AVAILABILITY OF AVHRR SATELLITE DATA AND NDBC BUOY DATA FROM THE SANTA BARBARA CHANNEL-SANTA MARIA BASIN CIRCULATION STUDY

Brett N. Lesh

Center for Coastal Studies, Scripps Institution of Oceanography, La Jolla, CA 92093-0209
(858) 534-7561, FAX (858) 534-0300, E-mail: blesh@coast.ucsd.edu

ABSTRACT

Advanced Very High Resolution Radiometer (AVHRR) satellite data and National Data Buoy Center (NDBC) buoy data of the Santa Barbara Channel (SBC) and Santa Maria Basin (SMB) are acquired and archived in the Data Zoo at the Center For Coastal Studies. The AVHRR data set is acquired by polar-orbiting National Oceanic and Atmospheric Administration (NOAA) satellites and processed daily. Some images are presented here. NDBC moored buoy data and Coastal Marine Automated Network (CMAN) data are acquired and archived. Plots and maps are presented here. AVHRR, NDBC moored buoy data, and CMAN data are accessible through the Internet. Instructions on how to access the data, the format the data is in, data processing, and the availability of the data are discussed.

Keywords: Web, Internet, access data, Advanced Very High Resolution Radiometer, National Data Buoy Center , winds, satellite images, Coastal Studies ASCII, sea surface temperature, buoys.

INTRODUCTION

Advanced Very High Resolution Radiometer (AVHRR) High Resolution Picture Transmission (HRPT) satellite image data, National Data Buoy Center (NDBC) buoy data, and Coastal Marine Automated Network (CMAN) data acquired during the Santa Barbara Channel-Santa Maria (SBC-SMB) Basin Circulation Study since 1992 will be discussed. AVHRR HRPT data for channel 4 (infrared) is archived and accessible through the World Wide Web. NDBC buoy data is archived from all buoys around the Santa Barbara Channel and Santa Maria Basin. Data archived for NDBC buoys are wind speed and direction, atmospheric temperature, atmospheric pressure, and sea surface temperature (SST). Data for NDBC buoys is archived in Coastal Studies ASCII (CSA) format. CMAN stations are the same as NDBC buoys except there is no sea surface temperature. The collection, processing, and availability on the World Wide Web is discussed.

AVHRR IMAGE DATA

AVHRR HRPT data have been received since March of 1992 as part of the SBC-SMB Circulation study. This data is captured using a satellite dish and Seaspace's Terascan acquisition software and hardware system. The data is then calibrated to engineering units which is percent albedo for channels 1 and 2 and brightness temperature for AVHRR channels 3, 4, and 5. Channel 4 is used as a estimation of sea surface temperature when it is cloud free. Satellite data is important since its spatial resolution is high and images are taken in one synoptic state. There are on average four images a day that have HRPT data in the SBC-SMB area.

Instruments

The AVHRR is carried on the National Oceanic and Atmospheric Administration (NOAA) Polar Orbiting Environmental Satellite (POES) (Figure 1). POES satellites are in near-polar sunsynchronous orbit at 833 km height which allows them to cover the globe twice daily. The resolution is 1.1 km at nadir. AVHRR has 5 channels, two visible and three infrared (VIS, 0.62 Fm and 0.91 Fm; IR, 3.7 Fm, 10.8 Fm, and 12.0 Fm). The infrared channels have a noise equivalent differential temperature of approximately 0.12°C when viewing the ocean surface.
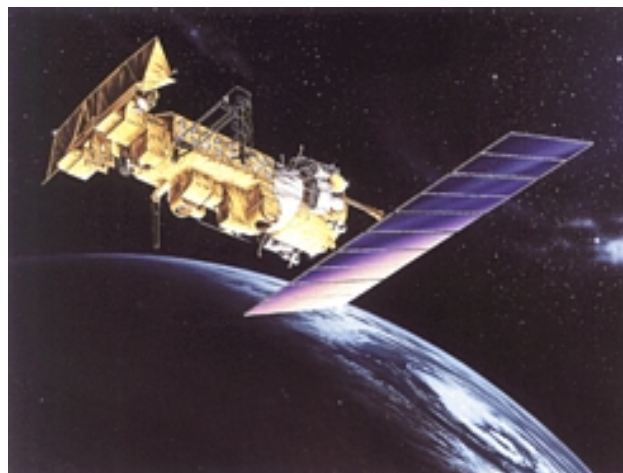

Figure 1. AVHRR Satellite.

Data Processing

HRPT data is received on a satellite dish whenever one of the AVHRR sensors is recording data and within sight of a receiver dish. These data are then calibrated and registered to the SBC-SMB area using Seaspace's Terascan software system. Now the data is ready to be looked at with the Terascan system, where the coast is navigated by hand to the coastline in the SBC-SMB area. After all this is done the images are archived in Terascan Data Format (TDF). Monthly SST means have been made for 1993 through 1998 (see Figure 2 for 1998). SST means were made by first making good daily images to reduce cloud cover. Good daily images are made by taking all images for a given day and removing all ludicrous values and picking the maximum value in each position. The mean of these reduced cloud daily images taken over each month is the monthly mean.

Web Access

AVHRR data can viewed in a few different ways on the web. Images since 1993 are saved as ".gif" files for a specific temperature range (10°C to 20°C) and can be found at the following website:

www-ccs.ucsd.edu/research/sbcsmb/sat_images/ data_archive.cgi (Figure 3).

You can also enhance the latest 30 images to get a better look. This page will let you enter a color pallette and a temperature range for the latest 30 images. The best way to do this is to enter a big range and then narrow it down by looking at the temperature scale and choosing the values that seem appropriate. This can be done at this website:

www-ccs.ucsd.edu/research/sbcsmb/sat_images/ dataviewer.cgi (Figure 4).

Some cloud free images are processed to bring out all the details. These can be found at this website:

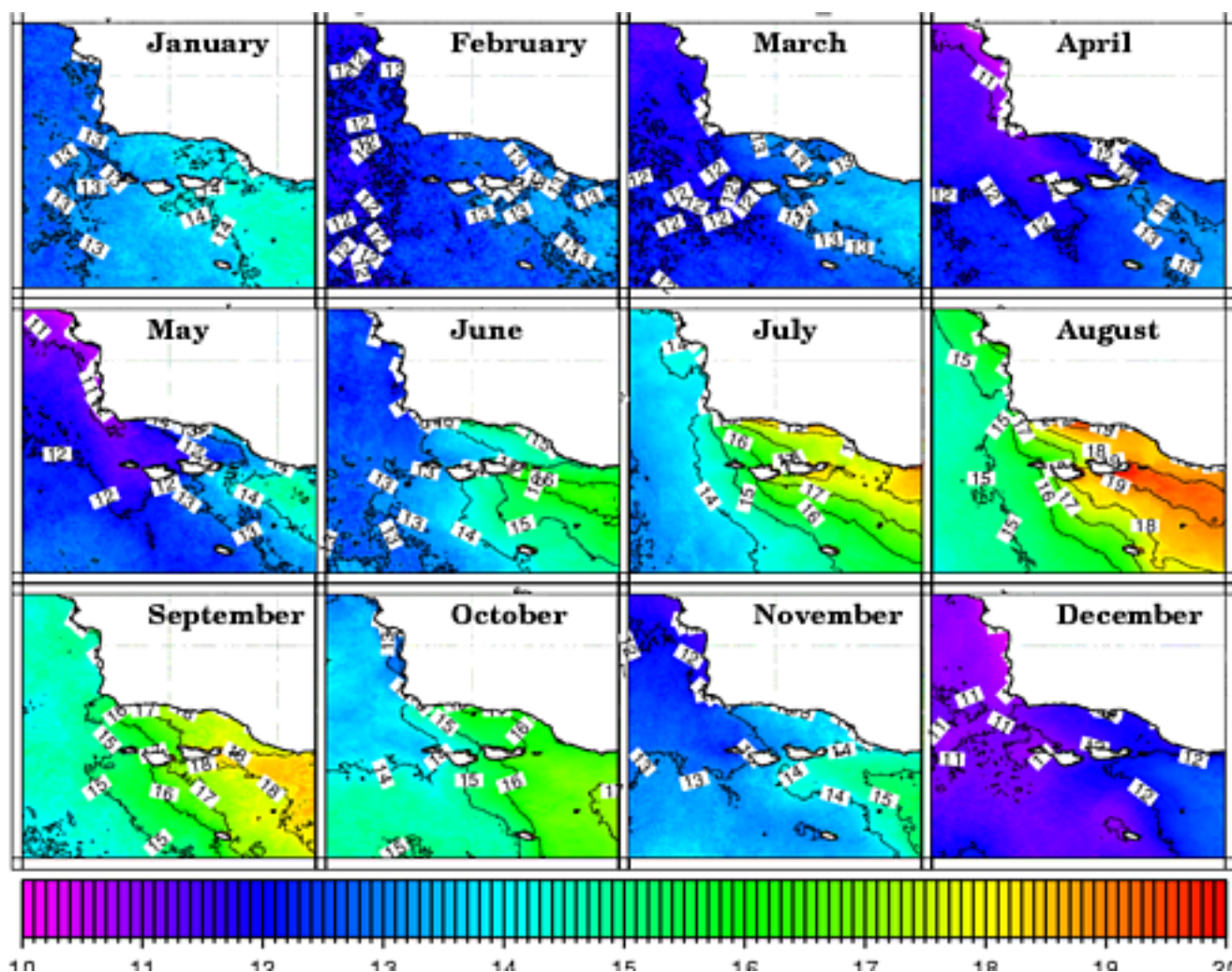**www- ccs.ucsd.edu/research/sbcsmb/sat_images/ clearimages.cgi.**

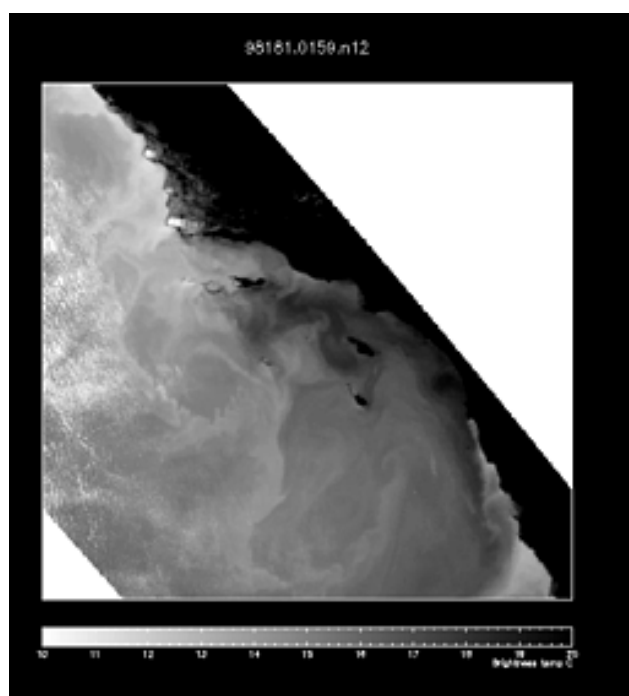**Figure 2. 1998 Monthly SST means derived from AVHRR images.**
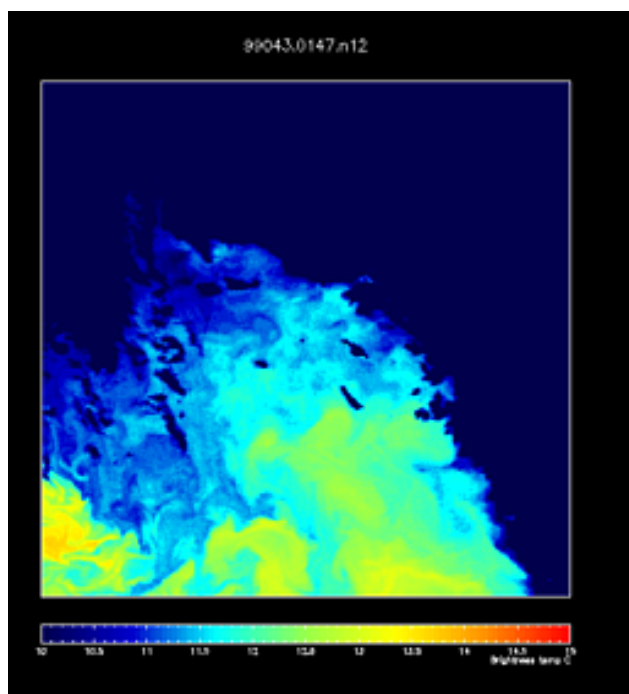
Figure 3. AVHRR image made from Dataviewer.

Figure 4. AVHRR image from archives.

Monthly averages can be found at website:

www-ccs.ucsd.edu/research/sbcsmb/sat_images/ analysis.html (Figure 2).

There have also been some movies of AVHRR data with drifter tracks overlaid which can be found at website:
www-ccs.ucsd.edu/ research/sbcsmb/sat_images/ movies.html.

NDBC BUOY AND CMAN DATA

NDBC buoy data have wind direction, wind speed, atmospheric temperature, atmospheric pressure, and SST data, while CMAN stations have the same without SST. These data have been taken during the SBC/SMB Circulation study. The data has been taken from 3 m buoys, 10 m buoys, 6 m nomad buoys, and the CMAN station at Point Arguello.

Instrumentation

NDBC buoys used in this study have been one of three types; 3 m discus buoys (Figure 5), 10 m discus buoys (Figure 6), and 6 m nomad buoys (Figure 7). They each contain wind direction, wind speed, atmospheric pressure, atmospheric temperature, and SST data. They were deployed by NOAA and data is received by NDBC in real-time. Real-time messages coded in FM-13 (buoys) and FM-12 (CMAN) are posted on a internet server maintained by University Corporation for Atmospheric Research (UCAR). CMAN Station PTGC1 has all the same data except that it does not have any sea surface temperature information. It also posts data to the server maintained by UCAR. For positions of NDBC buoys see Figure 8.

Data Processing

Data for NDBC buoys and CMAN stations are processed in two different ways, one is for real-time purposes and the other is for archiving. Data for NDBC buoys and CMAN stations is available from NDBC over the web. It is quality controlled and put in f291 format. It is then downloaded and formatted into CSA format and archived. The CSA files are hourly averages of ten minute data. Real-time data received from UNIDATA in FM-12 and FM-13 format is downloaded daily and decoded. This data is used as daily real-time winds and is also hourly averages.
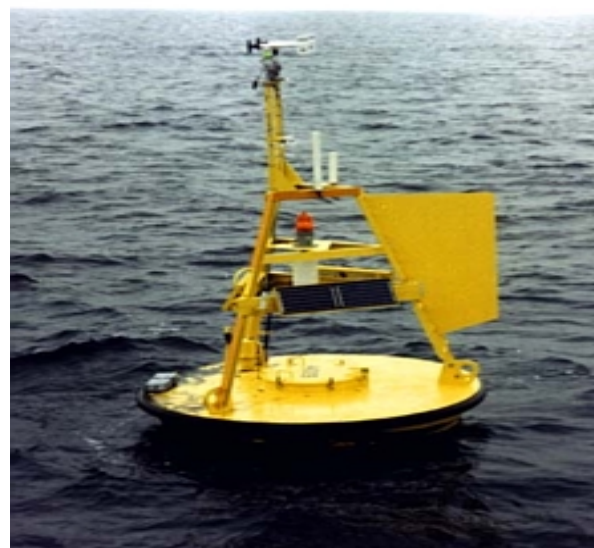

Figure 5. Three meter buoy.
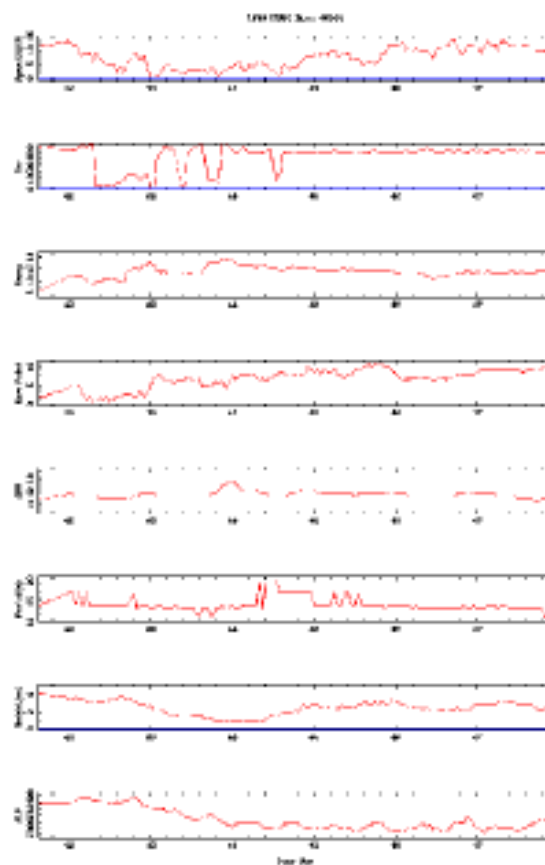
Figure 6. Ten meter buoy.

Figure 7. Six meter buoy.

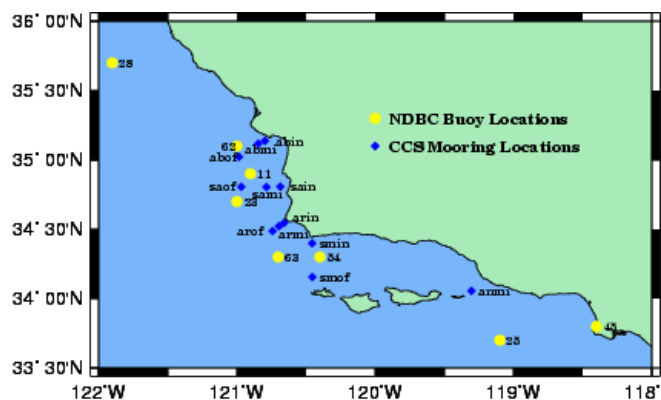Figure 9. Times series of NDBC buoy data from web page.

Figure 8. Positions of NDBC buoys.

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CSA Format

CSA is a data format that is composed of a five line header which the data follows.The first and second lines of the header show the relevant information such as the start time, number of points, sample interval, elevation, latitude, longitude and relevant units, while the third line has the actual values. The fourth line contains the variable names and the fifth has the variable units. For example:

```
start_time  npts samp_interv  elev lat  lon
yymmddhhmmss #_pts seconds meters deg deg
970101005000 8759 3600.00  10.0034.3000120.4000
north east atm_pressure atm_temp_drysea_surf_temp
 m_s  m_s  hPa  deg_C deg_C
0.7100 -8.0700 1018.300  14.600 14.200
-0.1200 -6.8000 1018.900  14.900 14.200
-0.3500 -6.6900 1019.300  14.600 14.200
0.9600 -6.8300 1019.400  14.900 14.200
2.6600 -8.1800 1019.500  14.900 14.200
```

Web Access

There are a few ways to view the NDBC data. Real-time data is plotted and available daily along with ASCII columns of the latest three days of data if you click on a buoy on the following web page:

www-ccs.ucsd.edu/research/sbcsmb/buoys/ immap/ (Figure 9).

Archived quality controlled data is available in CSA format at web page:

gopher://gopher-ccs.ucsd.edu:70/11/zoo/ndbc/ buoydata.

A good explanation and source of data is located at website:

seaboard.ndbc.noaa.gov/

LITERATURE CITED

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