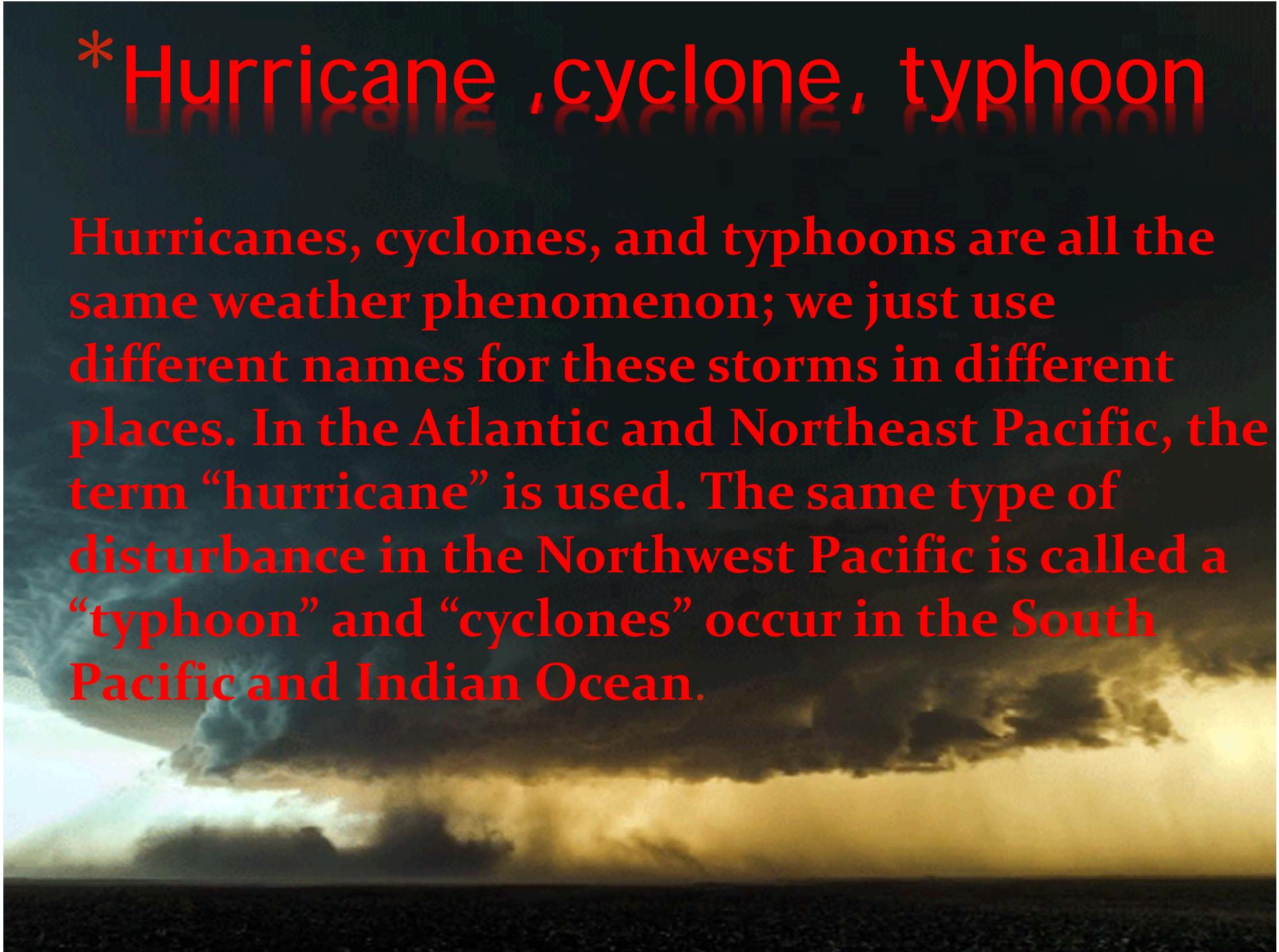


*Extreme Weather Phenomena

***Definition:** Severe weather phenomena are weather conditions that are hazardous to human life and property. Severe weather can occur under a variety of situations, but three characteristics are generally needed: a temperature or moisture boundary, moisture, and instability in the atmosphere.

*Hurricane ,cyclone, typhoon

Hurricanes, cyclones, and typhoons are all the same weather phenomenon; we just use different names for these storms in different places. In the Atlantic and Northeast Pacific, the term “hurricane” is used. The same type of disturbance in the Northwest Pacific is called a “typhoon” and “cyclones” occur in the South Pacific and Indian Ocean.



A dark, overcast sky above a city skyline at night. The city lights are visible through the clouds, creating a dramatic and moody atmosphere.

A transient storm of lightning and thunder,
usually with rain and gusty winds,
sometimes with hail or snow, produced by
cumulonimbus clouds.

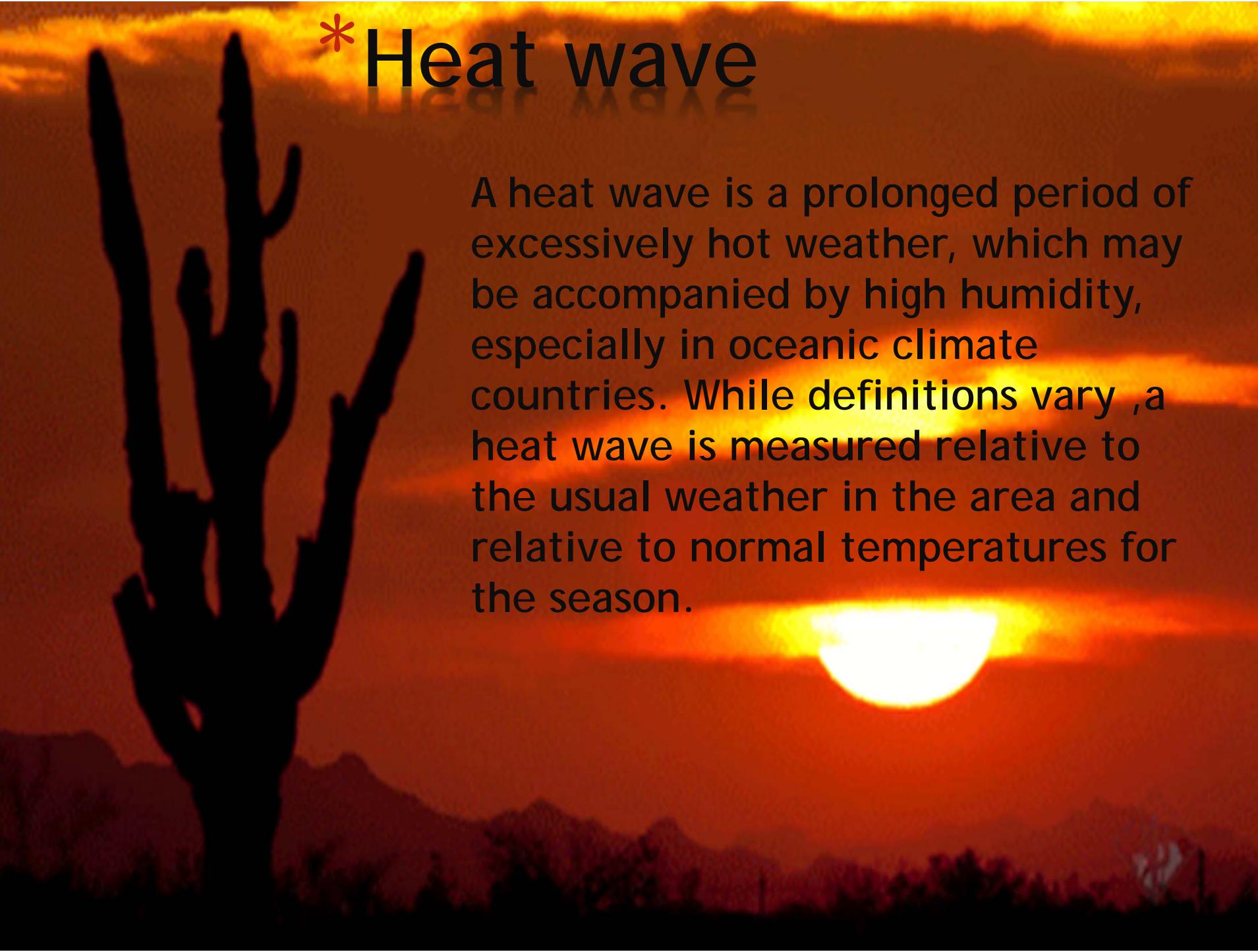
*Thunderstorm

*Tornado



A localized, violently destructive windstorm occurring over land, especially in the Middle West, and characterized by a long, funnel-shaped cloud extending toward the ground and made visible by condensation and debris.

*Heat wave

A photograph of a desert landscape at sunset. In the foreground, several saguaro cacti stand tall as dark silhouettes against the bright orange and yellow hues of the setting sun. The sun itself is a large, luminous orb in the lower right corner. The sky is filled with warm, glowing clouds, and the horizon shows distant, dark mountain ridges.

A heat wave is a prolonged period of excessively hot weather, which may be accompanied by high humidity, especially in oceanic climate countries. While definitions vary ,a heat wave is measured relative to the usual weather in the area and relative to normal temperatures for the season.

*Blizzard

A violent snowstorm with winds blowing at a minimum speed of 35 miles (56 kilometers) per hour and visibility of less than one-quarter mile (400 meters) for three hours.





*Fog

A thick cloud of tiny water droplets suspended in the atmosphere at or near the earth's surface which obscures or restricts visibility (to a greater extent than mist; strictly, reducing visibility to below 1 km).

J.C. Watson

EXTREME WEATHER



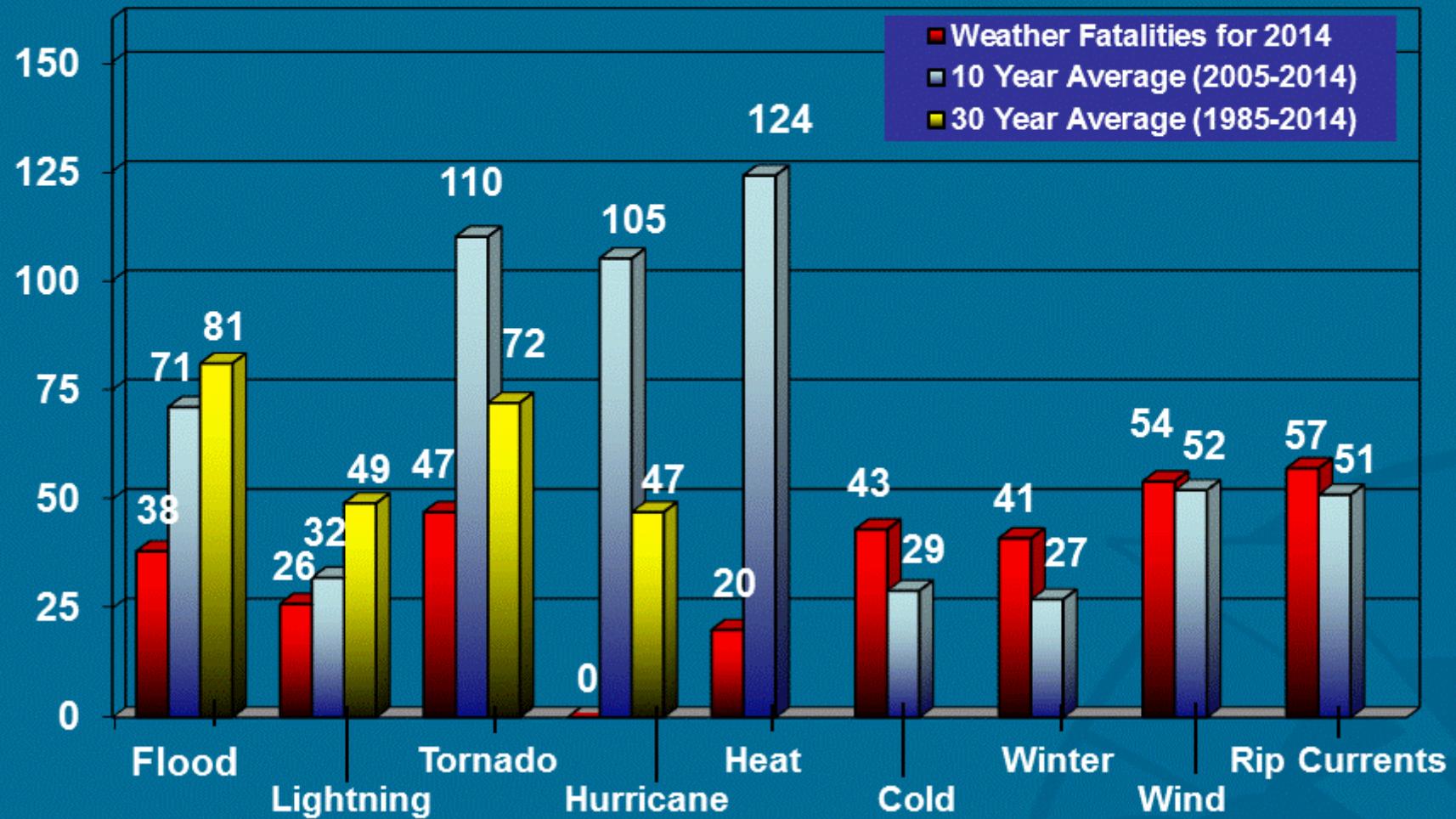
SOCIAL ASPECTS OF WEATHER

- Weather data (rainfall, storm tracks, storm intensities, etc.) generally are readily available, often online. Data on the societal impacts of weather, however, are not. This presentation includes the resources we have found that contain societal impacts data.





Weather Fatalities



- Hurricanes, tornadoes, and other variations of high wind are Mother Nature's haymaker, claiming more than 13,000 lives per year. This high number is the product of the worldwide population not having practical shelter from wind. Many communities around the world lack an area to protect themselves from them.



The sad numbers : in 2011 more than 570 people lost their lives in the US alone. Since 2006, more than 15.000.000 dollars worth of damage are caused due to tornadoes every year. Each year, flooding causes more than 13.000 deaths worldwide.



Therefore, extreme weather is not to be taken lightly, and we should always make sure we are prepared for the worst.

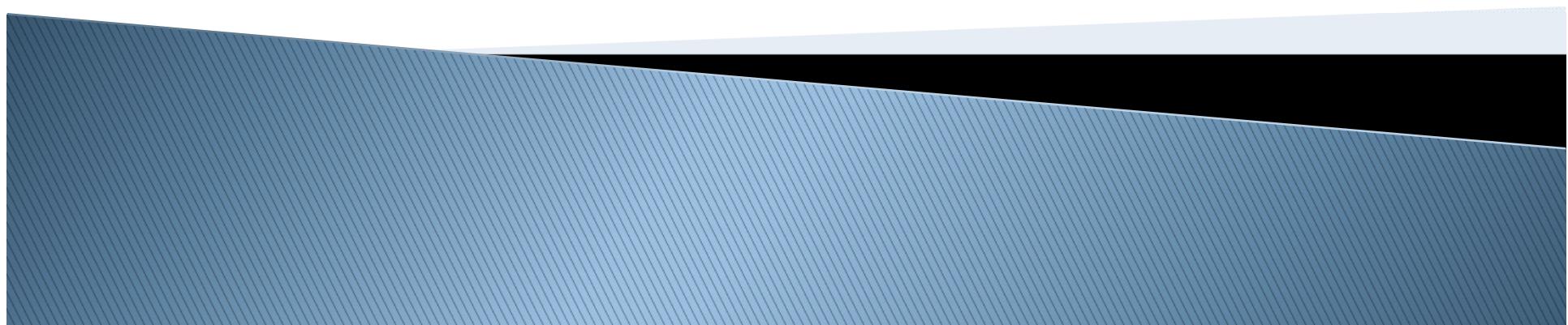


-

THANK YOU FOR YOUR TIME

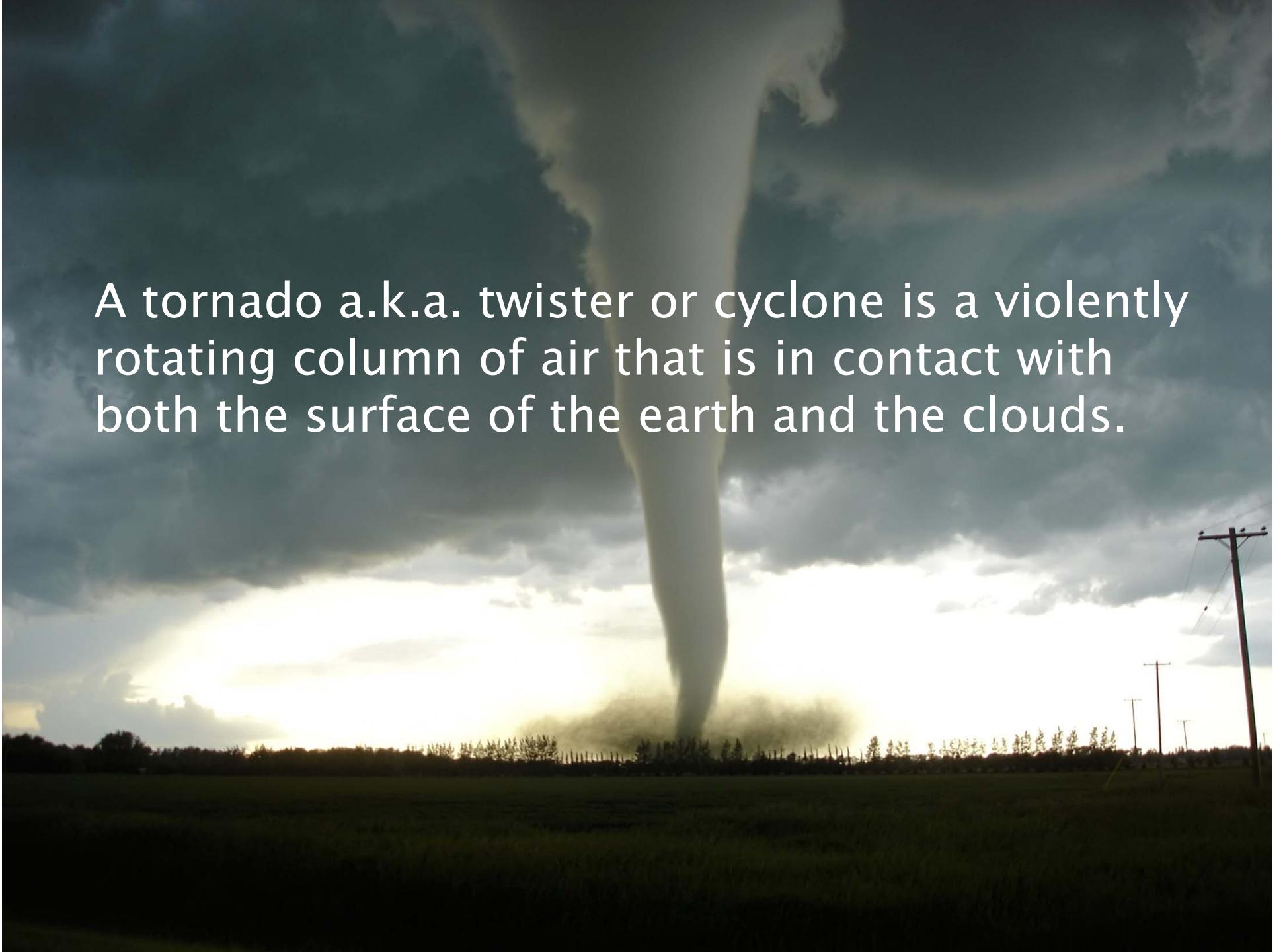
EXTREME WEATHER PHENOMENA

E8 Level
Teacher: Mrs. Koliou Efi



TORNADOES



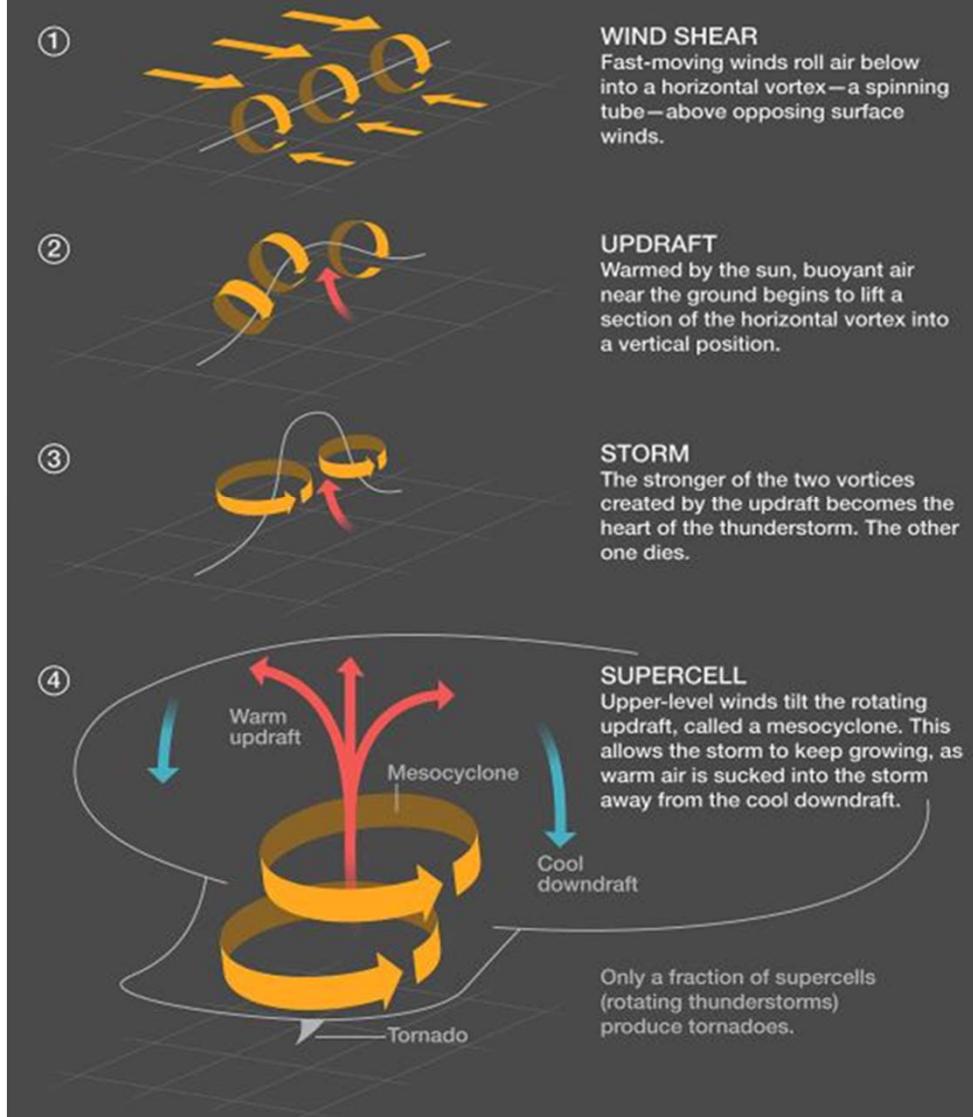


A tornado a.k.a. twister or cyclone is a violently rotating column of air that is in contact with both the surface of the earth and the clouds.

- Tornadoes have been observed on every continent except Antarctica. They have been most documented in North America, where an estimated 1,200 strike the United States each year, but they frequently appear in many other countries.
- The most notoriously affected region in the United States, called "Tornado Alley," includes the Great Plains states of Kansas, Nebraska, and the Dakotas, as well as parts of Texas. Large-scale weather patterns tend to converge on that area, making tornadoes more likely.

How a Tornado Forms

While tornadoes can differ in size, strength, and location, they all share certain characteristics. They are spawned from a type of rotating storm called a supercell thunderstorm.



▶ HOW DO WE RANK
TORNADOES ??



Tornado Risk Worldwide



WHEN ARE TORNADOES MOST LIKELY??

- › Tornado season usually refers to the time of year the U.S. sees the most tornadoes. The peak “tornado season” for the Southern Plains is during May into early June. On the Gulf coast, it is earlier during the spring. In the northern plains and upper Midwest, tornado season is in June or July. But, remember, tornadoes can happen at any time of year. Tornadoes can also happen at any time of day or night, but most tornadoes occur between 4-9 p.m.



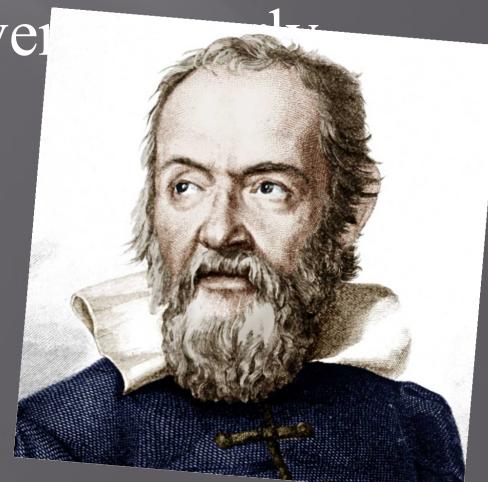
History of weather forecasting

EARLY HISTORY

- The art of weather forecasting began with early civilizations using reoccurring astronomical and meteorological events to help them monitor seasonal changes in the weather.
- Around 650 B.C., the Babylonians tried to predict short-term weather changes based on the appearance of clouds and optical phenomena such as haloes.
- By 300B.C., Chinese astronomers had developed a calendar that divided the year into 24 festivals, each festival associated with a different type of weather.

EARLY HISTORY

- By the end of the Renaissance, it had become increasingly evident that the speculations of the natural philosophers were inadequate and that greater knowledge was necessary to further our understanding of the atmosphere. In order to do this, instruments were needed to measure the properties of the atmosphere, such as moisture, temperature, and pressure
- Galileo Galilei was the first to invent a thermometer

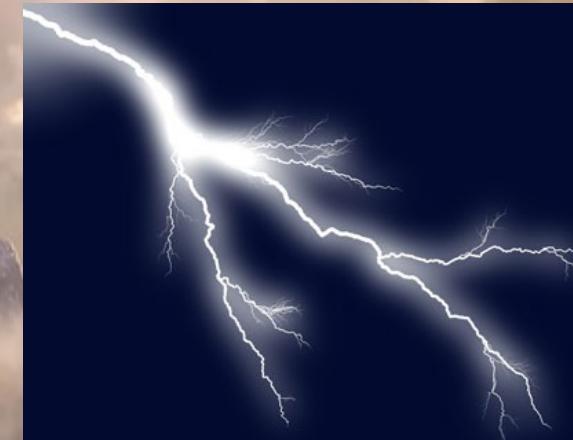


WEATHER FORECASTING IN ANCIENT GREECE

- Ancient Greek mythology is an example of how early civilizations tried to explain the unexplainable at the time forces of nature, weather and astronomy. Many ancient Greek gods and goddesses were elements of weather and seasons personified.
- Ancient Greeks, as well as other civilizations of that time, often attributed weather changes and natural phenomena to the gods.

GREEK GODS

Ancient Greeks believed in Poseidon, god of sea and earthquakes, Hephaestus, god of volcanoes, Zeus, king of all gods and god of sky, thunder, lightning and rain.



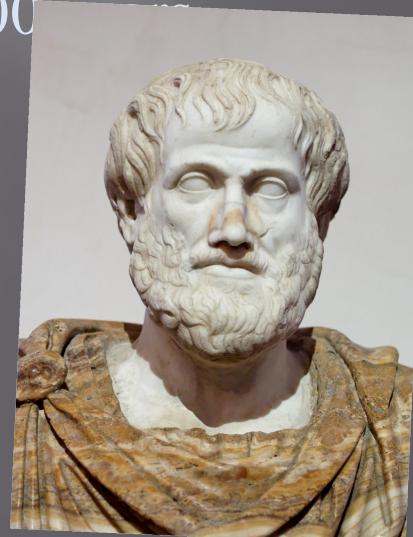
THE CONTRIBUTION OF ANCIENT GREEKS TO THE EVOLUTION OF WEATHER FORECASTING

- However, thanks to their continuous observation of nature, ancient Greeks had a great understanding of weather and climate in general. It may not have been as advanced as modern science but their basic knowledge helped them to better understand weather changes and find ways to benefit from them.

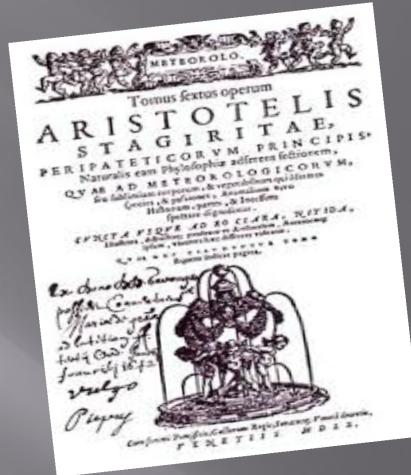


ARISTOTLE AND METEOROLOGICA

- Around 340 B.C., the Greek philosopher Aristotle wrote *Meteorologica*, a philosophical treatise that included theories about the formation of rain, clouds, hail, wind, thunder, lightning, and hurricanes. Aristotle made some remarkably acute observations concerning the weather, along with some significant errors, and his four-volume text was considered by many to be the authority on weather theory for almost 2000 years.



■ THIS WAS THE BEGINNING OF WEATHER FORECASTING



Extreme Weather Phenomena



- Whenever there is an extreme weather event, such as a flood or drought, people ask whether that event was caused by global warming. Unfortunately, there is no straightforward answer to this question.
- Weather is highly variable and extreme weather events have always happened. Detecting trends takes time, particularly when observational records are rare or even missing in certain regions.
- An increase in extreme weather is expected with global warming because rising temperatures affect weather parameters in several ways.
- Changes in the frequency of extreme events coinciding with global warming have already been observed, and there is increasing evidence that some of these changes are caused by the impacts of human activities on the climate

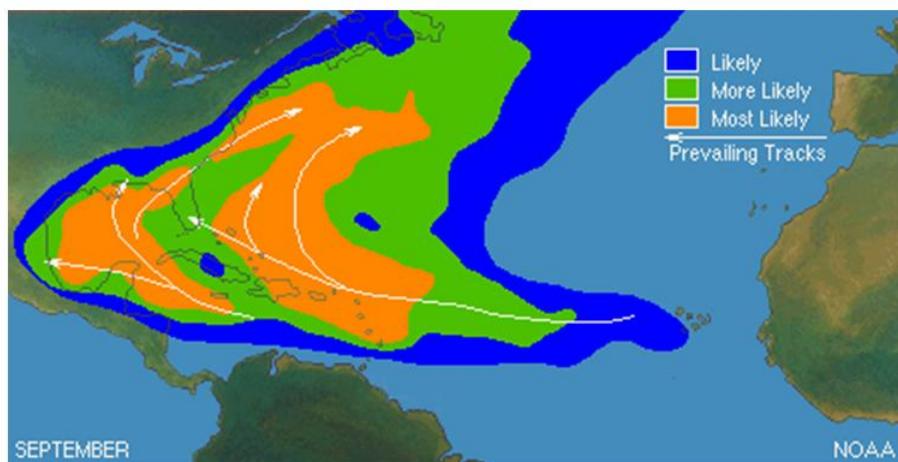


TROPICAL CYCLONES

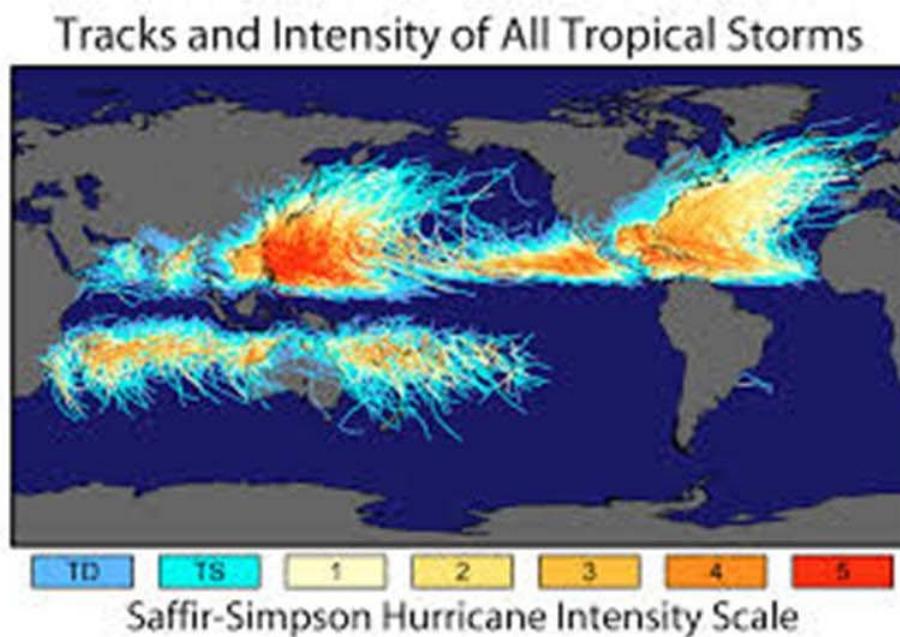
- Tropical Cyclones are any large organized storms that form over warm water . This includes everything from tropical depressions to massive category five hurricanes. A tropical cyclone is said to make landfall when and where the center of the storm comes ashore. The radius of most storms averages about 300 miles, so areas far from landfall can still feel the effects .



- Probably the most important factor in hurricane development is an existing disturbance. In the Atlantic Ocean these disturbances are usually provided by storm systems coming off the northwestern coast of Africa. They begin as poorly organized groups of thunderstorms.



- Another important ingredient for storm development is a warm sea surface temperature. In order for a tropical cyclone to have enough energy to develop it must pass over sea surface temperatures that are at least 80°F, and the warmer the better.



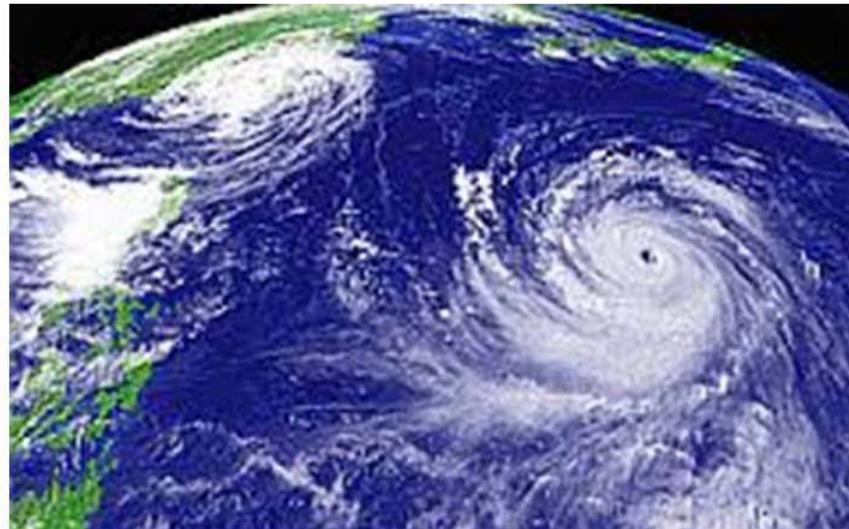
- One reason September marks the peak of hurricane season is because at this point in the year the ocean has acquired all the summertime heating but has not started to cool down yet, so sea surface temperatures are warmest.



- Vertical wind shear also influences the development of tropical cyclones. Strong winds aloft blow hurricanes apart, so low vertical wind shear is necessary for hurricane development.



- High relative humidity in the surrounding air is also important because a tropical cyclone weakens if dry air gets wrapped up in it.



Droughts

What is Drought ?

Drought is an insidious hazard of nature . It is often referred to as a “ creeping phenomenon ” and its impacts vary from region to region .



Droughts

Occurrences of droughts per region

■ Acute ■ Severe ■ High ■ Moderate ■ Low ■ No data



Causes of drought

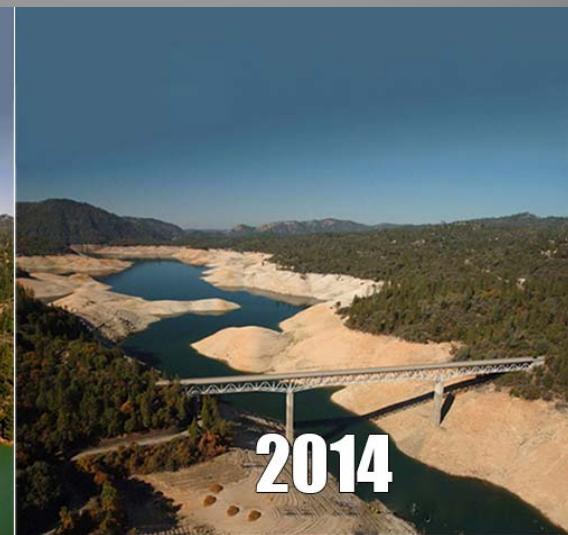
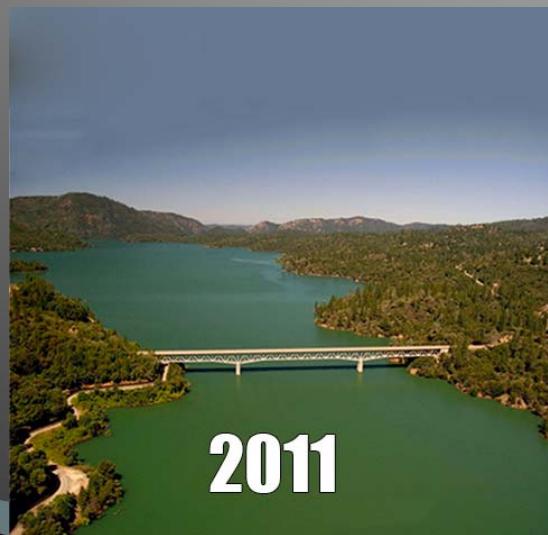
- Reduced rainfall results in drought
- Occurs because water vapour not brought by air currents to right areas at right times
- Unusual current of cold and warm water in oceans creates high pressure . El Nino causes drought in Asia.
- Mountains prevent wind from blowing moisture to needy regions



DROUGHT COMPARISON

April 1, 2013

April 1, 2014

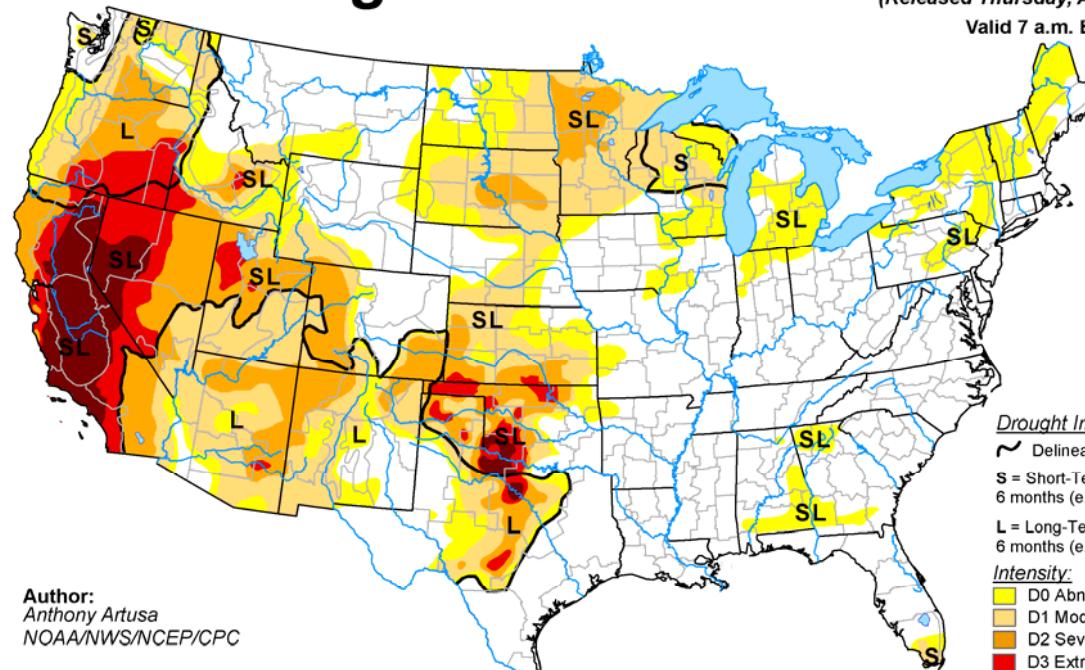


U.S. Drought Monitor

April 28, 2015

(Released Thursday, Apr. 30, 2015)

Valid 7 a.m. EST



Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC

Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

Key Elements in weather forecasting

*Which are they?
How much do we
know about them?*

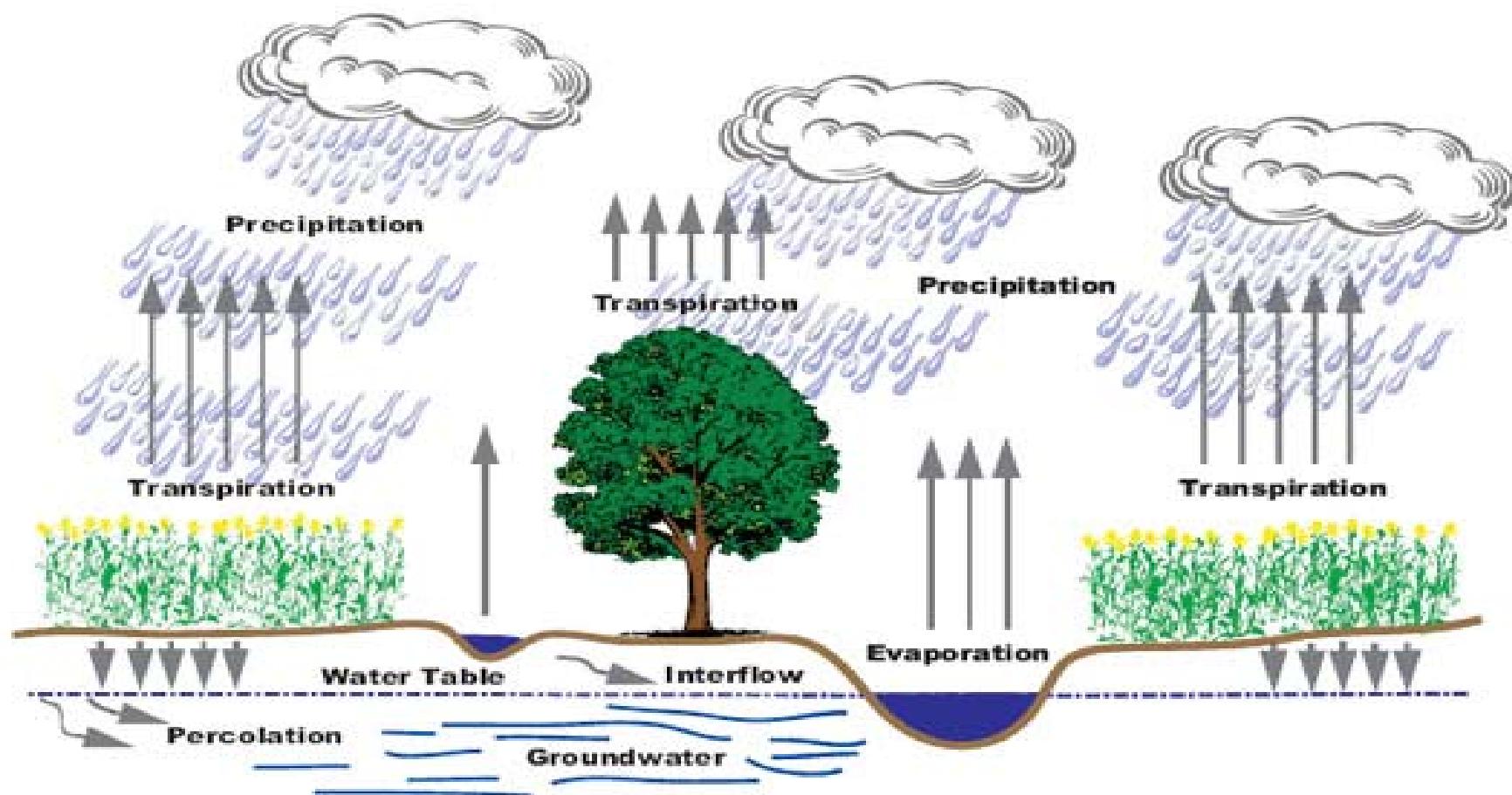


5 points concerning geography :

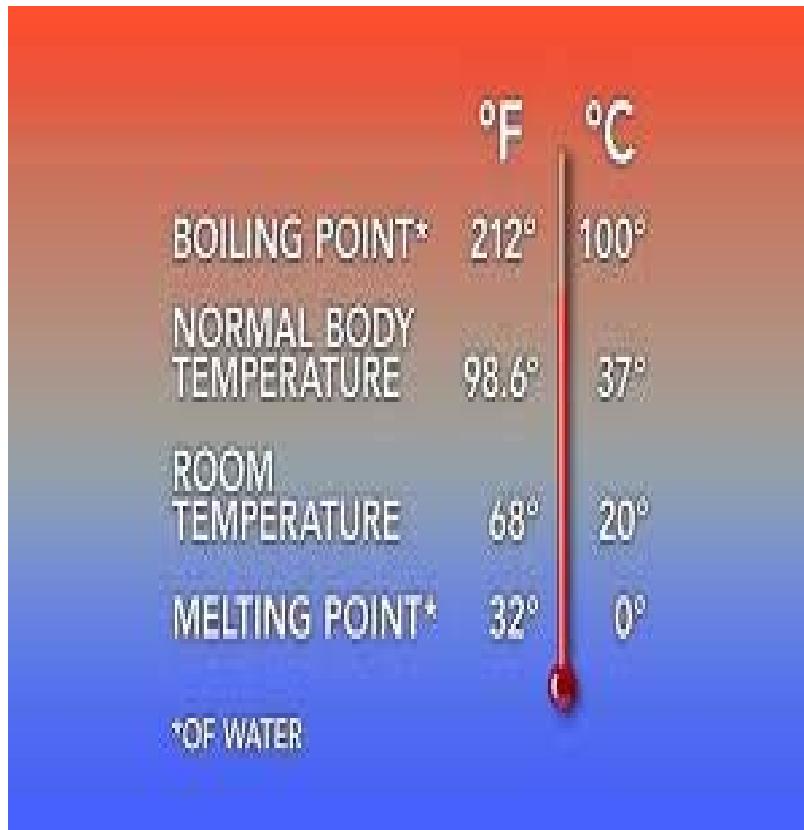
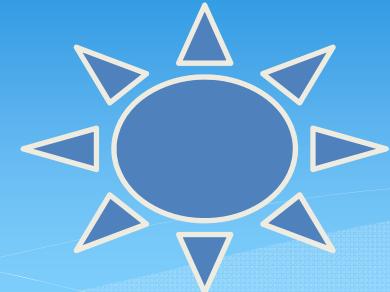


- Coastal areas are warmer in winter and cooler in summer
- In hilly areas hot air moves up the slopes during the day and won the slopes at night.
- High altitude areas are usually colder.
- The air above cities is often warmer than the surrounding area.
- In coastal areas, cool air blows inland during the day and out to sea at night.

Rain Formation



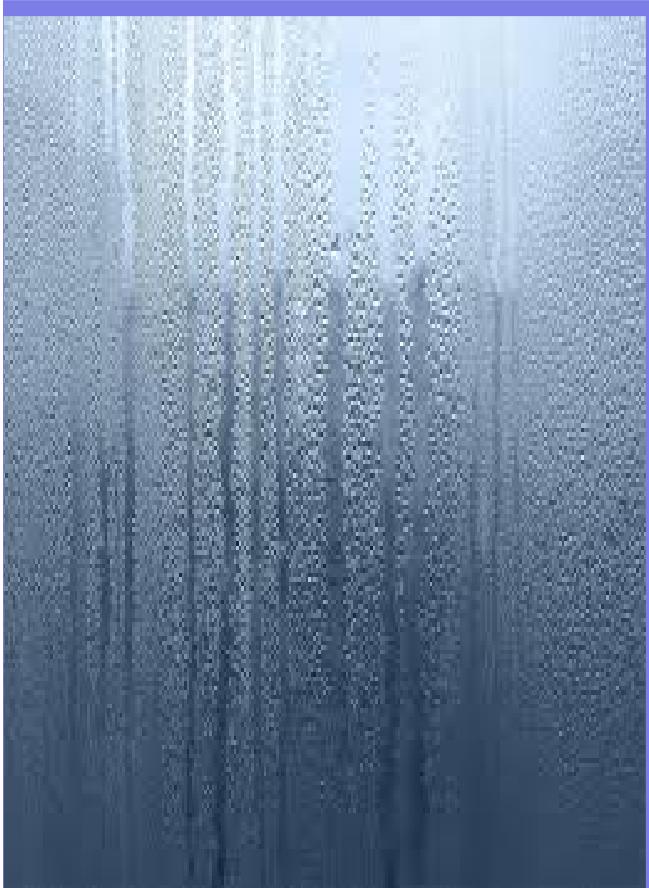
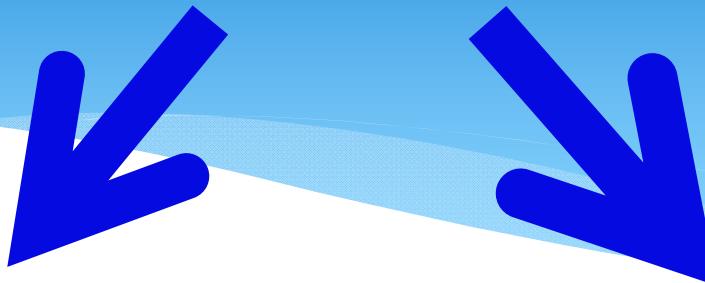
TEMPERATURE



$$* \text{ } ^\circ\text{F} = -17.77778 \text{ } ^\circ\text{C}$$

- * 40° Fahrenheit is 5 Celsius
- * 50° Fahrenheit is 10 Celsius
- * 60° is 15 Celsius and
- * 70° is 20 Celsius
- * 80° Fahrenheit is 26 and
- * 90° is a shade over 32 Celsius

HUMIDITY

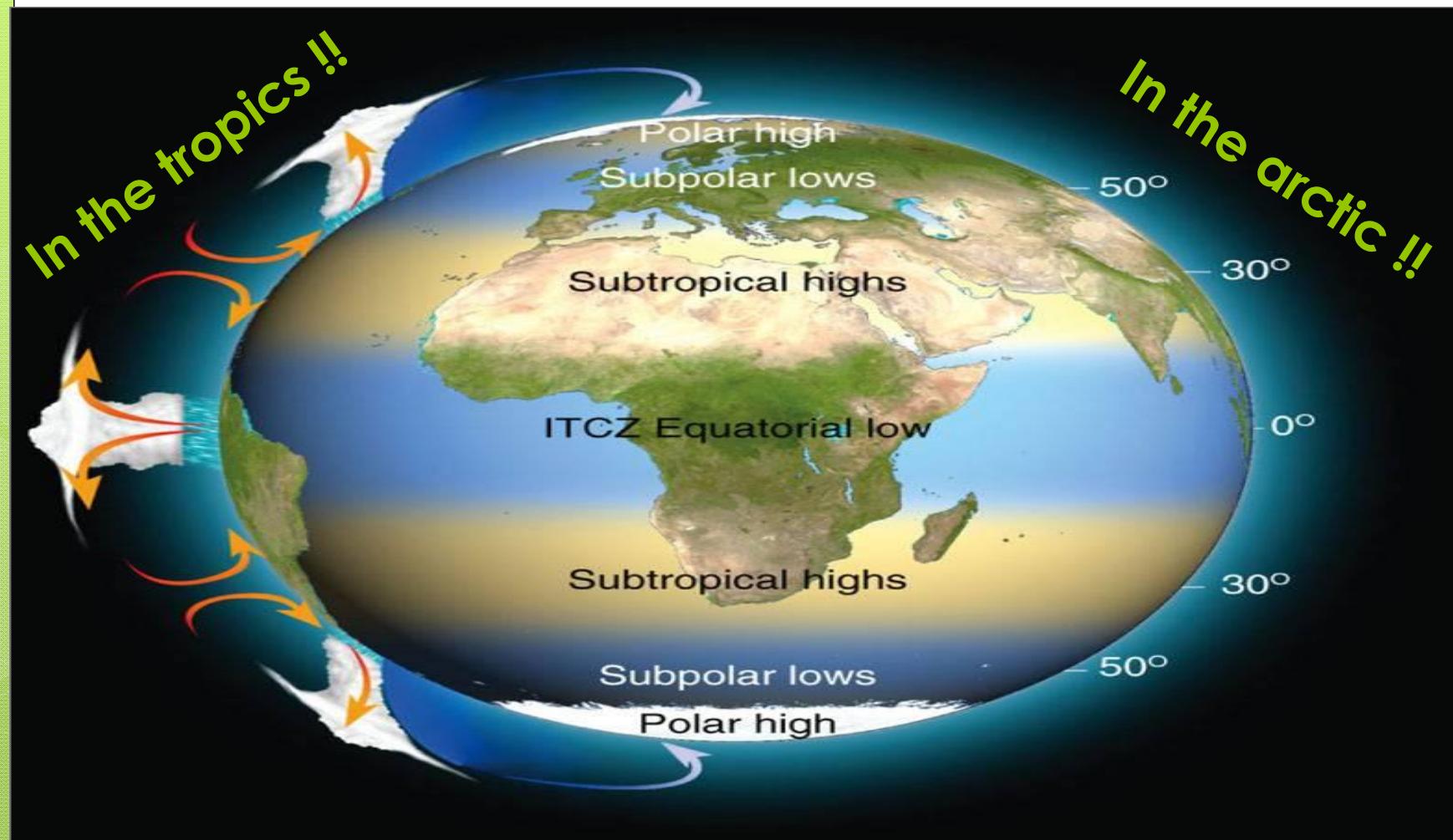


- Is the amount of water vapor* in the air
- Indicates the likelihood of precipitation, dew, or fog

*Water vapor is the gaseous state of water and is invisible.

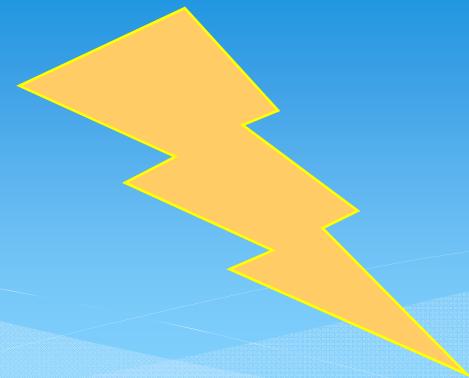


BAROMETRIC PRESSURE





STORMS



HOW IS A STORM FORMED?

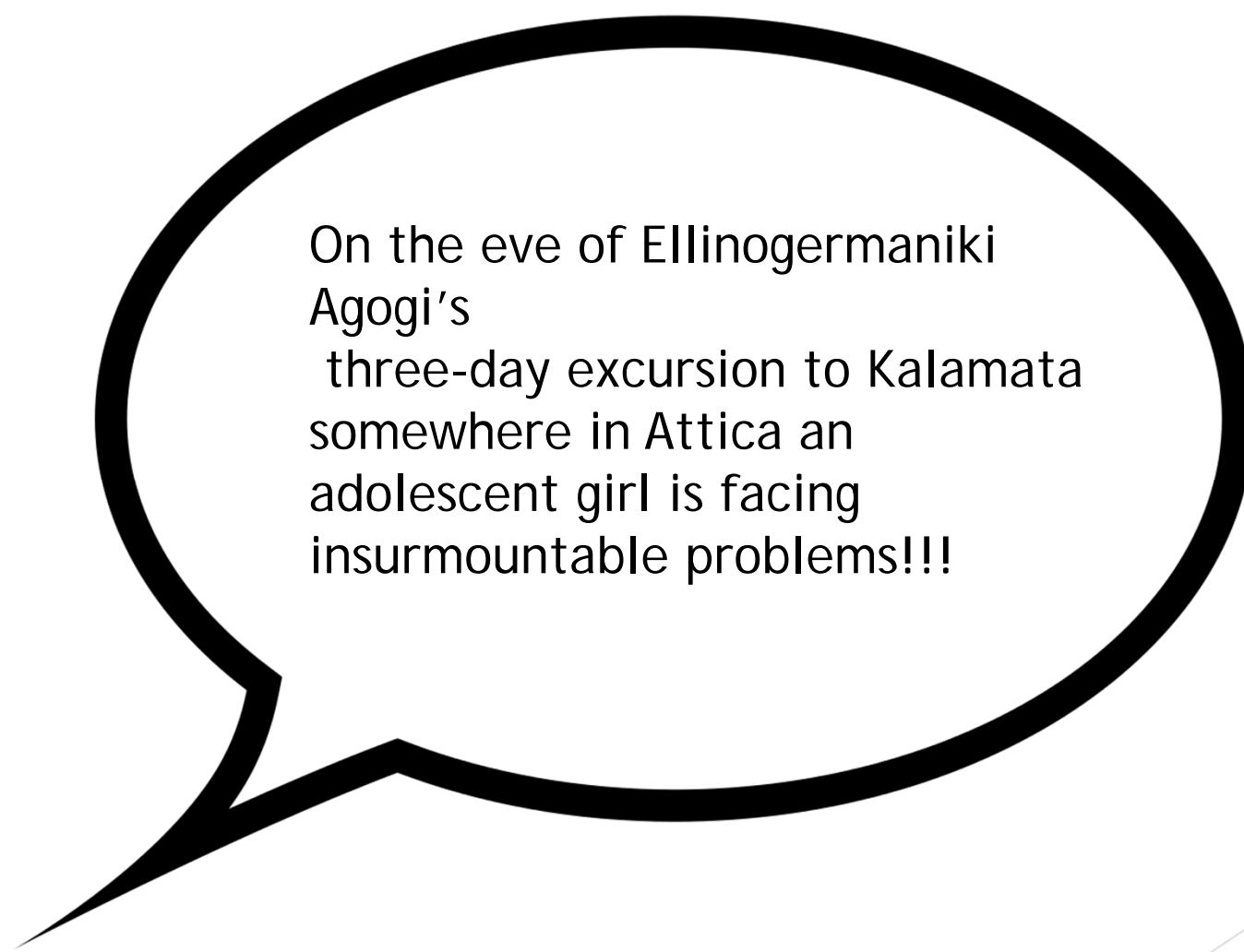
1. Fronts of cooler air flow down from the north to displace its warmer counterparts here
2. A counterclockwise flow in the front is created
3. The water in that air cools and condenses into clouds



THEODORA FILOPOULOU
IOANNA VAMVAKA

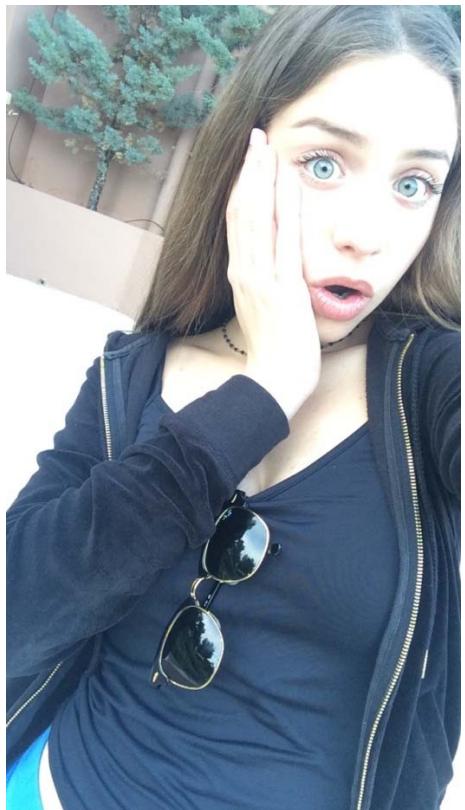
THE IMPORTANCE OF WEATHER FORECASTING IN OUR LIVES





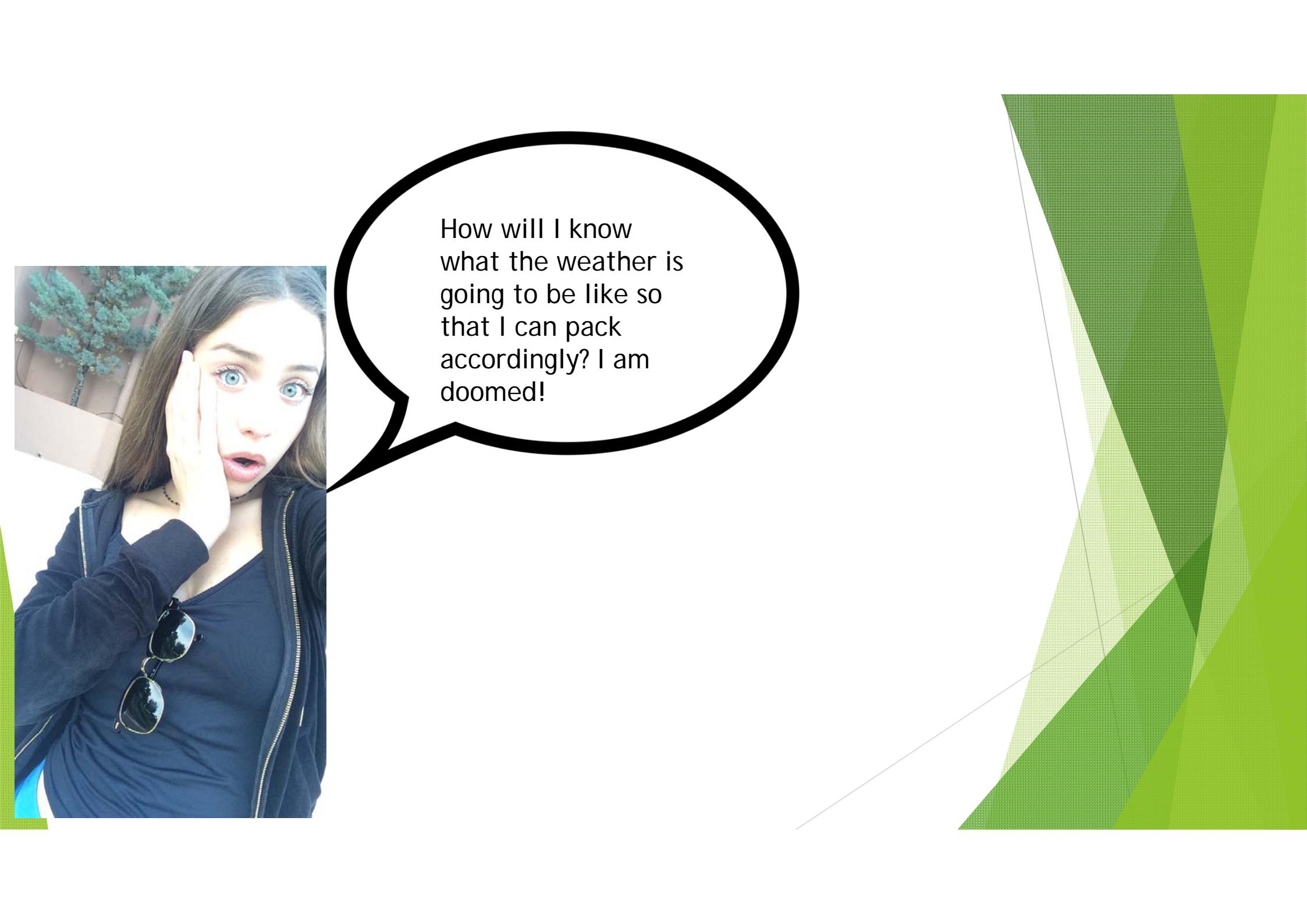
On the eve of Ellinogermaniki
Agogi's
three-day excursion to Kalamata
somewhere in Attica an
adolescent girl is facing
insurmountable problems!!!



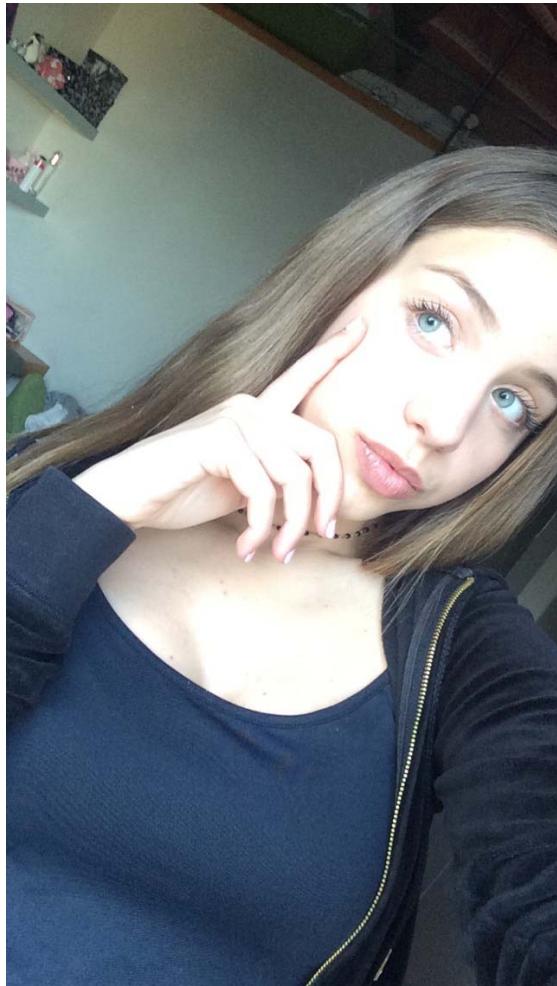


OH MY GOD! The
whole area has a
problem with
Internet access!
What am I going to
do now??

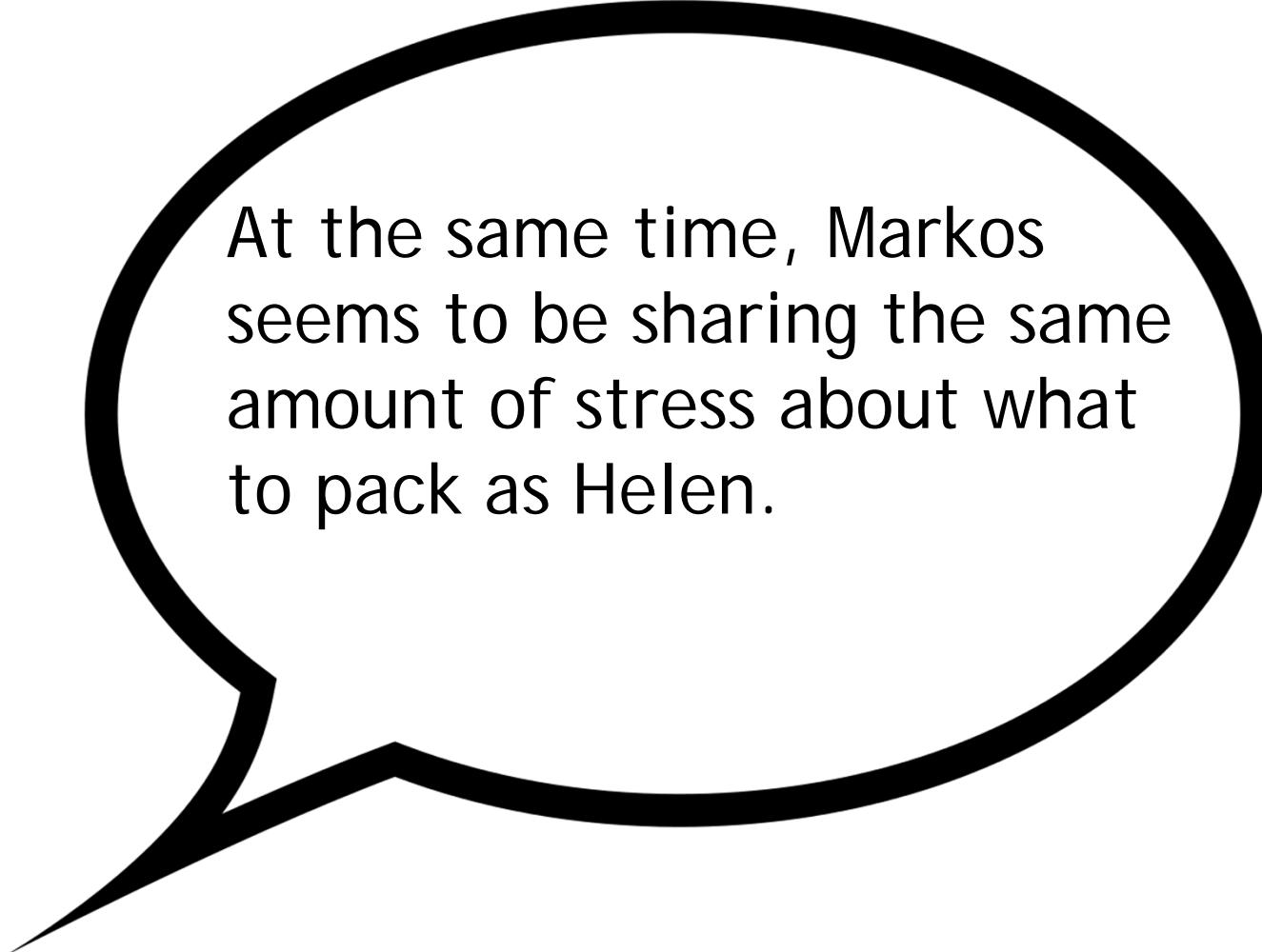




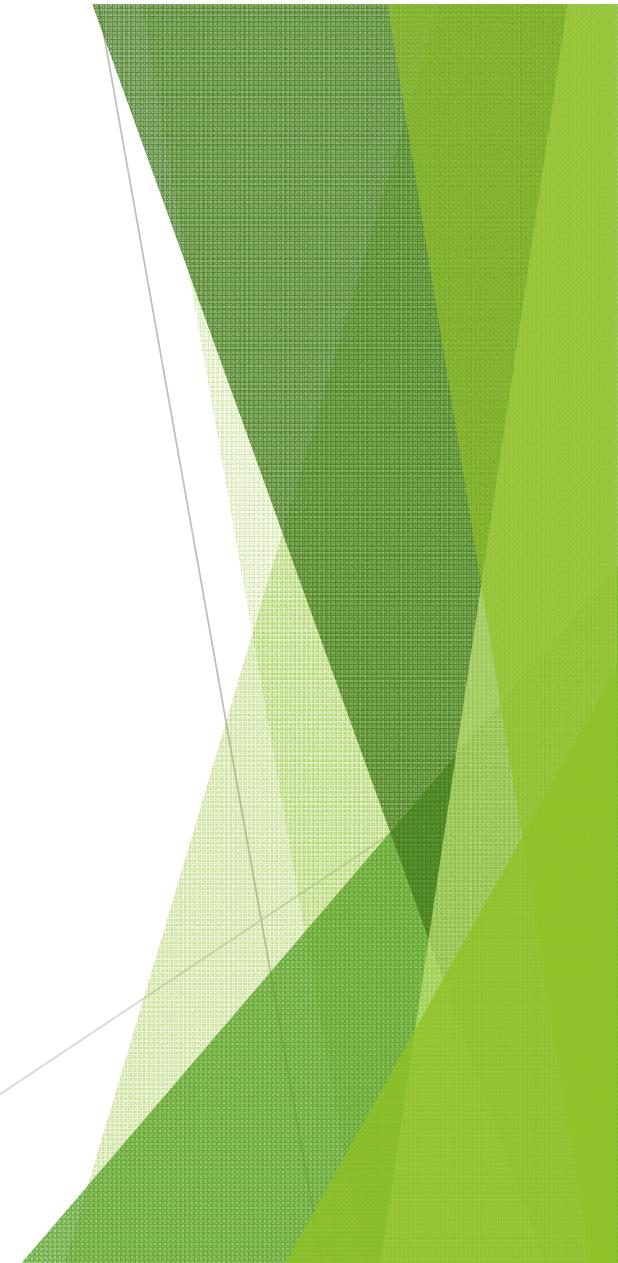
How will I know
what the weather is
going to be like so
that I can pack
accordingly? I am
doomed!



Wait a minute! I know
who can help me! Not
Super-Man, but the
Weather-Man!! I'm
calling Markos.



At the same time, Markos seems to be sharing the same amount of stress about what to pack as Helen.





I have to tell my mom to pack my stuff for tomorrow. I am too bored to do anything.

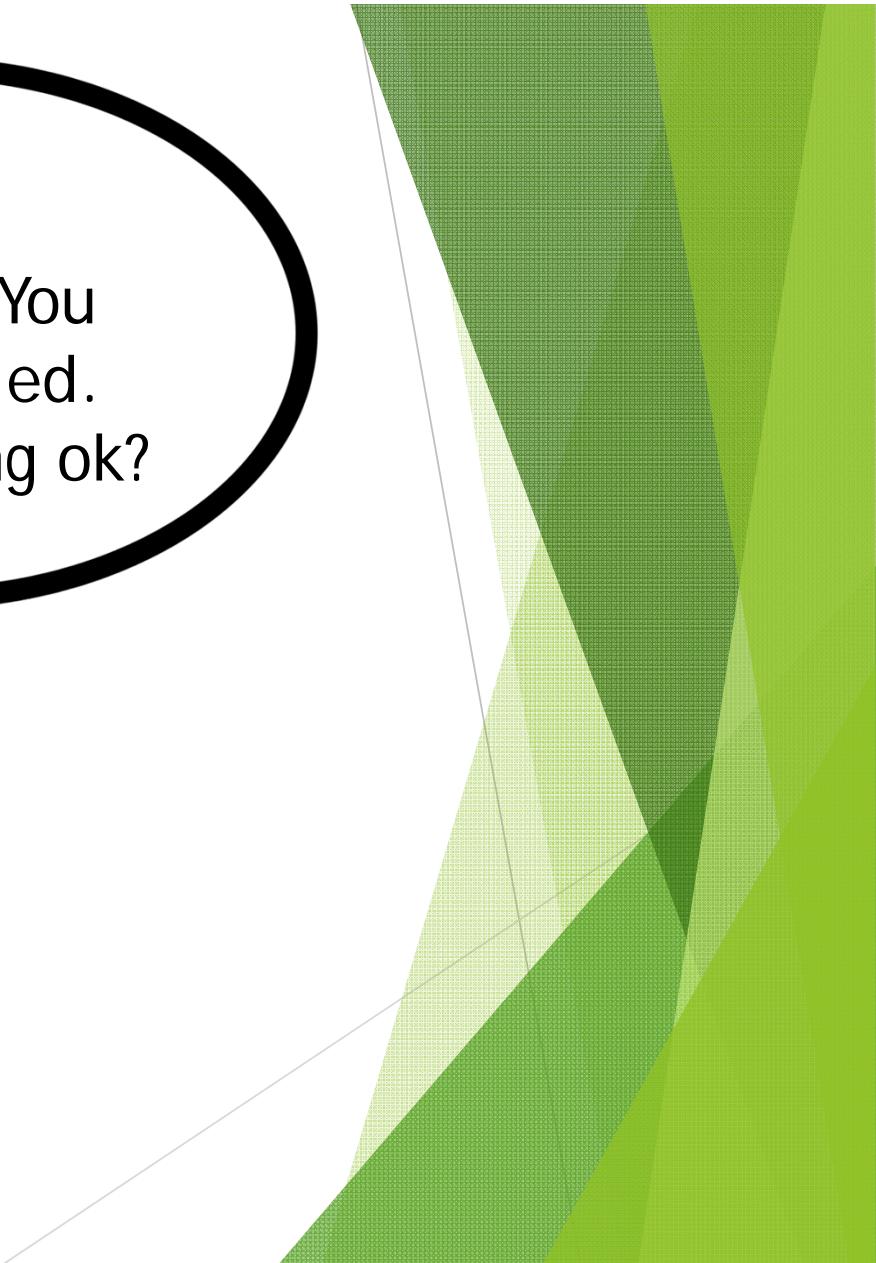


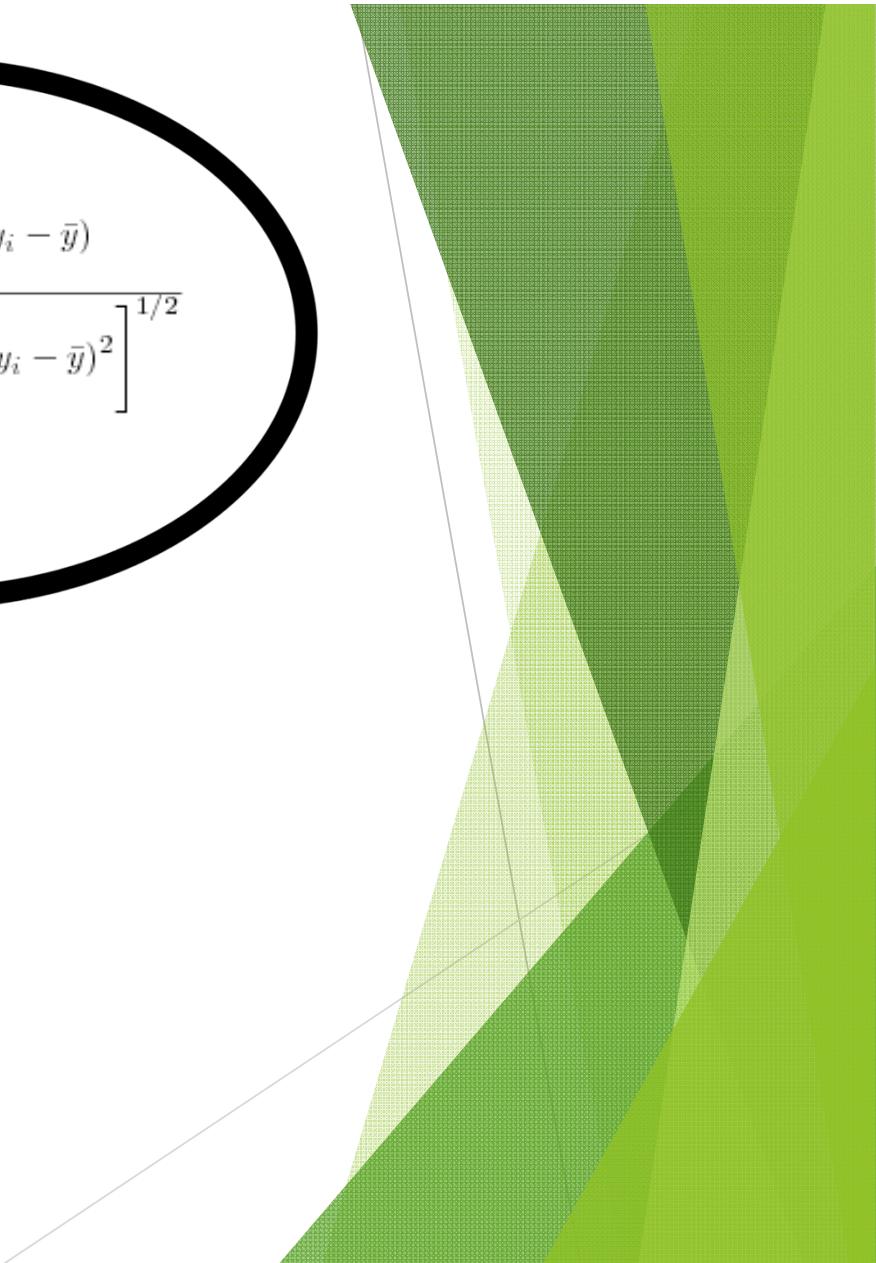
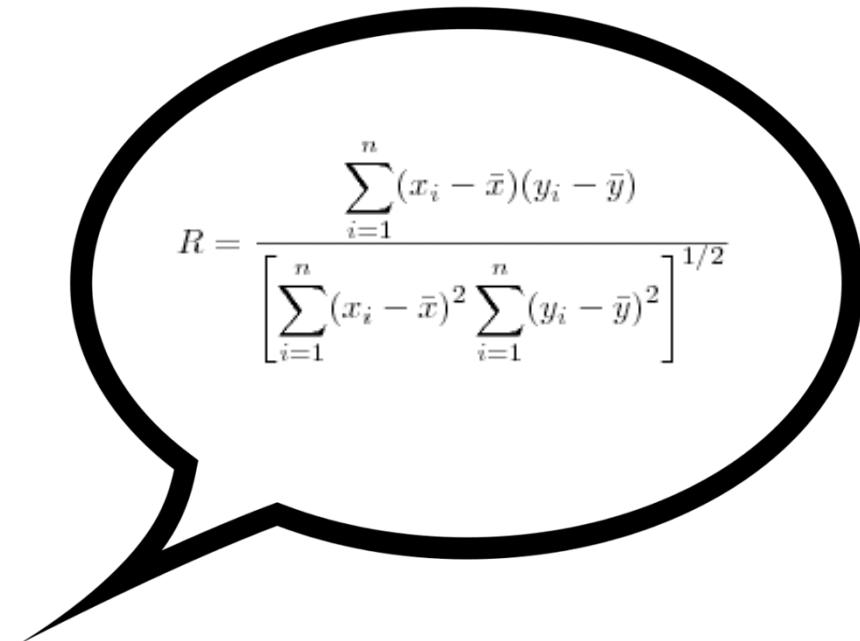
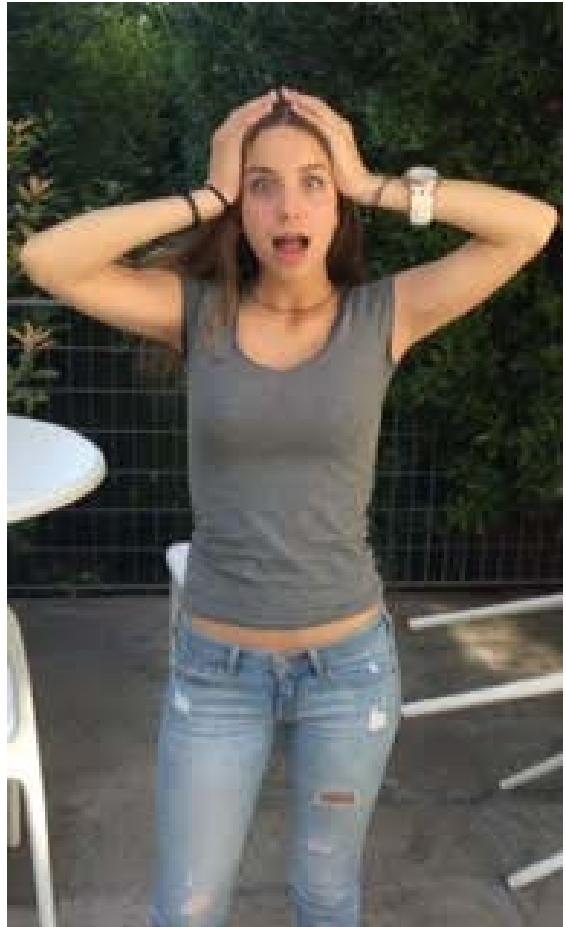
Oh! Helen is
calling! I
wonder what
she wants.

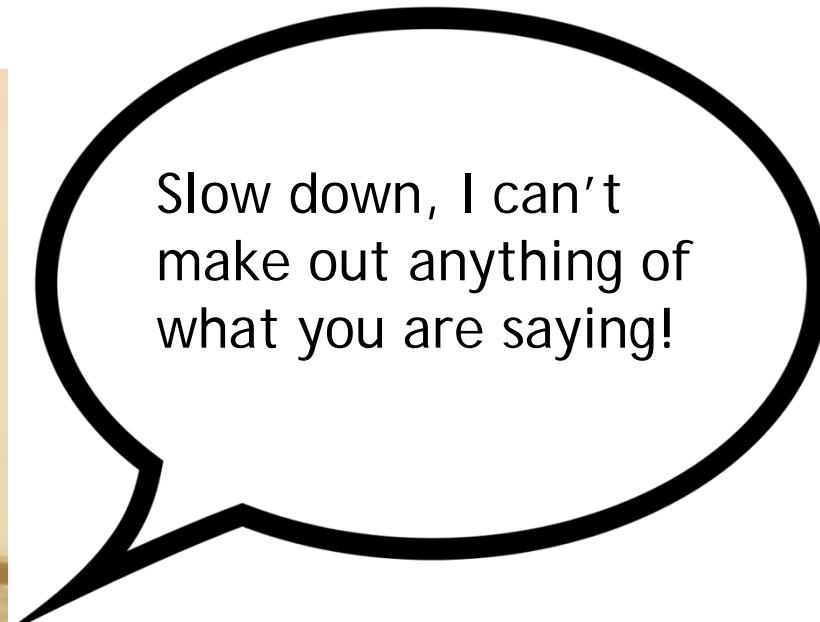


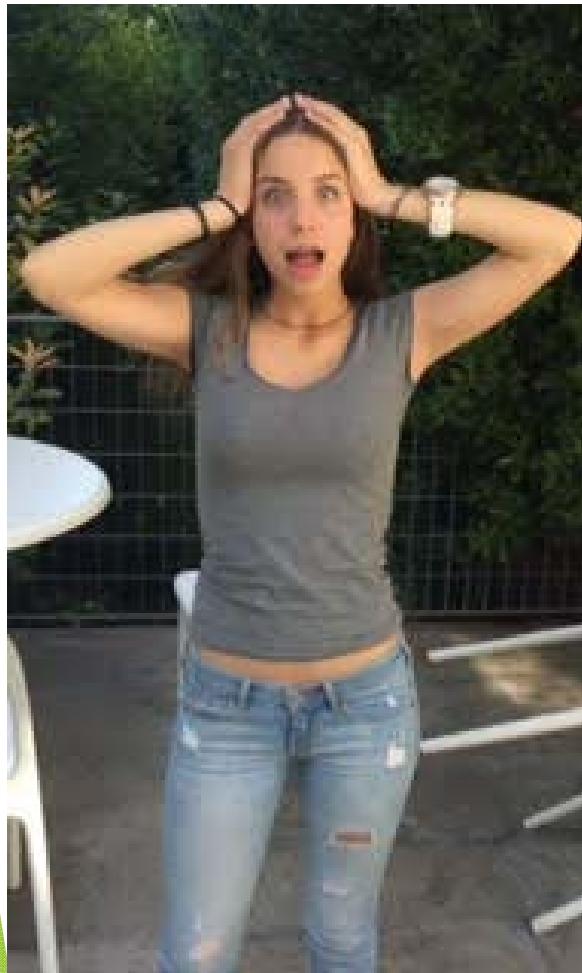


Hi Helen!
What's up? You
sound worried.
Is everything ok?

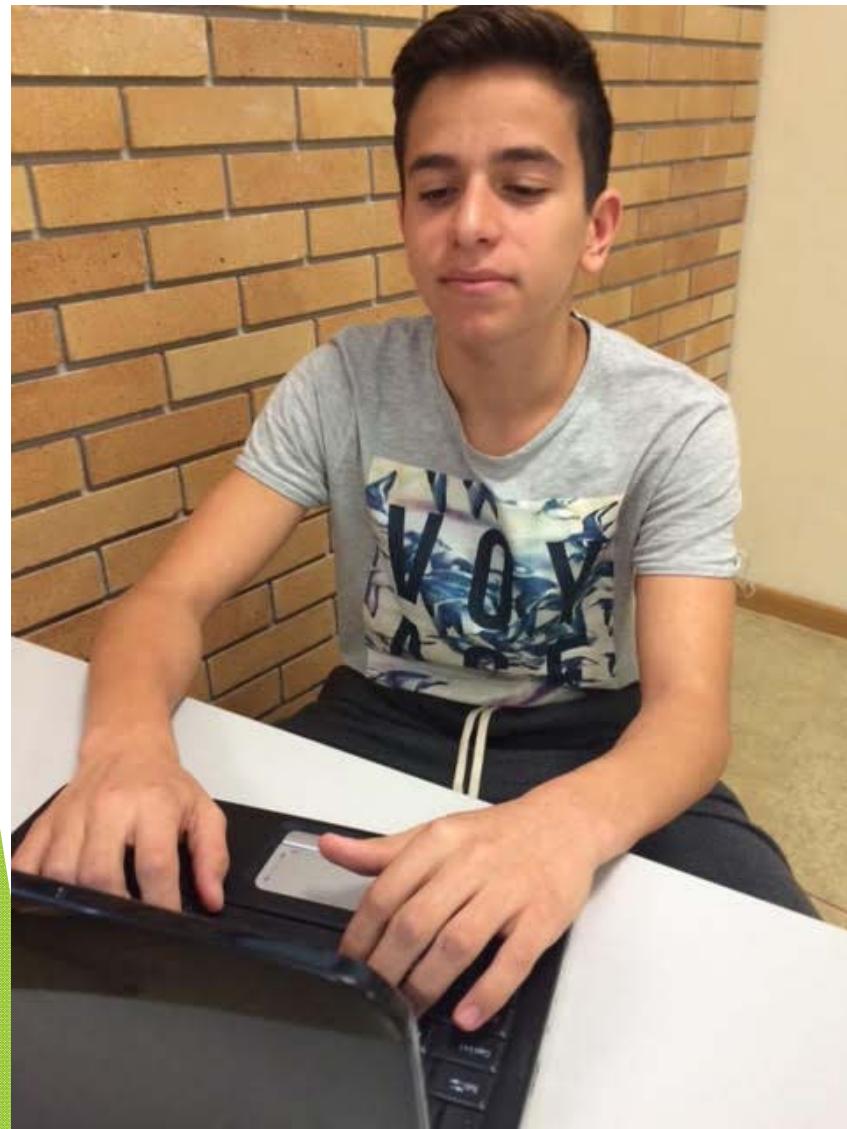








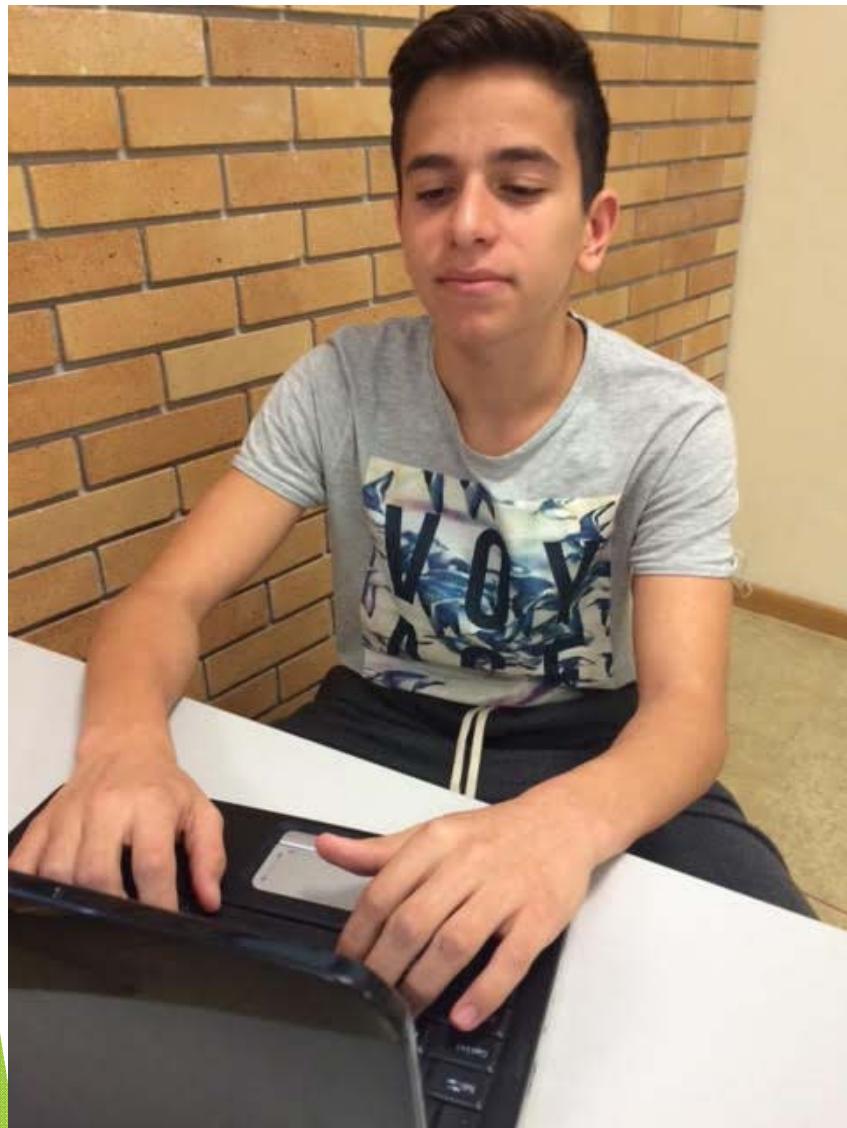
I need you to
google the weather
forecast for
Kalamata for the
next three days!



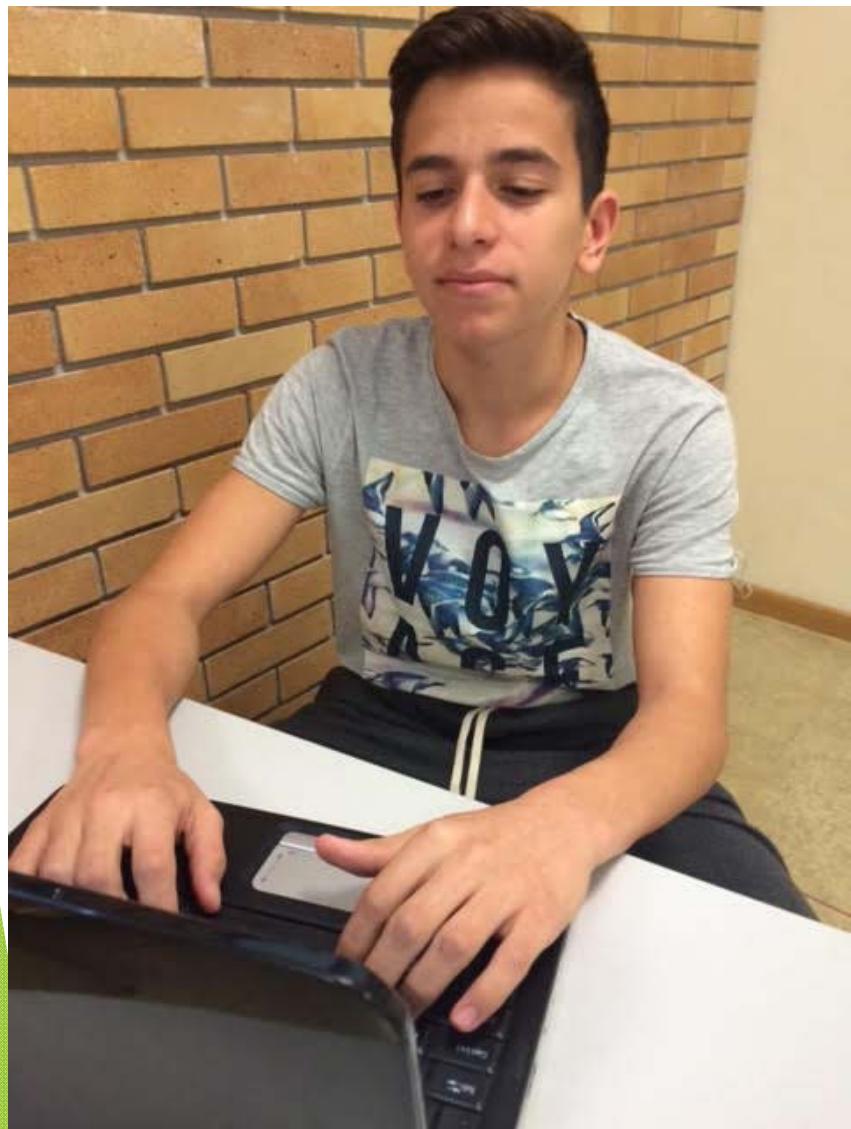
Easy Breezy!! Hang on a minute... Well it says here that it will be predominantly sunny with high temperatures.



Great! I'll take all
my trendy T-Shirts,
shorts and floral
mini dresses.
Thanks!!



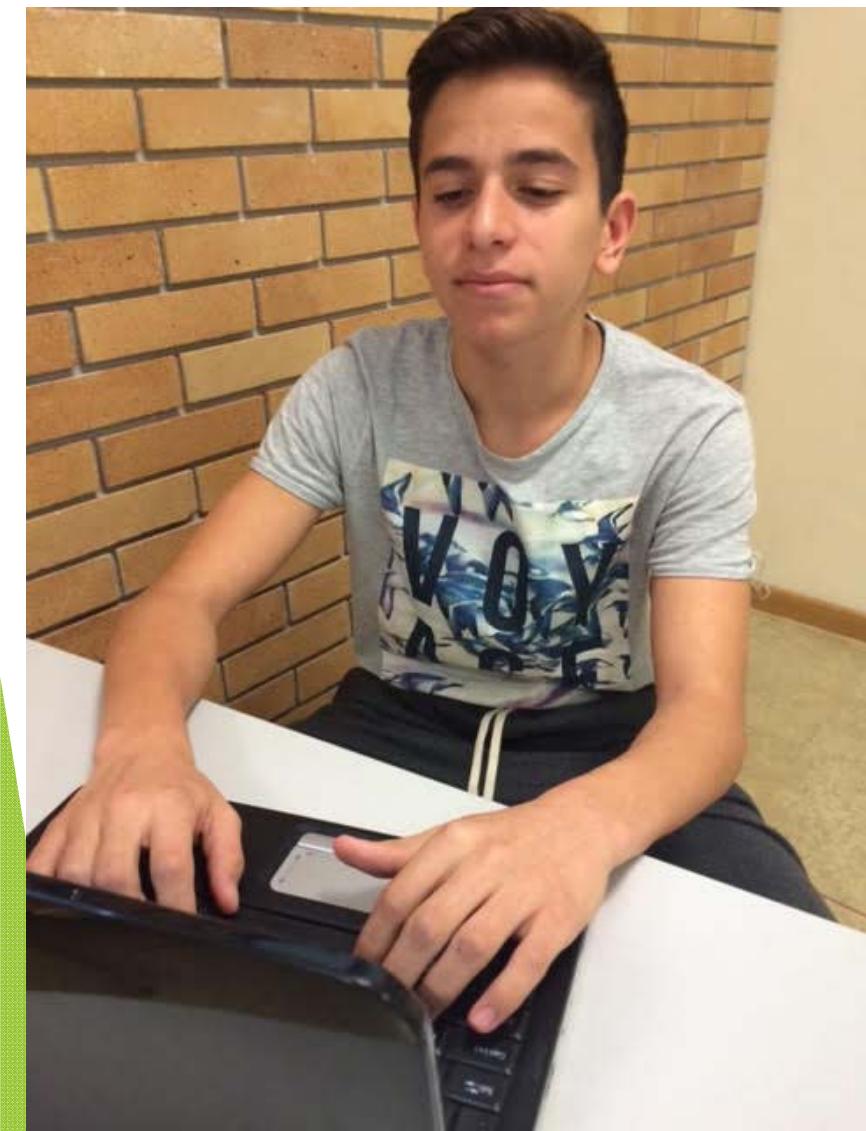
Oops! Just a minute!
It says here that on
Friday there is
increased likelihood
of rain!



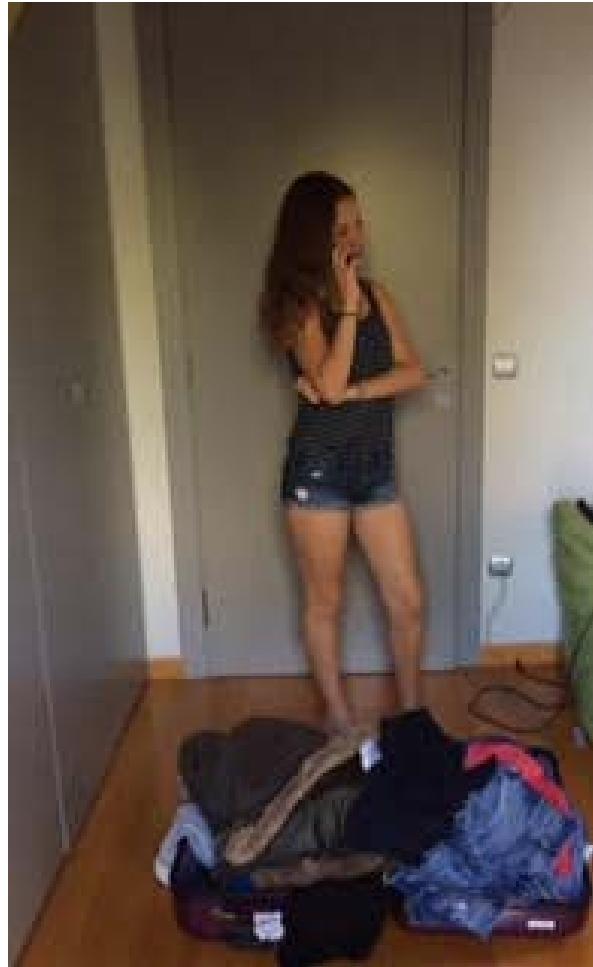
WAIT, WAIT, WAIT! I just
read that on Saturday
there will be strong
winds and the
temperature will drop
dramatically!



So this means I'll
need to pack a
couple of jackets
and maybe a scarf...



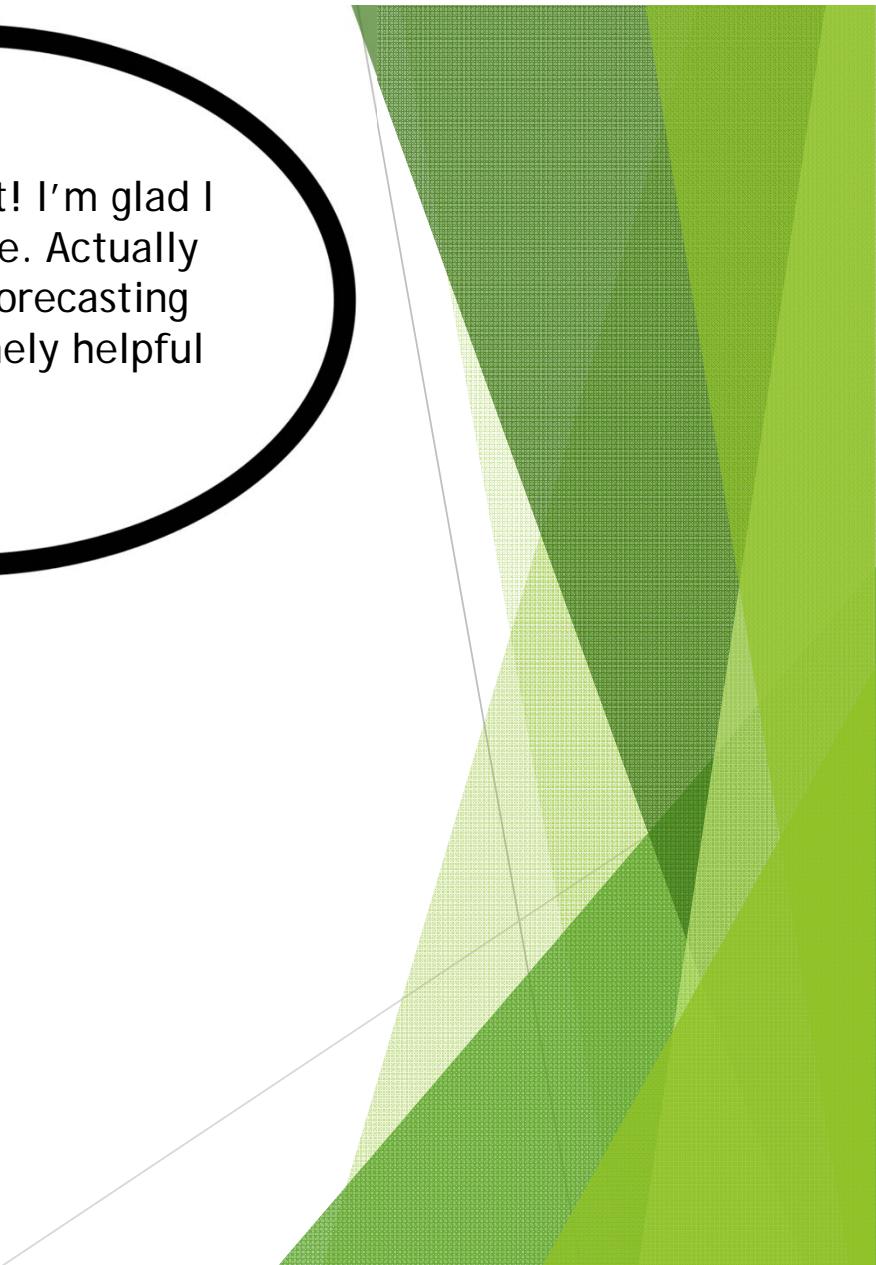
Helen, I know you'll think
I'm crazy, but I am now
reading on another website
that on Sunday it's going to
be bitterly cold. It may even
SNOW!



No harm done!! I'll just pack my fur coat and my ski boots. Markos you're an angel. I don't know what I would have done without you!!

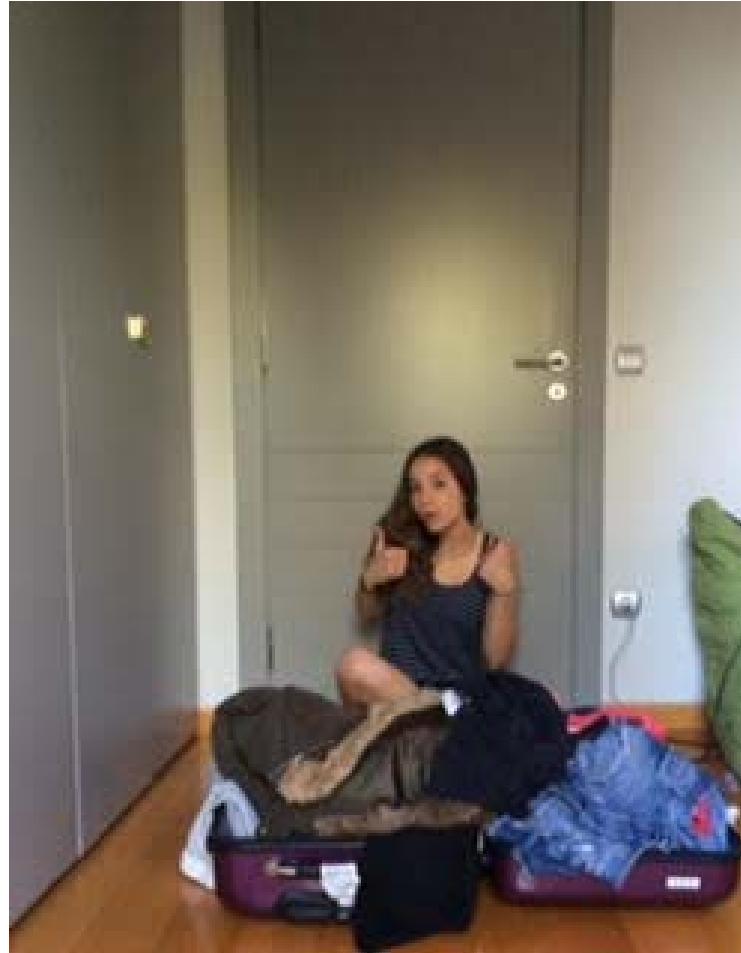


Don't mention it! I'm glad I was of assistance. Actually these weather forecasting sites are extremely helpful and accurate!!!





You can say that again!! Thanks to them I am not going to carry any unnecessary stuff.



Now I can sleep
tight and travel
light!!!!

THE END

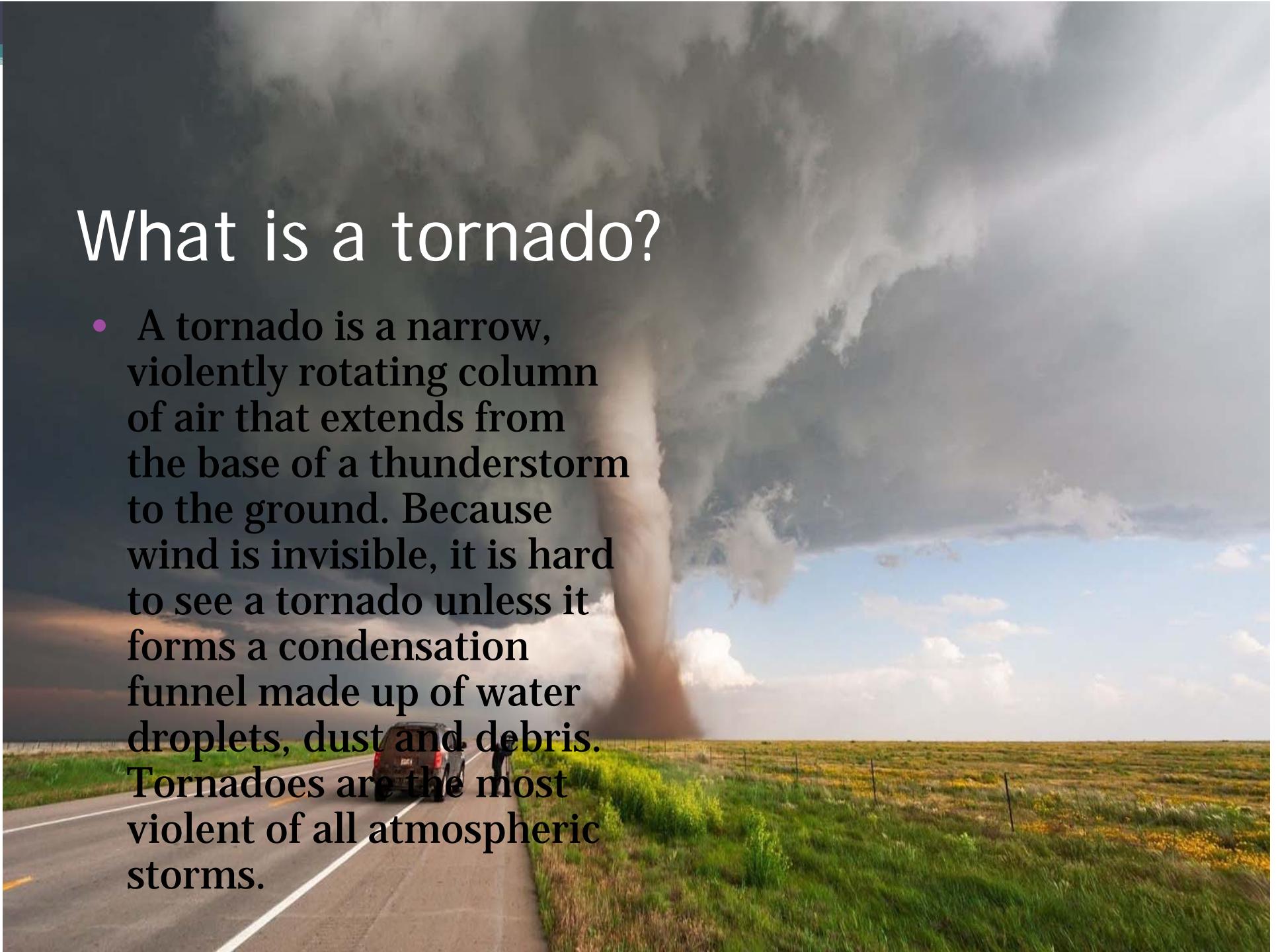
TORNADO BASICS

Q&A



What is a tornado?

- A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust and debris. Tornadoes are the most violent of all atmospheric storms.



Where do tornadoes occur?

- Tornadoes occur in many parts of the world, including Australia, Europe, Africa, Asia, and South America. Even New Zealand reports about 20 tornadoes each year. Two of the highest concentrations of tornadoes outside the U.S. are Argentina and Bangladesh.



How many tornadoes occur in the U.S. each year?

- About 1,200 tornadoes hit the U.S. yearly. Since official tornado records only date back to 1950, we do not know the actual average number of tornadoes that occur each year. Plus, tornado spotting and reporting methods have changed a lot over the last several decades.



Where is tornado alley?

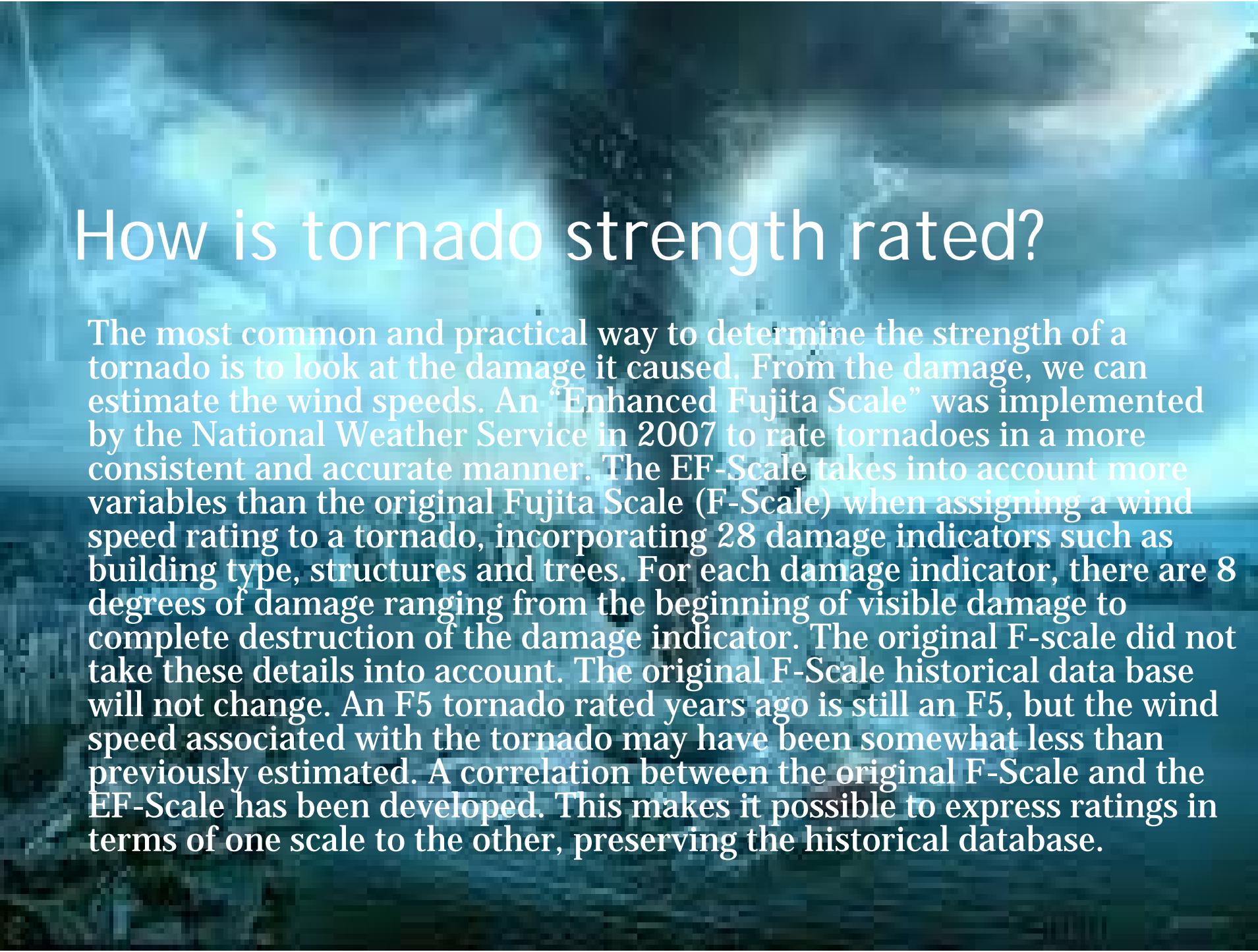
- Tornado Alley is a nickname invented by the media for a broad area of relatively high tornado occurrence in the central U.S. Various Tornado Alley maps look different because tornado occurrence can be measured many ways: by all tornadoes, tornado county-segments, strong and violent tornadoes only, and databases with different time periods. *Please remember, violent or killer tornadoes do happen outside “Tornado Alley” every year.*



When are tornadoes most likely?

- Tornado season usually refers to the time of year the U.S. sees the most tornadoes. The peak “tornado season” for the Southern Plains is during May into early June. On the Gulf coast, it is earlier during the spring. In the northern plains and upper Midwest, tornado season is in June or July. But, remember, tornadoes can happen at any time of year. Tornadoes can also happen at any time of day or night, but most tornadoes occur between 4–9 p.m.





How is tornado strength rated?

The most common and practical way to determine the strength of a tornado is to look at the damage it caused. From the damage, we can estimate the wind speeds. An "Enhanced Fujita Scale" was implemented by the National Weather Service in 2007 to rate tornadoes in a more consistent and accurate manner. The EF-Scale takes into account more variables than the original Fujita Scale (F-Scale) when assigning a wind speed rating to a tornado, incorporating 28 damage indicators such as building type, structures and trees. For each damage indicator, there are 8 degrees of damage ranging from the beginning of visible damage to complete destruction of the damage indicator. The original F-scale did not take these details into account. The original F-Scale historical data base will not change. An F5 tornado rated years ago is still an F5, but the wind speed associated with the tornado may have been somewhat less than previously estimated. A correlation between the original F-Scale and the EF-Scale has been developed. This makes it possible to express ratings in terms of one scale to the other, preserving the historical database.

How do tornadoes form?

The truth is that we don't fully understand. The most destructive and deadly tornadoes occur from supercells, which are rotating thunderstorms with a well-defined radar circulation called a mesocyclone. (Supercells can also produce damaging hail, severe non-tornadic winds, unusually frequent lightning, and flash floods.) Tornado formation is believed to be dictated mainly by things which happen on the storm scale, in and around the mesocyclone. Recent theories and results from the VORTEX2 program suggest that once a mesocyclone is underway, tornado development is related to the temperature differences across the edge of downdraft air wrapping around the mesocyclone. Mathematical modeling studies of tornado formation also indicate that it can happen without such temperature patterns; and in fact, very little temperature variation was observed near some of the most destructive tornadoes in history on 3 May 1999.

The background of the slide features a photograph of a coastal town nestled at the base of a range of mountains. The town appears to be built on a hillside, with buildings and infrastructure visible. The surrounding landscape is a mix of green vegetation and rocky terrain, with the ocean visible in the distance under a clear sky.

Weather Station

Basic Instruments

Weather Station

Weather Station is a system for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate.

Weather Station Sensors

Typical weather stations have the following sensors:

- Temperature Sensor
- Relative Humidity Sensor (Hygrometer)
- Barometric Pressure Sensor
- Wind Speed & Wind Direction Sensors (Anemometer)
- Rain Gauge

Temperature Sensor

- Temperature is the second most common measurement variable in the world(after time).
- Temperature sensors used in weather stations to measure air temperature are of different types and highly accurate.



Relative Humidity Sensor

- Humidity is the amount of moisture or water vapor present in the air.
- Humans can be comfortable within a wide range of humidities depending on the temperature (ideally 50%-60%).
- Extremely low humidity may cause nosebleeds, eye irritations and aggravate allergies.



Barometric Pressure Sensor

- Atmospheric pressure is an indicator of weather.
- Under most conditions it forecasts weather for 12 to 24 hours ahead.
- A rapid drop in atmospheric pressure means that a low-pressure system is arriving.
- Low-pressure → cloudy, rainy, or windy weather.
- High-pressure → clear skies, cool, dry air.



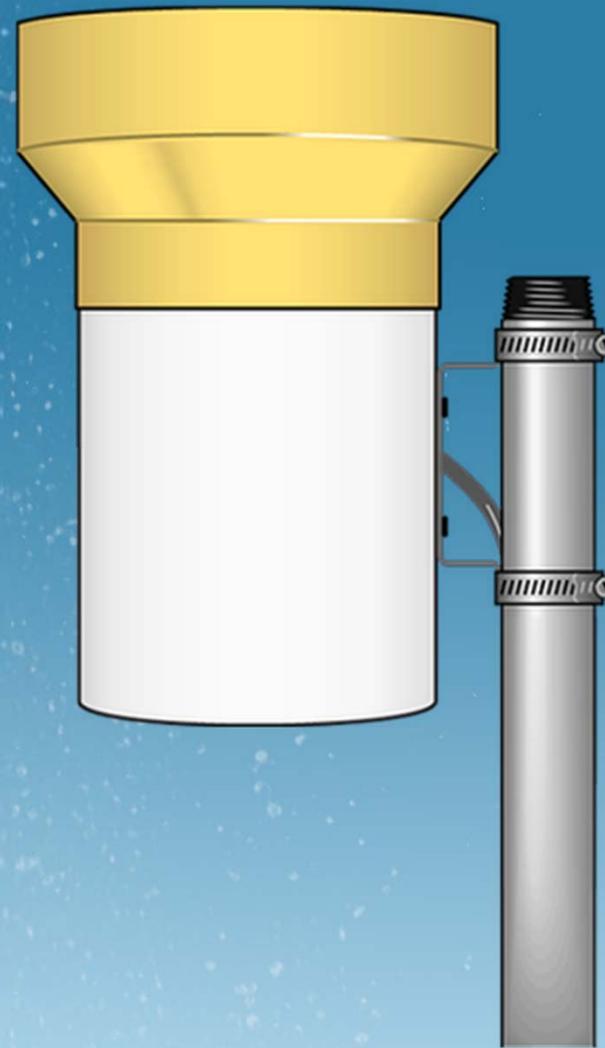
Wind Speed & Direction Sensor Anemometer

- An anemometer is an instrument that measures wind speed and wind direction.
- The most common type of anemometer has three or four cups and a vane.
- The stronger the wind blows, the faster the rod spins.



Rain Gauge

- A rain gauge sensor is an instrument that gathers and measures the amount of liquid precipitation over a set period of time.



All-in-one Sensors

- Modern weather stations are equipped with instruments that combine all the above sensors in one unit.



END

Konstantinos
Larintzakis &
George Poulopoulos