SO AIR TRAVELS FROM **COOL** TO **HOT**.) NOW REMEMBER WHAT IS **COOLER** AT DAY & NIGHT:



DURING THE **DAY**, **WATER** IS COOLER. THE LAND IS HEATED **QUICKLY**, WHILE THE WATER **LONGER** TO ABSORB HEAT. THEREFORE, THE **WATER** IS **COOLER** THAN LAND DURING THE **DAY**. SINCE AIR TRAVELS FROM **COOL TO HOT**, THE BREEZE COMES FROM THE **OCEAN**. THIS IS CALLED A **SEA BREEZE** BECAUSE WINDS ARE NAMED AFTER THE DIRECTION **FROM** WHICH THEY ARE COMING.

THE OPPOSITE IS TRUE. AT **NIGHT**, **LAND** IS COOLER. THE LAND COOLS OFF **QUICKLY**, WHILE THE WATER TAKES **LONGER** TO LOSE THE HEAT IT ABSORBED DURING THE DAY. THEREFORE, THE **LAND** IS **COOLER** THAN THE OCEAN AT **NIGHT**. BECAUSE THE BREEZE IS TRAVELING FROM THE COOLER LAND TOWARD THE WARMER WATER, IT IS CALLED A **LAND BREEZE**.

## MOUNTAIN & VALLEY BREEZES

DURING THE DAY, THE SUN HEATS **THE SIDES OF THE MOUNTAINS** CAUSING THAT AIR TO RISE WHILE THE COOLER AIR FROM THE VALLEY RUSHES UP THE MOUNTAINSIDE TO TAKE ITS PLACE. SINCE THE AIR IS COMING FROM THE VALLEY, IT IS CALLED A **VALLEY BREEZE**.

AT NIGHT, THE **MOUNTAINS COOL OFF QUICKLY** BECAUSE THE WIND TAKES IT AWAY, WHILE THE AIR IN THE VALLEY IS SOMEWHAT TRAPPED. THIS CAUSES THE VALLEY AIR TO BE WARMER THAT THE MOUNTAIN. SINCE AIR TRAVELS FROM **COOL TO HOT**, THE COOLER, DENSER, HEAVIER MOUNTAIN AIR SINKS DOWN INTO THE VALLEY. BECAUSE IT IS COMING FROM THE MOUNTAIN, IT IS CALLED A **MOUNTAIN BREEZE**.

