CATALOG DOCUMENTATION
NATIONAL COASTAL ASSESSMENT- NORTHEAST DATABASE
YEAR 2000 STATIONS
LIGHT ATTENUATION DATA: "ATTENCO"

TABLE OF CONTENTS

1. DATASET IDENTIFICATION

 1.1 Title of Catalog document
   National Coastal Assessment-Northeast Region Database
   Year 2000 Stations
   WATER QUALITY - LIGHT ATTENUATION DATA

 1.2 Authors of the Catalog entry
   John Kiddon, U.S. EPA NHEERL-AED
   Harry Buffum, CSC Corp.

 1.3 Catalog revision date
   December 29, 2003

 1.4 Dataset name
   ATTENCO

 1.5 Task Group
   National Coastal Assessment-Northeast

 1.6 Dataset identification code
   014

 1.7 Version
   001

 1.8 Request for Acknowledgment
   EMAP requests that all individuals who download EMAP data acknowledge the
   source of these data in any reports, papers, or presentations. If you
   publish these data, please include a statement similar to: "Some or all of
   the data described in this article were produced by the U. S. Environmental

Protection Agency through its Environmental Monitoring and Assessment Program (EMAP)".

2.   INVESTIGATOR INFORMATION (for full addresses see Section 13)

  2.1 Principal Investigators
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  2.2 Sample Collection Investigators
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  2.3 Sample Processing Investigators
   Not Applicable

3.   DATASET ABSTRACT

  3.1 Abstract of the Dataset
   This data file reports the attenuation coefficient (ATTENCO) calculated
   from in situ photosynthetically active radiation (PAR) and depth data
   collected at NCA Northeast estuaries during the Summer of 2000. The
   attenuation coefficient (k) is related to the PAR readings at surface (I_o)
   and depth (I_z) by the expression: $I_z/I_o = \exp(-kz)$, where z is depth. The
   file also reports the number of readings used to calculate the coefficient.
   Raw data used in the calculations are not included here but are available
   from the database manager (Section 10.3). One record is presented per
   sampling event.

  3.2 Keywords for the Dataset
   Attenuation coefficient, PAR, photosynthetically active radiation

4.   OBJECTIVES AND INTRODUCTION

  4.1 Program Objective
   The National Coastal Assessment (NCA) is a national monitoring and
   assessment program with the primary goal of providing a consistent
   evaluation of the estuarine condition in U.S. estuaries. It is an
   initiative of the Environmental Monitoring and Assessment Program (EMAP),
   and is a partnership of several federal and state environmental agencies,
   including: EPA's Regions, Office of Research and Development, and Office of
   Water; state environmental protection agencies in the 24 marine coastal
   states and Puerto Rico; and the United States Geological Survey (USGS) and
   the National Oceanic and Atmospheric Agency (NOAA). The five-year NCA
   program was initiated in 2000, and is also known as the Coastal 2000
   Program.

   Stations were randomly selected using EMAP's probabilistic sampling
   framework and were sampled once during a summer index period (June to

October). A consistent suite of indicators was used to measure conditions in the water, sediment, and in benthic and fish communities. The measured data may be used by the states to meet their reporting requirements under the Clean Water Act, Section 305(b). The data will also be used to generate a series of national reports characterizing the condition of the Nation's estuaries.

4.2 Dataset Objective

The objective of the ATTENCO data file is to report values of attenuation coefficients calculated from in situ PAR measurements in the water column.

4.3 Dataset Background Discussion

A two-year sampling design was employed for 2000-2001 NCA program in the Northeast. Analysts may therefore wish to consider the two years of data together.

This file presents the light attenuation coefficient (ATTENCO), which is calculated from PAR and depth measurements. The attenuation coefficient (k) is related to the PAR readings at surface (Io) and depth (Iz) by the expression: $Iz/Io = exp(-kz)$, where z is depth in meters. Section 6.2 describes the calculation procedure. Smaller positive values of ATTENCO indicate clearer water (deeper penetration of light through the water column).

PAR values were measured at regular intervals on both the downcast and upcast (see Section 5.1.2); however, only the downcast data were used to calculate ATTENCO. The parameter PAR_RECS reports the number of PAR measurements used in the calculation. Several QA flags are used to highlight which may diminish confidence in the calculated coefficient (see Section 4.4).

NCA planners provide two alternate locations for a station location in the event that the original location cannot be sampled. The parameter STA_ALT indicates whether the station location was the original site, first alternate, or second alternate—STA_ALT = "A", "B", or "C", respectively. Also refer to discussion in the STATIONS metadata file regarding use of this parameter during analysis of the data.

4.4 Summary of Dataset Parameters
* denotes parameters that should be used as key fields when merging data files

*STATION	Station name
*STAT_ALT	Alternate Site Coded (A, B, or C)
*EVNTDATE	Event date
ATTENCO	Calculated PAR Attenuation Coefficient
PAR_RECS	Number of PAR readings
QACODE	PAR-A Surface PAR readings were not recorded; alternate calculation procedure used (Section 6.2)
	PAR-B Fewer than four PAR readings recorded; diminished reliability of the estimate is possible
	PAR-C Calculated attenuation coefficients less then zero (not valid); reported as zero

5. DATA ACQUISITION AND PROCESSING METHODS

5.1 Data Acquisition
The sample collection methods used by USEPA trained field crews will be described here. Any significant variations by NCA partners are noted in Section 5.1.12. Details regarding NCA partners are reported in the STATIONS data file.

5.1.1 Sampling Objective
Obtain in situ measurements of PAR in the water column of estuaries in the NCA region.

5.1.2 Sample Collection: Methods Summary
PAR was measured with a LICOR PAR sensor separately or attached to Hydrolab Datasonde or similar instrument. A deck sensor, if available, was located on the boat deck in an unshaded location. The PAR sensor was lowered on the sunny (or at least unshaded) side of the boat to a depth of about 0.5 meters, and PAR values were allowed to stabilize. PAR levels were recorded from both the in situ and surface sensors (if a deck sensor was present), along with the water depth of the PAR meter. Measurement intervals were as follows:

  Shallow sites (< 2 m): at every 0.5 m interval;
  Moderate depths (>2 to <10 m): at 0.5 m (near-surface) and every 1-m interval to near-bottom (0.5 m off-bottom);
  Deep sites (>10 m): at 0.5 m (near-surface) and every 1-m interval to 10 m, then at 5-m intervals, thereafter, to near-bottom (0.5 m off-bottom).

  Measurements were recorded at the same intervals on the upcast. If the meter hit the bottom, 2-3 minutes were allowed for the disturbed conditions to settle before taking subsequent readings. All surface and in situ data from downcasts and upcasts are available from the data manager (Section 10.3).

5.1.3 Beginning Sampling Dates
  8 July 2000

5.1.4 Ending Sampling Dates
  8 October 2000

5.1.5 Sampling Platform
  Samples were collected from gasoline or diesel powered boats, 18 to 133 feet in length

5.1.6 Sampling Equipment
  Quantum sensors measure photosynthetically active radiation (PAR) in the 400 to 700 nm waveband. The unit of measurement is micromoles per second per square meter ($\mu mol\ s^{-1}m^{-2}$). LICOR PAR sensor readings were recorded concurrently with hydrographic data from Hydrolab or similar instrument. PAR readings were recorded on datasheets and entered by hand into excel spreadsheets or recorded using a software program such as Procomm.

5.1.7 Manufacturer of Sampling Equipment
LICOR L1100 light meter, LI-COR, Inc.

5.1.8 Key Variables
Not applicable

5.1.9 Sample Collection: Calibration
No daily field calibration procedures are required for the LICOR light
meter. The meters were calibrated at the beginning of the season using a
calibration kit provided by the manufacturer.

5.1.10 Sample Collection: Quality Control
There are several field QC measures to help ensure taking accurate
measurements of light penetration. The "deck" sensor was situated in full
sunlight (i.e., out of any shadows), likewise, the submerged sensor was
deployed from the sunny side of the vessel and care was taken to avoid
positioning the sensor in the shadow of the vessel. To minimize effects
of a disturbed water column, only data collected on the downcast were
used in calculating ATTENCO.

5.1.11 Sample Collection: References
Strobel, C.J. 2000. Coastal 2000-Northeast Component: Field Operations
Manual U. S. Environmental Protection Agency, National Health and
Environmental Effects Research Laboratory, Atlantic Ecology Division,
Narragansett, RI. EPA

5.1.12 Sample Collection: Alternate Methods
Consult the STATIONS data file for cooperative agreement code (ST_COOP)
The different partners used the following equipment:

ST_COOP	Water Profile Equipment
CT	Sea-bird SBE-19
CT-FSH	Sea-bird SBE-19
DE	Hydrolab Datasonde
MA	Hydrolab Datasonde or Quanta
MA-FSH	Hydrolab Datasonde
ME	Hydrolab Datasonde
NH	YSI model 6600_M
NJ-C	Hydrolab Datasonde
NJ-DB	Hydrolab Datasonde
NY	YSI model 6600_M or YSI 85 or Seabird model 25
RI	Hydrolab Datasonde
RI-FSH	Hydrolab Datasonde

5.2 Data Preparation and Sample Processing
No analytical processing was involved for the ATTENCO parameters.

5.2.1 Sample Processing Objective

Not applicable

5.2.2 Sample Processing: Methods Summary
Not applicable

5.2.3 Sample Processing: Calibration
Not applicable

5.2.4 Sample Processing: Quality Control
Not applicable

5.2.5 Sample Processing: References
Not applicable

5.2.6 Sample Processing: Alternate Methods
Not applicable

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Value
PAR Attenuation Coefficient

6.2 Data Manipulation Description
Attenuation coefficients were extracted from discrete PAR water profile data files by first sorting the PAR records from the same water profile by downcast and upcast, then selecting the downcast records for analysis. The attenuation coefficient (k) is related to the PAR readings at surface (Io) and depth (Iz) by the expression: $Iz/Io = \exp(-kz)$, where z is depth in meters. The attenuation coefficient k is calculated as the slope obtained via regression of $\{-\ln(Iz/Io) \text{ vs } z\}$. The ratio (Iz/Io) was calculated using simultaneous readings from respective PAR sensors (time intervals agreeing to within 1 second). PAR data collected deeper than the 1% light level was excluded to yield a more accurate attenuation coefficient.

In some cases, surface PAR values (Io) were not measured. The attenuation coefficient was then taken to be the slope obtained via regression of $\{-\ln(Iz) \text{ vs } z\}$. Values of ATTENCO calculated in this manner are accompanied by a QACODE = PAR-A.

7. DATA DESCRIPTION

7.1 Description of Parameters

7.1.1 Components of the Dataset

PARAMETER	TYPE	LENGTH	LABEL
STATION	Char	9	Station Name
STAT_ALT	Char	1	Alternate Site Code (A, B, or C)
EVNTDATE	Num	8	Event Date

```
        ATTENCO              Num          8      PAR Attenuation Coefficient
        PAR_RECS             Num          8      Number of PAR readings
        QACODE               Char        18      QA Qualifier
```

  7.1.2 Precision of Reported Values
    ATTENCO is reported to three significant digits.

  7.1.3 Minimum Value in Dataset
    ATTENCO   0.00
    PAR_RECS   1

  7.1.4 Maximum Value in Dataset
    ATTENCO   22.9
    PAR_RECS   201

 7.2 Data Record Example

  7.2.1 Column Names for Example Records

 STATION   STAT_ALT   EVNTDATE ATTENCO   PAR_RECS   QACODE

   7.2.2 Example Data Records

```
STATION        STAT_ALT        EVNTDATE        ATTENCO       PAR_RECS    QACODE
CT00-0021         A            08/07/00         0.698           79       PAR-A
CT00-0023         A            08/08/00         0.444          121       PAR-A
CT00-0025         A            08/08/00         0.603           69       PAR-A
```


8.   GEOGRAPHIC AND SPATIAL INFORMATION

  8.1 Minimum Longitude (Westernmost)
     -75.7737 decimal degrees

  8.2 Maximum Longitude (Easternmost)
     -67.0939 decimal degrees

  8.3 Minimum Latitude (Southernmost)
      38.4521 decimal degrees

  8.4 Maximum Latitude (Northernmost)
      44.9456 decimal degrees

  8.5 Name of area or region
    The National Coastal Assessment Northeast Region covers the northeastern US
    coastline from Maine to Delaware.

9.   QUALITY CONTROL AND QUALITY ASSURANCE

  9.1 Measurement Quality Objectives

The measurement quality objectives of the EMAP-Estuaries program specify
accuracy and precision requirements of 10% in the water physical
parameters. Reference: U.S. EPA. 2001. Environmental Monitoring and
Assessment Program (EMAP): National Coastal Assessment Quality Assurance
Project Plan 2001-2004. U.S. Environmental Protection Agency, Office of
Research and Development, National Health and Environmental Effects
Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL.
EPA/620/R-01/002. 189 p.

9.2 Data Quality Assurance Procedures
The data were reviewed to assure consistency among partners regarding
sampling procedures, reporting format, *etc*. All measurements were
performed in the field

9.3 Actual Measurement Quality
No field replicates were measured for these parameters

10. DATA ACCESS

10.1 Data Access Procedures
Data can be downloaded from the web
http://www.epa.gov/emap/nca/html/regions/index.html

10.2 Data Access Restrictions
None

10.3 Data Access Contact Persons
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10.4 Dataset Format
ASCII (CSV) and SAS Export files

10.5 Information Concerning Anonymous FTP
Not available

10.6 Information Concerning WWW
No gopher access, see Section 10.1 for WWW access

10.7 EMAP CD-ROM Containing the Dataset
Data not available on CD-ROM

11. REFERENCES

Strobel, C.J. 2000. Environmental Monitoring and Assessment Program:
Coastal 2000 - Northeast component: field operations manual. Narragansett
(RI): U.S. Environmental Protection Agency, National Health and

Environmental Effects Research Laboratory, Atlantic Ecology Division.
EPA/620/R-00/002. 68 p.

U.S. EPA. 2001. National Coastal Assessment: Field Operations Manual. U.S.
Environmental Protection Agency, Office of Research and Development,
National Health and Environmental Effects Research Laboratory, Gulf Ecology
Division, Gulf Breeze, FL. EPA/620/R-01/003. 72 p.

U.S. EPA. 2001. Environmental Monitoring and Assessment Program (EMAP):
National Coastal Assessment Quality Assurance Project Plan 2001-2004. U.S.
Environmental Protection Agency, Office of Research and Development,
National Health and Environmental Effects Research Laboratory, Gulf Ecology
Division, Gulf Breeze, FL. EPA/620/R-01/002. 189 p.

12. TABLE OF ACRONYMS

AED	Atlantic Ecology Division
CSC	Computer Sciences Corporation
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
NCA	National Coastal Assessment
NHEERL	National Health and Environmental Effects Research Laboratory
PAR	Photosynthetically Active Radiation
QA/QC	Quality Assurance/Quality Control
umol	micro mole
WWW	World Wide Web

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