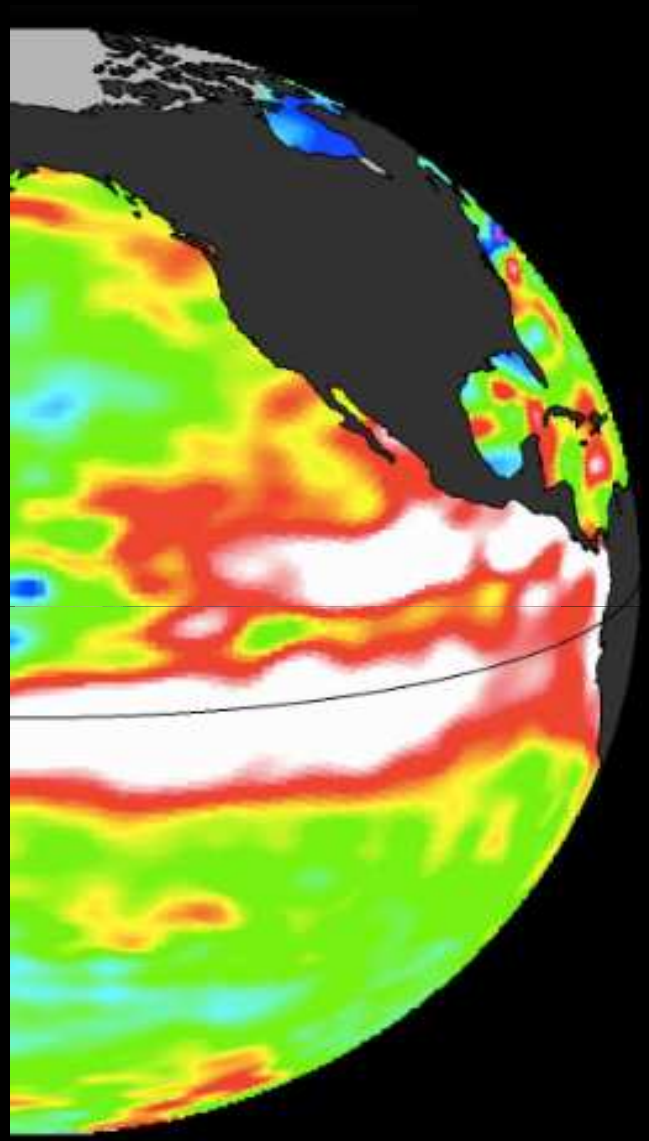


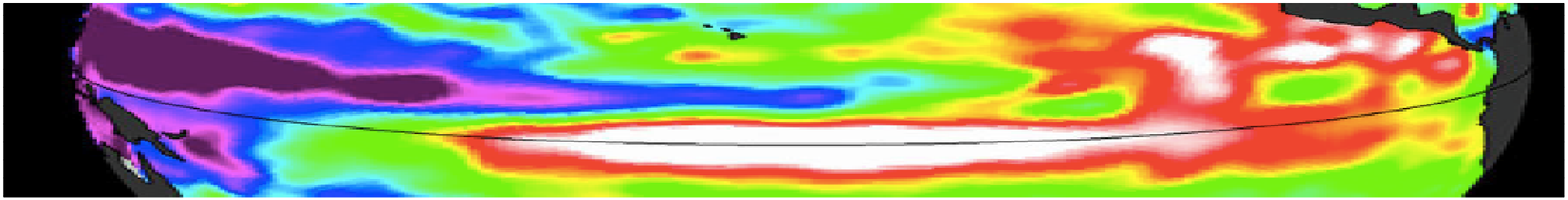
Observations of El Niño impacts using in situ GLOBE protocols and satellite data

Danielle De Staerke, CNES
Margaret Srinivasan, JPL

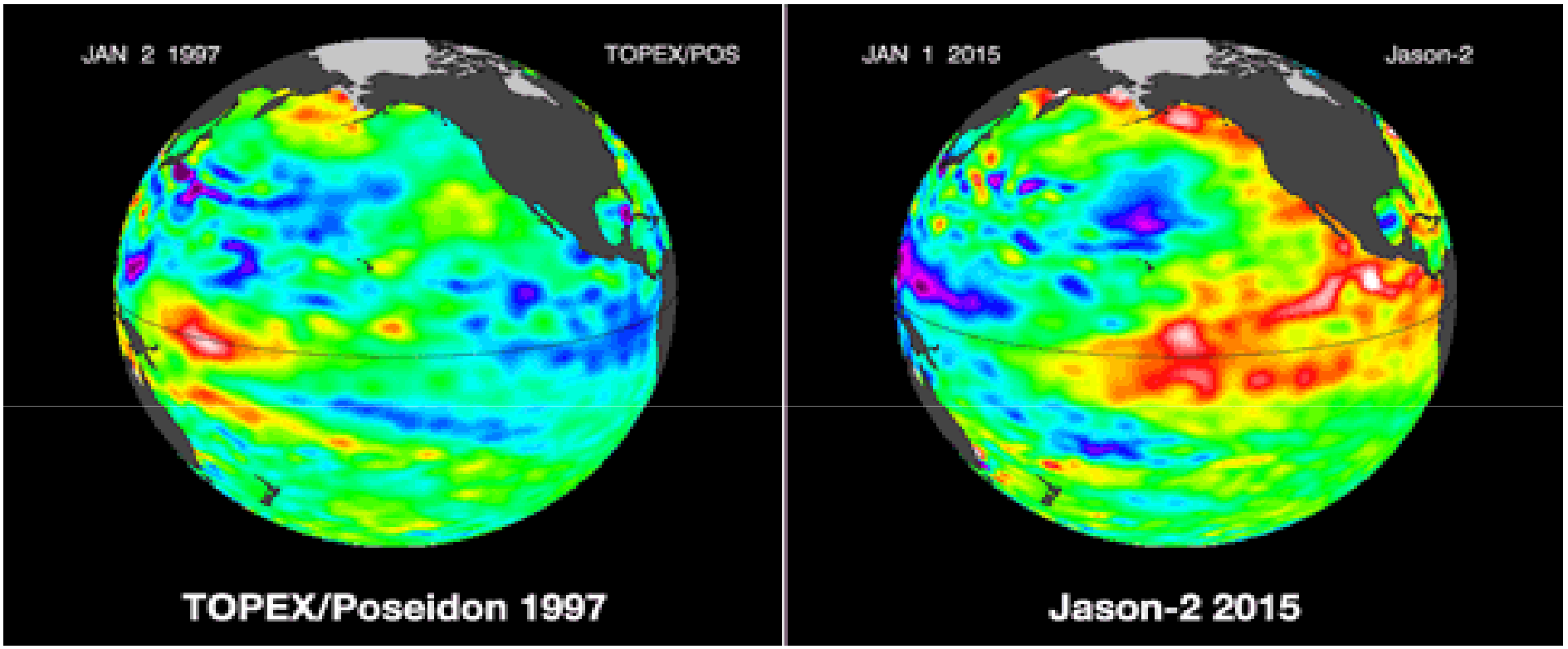
OSTST Meeting, 20 October 2015, Reston, VA

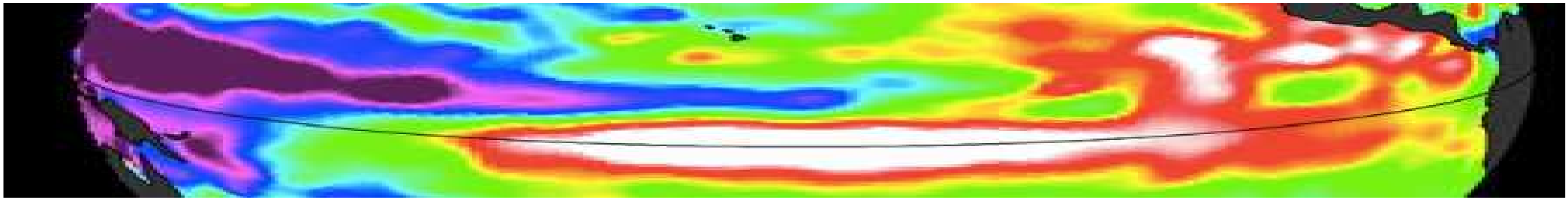
Outline

- **El Nino phenomena**
  - 2015 El Nino
  - Seasonal Impacts
  - Ecosystem Impacts
  - Educational Objectives
- **Indirect study with scientific data as well as with historic climates average**
  - Example of Impact of ENSO on Penguins in the Indian Ocean (ARGONAUTICA)
  - Remote sensing data (satellites, airborne, etc.)
- **Doing measurements at school with GLOBE**
  - The GLOBE Program
  - GLOBE Measurement Protocols
  - Relevant GLOBE tools
  - GLOBE El Nino Activities
- **Summary**



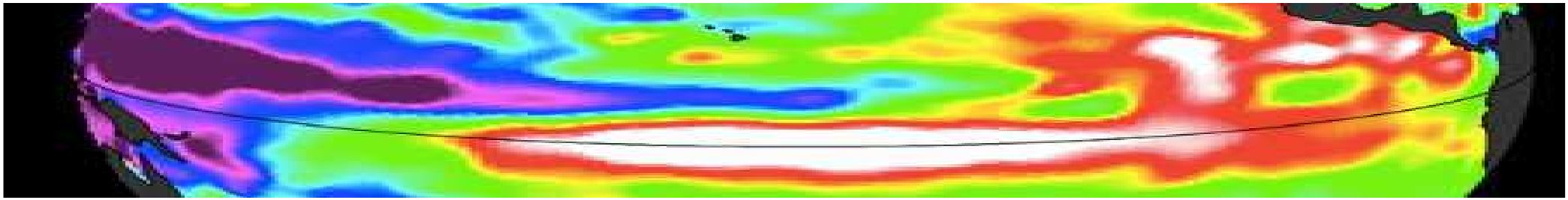
2015 El Niño


JAN 2 1997
TOPEX/POS
TOPEX/Poseidon 1997
JAN 1 2015
Jason-2
Jason-2 2015



Seasonal Impacts

- **Fall** -- increased eastern Pacific tropical storm activity
- **Winter** -- Localized flooding possible, but also possibility of below average precipitation on a month-to-month basis – 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.

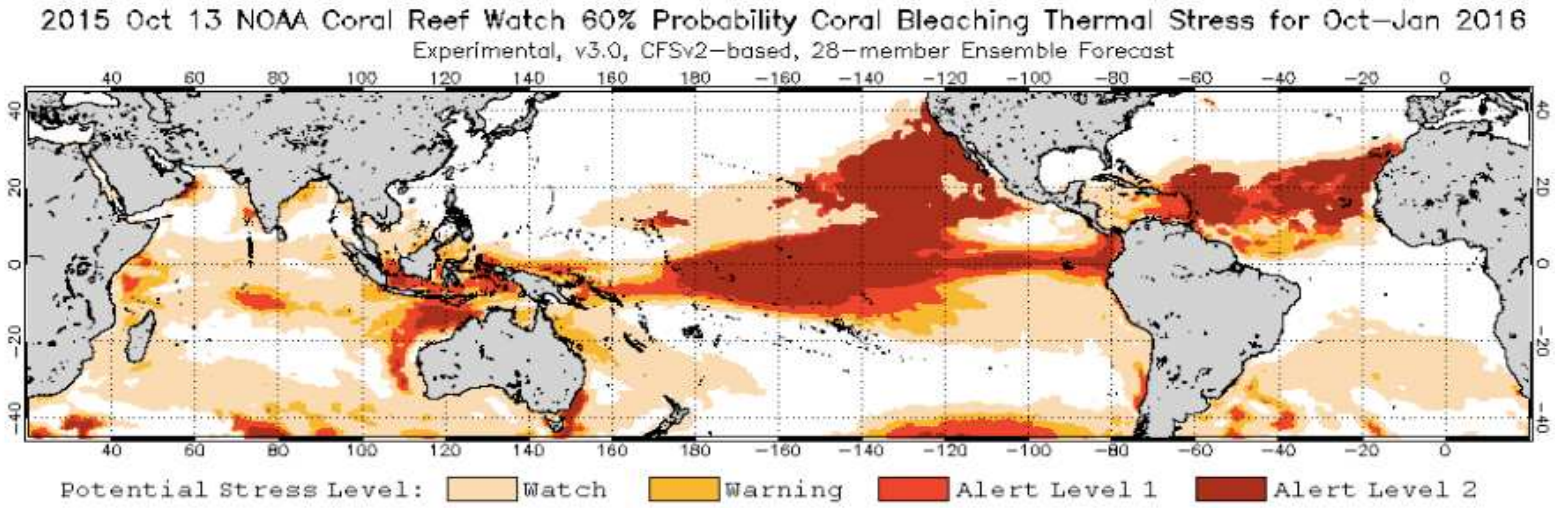


Ecosystem Impacts

- Fisheries
- Sea Lion mortality
- Coral bleaching

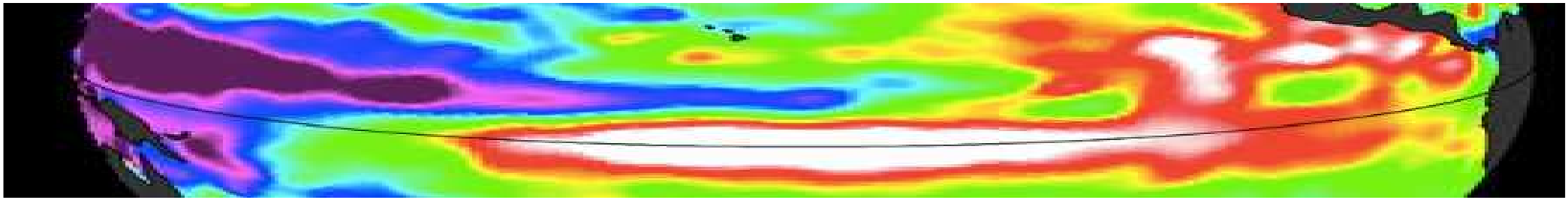
COLUMBIA RIVER — Salmon fishermen in the Columbia River's Buoy 10 fishery this week encountered Humpback whales. They have been sighted within the Columbia River in recent days.
Daily Astorian

Unusual Mortality Event – Sea Lions in Rehab.
Credit: Pacific Marine Mammal Center



Educational Objectives: El Nino 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.



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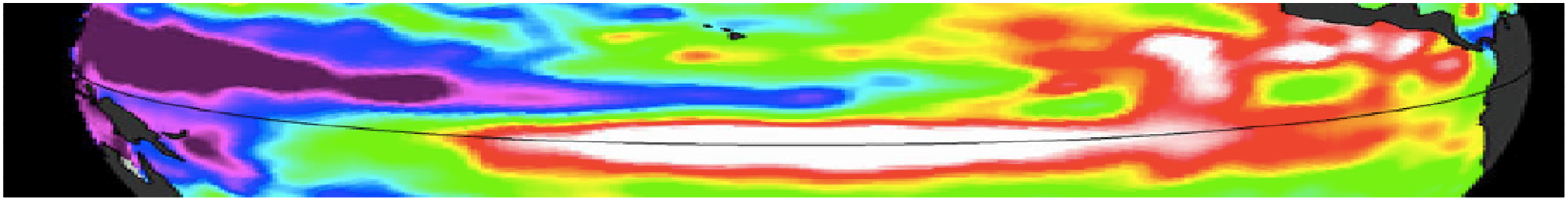
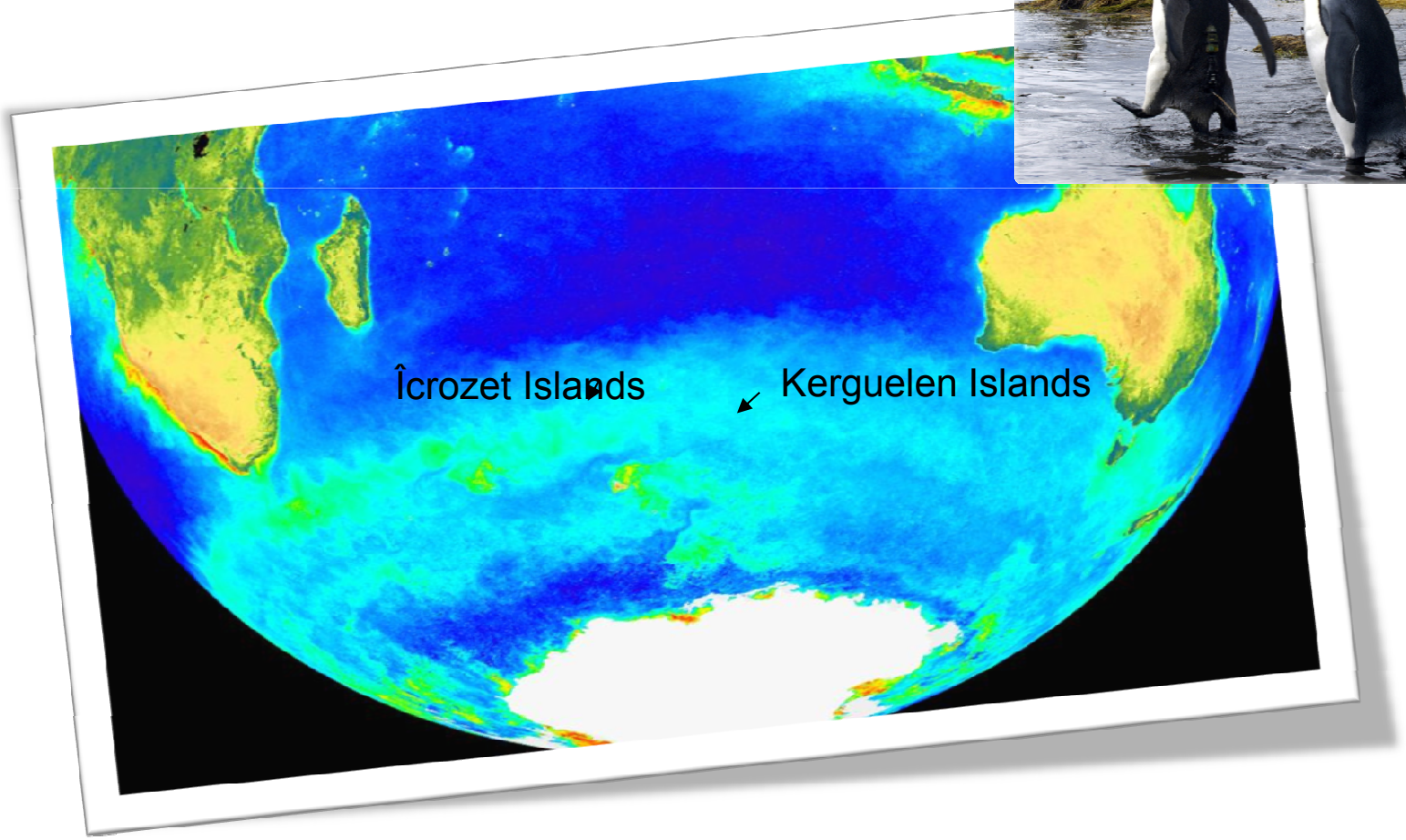
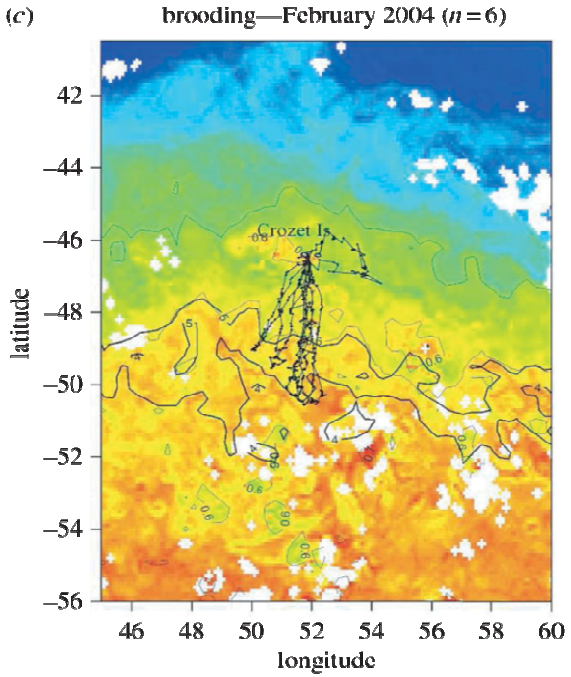


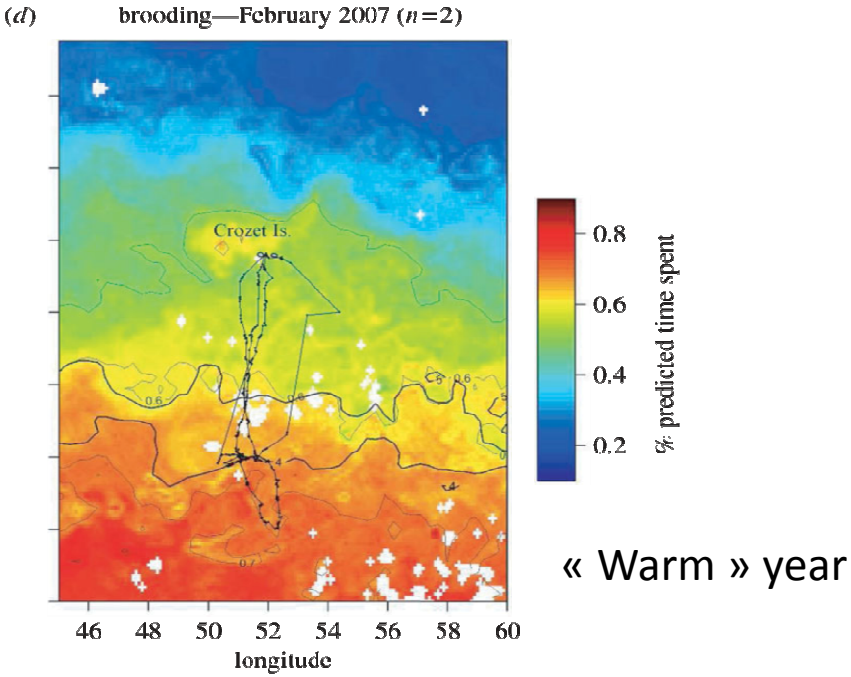
Example of impact of ENSO on Penguins in Indian Ocean (ARGONAUTICA)



ENSO impacts on Penguins (continued)

« Cold » year

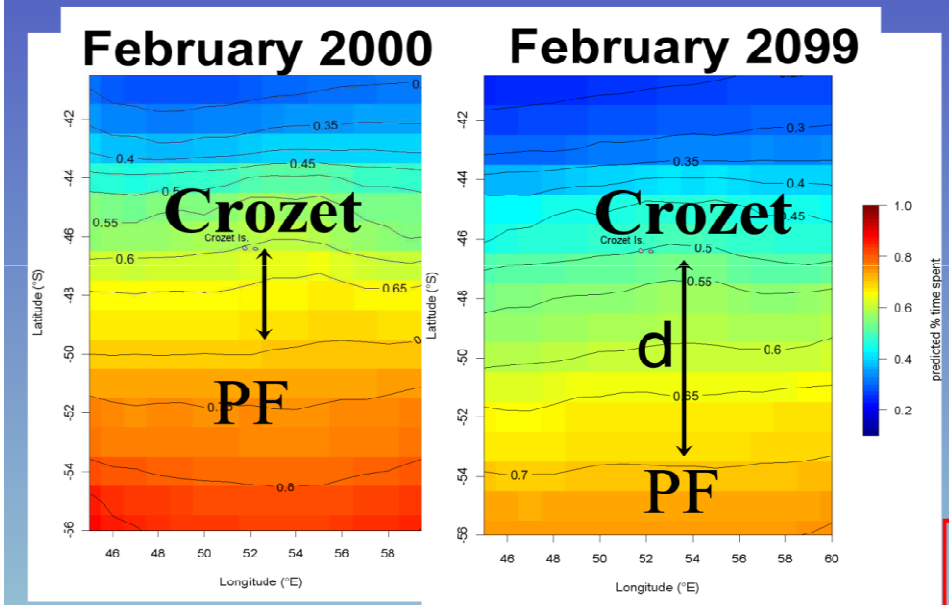


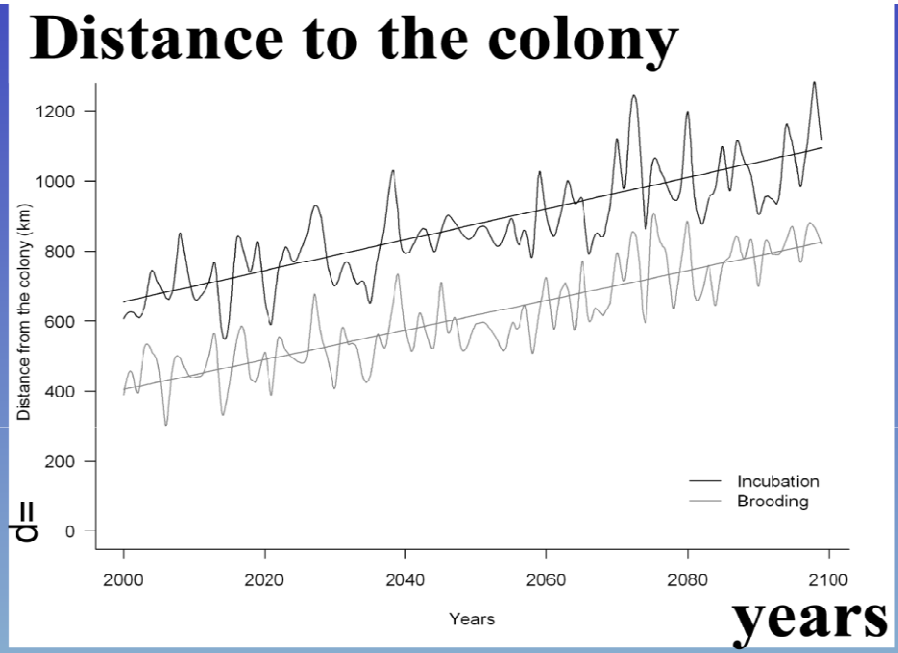


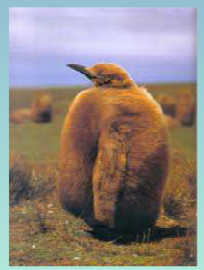
« Warm » year

- King Pinguins from Crozet find their food in the circumpolar Antarctic current
- The « warm » years the current is located further south than usual. The Penguins have to go farther to find the food.
- If it take too long the chick may passed away..

Projection for the 22nd century…







Projected grounds (2010-2099)

-Remoteness of the penguins fishing grounds south : 42 km / decade

Minimal distance to favourable habitats

400 ----> 800 km

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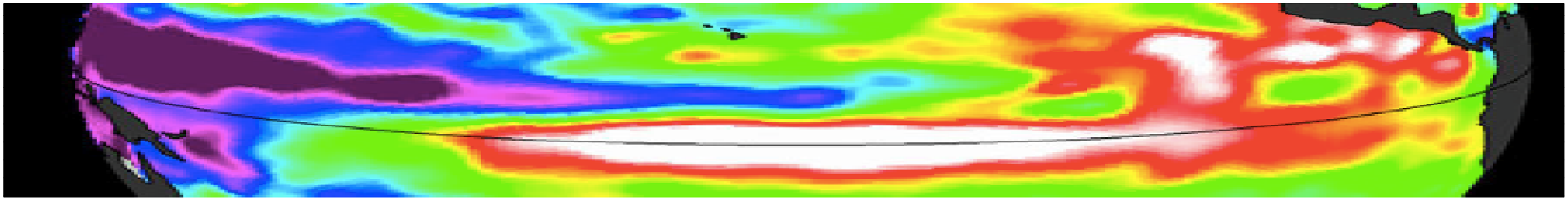


THE GLOBE PROGRAM

CONNECTING THE NEXT GENERATION OF SCIENTISTS

International Scientific and Educational Program

Since the start of the GLOBE Program over 20 years ago, GLOBE classrooms:

•utilize carefully developed daily, weekly, or seasonally protocols i.e., maximum, minimum and current temperatures, rainfall, soil moisture, and others, to measure changes in the environment

•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.** **www.globe.gov**

Notable numbers:

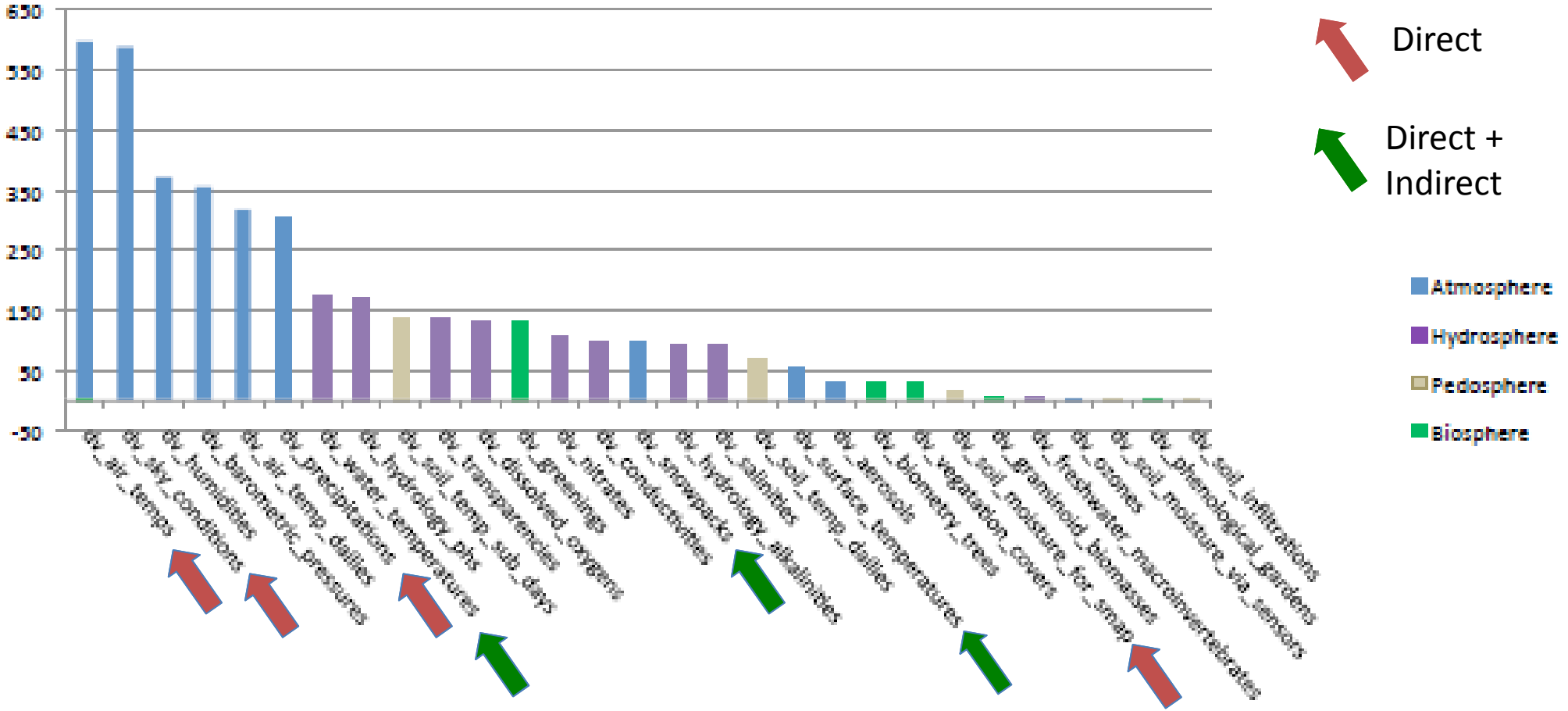
115 countries

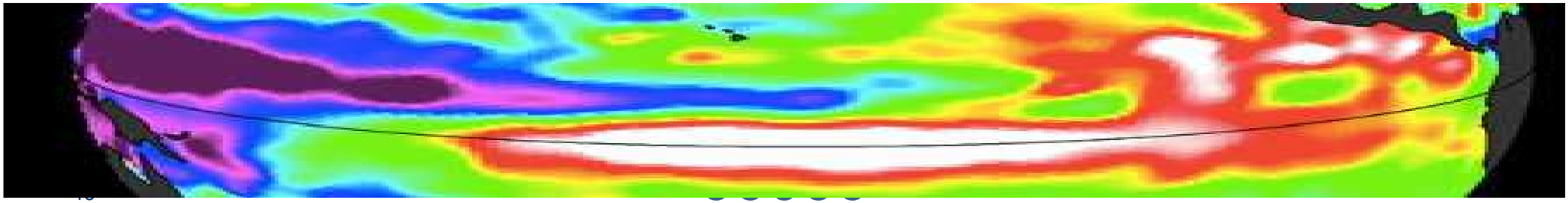
21 000 teachers

Over half a million students

127 000 000 measurements

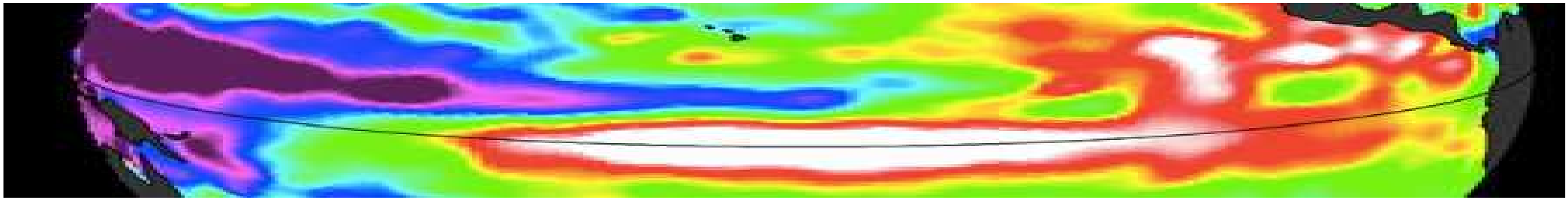
GLOBE measurement protocols





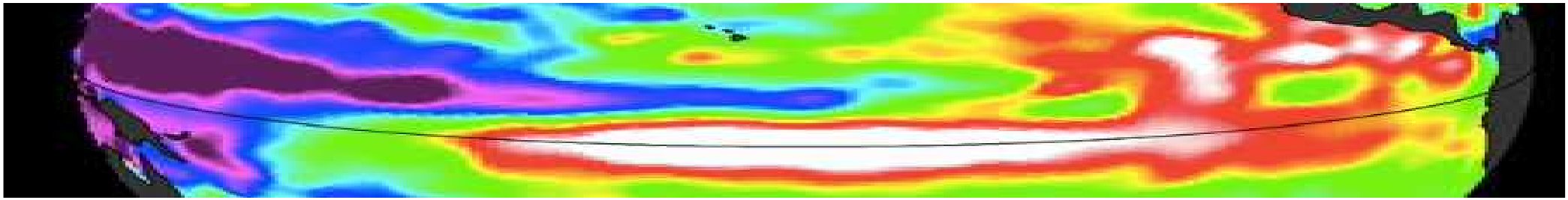
Relevant GLOBE tools

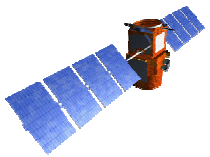
- Protocols
- Measurement Campaigns
  - Aerosols (Calipso)
  - Clouds (Cloudsat)
  - Precipitation; GPM
  - Soil Moisture; SMAP, SMOS
- Scientists support



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.
- GLOBE Visualizations were developed to include extended La Niña/El Niño predictions & long-term monthly averages of mean air temperature & total precipitation.
- Classroom El Niño Activities
  - How Does El Nino Affect Rainfall & Temperature?
  - Looking for the Effects of El Niño in GLOBE Student Data
  - Student Web Chats





Summary

We 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 (i.e., SWOT)