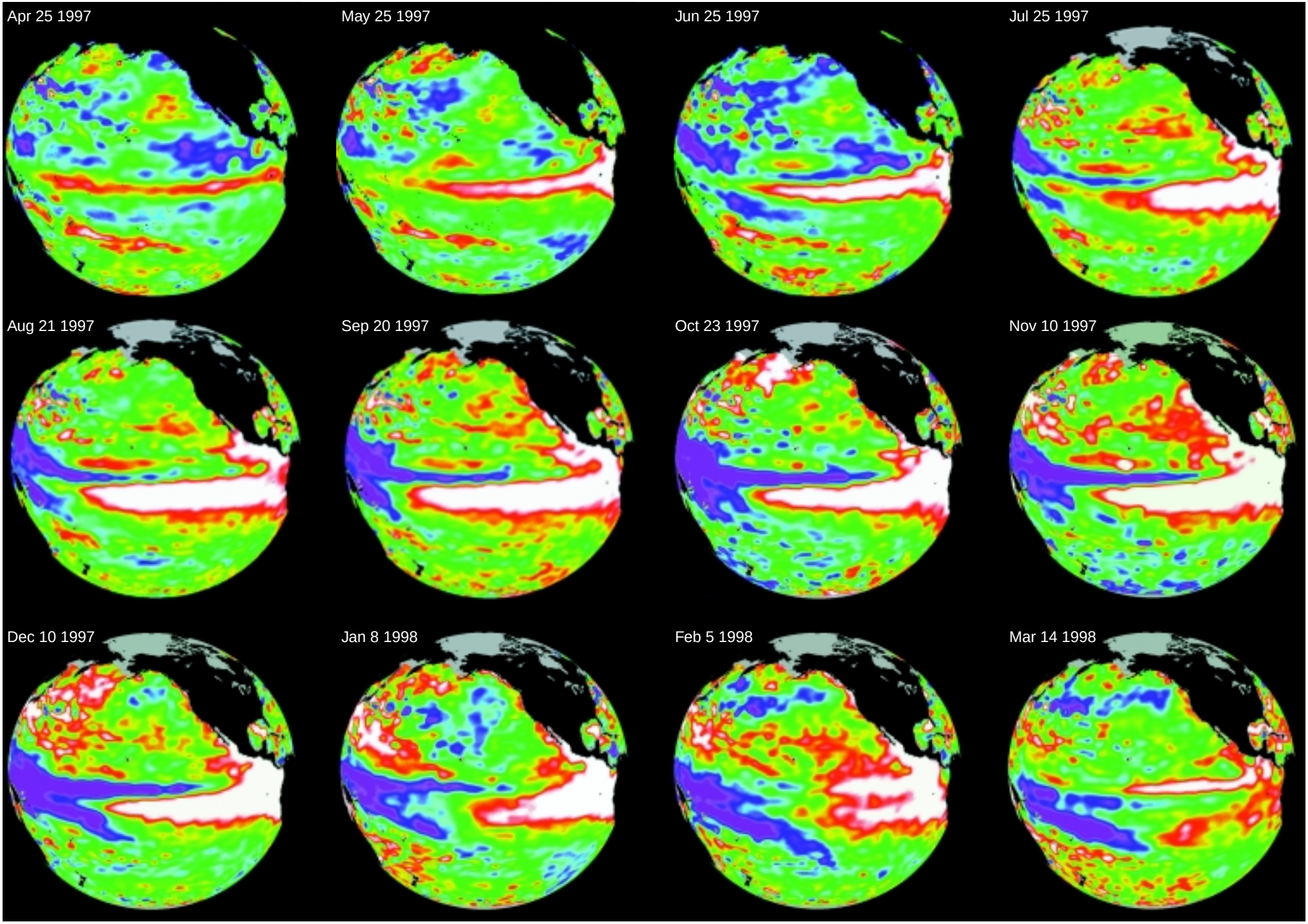
National Aeronautics and Space Administration

Goddard Space Flight Center

Jet Propulsion Laboratory
California Institute of Technology

Centre National d'Études Spatiales

1997-98 El Niño



1997-98 El Niño

This image shows the progression of the 1997-98 El Niño as derived from the TOPEX/Poseidon satellite. Developed by NASA and the Centre National d'Etudes Spatiales (CNES), TOPEX/ Poseidon uses onboard radar altimeters to bounce radar signals off the ocean's surface to obtain precise measurements of the distance between the satellite and the sea surface. These data are combined with high precision orbit data from the Global Positioning System (GPS) of satellites to produce image maps of sea surface height for tracking phenomena such as El Niño . These images show a complete map of global ocean topography, the hills and valleys found on the sea surface. Along the equator, elevated topography (hills) indicate warmer than normal water while areas of low topography (valleys) indicate cooler than normal water. With this detailed knowledge, scientists can then calculate the speed and direction of worldwide ocean currents.

The colors represented in the images show sea level height relative to average. The white and red areas indicate areas of higher than normal sea surface heights. In the white areas, the sea surface is between 14 and 32 centimeters (6 to 13 inches) above normal; in the red areas it is approximately 10 centimeters (4 inches) above normal. The green areas indicate normal conditions, while purple indicates areas that are at least 18 centimeters (7 inches) below normal sea level.

The images show the progression of the large warm water mass with high sea-surface elevations from the seas northeast of Australia, across the equatorial Pacific, to the west coast of South America. At its peak (November 10, 1997), the surface area covered by the warm water mass was about one and a half times the size of the continental United States, with sea-surface height in the eastern Pacific (near the Galapagos Islands) 35 centimeters (~14 inches) higher than normal. The added amount of warm water near the Americas with a temperature between 21-30 degrees Celsius (70-85 degrees Fahrenheit), was about 30 times the volume of water in all the U.S. Great Lakes combined. The difference between the abnormally high amount of heat in the near-surface waters and the usual amount of heat in the same area is about 93 times the total energy from fossil fuels consumed by the United States in 1995.

The climatic event has been given the name El Niño, a Spanish term for a "boy child," because of a warm current that first appeared off the coast of South America around Christmas. Past El Niño events have often caused unusually heavy rain and flooding in California, unseasonably mild winters in the Eastern United States and severe droughts in Australia, Africa and Indonesia. Better predictions of extreme climate episodes like floods and droughts could save the United States billions of dollars in damage costs. El Niño events usually occur approximately every two to seven years.

An El Niño event is thought to be triggered when the normal westward blowing trade winds weaken and in some instances even reverse direction. This change in the winds allows the large mass of warm water that is normally located in the western Pacific to move eastward along the equator until it reaches the coast of South America. This displaced pool of unusually warm water increases evaporation, allowing for increased convection (formation of tall cumulus clouds and thunderstorms) and consequently, alters typical atmospheric jet stream patterns around the world.

Additional information can be found on the World Wide Web at:

http://topex-www.jpl.nasa.gov
and
http://nsipp.gsfc.nasa.gov/enso/

Images courtesy of the Jet Propulsion Laboratory (JPL)

For the Classroom: Research Topics

• Jet Streams

El Niño is thought to be responsible for altering weather patterns around the world. Research the topic of jet streams to find out the difference between the polar jet stream and the subtropical jet stream. Then describe the changes in jet stream patterns that El Niño is thought to be responsible for and how these "detours" affect the weather in the United States and around the world.

• El Niño and Disease

Changes in temperature, precipitation, humidity, and storm patterns are thought be associated with upsurges in infectious diseases. Using recent articles from major newspapers, magazines, and the internet, research the diseases that are thought to be connected to the El Niño phenomenon.