The Benguela Niño 1995 as observed by satellites.

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ABSTRACT - The Benguela region off the coast of south-west Africa experiences a climatic perturbation similar to the El Niño phenomenon in the Pacific Ocean. This Benguela Niño seems to occur about once per decade. It is characterised by higher surface temperature, lower surface salinity and increased sea level. It was last observed in 1995. Here we describe the Benguela Niño 1995 by using satellite measurements.

1. Introduction.

The Benguela Niño was described by Shannon et.al (1986). Early 1995, CTD measurements revealed high temperature anomalies and low salinities in the upper ocean layers off the Angolan and Namibian coast (Gam 98), indicating that a Benguela Niño was in progress.

It is currently not fully understood how the El Niño process initiates, but the coupling between ocean and atmosphere is a key factor. The usually strong and persistent trade winds pile up water at the western side of the basin. When the trades relax, a Kelvin wave is believed to propagate eastward along the equatorial wave-guide, transporting warm water towards the African coast. As a consequence, the thermocline deepens, the upwelling ceases and the sea surface elevates. This is the hypothesis we seek to test in this presentation.

2. Data

The Topex/Poseidon satellite operates within 60 degrees north and south, with grid size 0,5 x 0,5 degrees. It has provided continuous measurements of sea surface height (SSH) every 10th day since 1992. The data are anomalies, and they have been corrected for a number of disturbing elements, such as tides and air pressure. The measurements closest to shore are characterised by noise and missing data. These series show large fluctuations, anomalies up to 700 mm occur, while anomalies taken further from shore rarely exceeds 300 mm. To avoid gaps caused by missing data, interpolated values have been inserted in the data series.

The wind data used are the Atlas and Ardizzone SSMI-derived winds, ver.2, PO-DAAC gridding. The values are five-day averages within a 0,5 x 0,5 degrees sized area, measured 10 meters above the sea surface. As with the surface elevation data, gaps caused by missing data have been replaced by interpolated values.

The SST data used are again five-day averages within an area 0,5 x 0,5 degrees in size. The NOAA –7, -9, -11 and –14 satellites carrying an AVHRR sensor provided the data.

3. Results and discussion

The average SSH anomaly from 1992 to 1997 in the Benguela area was –1,22 mm, while from Dec. 1994 to May 1995 it was +19,7 mm. An example of the SSH anomaly from near 13°S, 13°E, which is 180 km from the coast of southern Angola, is shown in figure 1.a. The Benguela Niño 1995 (BN-95) clearly emerges as a positive anomaly, starting in January, with a peak above 20 mm in February, disappearing in May. The corresponding temperature signal is seen in figure 1.b. The temperature signal seems to lead the SSH signal with a couple of months in the beginning of the BN-95 period, while they both fade out simultaneously. The maximum temperature was above 4°C in March'95. Note that both SSH and SST reveal rather strong negative anomalies preceding the BN-95.

To check if the BN-95 is triggered as described above, we have plotted several time series of the east component of the wind speed. A typical example near the equator some 700 km from the Brazilian coast is shown in Fig. 1.c. As expected, the BN-95 is associated with a relaxation in the trade winds, but there is no time lag between the relaxation and the BN-95. A Kelvin wave will need a few months to cross the Atlantic, so the time lag should have been clearly visible in Fig. 1.

The wind time-series shown in Fig.1.c are quite typical for the whole equatorial Atlantic, even at the eastern side the trade wind diminished during BN-95. A possible interpretation is therefore that the BN-95 is also influenced by local winds. When the trades are reduced, so is the upwelling, and warm water may approach the coast from the adjacent open ocean. Later, when the Kelvin wave finally arrives, the local effect is enforced by the El Niño mechanism.

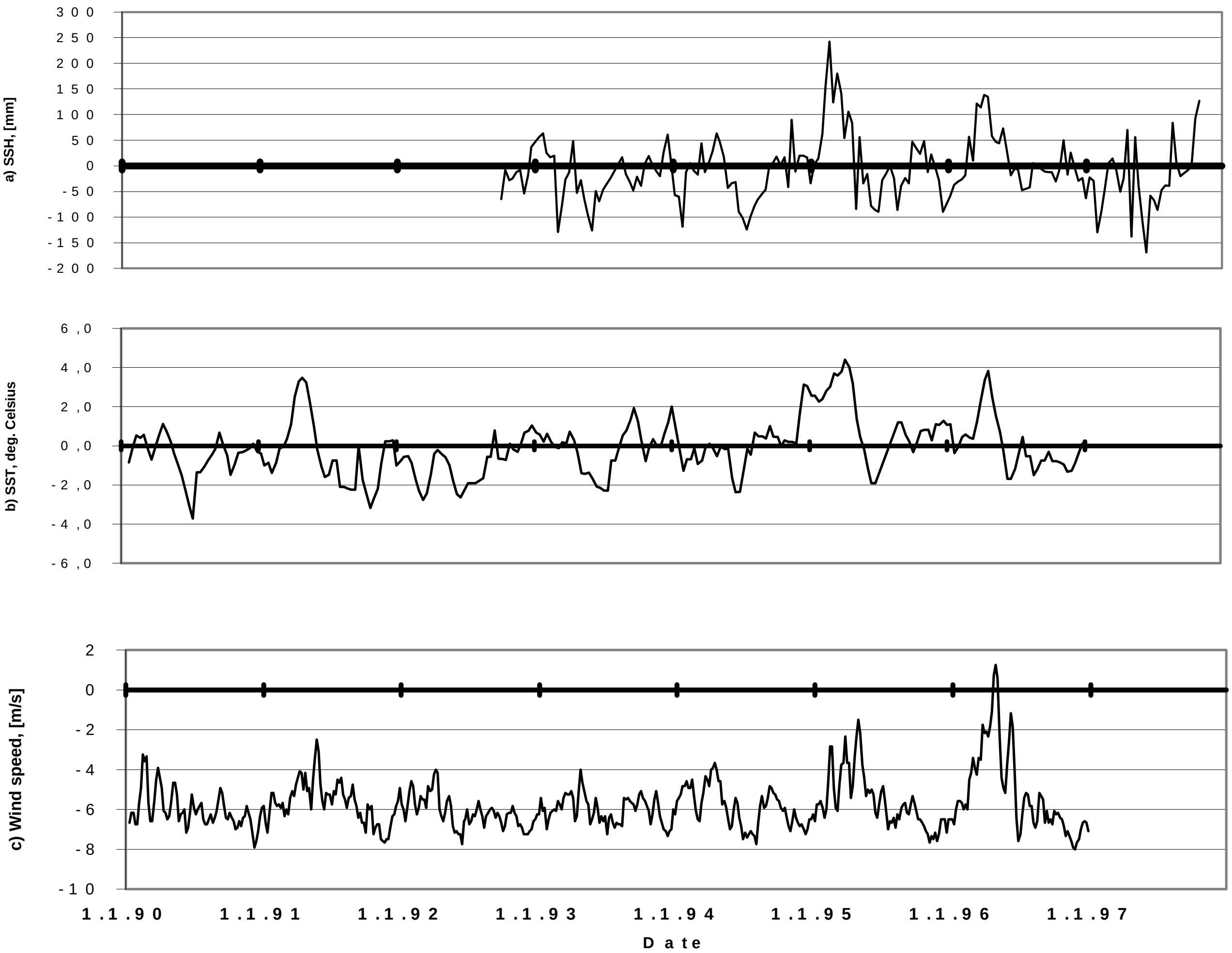

Fig. 1. Time series of a) Sea surface height anomalies (SSH), b) Sea surface temperature anomalies (SST), and c) Eastward wind component. SST and SSH is measured 180 km from the Angolan coast, while the wind speed is measured at 30°W, 700 km off the Brazilian coast.

References.

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