Detection of 2002-2003 El Niño Using EOS and OSMI Data

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Abstract: Interannual variability in the patterns of satellite-derived pigment concentrations, sea-level height anomaly, sea surface temperature anomaly, and zonal wind anomaly are observed during the 2002-2003 El Niño. The largest spatial extent of the phytoplankton bloom was recovery from El Niño over the equatorial Pacific. The evolution towards a warm episode (El Niño) started from spring of 2002 and continued during January 2003, while equatorial Sea Surface Temperature Anomaly (SSTA) remained greater than +1°C in the central equatorial Pacific. The EOS (Earth Observing System) and OSMI (Ocean Scanning Multispectral Imager) data are used for detection of dramatic changes in the patterns of pigment concentration during El Niño.

Keywords: El Niño, SST, OSMI, EOS

1. Introduction

El Niño is a disruption of the ocean-atmosphere system in the Tropical Pacific having important consequences for weather and climate around the globe. El Niño occurs when sea surface temperatures in the equatorial Pacific Ocean remain above average for more than several months. This usually triggers a chain reaction of atmospheric and weather changes around the globe.

In this paper, 2002-2003 El Niño was investigated with Earth Observing System (EOS) and Tropical Atmosphere Ocean (TAO) data. Here we combine the biological and dynamical information from the moorings, Sea-viewing Wide Field-of view Sensor (SeaWiFS), and reanalysis data that can be helpful for the description of the biological-dynamical coupling in the equatorial Pacific. It is also examined whether the global distribution of chlorophyll by OSMI can be used for detection of El Niño.

2. Data

The datasets used for this study consist of TAO array data, National Center for Environmental Prediction (NCEP) optimum interpolation (OI) sea surface temperature (SST) and reanalysis data, SeaWiFS and Ocean Scanning Multispectral Imager (OSMI) chlorophyll concentration.

The NOAA OI.v2 SST monthly fields are derived by a linear interpolation of the weekly optimum interpolation (OI) version 2 fields to daily fields then averaging the daily values over a month. The monthly fields are in the same format and spatial resolution as the weekly fields.

The NCEP OI SST data is produced using in situ and satellite SST's plus SST's simulated by sea-ice cover. A description of the OI SST analysis is found in Reynolds and Smith (1994) and the bias correction improves the large scale accuracy of the OI SST. The SST anomaly (SSTA) is the departure from the adjusted OI climatology for 1971 – 2000 base periods. The NCEP reanalysis data has a horizontal resolution of 2.5° **x** 2.5° and 17 vertical levels (Kalnay et al., 1996). Through internet site, the reanalysis data are available for the period starting from 1949 up to the present.

3. Analysis of the 2002-2003 El Niño

Through the analysis of meteorological and oceanic data (SST, sea level height, ocean color, wind field) investigation into the 2002-2003 El Niño was carried out. Satellite data as well as TAO data were acquired for analysis. The TAO data are very useful for El Niño and La Nina. During the period of 2002 – 2003 El Niño occurring

Fig. 1. show NCEP SSTA in November, and December 2002, when an El Niño matured, and gradually destroyed El Niño in January 2003. SSTA in November 2002 was close to the highest value observed during the 2002-2003 El Niño.

The average of ocean variables of the equator areas ranging between 2° S - 2° N was obtained from TAO data. Fig. 2. shows sea temperature and anomaly distribution of observations (NOAA: http://www.pmel.noaa.gov/tao/elnino). During the occurrence and maturing period of an El Niño from 2002-2003, the SST rose over 3 ° C.

SeaWiFS, which was launched by NASA in August 1997 and is currently in operation, has the same sensor characteristics as those of OSMI – observing ocean color through chlorophyll distribution. Fig. 3. (not shown) displays the ocean color of identical periods, showing the plankton distribution of the ocean.

4. Conclusions

The evolution towards a warm episode (El Niño) started from spring of 2002 and continued during January 2003, while equatorial SSTA remained greater than +1° C in the central equatorial Pacific. The El Niño in 2002-2003 is the first El Niño of the 21th century. Recent values of atmospheric and oceanic indices are considerably smaller in magnitude than those observed during the 1997-1998 El Niño. The OSMI data continuously can be used for detection of changes in the patterns of pigment concentration.

During the maturing period of an El Niño in 2002-

2003, the sea surface temperatures of the Pacific Ocean near the South America coast warmed 2 ~ 3° C. That is a strong sign that the Pacific is headed for an El Niño condition that could last more than a year.

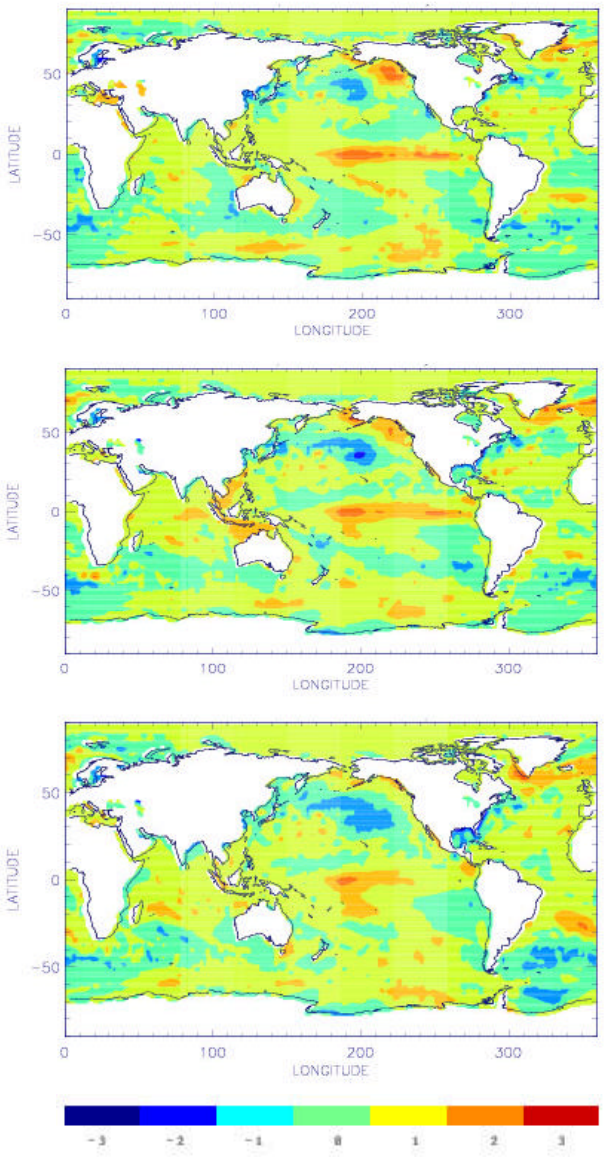

Fig. 1. SSTA observed in November, December of 2002, and January of 2003.

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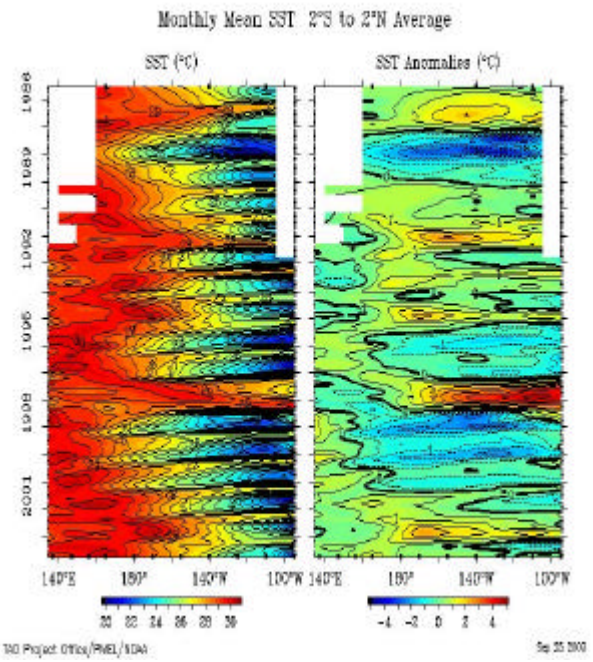

Fig. 2. Sae surface temperature and anomaly distribution of the observations/averages observed from TAO between 2° S - 2° N. <NOAA: http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html#recent>

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