



Friends

for Georgia 4-H'ers

Weather and Climate

Name _____

Grade _____ Teacher _____

School _____





CONTENTS:

What's Trending with Weather and Climate?	3
Weather Map /Cloud Journaling	4 - 5
Tools of the Trade	6
Meet the Experts/Spotlight on Careers	7
Is it Weather or Climate?/ Weather Vocabulary . .	8

Do you know the difference between weather and climate?

The main difference between weather and climate is the time scale over which the conditions are described. Weather generally describes the atmosphere during short time frames like hours or days. Climate generally refers to conditions that span months, years, or even decades. One way to remember this is that weather tells us what to wear on any given day, and the climate tells us what kind of wardrobe to own. Knowing this, join me, Arch the Dog, as we explore much more about weather and climate!

Georgia 4-H is a partner in public education and strives to incorporate Georgia Standards of Excellence in the education materials for in-school use. The following Georgia Standards of Excellence are correlated to the content delivery included in this publication.

S4E3. Obtain, evaluate, and communicate information to demonstrate the water cycle.

- Plan and carry out investigations to observe the flow of energy in water as it changes states from solid (ice) to liquid (water) to gas (water vapor) and changes from gas to liquid to solid.
- Develop models to illustrate multiple pathways water may take during the water cycle (evaporation, condensation, and precipitation).

S4E4. Obtain, evaluate, and communicate information to predict weather events and infer weather patterns using weather charts/maps and collected weather data.

- Construct an explanation of how weather instruments (thermometer, rain gauge, barometer, wind vane, and anemometer) are used in gathering weather data and making forecasts.
- Interpret data from weather maps, including fronts (warm, cold, and stationary), temperature, pressure, and precipitation to make an informed prediction about tomorrow's weather.
- Ask questions and use observations of cloud types (cirrus, stratus, and cumulus) and data of weather conditions to predict weather events.
- Construct an explanation based on research to communicate the difference between weather and climate.



Think Green! Not just 4-H Green...but let's help do our part to recycle and reuse. Save this book, reread it or pass it along to a friend. If it's too worn, please recycle it.





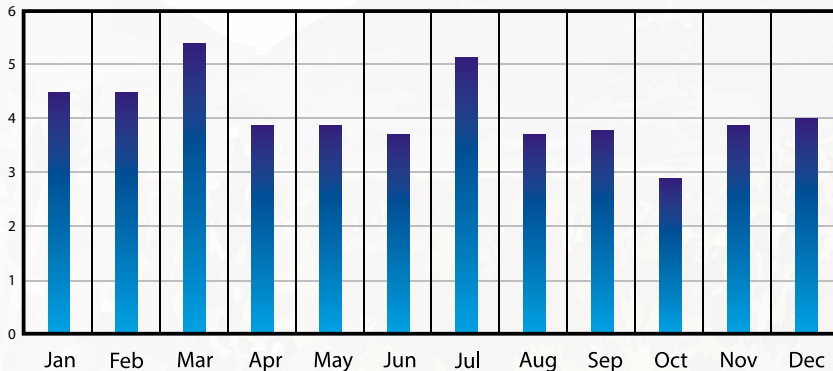
WHAT'S TRENDING WITH WEATHER AND CLIMATE?

Climatologists create graphs using weather observations that have been collected over long periods of time (at least 30 years). The observations are collected from land-based weather stations, ships, buoys, and satellites passing over Earth. Climatologists study these graphs to identify trends in weather patterns. A trend is a long-term movement in a series of data points. Trends can go up or down, or move very little.

Please explore the example below and answer the questions provided to learn more about trends in weather patterns.

Total Average Rainfall (Inches) – Fulton County, GA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
4.5	4.5	5.4	3.9	3.9	3.7	5.1	3.7	3.8	2.9	3.9	4	49.3

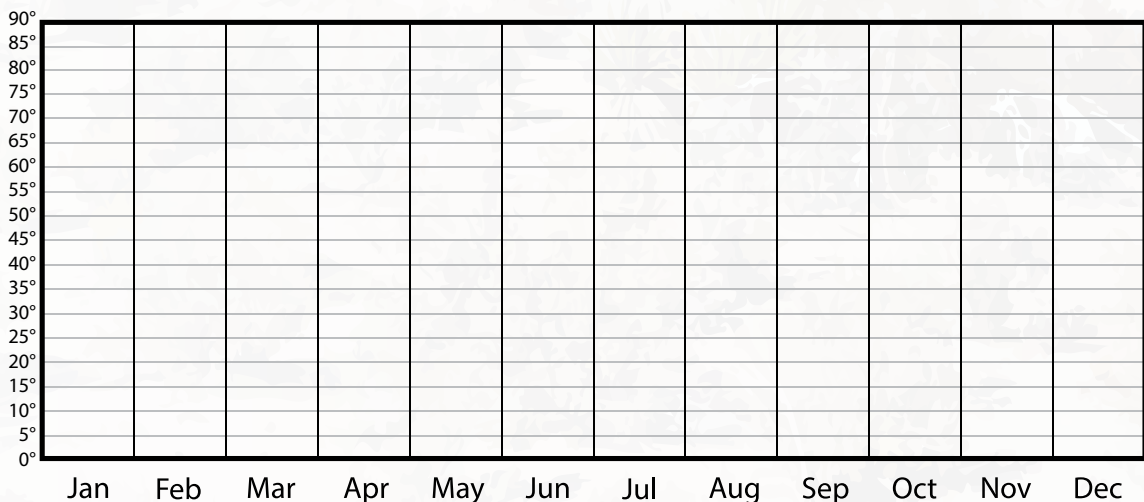


1. On average, how much rainfall does Fulton County, GA receive in the month of July? _____ inches
2. On average, which month receives the lowest amount of rainfall in Fulton County, GA? _____
3. On average, which month receives the highest amount of rainfall in Fulton County, GA? _____

Now, let's build our own graph. Create a maximum temperature graph below using the data provided to the right.

Average Maximum Temperature (°F) – Fulton County, GA

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
52.1	56.3	64.0	72.8	80.2	86.3	88.6	87.9	82.2	72.9	63.1	54.1



To learn more or find data for different parts of Georgia, please visit:
<http://agroclimate.org/tools/climate-risk/>



GAUGE YOUR KNOWLEDGE

2005 – Hurricane Katrina

Hurricane Katrina first made landfall in Louisiana on August 29, 2005, as a Category 3 storm. Bringing hurricane conditions to the Louisiana, Mississippi, and Alabama coasts, Katrina's damaging effects included widespread wind damage, storm surge damage, and failed levee systems.



CAN YOU

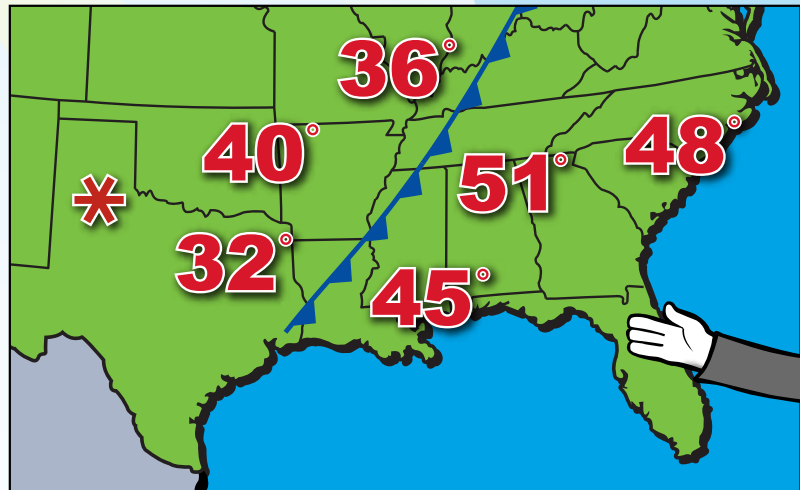
Read A Weather Map?

Meteorologists use symbols on surface weather maps to convey information about weather observations at a particular time. The weather maps in newspapers or on television weather forecasts are simplified versions of these surface maps.

Examine this fictional map and practice interpreting the information by answering the questions.

Map Questions

1. What is the coldest temperature recorded on this date? _____
2. What type of front is depicted on the map? _____
3. What type of weather is reported in Texas? _____

**Cold Front Warm Front****Stationary Front****Temperature (°F)****32°**

SNOW
 RAIN
 DRIZZLE
 FOG
 THUNDERSTORM
 HAIL

Now it's your turn to be the meteorologist! Create a weather map using the symbols provided to depict the conditions.



Weather Conditions

- A warm front is moving from the south to the north.
- The temperature in northern Florida is 75°F.
- The temperature in western Tennessee is 78°F.
- The temperature in eastern North Carolina is 69°F.
- It is raining in southern Georgia.



Wh
Clou
Loca
Date

Draw your

GAUGE YOUR KNOWLEDGE

2008 – U.S. Drought

The United States experienced drought conditions throughout 2008. Record low lake levels were reported in areas of the Southeast, and the heat and drought conditions also caused agricultural losses across a large portion of the U.S.



CLOUD JOURNALING

WHAT'S A CLOUD GOT TO DO WITH WEATHER?

Clouds can indicate good weather or bad weather, can offer relief from direct sunlight, and even provide precipitation. Scientists recognize ten basic types of clouds that are defined by their height as either high-level clouds, mid-level clouds, or low-level clouds.



For more information about the ten basic cloud types (including pictures), visit <http://www.srh.noaa.gov/srh/jetstream/clouds/cloudwise/types.html>



Stratus

low clouds that occur as a uniform gray layer stretching from horizon to horizon; they may produce drizzle, and where they intersect the ground, they are classified as fog



Cirrus

high thin cloud occurring as silky strands and composed of ice crystals



Cumulus

clouds that develop as a consequence of the updraft in convection currents; they resemble huge puffs of cotton floating in the sky

Use the spaces provided to record your own observations about the clouds you see over time. Try making and recording observations for several days, and think about what kinds of clouds you see and what they might indicate about the weather conditions.

Be sure to record the location, date, and time you observe each type of cloud.

Which clouds do you see?

Cloud Type: _____

Location: _____

Date: _____ Time: _____

Draw your cloud:

Which clouds do you see?

Cloud Type: _____

Location: _____

Date: _____ Time: _____

Draw your cloud:

Which clouds do you see?

Cloud Type: _____

Location: _____

Date: _____ Time: _____

Draw your cloud:

Which clouds do you see?

Cloud Type: _____

Location: _____

Date: _____ Time: _____



Draw your cloud:



2011 – Tornado in Joplin, Missouri

On Sunday, May 22, 2011, an EF-5 tornado hit the city of Joplin, Missouri. The tornado had wind speeds greater than 200 mph, was three-quarters of a mile wide, and had a track lasting six miles. This tornado was also a part of a larger outbreak of an estimated 180 tornadoes in the central and southern states over the course of several days.



TOOLS OF THE TRADE

Scientists use a variety of instruments to measure and study the weather.
Can you match up the weather instruments below with their definitions?

1. ____ An instrument used to measure the water vapor content of the atmosphere
2. ____ An instrument that measures the speed or force of the wind
3. ____ An instrument for measuring rainfall
4. ____ An instrument for measuring temperature
5. ____ An instrument used to measure atmospheric pressure

A. Anemometer

B. Barometer

C. Rain Gauge

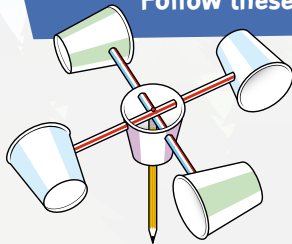
D. Thermometer

E. Psychrometer

MAKE YOUR OWN

Weather Instrument

As you learned above, anemometers are instruments that measure the speed or force of the wind.
Did you know you can make your own anemometer?
Follow these simple instructions below to get started being a weather scientist!



Materials:

5 three ounce paper cups
2 straight plastic straws
straight pin (or push pin)
pencil with eraser
paper hole punch
stapler
scissors
ruler

1. Take four of the cups and use the paper punch to punch one hole in each, about a half inch below the rim.
2. Take the fifth cup and punch four equally spaced holes about a ¼ inch below the rim. Then punch a hole in the center of the bottom of the cup.
3. Take one of the four cups and push a soda straw through the hole. Fold the end of the straw and staple it to the side of the cup across from the hole. Repeat this procedure for another one-hole cup and the second straw.
4. Slide one cup and straw assembly through two opposite holes in the cup with four holes. Push another one-hole cup onto the end of the straw just pushed through the four-hole cup.
5. Bend the straw and staple it to the one-hole cup, making certain that the cup faces the opposite direction from the first cup. Repeat this procedure using the other cup and straw assembly and the remaining one-hole cup.
6. Align the four cups so that their open ends face in the same direction either clockwise or counter-clockwise around the center cup.
7. Push the straight pin through the two straws where they intersect.
8. Push the eraser end of the pencil through the bottom hole in the center cup. Push the pin into the end of the pencil eraser as far as it will go.
9. Now your anemometer is ready for use!

Source for Activity: "Forces of Nature: 4-H Aggie Adventures for Kids, Utah State University Cooperative Extension" <http://utah4h.org/staffresources/stemcampguides>

GAUGE YOUR KNOWLEDGE

2014 – Winter Storms

In late January of 2014, a winter storm caused widespread damage across the Southeast, bringing snow, sleet, and freezing rain. The winter weather and limited road-clearing equipment resulted in massive travel disruptions when thousands of vehicles were abandoned on highways around Atlanta.



MEET THE EXPERTS

Photo courtesy of UGA Photographic Services



Director of UGA's Atmospheric Science Program

— **Dr. J. Marshall Shepherd** is a leading international expert in weather and climate. Dr. Shepherd was the 2013 President of American Meteorological Society (AMS), the nation's largest and oldest professional/science society in the atmospheric and related sciences. Dr. Shepherd is Director of the University of Georgia's (UGA) Atmospheric Sciences Program and Full Professor in the Department of Geography. He is the Georgia Athletic Association Distinguished Professor of Geography

and Atmospheric Sciences. Dr. Shepherd is also the host of The Weather Channel's Award-Winning Sunday talk show *Weather Geeks*, a pioneering Sunday talk show on national television dedicated to science and contributor to *Forbes Magazine*. In 2014, Ted Turner and his Captain Planet Foundation honored Dr. Shepherd with its Protector of the Earth Award. Prior recipients include Erin Brockovich and former EPA Administrator Lisa Jackson. He is also the 2015 Recipient of the Association of American Geographers (AAG) Media Achievement award, the Florida State University Grads Made Good Award and the UGA Franklin College of Arts and Sciences Sandy Beaver Award for Excellence in Teaching. In 2015, Dr. Shepherd was invited to moderate the White House Champions for Change event. Prior to UGA, Dr. Shepherd spent 12 years as a **Research Meteorologist** at NASA-Goddard Space Flight Center and was Deputy Project Scientist for the Global Precipitation Measurement (GPM) mission, a multi-national space mission that launched in 2014. President Bush honored him on May 4th 2004 at the White House with the Presidential Early Career Award for pioneering scientific research in weather and climate science. Dr. Shepherd is a Fellow of the American Meteorological Society. Two national magazines, the AMS, and Florida State University have also recognized Dr. Shepherd for his significant contributions. In 2016, Dr. Shepherd was the Spring Commencement speaker at his 3-time Alma Mater, Florida State University and was recently selected for an SEC Academic Leadership Fellows program.

Dr. Shepherd is frequently sought as an expert on weather, climate, and **remote sensing**. He routinely appears on CBS Face The Nation, NOVA, The

Today Show, CNN, Fox News, The Weather Channel and several others. His TedX Atlanta Talk on "Slaying Climate Zombies" is highly regarded and cited. Dr. Shepherd is also frequently asked to advise key leaders at NASA, the White House, Congress, Department of Defense, and officials from foreign countries. In February 2013, Dr. Shepherd briefed the U.S. Senate on **climate change** and extreme weather. He has also written several editorials for CNN, Washington Post, Atlanta Journal Constitution, and numerous other outlets and has been featured in Time Magazine, Popular Mechanics, and NPR Science Friday. He has over 90 peer reviewed scholarly publications. NASA, National Science Foundation, Department of Energy, Defense Threat Reduction Agency, and U.S. Forest Service have funded his scholarly research. Dr. Shepherd was also instrumental in leading the effort for UGA to become the 78th member of the University Corporation for Atmospheric Research (UCAR), a significant milestone for UGA.

Dr. Shepherd currently serves on the Earth Science Subcommittee of the NASA Advisory Council. He was a member of the National Oceanic and Atmospheric Administration (NOAA) Science Advisory Board, Atlanta Mayor Kasim Reed's Hazard Preparedness Advisory Group, United Nations World Meteorological Organization steering committee on aerosols and precipitation, 2007 Inter-governmental Panel on Climate Change (IPCC) AR4 contributing author team, National Academies of Sciences (NAS) Panels on climate and national security, extreme weather attribution, and urban meteorology. Dr. Shepherd is a past editor for both the *Journal of Applied Meteorology* and *Climatology and Geography Compass*, respectively.

Dr. Shepherd received his B.S., M.S. and PhD in **physical meteorology** from Florida State University. He was the first African American to receive a PhD from the Florida State University Department of Meteorology, one of the nation's oldest and respected. He is also the 2nd African American to preside over the American Meteorological Society. He is a member of the AMS, American Geophysical Union, Association of American Geographers (AAG), Sigma Xi Research Honorary, Chi Epsilon Pi Meteorology Honorary, and Omicron Delta Kappa National Honorary. He is also a member of the Alpha Phi Alpha Fraternity, Inc. and serves on various National Boards associated with his alma mater. Dr. Shepherd co-authored a children's book on weather and weather instruments called *Dr. Fred's Weather Watch*. Dr. Shepherd is originally from Canton, Georgia. He is married to Ayana Shepherd and has two kids, Anderson and Arissa.

SPOTLIGHT ON CAREERS

Climatologist — **Pam Knox** is an **agricultural climatologist** for the University of Georgia's College of Agricultural and Environmental Sciences. She provides information on climate and agriculture to Extension agents, farmers, businesses, scientists and educators around the Southeast by giving presentations, writing a daily blog, and answering phone and email questions from a wide variety of groups and individuals. She also gives interviews to local newspapers and television and radio reporters about how the current weather and climate are affecting crops around Georgia. Pam's background is in meteorology, math, and physics, but she has been doing climate work for universities and the National Weather Service for most of the last 30 years. In her spare time, Pam makes quilts using sewing skills she learned in 4-H in Michigan.



Meteorologist — **Matt Daniel** joined WMAZ in August 2014 and serves as the Weekend Meteorologist. He currently writes for EarthSky.org, which talks about the latest science stories around the world. Matt has always had the passion for weather since the age of three, and has always enjoyed **weather forecasting** and studying tropical cyclones. Matt has won several awards in forecasting excellence, and made it into the final four of a weather forecasting competition that pairs up professors, graduate students, and undergraduates across the country. He is an active member of the American Meteorological Society, and enjoys reaching out to the community through events and school activities to simply increase weather awareness. Whether it is at schools or on television, he likes to inform and teach everyone of all ages not only how the weather will impact them but why it is occurring.



2015 – Western Wildfires

Wildfires burned over 10.1 million acres across the U.S. in 2015, surpassing 2006 for the highest annual total of U.S. acreage burned since record-keeping began in 1960. Affected states included: California, Alaska, Oregon, Washington, Idaho, Montana, North Dakota, Colorado, Wyoming, and Texas.

Reference for Gauge Your Knowledge: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2016). <https://www.ncdc.noaa.gov/billions>



IS IT WEATHER OR CLIMATE?

The main difference between weather and climate is the time scale over which conditions are described. Weather generally describes the atmosphere during short time frames like hours or days, and climate generally refers to conditions that span months, years, or even decades.

Label these six statements as either WEATHER (W) or CLIMATE (C).

How do we differentiate between weather and climate?



1. ____ **Hurricane** A hurricane makes landfall along the West Coast of Florida at 2:00 p.m. on Saturday
2. ____ **Drought** Drought associated with the Great Dust Bowl in the 1930s (an extended period during with an extreme deficit in precipitation)
3. ____ **Annual Rainfall** The amount of precipitation measured over the course of a year
4. ____ **Tornado** A tornado staying on the ground for four hours and tracking 180 miles
5. ____ **Clear Sky** A clear nighttime sky in the summer
6. ____ **Ice Age** A geological period during which Earth exhibited a reduced global temperature and an increased presence of large glaciers and ice sheets



WEATHER VOCABULARY

In the Meet the Experts feature, you read about three people whose careers center around weather and climate. You may have been introduced to some cool new vocabulary. Take a closer look at these words to learn more.

Agricultural Climatology is the study of climate as to its effect on crops.

Climate Change is a long term change in the earth's climate, especially a change due to an increase in average atmospheric temperature.

Physical Meteorologist is an individual that studies optical, electrical, acoustical and thermodynamic phenomena in the atmosphere, including the physics of clouds and precipitation.

Remote Sensing is the collection of information about an object without being in direct physical contact with it, gathering data with radar or infrared photography.

Research Meteorologist is an individual that studies more specific areas of weather like severe weather or climate change.

Weather Forecasting is the prediction of what the atmosphere will be like in a particular place by using technology and scientific knowledge to make weather observations.



REFERENCES AND RESOURCES

All activities adapted from Weather and Climate Variability Toolkit, published 2013. Toolkit was made possible through a grant from USDA NIFA: Climate variability to climate change: Extension challenges and opportunities in the Southeast USA and written and compiled by **Melissa Griffin** (FSU), **Kathy Fearon** (FSU), and **Heather Kent** (UF)

Compiled and Written by: **Melanie Biersmith** and **Mandy Marable**, UGA State 4-H Extension Faculty

Reviewed by: **Heather Kent**, University of Florida IFAS Extension and **Pam Knox**, University of Georgia

Design and Layout by: **Tim Welsh & Brandon Duncan**

Laura Perry Johnson, Associate Dean for Extension

Arch D. Smith, State 4-H Leader/Director of 4-H

Sam L. Pardue, Dean and Director, College of Agricultural and Environmental Sciences

Departmental Publication 4-H FM-13

Printed 2017

The University of Georgia and Ft. Valley State University, the U. S. Department of Agriculture and counties of the state cooperating. Cooperative Extension, the University of Georgia College of Agricultural and Environmental Sciences offers educational programs, assistance and materials to all people without regard to race, color, national origin, age, gender or disability.

**An Equal Opportunity/Affirmative Action/Veteran/Disability Institution
Committed to a Diverse Work Force**

Funding for this publication provided by a grant from USDA NIFA received from the University of Florida IFAS Extension 4-H Youth Development program an Equal Opportunity Institution.

Issued in furtherance of Cooperative Extension work, Acts of May 18 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences (CAES) and the U.S. Department of Agriculture cooperating.

References for Weather Vocabulary: <http://study.com/academy/lesson/weather-forecasting-definition-types.html> <http://www.nssl.noaa.gov/people/jobs/careers.php>
<http://oceanservice.noaa.gov/facts> <http://encyclopedia2.thefreedictionary.com/>

UF IFAS
UNIVERSITY of FLORIDA

USDA

United States
Department of
Agriculture

National Institute
of Food and
Agriculture