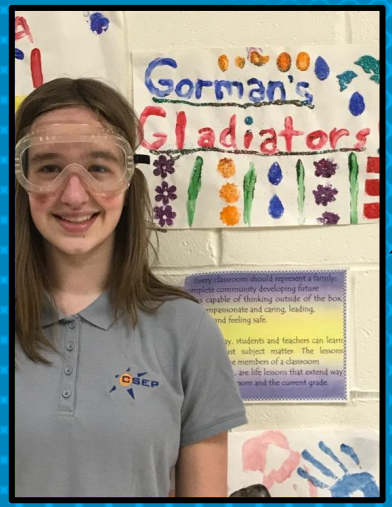
ENSO SODA WEBINAR
FEBRUARY 2018

MEDFORD MEMORIAL MIDDLE SCHOOL
MEDFORD, NEW JERSEY
USA



HELLO!

I'm Anna.

8th grade, 13 yo, artist, baker, made cinnamon sugar muffins this week

"I like the GLOBE program because I feel like a scientist."

1.

WHO WE ARE AND WHERE WE'RE FROM...

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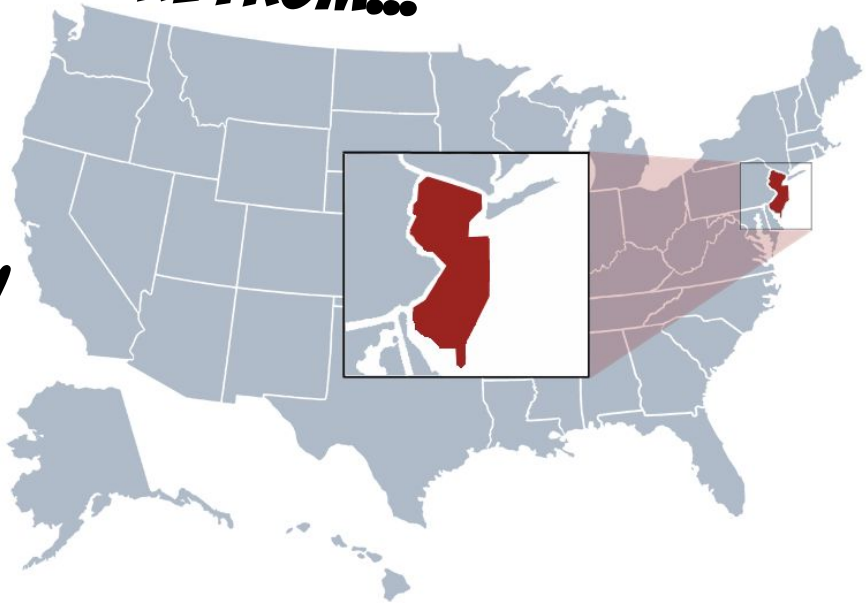
New Jersey



WHO WE ARE AND WHERE WE'RE FROM...

20 miles from Philadelphia and

40 miles from the Atlantic Ocean

WHO WE ARE AND WHERE WE'RE FROM...

Burlington County
Medford Township

WHO WE ARE AND WHERE WE'RE FROM...

Medford Memorial Middle School

WHO WE ARE AND WHERE WE'RE FROM...

1st period Challenge Class

CSEP
CITIZEN SCIENCE EDUCATION PROGRAM

2.

WHAT EXACTLY IS CSEP?

CITIZEN SCIENCE EDUCATION PROGRAM

- Founded by two middle school students and Ms. Gorman in 2012
- Beneficial Bank School Challenge – won $5000
- Upgraded automated weather station
- First class in SY 2013–2014
- This is the 5th year!!!

"Students Making a Difference, Improving Scientific Literacy Around the Globe"

#1 BIG CONCEPT

Students improve their own scientific literacy by participating in the GLOBE program and associated campaigns and mimicking the work of professionals.

#2 BIG CONCEPT

Students conduct science education outreach for the community, applying what is learned in the classroom to the real world!

$12,600
that's a lot of money

1000+ ADULTS/KIDS
and a lot of people educated

100%
total success...almost


We want
You !

HANDING OFF TO...

HELLO!

My name is Hannah.

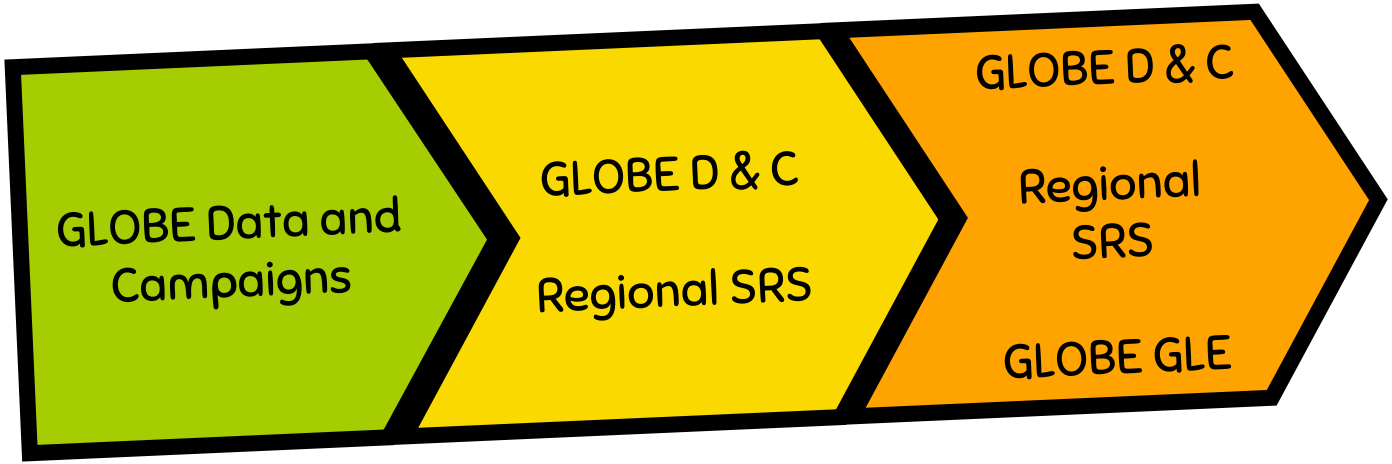
8th grade, 13 yo

“I’m currently in CSEP because my sister is a CSEP Alumna and recommended it to me. I love it!”

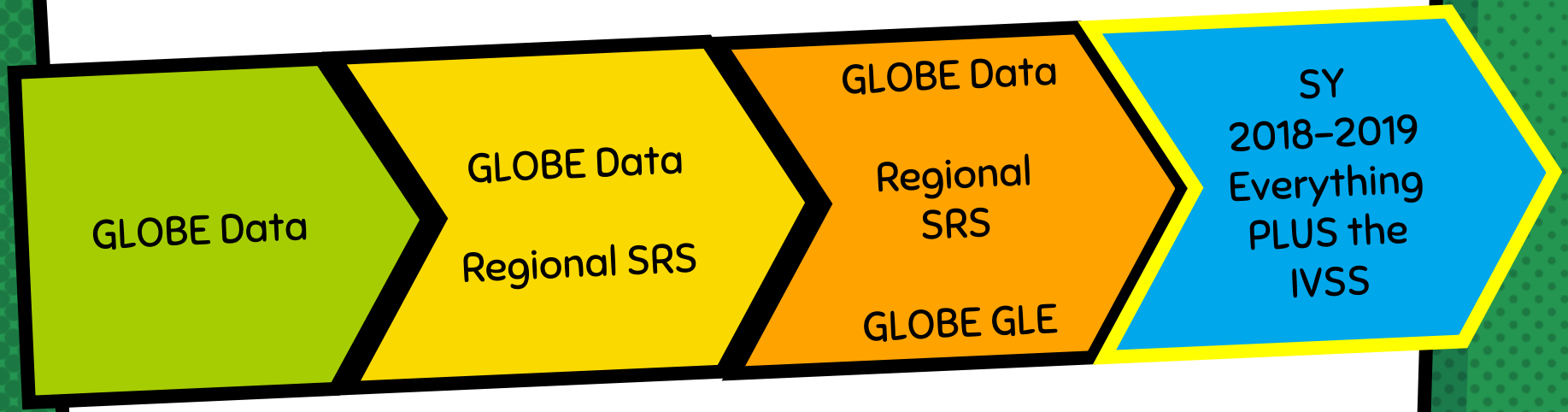
3.

CSEP'S INVOLVEMENT IN GLOBE!

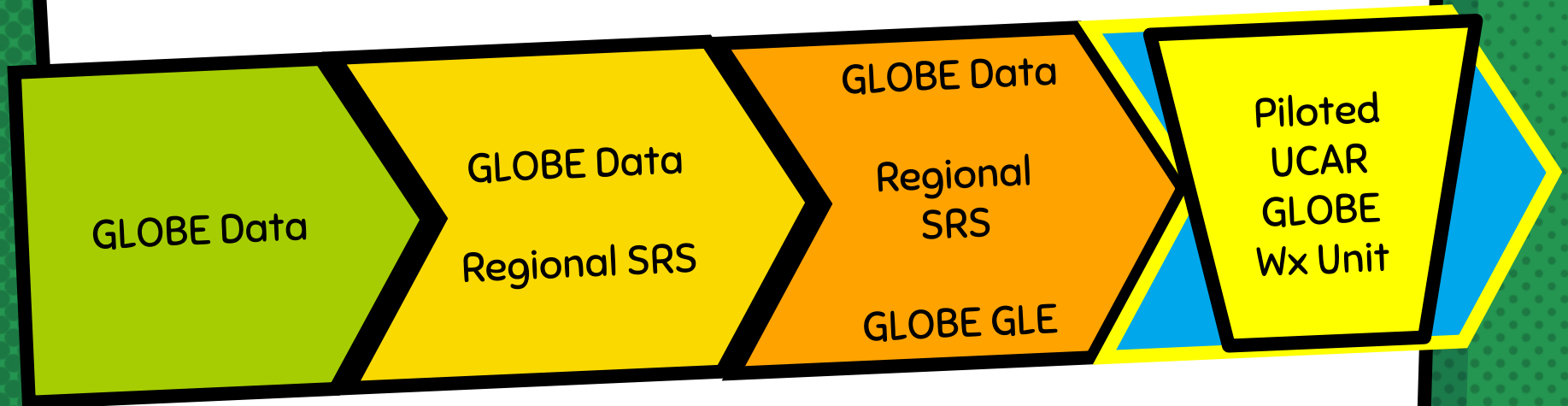
TRYING NEW THINGS ALL THE TIME!



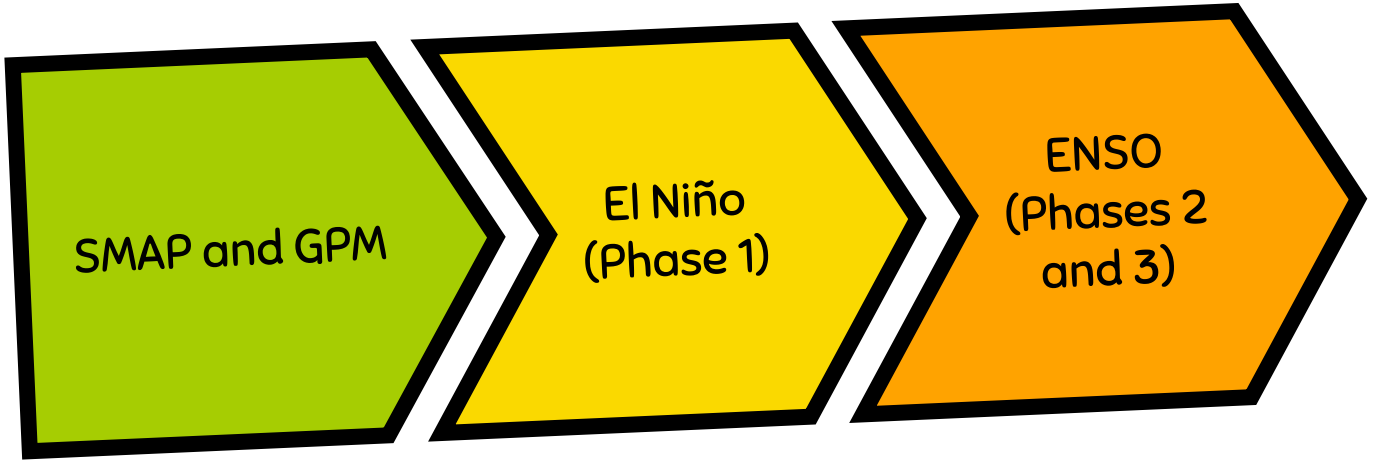
GETTING MORE AND MORE INVOLVED!



OCT 17 - JAN 18, CSEP PILOTED A GLOBE WX UNIT!



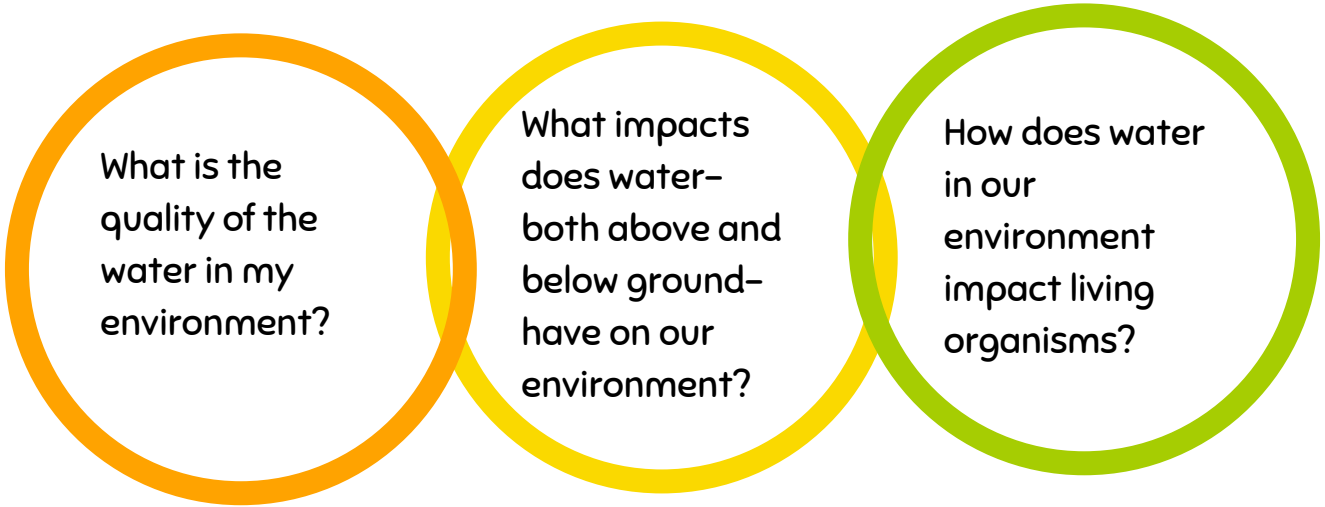
ENSO? CSEP HAS BEEN INVOLVED SINCE THE BEGINNING!



PHASE 3 "WATER IN OUR ENVIRONMENT"

ENSO
(Phase 3)

THE THREE GUIDING INVESTIGATIVE QUESTIONS!



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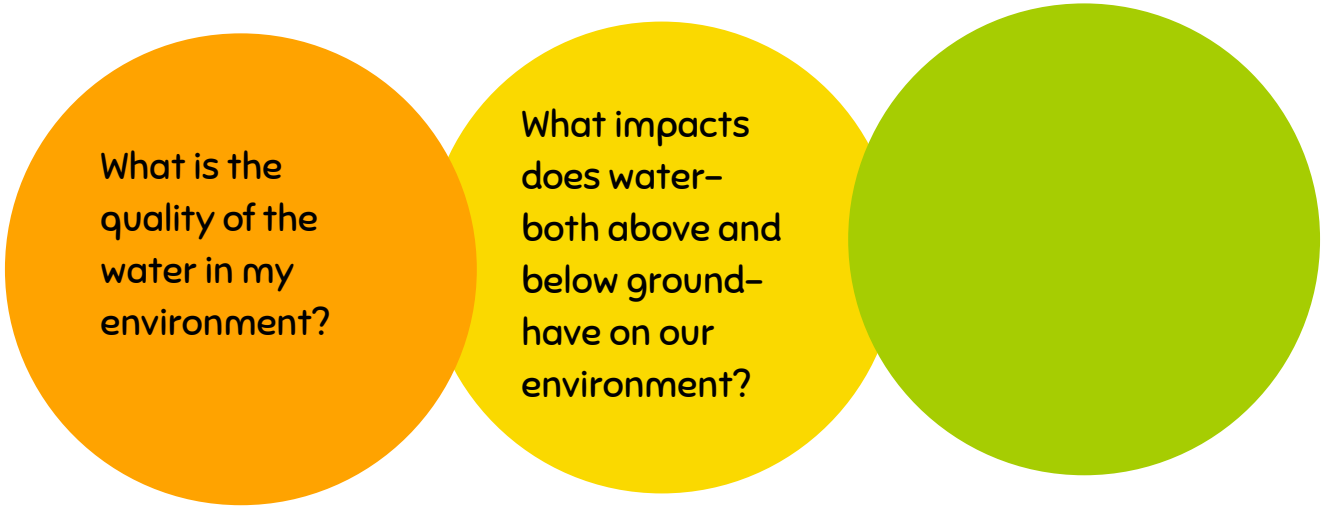
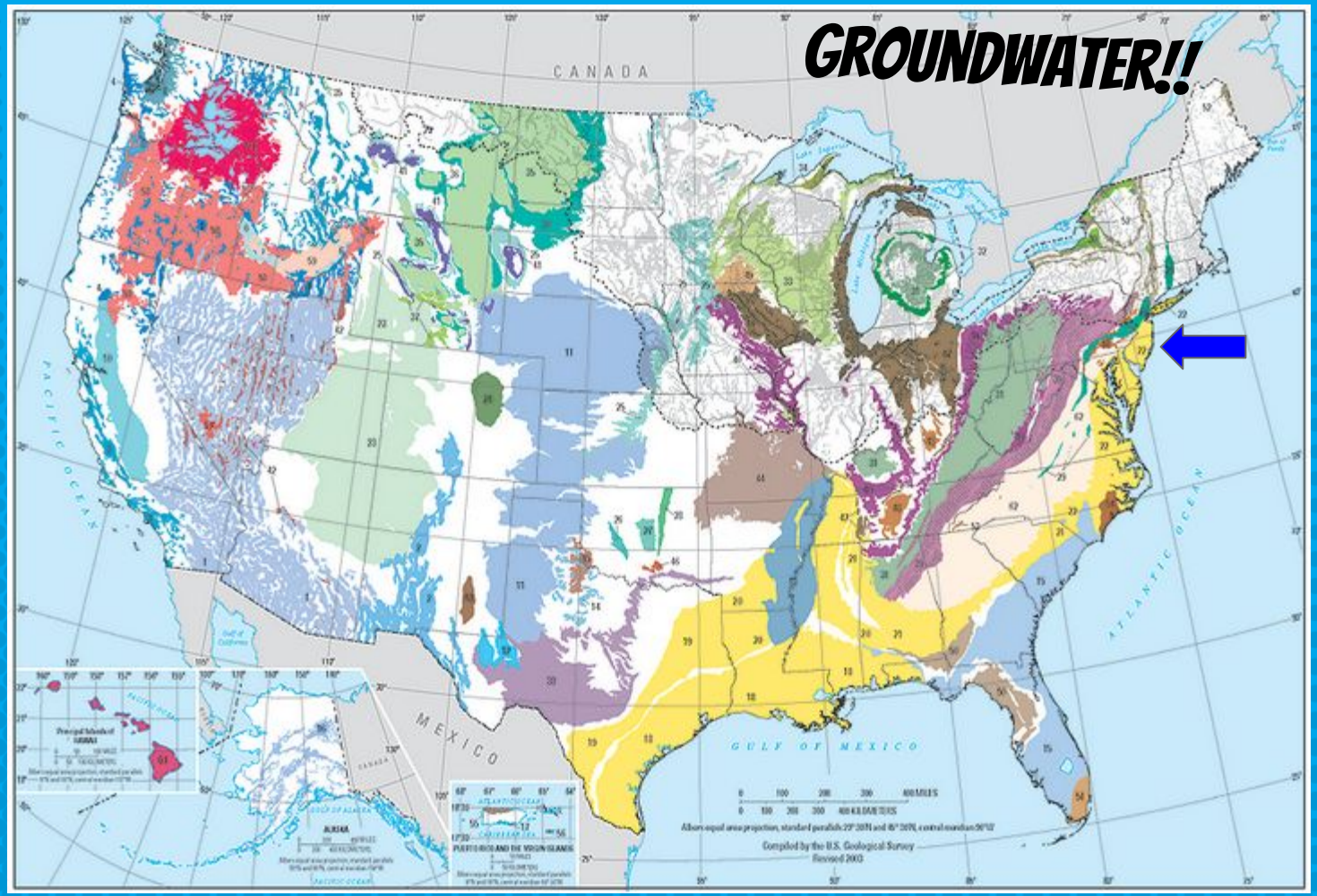



GROUNDWATER!!
CANADA
MEXICO
GULF OF MEXICO
PACIFIC OCEAN
ATLANTIC OCEAN
Compiled by the U.S. Geological Survey
Revised 2003

4.

CSEP'S ENSO PHASE 3 STORY...

FOREWARD

IT ALL STARTED WITH THE GLOBE ENSO CAMPAIGN!

Chapter 1

Once upon a time, there was some water vapor.

CHAPTER 2

THIS WATER VAPOR CONDENSED AND FORMED CLOUDS.

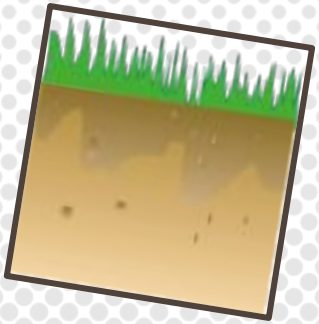
CHAPTER 3

THE CLOUDS GREW HEAVY AND SOON IT RAINED.

CHAPTER 4

WHEN THE RAIN HIT THE GROUND, SOME INFILTRATED

THE SOIL.



CHAPTER 5

SOMETIMES THE WATER STAYED IN THE SOIL FOR A FEW DAYS.

CHAPTER 6

WITH ALL THIS WATER, CSEP JUNIOR SCIENTISTS HAD TO BE AS ACCURATE AS POSSIBLE WHEN COLLECTING DATA.

AND THEY ALL LIVED HAPPILY EVER AFTER!

AND NOW TO CARRY ON OUR STORY...

HELLO!

I am Nikki.

8th grade, 13 yo, soccer player, just came back from Virginia at a regional tournament for state teams...we won!

"I want to be a scientist when I grow up. GLOBE and CSEP provide amazing opportunities for me."

5.

THE STORY IN MORE DETAIL!

Six chapters to our story...

Water Vapor

How do atmospheric rivers affect the amount of precipitation in our area?

Clouds

How accurately can we predict the weather based on cloud observations alone?

Precipitation

How do wind direction and speed affect the chemistry of rainwater?

Soil pH and Water

How does pH of the soil affect pH of water?

Soil Moisture Memory

How long is the soil "moisture memory" from a recent rain?

New SMAP Protocol

How much more accurate is a new soil collection protocol for volumetric measurements of soil moisture?

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... LAST, BUT NOT LEAST!

HELLO!

I am Jalyn.

8th grade, 13 yo, another soccer player, Nikki and I are on the same club team

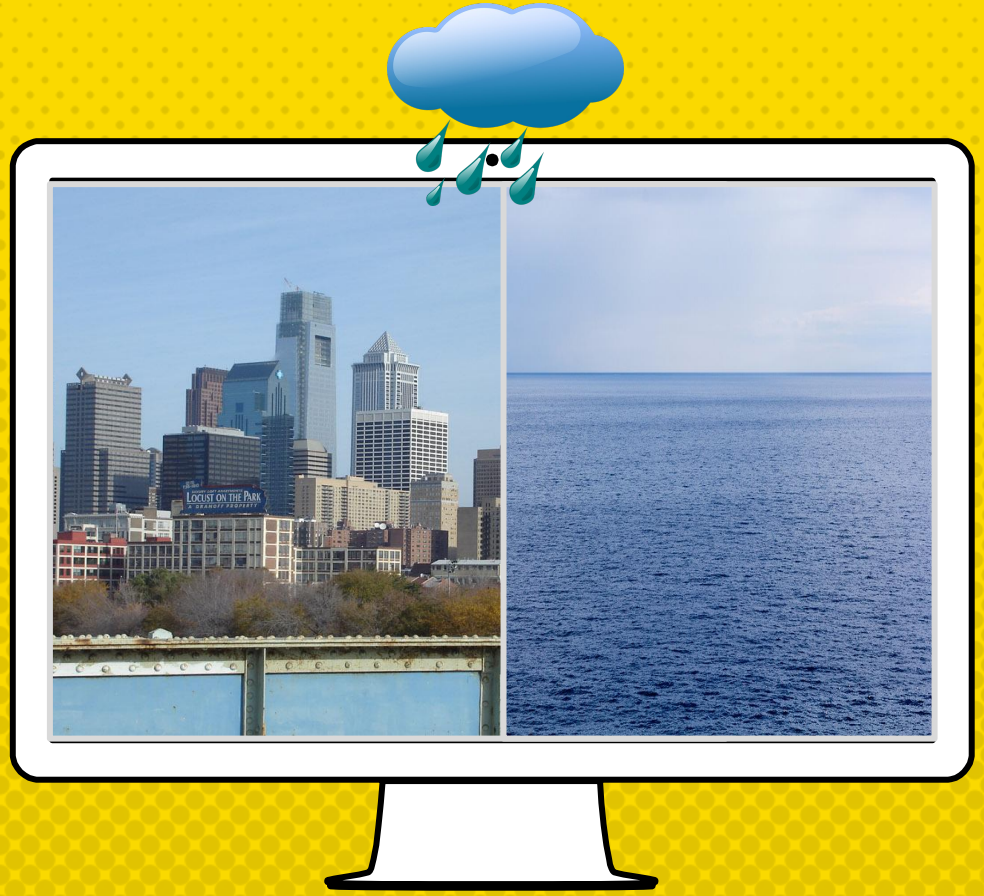
“I feel lucky I’m able to do actual research, and I really appreciate the opportunity to collaborate with other students.”

5.

CHAPTER 3 - OUR TEAM'S RESEARCH...

RAINWATER

We knew we wanted to combine rainwater with our location (in between a major city and a major ocean).



WIND DIRECTION

East winds would bring chemicals from the ocean. West winds would bring pollution from Philadelphia.

WERE WE EVEN ON THE RIGHT TRACK?

Atmos. Chem. Phys., 13, 2321–2330, 2013
www.atmos-chem-phys.net/13/2321/2013/
doi:10.5194/acp-13-2321-2013

Atmospheric Chemistry and Physics
Open Access

Dynamics of the chemical composition of rainwater throughout Hurricane Irene

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Received: 6 July 2012 – Published in Atmos. Chem. Phys. Discuss.: 15 October 2012
Revised: 17 January 2013 – Accepted: 6 February 2013 – Published: 1 March 2013

Abstract. Sequential sampling of rainwater from Hurricane Irene was carried out in Wilmington, NC, USA on 26 and 27 August 2011. Eleven samples were analyzed for pH, major ions (Cl^-, NO_3^-, SO_4^{2-}, Na^+, K^+, Mg^{2+}, Ca^{2+}, NH_4^+), dissolved organic carbon (DOC) and hydrogen peroxide (H_2O_2). Hurricane Irene contributed 16 % of the total rainwater and 18 % of the total chloride wet deposition received in Wilmington NC during all of 2011. This work highlights the main physical factors influencing the chemical composition of tropical storm rainwater: wind speed, wind direction, back trajectory and vertical mixing, time of day and total rain volume. Samples collected early in the storm, when winds blew out of the east, contained dissolved components indicative of marine sources (salts from sea spray and low DOC). The sea-salt components in the samples had two maxima in concentration during the storm the first of which occurred before the volume of rain had sufficiently washed out sea salt from the atmosphere and the second when back trajectories showed large volumes of marine surface air were lifted. As the storm progressed and winds shifted to a westerly direction, the chemical composition of the rainwater became characteristic of terrestrial storms (high DOC and NH_4^+ and low sea salt). This work demonstrates that tropical storms are not only responsible for significant wet deposition of ma-

1 Introduction

Extreme weather events that include heavy rain and high winds can result in significant depositional fluxes of chemical species over short periods of time, resulting in a significant impact on the biogeochemistry of the receiving watersheds (Avery et al., 2004). Most notably, tropical storm systems have been shown to be responsible for major depositions of sea salt (Na^+ and Cl^-) to land. Previous work at this site (Wilmington, NC, USA) has shown that single tropical weather events contributed over half the annual wet deposition of chloride (Cl^-) in 1984, 1989 (Willey and Kiefer, 1993) and 2006 (Miller et al., 2008). Similarly, the elemental analysis of rainwater collected during typhoon events in Okinawa Island, Japan revealed ion ratios consistent with the composition of sea salt (Sakihama and Tokuyama, 2005). The isotopic analysis of DOC in rainwater collected during two hurricanes revealed it was largely of marine origin (Raymond, 2005).

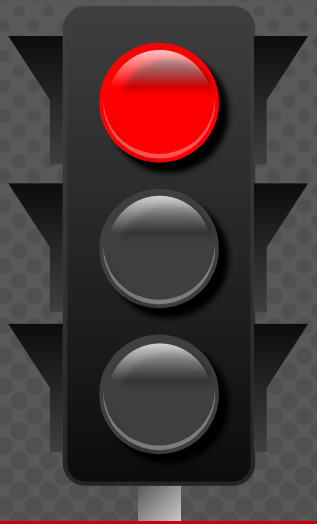
In addition to the deposition of marine-derived components to land as a result of hurricanes and typhoons, shifting winds during the course of a storm could result in delivery of terrestrial compounds to coastal waters via wet deposition.

SCIENTIST HELP!

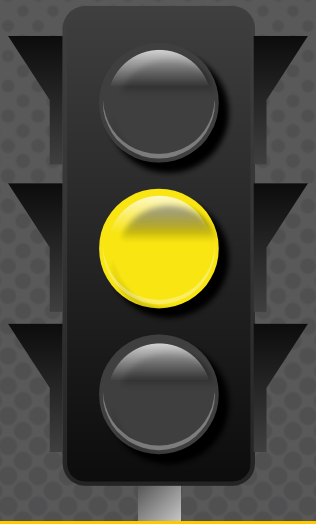
We e-mailed Dr. Mullaugh and she gave us some suggestions for our research.

Katherine M. Mullaugh, PhD
Assistant Professor
Department of Chemistry & Biochemistry
College of Charleston, South Carolina

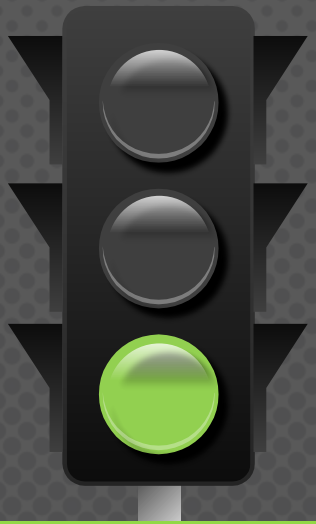
NARROWING DOWN OUR RESEARCH QUESTION...



X – Dissolved Oxygen
X – Hydrogen Peroxide
X* – Salinity



? – Dissolved Organic Carbon (link with university)
? – Cations/Anions (need new equipment)



Y – pH
Y* – Salinity
Y – Nitrates

6.

OUR FINAL RESEARCH QUESTION...

We broke it down into two parts...

Wind Direction and Speed

How do wind direction and speed affect the pH and salinity of rainwater?

(possibly check nitrates)

Amount and Rate of Rain

How do the amount of rain and rate of rain in a single rain event affect the pH of rainwater?

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HYPOTHESES

1. If there is an east wind, the salinity of the rainwater will be higher, because the air is coming from the ocean.
2. If there is a west wind, pH will be lower and nitrates will be higher, because there is pollution in the air coming from Philadelphia.
3. **If there is a lot of rain, the pH will rise from the start to the end of the event, because the acid in the rain will become diluted.

PROTOCOLS AND MATERIALS

Weather Report

Check weather report from various sources to identify future rain events, general direction of storm movement and predicted amounts.

Collection

We will use rain gauges a/o clean glass or plastic sampling jars/bottles with lids. Sites will be our school and sometimes our *homes.

Rain Samples

Depends on type of event.

1. Light rain
2. Heavy rain
3. Major storm (Nor'easter)

At a minimum, samples taken at the beginning, middle and end of an event. Sometimes hourly samples will be taken. In some cases, samples will only be taken if there is a significant shift in wind direction a/o speed.

GLOBE Data

In addition to multiple rain samples, we will also monitor a rain gauge for daily amounts of precipitation and pH when there is enough rainfall.

Water Chemistry

- pH paper
- pH meter
- Salinity kit
- Nitrate kit

PROTOCO

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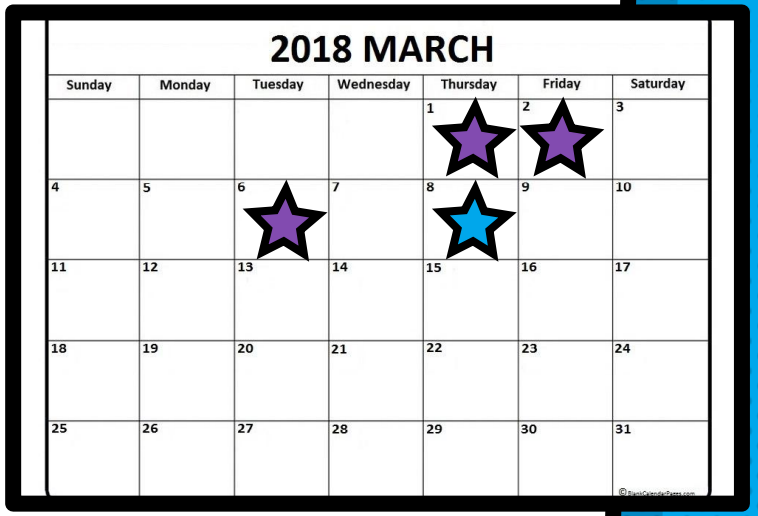
MOBILE WEATHER

We'll use our phones and the app that's tied in to our automated weather station for current conditions.

WE START THIS WEEK!

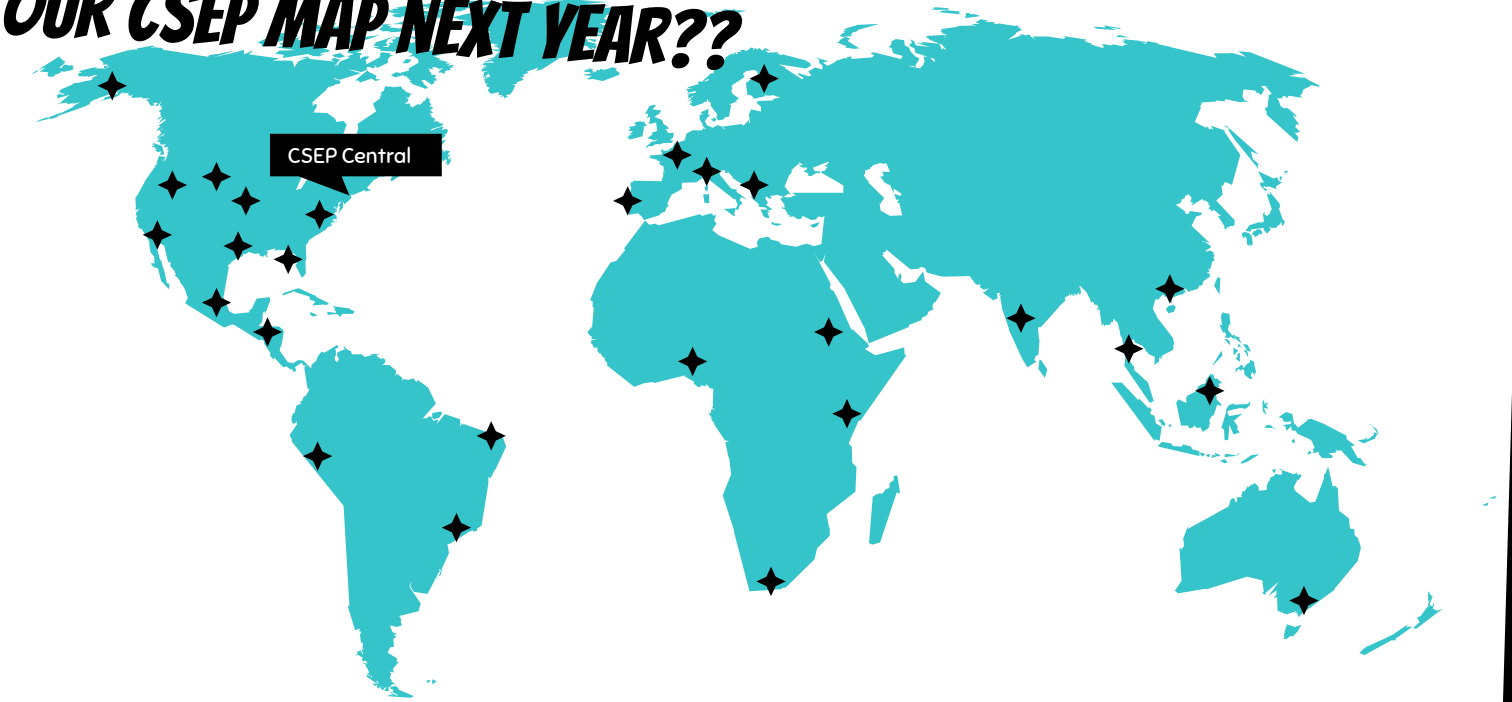
- We're expecting moderate rainfall tomorrow and Friday.
- Strong winds from the east and northeast, ending up from the north/northwest.
- After that, expecting light rain on Tuesday, 6 March. Maybe some snow on the 8th.
- Total research collection – six weeks.



TO RECAP!

1. WE WANT YOUR SCHOOL TO BECOME A CSEP SCHOOL!
2. WE WOULD LIKE TO WORK WITH YOUR SCHOOL TO COMPARE DATA ABOUT RAINWATER CHEMISTRY.
3. YOUR SCHOOL COULD WORK WITH ANY OTHER CSEP TEAM ON THEIR PROJECT.

OUR CSEP MAP NEXT YEAR??



THANKS!

If you want to join CSEP, or collaborate with us on our project, or collaborate with our fellow junior scientists on their projects, or if you have any questions not answered today, please contact Mrs. Vicky Gorman at vgorman@medford.k12.nj.us.