CATALOG DOCUMENTATION
NATIONAL COASTAL ASSESSMENT- NORTHEAST DATABASE
YEARS 2000-2006
LIGHT ATTENUATION DATA: "ATTENCO"

TABLE OF CONTENTS

1. DATASET IDENTIFICATION
2. INVESTIGATOR INFORMATION
3. DATASET ABSTRACT
4. OBJECTIVES AND INTRODUCTION
5. DATA ACQUISITION AND PROCESSING METHODS
6. DATA MANIPULATIONS
7. DATA DESCRIPTION
8. GEOGRAPHIC AND SPATIAL INFORMATION
9. QUALITY CONTROL AND QUALITY ASSURANCE
10. DATA ACCESS AND DISTRIBUTION
11. REFERENCES
12. TABLE OF ACRONYMS
13. PERSONNEL INFORMATION

1. DATASET IDENTIFICATION

1.1 Title of Catalog document
National Coastal Assessment-Northeast Region Database
Year 2000-2006 Stations
WATER QUALITY - LIGHT ATTENUATION DATA

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

1.3 Catalog revision date
November 2009

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 (NCA Northeast Region)

Donald Cobb, U.S. EPA NHEERL-AED
Walter Galloway, U.S. EPA NHEERL-AED
Stephen Hale, U.S. EPA NHEERL-AED
John Kiddon, U.S. EPA NHEERL-AED
Charles Strobel, U.S. EPA NHEERL-AED
Henry Walker, U.S. EPA NHEERL-AED

2.2 Sample Collection Investigators

Donald Cobb, U.S. EPA NHEERL-AED

2.3 Sample Processing Investigators

John Macauley, U.S. EPA NHEERL-GED

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 2000-2006. 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. 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 NCA program was initiated in 2000 and completed in 2006.

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 were also used to generate a series of national reports characterizing the condition of the Nation's estuaries http://www.epa.gov/nccr/.

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

Refer to Section 4.4 for a list of dataset parameters. Additional information about selected parameters are discussed in this section.

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).

The Table below indicates the number of records reporting attenuation coefficients by ST_COOP and Year, and can be used to identify systematic absences of data collection by coops. CT-FSH identify sites where trawling operations were conducted in CT. Some absent blocks reflect coop name changes in 2005/6; essentially ST_COOPs NJ-DB = DB, and DE = DI in the Table below. See the metadata file for STATIONS for discussion of the ST_COOP parameter. Only 2005/06 data for MD and VA are contained in this database; contact John Macauley (Section 13) for information regarding earlier data for these states.

Number of light attenuation records by ST_COOP and Year

Count of Records	Year							
ST_COOP	2000	2001	2002	2003	2004	2005	2006	Grand Total
ME	29	14	27	10	26	8		114
NH	38	64	8	38	13	8	18	187
MA	24			15	19	22	20	100
RI	35	34		18	14	24	24	149
CT	20	37	13	10	16	13	23	132
CT-FSH	9	12						21
NY	18	31	24	10	17	6	17	123
NJ-C	30	47	28	8	33			146
NJ-DB	34	36	32	31	25			158
DB						8	2	10
DE	18	19		17				54
DI						24	21	45
MD						23	25	48
VA						43		43
Grand Total	255	294	132	157	163	179	150	1330

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
10 July 2000

5.1.4 Ending Sampling Dates
3 October 2006

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 (µmol $s^{-1}m^{-2}$, which is equivalent to microEinseins per m2 per second). 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
DE	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

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) 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 were 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) 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 42.6
PAR_RECS 390

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
CT03-0021	A	8/20/2003	0.521	68	PAR-A
CT03-0034	A	8/27/2003	0.933	47	PAR-A
CT03-0035	A	8/27/2003	0.627	52	PAR-A

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude (Westernmost)

-77.304 decimal degrees

8.2 Maximum Longitude (Easternmost)

-66.946 decimal degrees

8.3 Minimum Latitude (Southernmost)

36.564 decimal degrees

8.4 Maximum Latitude (Northernmost)

45.1848 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
John Kiddon, U.S. EPA NHEERL-AED, Narragansett, RI
401-782-3034, 401-782-3030 (FAX), kiddon.john@epa.gov

Harry Buffum, Data Manager, Raytheon Corporation, Narragansett, RI
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

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
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

13. PERSONNEL INFORMATION

Chuck Audette, Database Analyst
Raytheon Corporation
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3092, 401-782-3030 (FAX), audette.chuck@epa.gov

Harry Buffum, Database Manager
Raytheon Corporation
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

Don Cobb, NCA Project Officer
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-9616, 401-782-3030 (FAX), cobb.donald@epa.gov

Walter Galloway, NCA Project Officer
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3096, 401-782-3030 (FAX), galloway.walt@epa.gov

Steve Hale, EMAP Information Manager
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3048, 401-782-3030 (FAX), hale.stephen@epa.gov

Melissa Hughes, Data Librarian
Raytheon Corporation
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3184, 401-782-3030 (FAX), hughes.melissa@epa.gov

John Kiddon, NCA Analyst and Northeast QA Manager
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3044, 401-782-3030 (FAX), kiddon.john@epa.gov

John Macauley, NCA QA Officer
U.S. Environmental Protection Agency, NHEERL-GED
1 Sabine Island Dr., Gulf Breeze, FL 32561
850-934-9353, macauley.john@epa.gov

Charlie Strobel, AED Analyst and Project Officer
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3180, 401-782-3030 (FAX), strobel.charles@epa.gov

Kevin Summers, Acting National NCA Program Director
U.S. Environmental Protection Agency, NHEERL-GED
1 Sabine Island Dr., Gulf Breeze, FL 32561
850-934-9244, summers.kevin@epa.gov

Hal Walker, Northeast NCA Program Director and Analyst
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3007, 401-782-3030 (FAX), walker.henry@epa.gov