

## 1. Abstract

The El Niño phenomenon is a periodic ocean condition that occurs every two to ten years in the central and east-central equatorial Pacific Ocean. It alters the normal patterns of ocean circulation, surface temperature, and evaporation, causing noticeable and often severe changes in weather conditions in many areas of the world. El Niño is the warm phase of the El Niño Southern Oscillation (ENSO), and usually reaches its peak between December and February time period.

El Niño and its worldwide consequences are studied by the school network of the GLOBE Program (www.globe.gov) which brings together students, teachers, and scientists in support of student research and validation of international Earth science research projects.

Since the start of the GLOBE Program over 20 years ago, GLOBE classrooms utilize carefully developed daily, weekly, or seasonally protocols such as maximum, minimum and current temperatures, rainfall, soil moisture, and others, to measure changes in the environment. The data collected by the students is entered in an online GLOBE database. In addition to the student-contributed data, automated stations also collect and send measurements to the GLOBE database.

Students compare their data with global data acquired by satellites to help validate the satellite data. With a potentially historic-level El Niño event thought to be on the horizon—possibly one of the strongest in 50 years—we will propose an emphasis on measurements from GLOBE schools that will support studies and satellite observations of El Niño. We plan to provide the schools with additional satellite data sets such as ocean temperature measurements from Advanced Very High Resolution Radiometer (AVHRR), sea surface elevation measurements from Jason-2 and 3 (after it launches), and others to be identified.

We wish to address and support the following educational objectives:

- Demonstrate how El Niño affects local precipitation and temperature across the globe,
- Link teachers, scientists and students to improve understanding of the local effects of El Niño on weather, ecosystems, and society, and compare these effects in different countries,
- Provide insights to the essential elements of satellite images and their use in identifying physical changes on Earth's surface,
- Strengthen scientific reasoning abilities in GLOBE students.

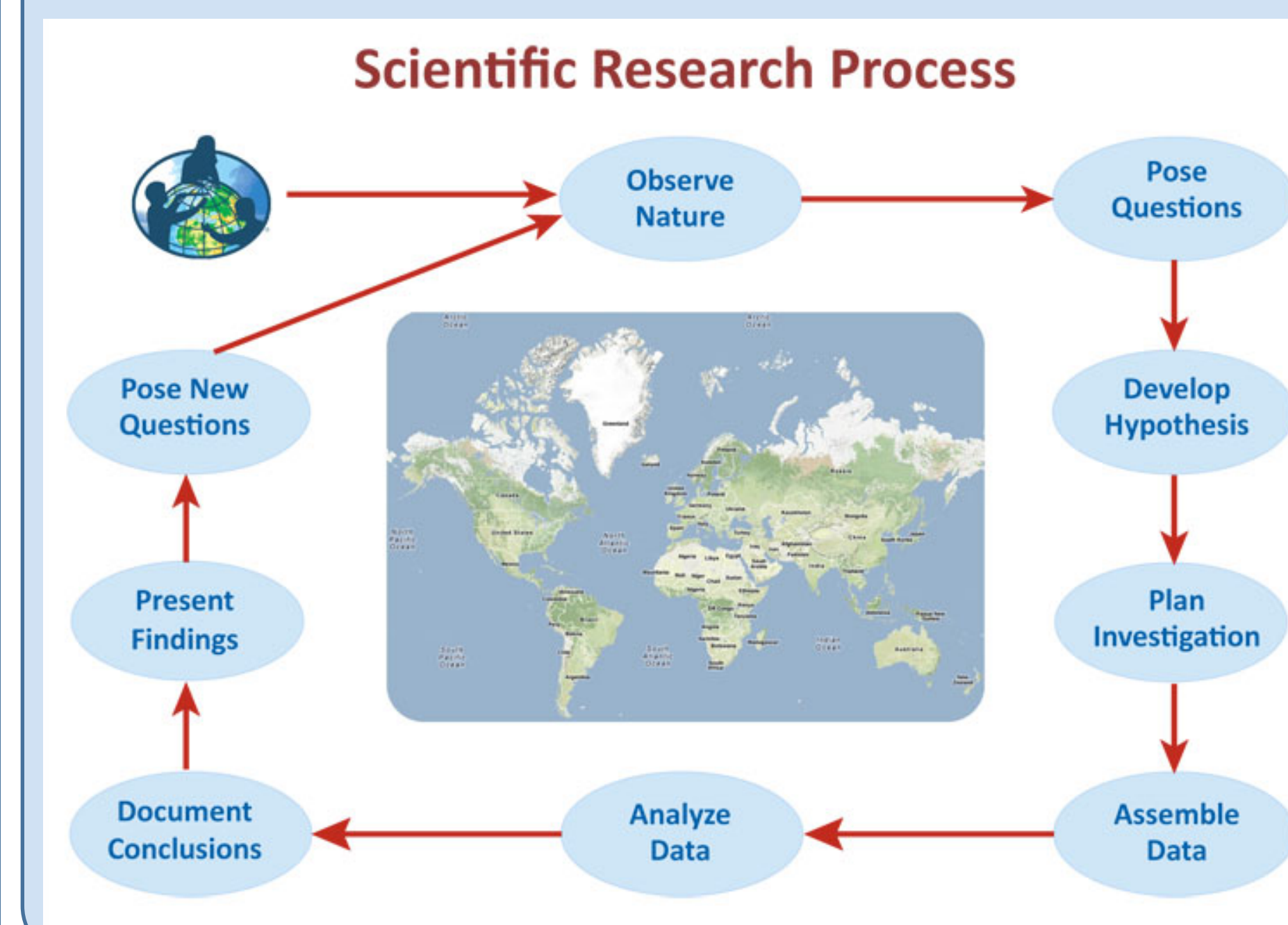
## 2. The GLOBE Program and NASA

GLOBE is a worldwide community of students, teachers, scientists and citizens working together to better understand, sustain and improve Earth's environment on local, regional and global scales. The mission of the program is to promote the teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery. GLOBE is jointly sponsored by NASA and the National Science Foundation (NSF), with support from NOAA and Department of State.

### Investigation Areas:

**Atmosphere/Climate • Hydrology • Land Cover/Biology • Phenology • Soils**

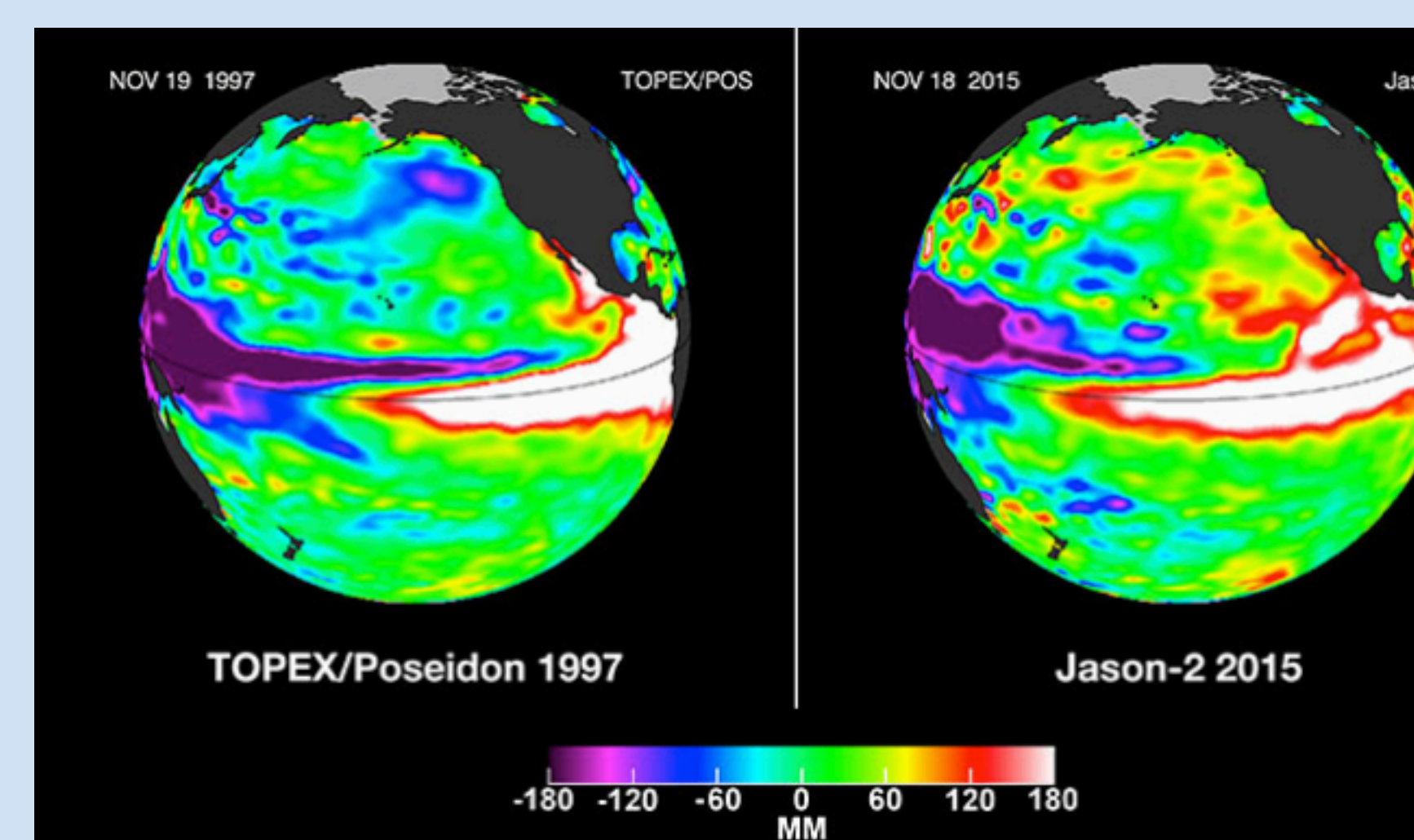
## 2. Methods



- Inquiry & Student Investigations
- Student Research & Engagement
- Interdisciplinary System Science
- Scientist involvement in GLOBE



## 4. Conclusions & Perspectives



How will El Niño affect the place where I live?

- Seasonal Impacts:**
- Fall** -- increased eastern Pacific tropical storm activity
  - Winter** -- Localized flooding possible (California...), but also below average precipitation severe drought (Indonesia...) -- variability across the season
  - Spring** -- whether we transition out of El Niño conditions or not, wildfire risk following growth of fine fuels, particularly if the region dries out.

### El Niño Assets:

Demonstrate how El Niño affects local precipitation and temperature across the globe, Link teachers, scientists and students to improve understanding of the local effects of El Niño on weather, ecosystems, and society, and compare these effects in different countries, Provide insights to the essential elements of satellite images and their use in identifying physical changes on Earth's surface, Strengthen scientific reasoning abilities in GLOBE students.

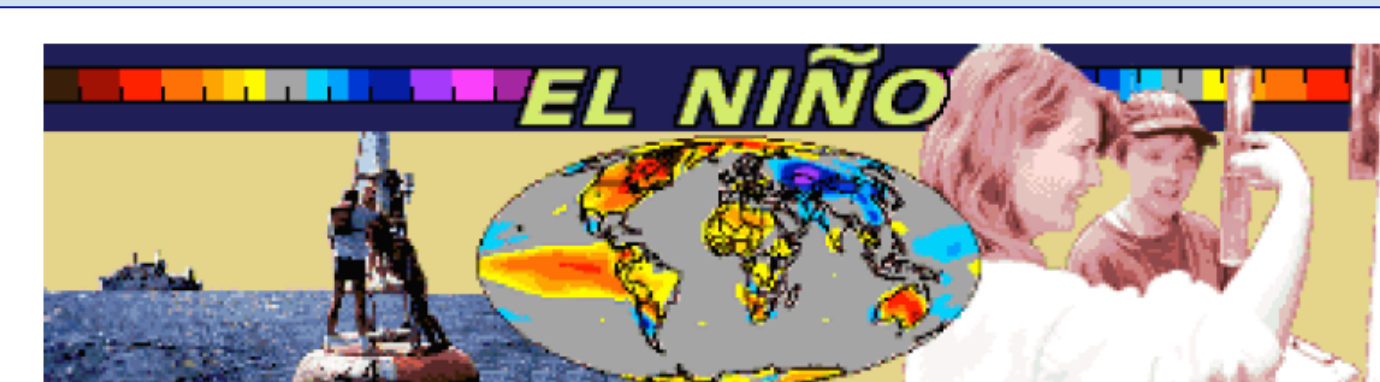


### Relevant GLOBE Tools:

#### Protocols

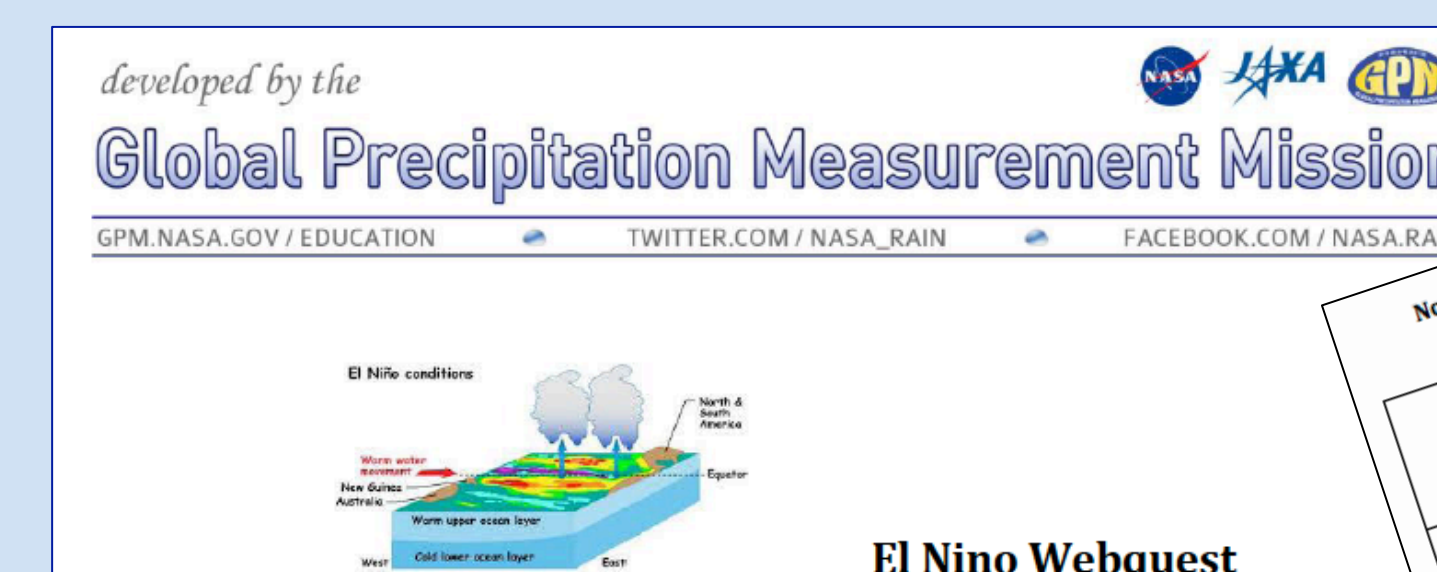
- Temperature (Max/min)
- Surface Temperature
- Precipitation (GPM)
- Soil Moisture; SMAP, SMOS
- Aerosols (Calipso)
- Green up Green down, flourish, fructification and seeding
- MUC land cover
- Soil Moisture; SMAP, SMOS

#### Scientists support



Looking for the Effects of El Niño in GLOBE Student Data

developed by the  
**Global Precipitation Measurement Mission**  
GPM NASA GOV / EDUCATION TWITTER.COM / NASA\_RAIN FACEBOOK.COM / NASA\_RAIN



El Niño Webquest

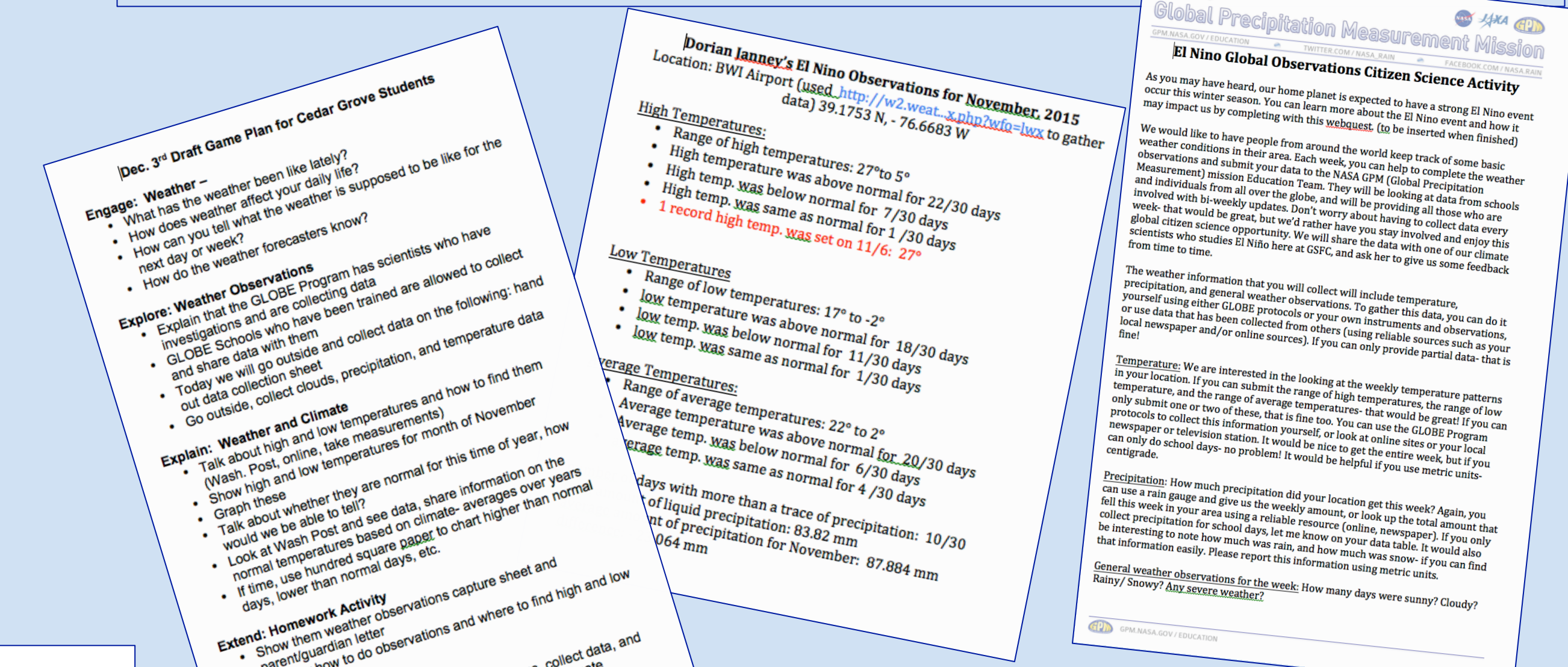
November Weather Data: all data is from the National Weather Service  
(from: <http://www.weather.gov/jetzi/midwest/index.php?y=11>)

Date	Maximum (High) temperature (°C)	Minimum (Low) temperature (°C)	Average temperature (°C)
11/1	19	7	13
11/2	18	3	10
11/3	23	5	14
11/4	19	12	17
11/5	20	12	16
11/6			

### GLOBE El Niño Activities:

During the El Niño & La Niña cycle of 1997-98, GLOBE students used their atmospheric measurements to track the effects of these phenomena on their local weather and provided useful information to scientists. Classroom El Niño Activities

- How Does El Niño Affect Rainfall & Temperature?
- Looking for the Effects of El Niño in GLOBE Student Data
- Student Web Chats



**Dorian Janney's El Niño Observations for November, 2015**  
Location: BWI Airport (code: BWI, W, West, Washington, DC, USA, 39.1753 N, -76.6683 W)

**Global Precipitation Measurement Mission**  
El Niño Global Observations Citizen Science Activity