

Humboldt current squid stranding in Chile related to sea surface patterns from ENVISAT

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ABSTRACT

The usual upwelling pattern observed from sea surface temperature images, off the Chilean Southern coast presented changes after February the 25th 2004 in relation to the normal features at the latitude of the Pacific ocean.

This event was registered using the instrument AATSR (Along Advance tracking radiometer) onboard ENVISAT satellite of the European Space Agency (ESA). These results are one chapter of the first application of this satellite in Chile.

We have related this feature to the stranding of hundred of giant squids (*Dosidicus gigas*, *Orbigni 1985*) in the beaches of the area, especially in the northern coast of the big island Chiloé, where this fact started, afterwards registered in the whole area, between latitude 40°S and 44°S.

These mesoscale observations are well correlated with the global models of NOAA, about the sea surface anomaly in the Pacific ocean, which demonstrated a global increase up to 1,5°C, regarding the normal conditions for the SST in this period of the year.

Key words: AATSR, ENVISAT, sea surface temperature, coastal upwelling, Humboldt Current squid, Chile

RESUMEN

Se describe la modificación de la señal del afloramiento que ocurre normalmente frente a las costas orientales del Pacífico sur, frente al litoral de Chile, en la X Región del país, a partir del 25 de febrero del 2004.

El evento se registró mediante datos del instrumento AATSR (Along Advance tracking radiometer), a bordo del satélite ENVISAT de la Agencia Espacial Europea (ESA). Estos resultados son parte de la primera aplicación de datos de ENVISAT en Chile.

Se ha relacionado este patrón con los varamientos de cientos de calamares de Humboldt o jibias (*Dosidicus gigas*, *Orbigni 1985*) en las playas de varias regiones, pero fundamentalmente observados a lo largo de la Isla de Chiloé, entre latitud 40°S y 44°S.

Las observaciones a mesoescala se corresponden con los resultados de los modelos globales de NOAA sobre la anomalía de la temperatura superficial del mar para este periodo del año.

Palabras clave: AATSR, ENVISAT, temperatura superficial del mar, calamar de la corriente de Humboldt, surgencia costera, Chile.

INTRODUCTION

During the last days of February 2004 more than 200 jumbo flying squids *Dosidicus gigas* (Orbigni, 1835) stranded on the beaches of the surrounding area of Ancud, in the northern coast of the big island Chiloé in the X region of Chile (Fig. 1). Afterwards the stranding of thousands of these animals went on in the region to the present time (May 2004).

The Humboldt current squid is the mayor Chilean invertebrate (*Fernandez and Vasquez, 1995*). This active squid is carnivorous and is the reason of a big concern of the artisan fishing fleet in the region. Its presence in these waters is a danger to all the natural resources.

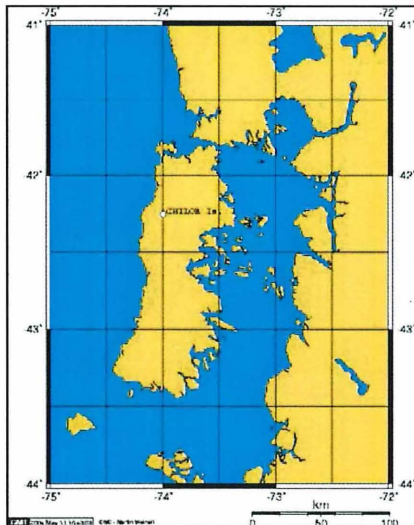


Figure 1: Map of the region of study

The giant squid habitat is located in oceanic areas (*Seibel and Gilly, 2004*). Its distribution, related to captures is defined in the upwelling regions that transport nutrients from deeper and colder waters, which determine a high biological productivity. In these areas the squids find the pelagic species

which maintain their diet (*Suda, 1973; Ehrhardt et al, 1986*).

Brito-Castillo et al. (2000), confirmed the hypothesis that the water temperature was the factor affecting the squid movements, and that the catch of squids could be successful in an optimum temperature range of 12.8 to 14.6°C.

METHODS

Satellite images analyses. Sea Surface Temperature (SST) images from the instrument AATSR (*Along Advance Tracking Radiometer*) from the European

Environmental Satellite ENVISAT were used. This satellite was launched in 2001 by the European Space Agency. It carried on board 10 instruments focused on the Earth Observation. This is the first application of the AATSR observations in Chile.

SST Level 2 images were obtained to analyse the sea surface temperature of the region by the Earth Observation helpdesk of ESA from ESRIN centre. Spatial resolution of the images corresponds to 1Km.

ENVISAT observations showed correspondence to the global models weekly sea surface temperature anomaly. These data were obtained by the International Research Institute for Climate Prediction (IRI), using the Reynolds and Smith model on a 1.0 x 1.0 deg. lat/lon grid. These data were of obtained from NOAA NCEP EMC CMB GLOBAL service.

Observations on the squids were obtained from the local fishermen and press information.

RESULTS AND DISCUSSION

AATSR images from ENVISAT demonstrated changes in the water mass conditions in the areas off the coast of Chile, at the latitude mentioned above, corresponding to the region of *Los Lagos*, after the 25th February. The general upwelling conditions observed during the most part of the year is well represented on the image from the last 12th of February (Fig 2). This pattern disappeared during the last days of February 2004. The influence of the coastal upwelling that enters the Channel between the big island and the continent was not observed after the 25th February (Fig. 3).

These warmer masses created an inclusion of cold water as they reached the front of the inner Gulf area (Gulf of Ancud). Separated by temperature, squids probably remained trapped in this lens (Fig 4.)

Positive anomalies of the sea surface temperature have been demonstrated to be responsible for a modification in the nutrients in the water column, a net decrease in upwelling and therefore an immediate dramatic change in the fisheries (Torres-Jimenez, 1999). These observations support our hypothesis, regarding the change of the upwelling observed by the SST-AATSR images from ENVISAT in relation with the stranding of *Dosidicus* individuals. We suppose that the warm water arrival to this Southern Chilean coast, and the decrease of the coastal upwelling affected the vertical and spatial distribution offshore of these cephalopods.

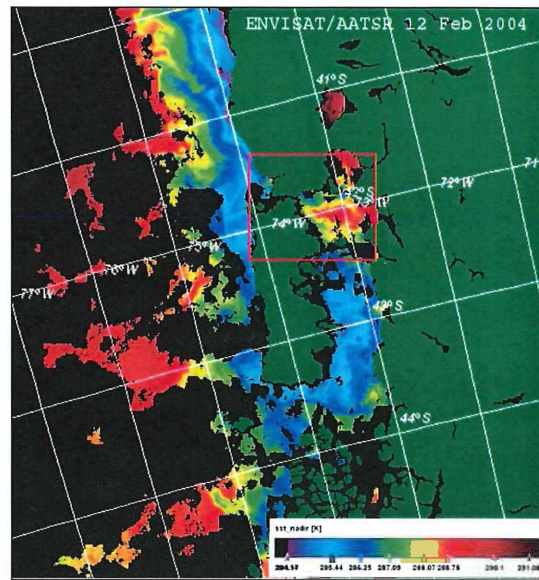


Figure 2: SST from AATSR. 12th February.
Rectangle over Chacao Channel

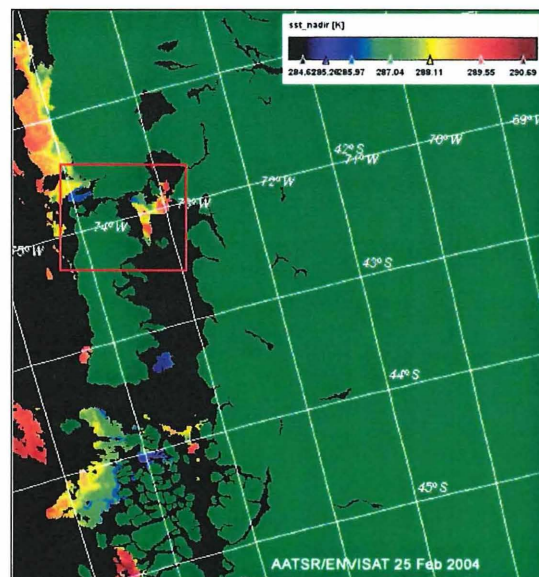
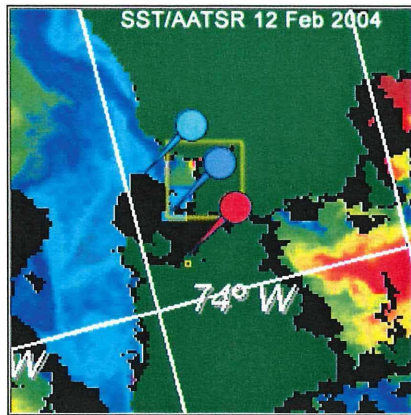
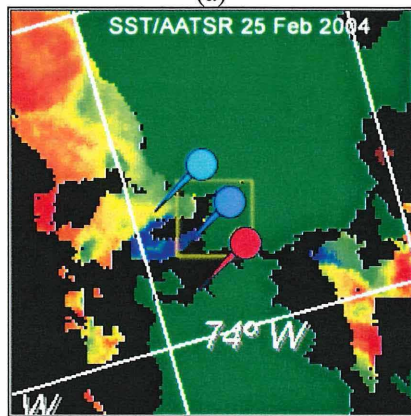


Figure 3: SST from AATSR. 25th February.
Rectangle over Chacao Channel.



(a)



(b)

Pin (a)	Value SST (°C)	Pin (b)	Value SST (°C)
1	12.71	1	15.29
2	11.65	2	12.67

Figure 4: Zoom of the area of study for the 12th of February (a) and 25th of February (b). The squids were cited in Ancud (red pin). The SST value of the pins (1 (sky-blue) and 2 (blue)) are in the table attached the figure.

These observations fit well with the global temperature models from the NOAA NCEP EMC Global Reyn_SmithOIv2 weekly ssta: Sea surface temperature anomaly, which describes positive anomaly between 0.5 to 1°C from open ocean (Fig. 5).

The natural resources for artisan fishery could be threaded. These resources are exploited by 16.400 registered fishermen, for the X Region of this country, which support about 40.000

people. ENVISAT can help also in predicting this natural phenomenon.

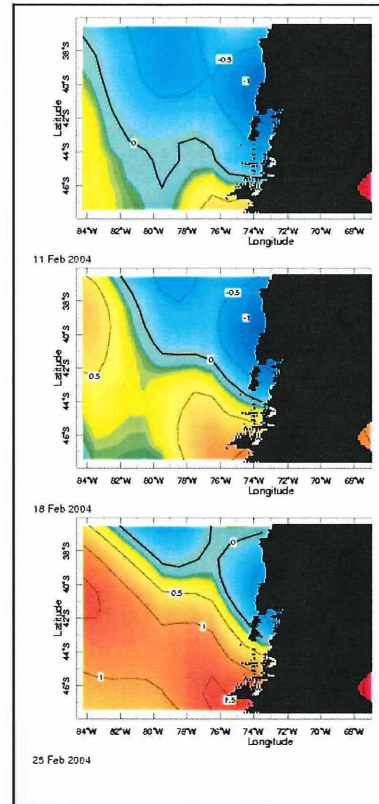


Figure 5: Sea Surface anomaly data from the NOAA NCEP EMC CMB Global Reyn_Smith OIv2 weekly ssta, from the last 3 week of February 2004.

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