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Southern California Bight Study
SCB2-29
R/V Robert G. Sproul
August 20–25, 1988

Donald J. Collins
An Van Tran

December 15, 1990

NASA

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Pasadena, California

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The research described in this publication was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

ABSTRACT

Time-series measurements of the incident surface downwelling irradiance and vertical profiles of the bio-optical properties of the ocean have been measured during the twenty-ninth cruise of the Southern California Bight Study during the period August 20-25, 1988. A summary of these data is presented to permit investigators an overview of the data collected. The data are available in digital form for scientific investigators. Requests for the data should be addressed to D. Collins (D.Collins/OMNET: (818) 354-3473).

ACKNOWLEDGMENTS

The assistance of the Captain and crew of the R/V Robert G. Sproul and of Richard Eppley, Ed Renger and Betsy Stewart is gratefully acknowledged.

CONTENTS

INTRODUCTION

The Southern California Bight Study (SCBS) is a long-term study of primary production and phytoplankton abundance in the Bight, implemented through a series of cruises that began in 1974 under the direction of Dr. Richard Eppley (cf. Eppley, et al., 1979 and Eppley and Holm-Hansen, 1986). The goal of the study is to describe the long-term evolution of primary production and phytoplankton abundance in the Bight using several cruises per year to produce a time series of the biological properties of the region and to understand the physical and biological processes that determine the environment in the Bight.

We participated in the twenty-ninth cruise of this effort, SCBS-29, collecting bio-optical data from the R/V Robert G. Sproul, during the period August 20-25, 1988. This cruise was conducted in calm seas, with intermittent overcast skies. Dr. Richard Eppley was the chief scientist. This report describes in graphical form an overview of the bio-optical data collected.

STATION DESCRIPTION

The stations occupied during the SCBS-29 cruise are shown in Figure 1 in the context of the complete set of stations occupied by the SCBS cruises and are referred to the CalCOFI grid of stations.

The Point Loma station, occupied on Julian day 233, is a near-shore station in relatively shallow water with high suspended load. No bottle casts were taken at this station, but transect data are available in the vicinity of the station.

Station 304, occupied on Julian day 234, is in 320 m of water on the outer edge of Santa Monica Bay on CalCOFI Line 87. An early morning bottle cast, taken before the first optical cast, has been used for the determination of nutrients, pigments, particulates and primary productivity as the nominal set of data obtained at each station. The first vertical profile of the set for this day does not have measurements of the salinity because of an error in the operation of that instrument.

Station 305, occupied on Julian day 235, is in 920 m of water in the center of the Santa Monica Basin on CalCOFI Line 87. The early morning bottle cast for this station, taken following the first optical cast, has been used for the determination of nutrients, pigments, particulates and primary productivity. The first vertical profile of the set for this day does not have reliable measurements of the stimulated fluorescence because of problems with the fluorometer on this cast.

Station 205, occupied on Julian day 236, is in 730 m of water east by south east of the southern tip of Santa Catalina Island on CalCOFI Line 90. The early morning bottle cast for this station, taken following the first optical cast, has been used for the determination of nutrients, pigments, particulates and primary productivity.

Station 202, occupied on Julian day 238, is in 54 m of water near Dana Point on CalCOFI Line 90 in an area characterized by high particulate loading and a strong subsurface-pigment maximum. The early morning bottle cast for this station, taken following the first optical cast, has been used for the determination of nutrients, pigments, particulates and primary productivity. The last vertical profile in the series on Julian day 238 was taken in deeper water near Station 202 and is characterized by a reduced particulate loading and a much-reduced pigment maximum.

DATA DESCRIPTION

The downwelling scalar photosynthetically available irradiance (PAR) was measured during the cruise using a Biospherical Instruments QSR-240 integrating scalar radiometer and using the on-deck measurements provided by the PAR sensor on the bio-optical profiling system described below. These data are shown in Figure 2 as a time-series plot. The mean scalar irradiance for the period of the cruise was 57.7 Ein/m^2-day, with the individual daily values shown in Table I. During each vertical cast of the spectroradiometer, the downwelling vector irradiance at the surface was measured in four spectral channels to provide a surface normalization for the in-water measurements and additional verification of the surface irradiance.

The in-water optical data were collected with a bio-optical profiling system (BOPS), an updated version of the BOPS originally developed by Biospherical Instruments and reported by Smith et al. (1984). The heart of the instrument was a Biospherical Instruments MER-1048 Spectroradiometer, which measured the downwelling spectral irradiance in 13 channels and the upwelling spectral irradiance and the upwelling spectral radiance in 8 channels each. The MER-1048 also had sensors for photosynthetically available radiation (PAR), depth, tilt and roll. In addition, temperature and conductivity were measured with a Sea-Bird CTD, chlorophyll fluorescence was measured with a Sea Tech fluorometer and beam transmission with a Sea Tech 25-cm transmissometer. The channel assignments for the radiometer and the units for each measurement are given in Table II. The MER-1048 acquired data 16 times per second, formed four averages per second and transmitted the resulting averages to a deck receiving unit. A Compaq-286 computer stored the data on a hard disk and provided an analysis capability. The spectroradiometer casts were interspersed between bottle casts using the stern A-frame. The starting time for each of the casts is listed in Table I. No data were available from the spectroradiometer on August 24, 1988 because this day was devoted to transect studies.

The results of the optical profiles are presented as separate downcast and upcast results for the same operation to give insight into the short-term variability of the data. The profile data were filtered to remove obvious data spikes, binned into one-meter averages and stored in the form of ASCII comma-separated files.

INDIVIDUAL STATION DATA PROFILES

For each downcast and upcast, vertical profiles of the measured temperature, salinity, fluorescence, beam transmission, and PAR are presented in Figures 3 through 28 to give a graphical overview of the data. Spectra of the downwelling irradiance, E_d, the upwelling irradiance, E_u, and the upwelling radiance, L_u, are presented in these figures as an overview of the optical data available from the cruise. The spectral plots represent the data at 1 m depth and at 5 m intervals, beginning at 5 m and extending to the maximum depth of the spectroradiometer, approximately 160 m, depending on the cast. The minimum depth of 1 m has been chosen for this overview because of the difficulty in the interpretation of data at the surface.

The data files are identified by a filename of the format:

S88dddnc ,

where S88 identifies the SCBS-29 cruise data from the R/V Robert G. Sproul, August 20-25, 1988, **ddd** is the Julian day, **n** is the cast number during the day and **c** identifies either the downcast or the upcast.

The radiance, irradiance, and PAR data are presented in calibrated units based on a laboratory calibration conducted by Biospherical Instruments on August 15, 1988. A second calibration after the cruise showed no significant deviation from these values. No corrections for ship shadow or other artifacts have been made to the data presented in this report, although we have developed routines for correcting such artifacts and calculating K, following the guidelines of Smith and Baker (1984, 1986) and Gordon (1985). The reader is referred to the references for a discussion of these problems.

The salinity was calculated from the temperature and conductivity measurements using the standard equations for practical salinity units (psu) as discussed by Millero, et al. (1980). The occasional spikes in salinity that are observed at the surface and at the thermocline result from an artifact caused by differences in the response time of the conductivity sensor and the temperature sensor.

Data from the Sea Tech fluorometer are presented in fluorescence units. The fluorometer has been calibrated using extracted chlorophyll and phaeopigment values from water samples taken on this cruise. These calibration results are not used in the figures in this report.

Data from the Sea Tech transmissometer are presented as percent transmission, where the vacuum transmission value is 100%. The interpretation of these results in terms of the beam transmission coefficient, c, as reported by Zaneveld, et al. (1979), has been accomplished. These results have not been included in this report.

The data are available in digital form for use by scientific investigators. Requests for the data should be addressed to D. Collins (D.Collins/OMNET: (818) 354-3473).

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TABLE I

PROFILE SUMMARY

DATE	STATION	CAST No.	E_{o} (Ein/m^2-day)	START TIME
8/20/88	Pt. Loma	S882331	51.51	12:57
8/21/88	304	S882341	43.53	08:27
		S882342		12:16
		S882343		15:54
8/22/88	305	S882351	51.07	08:02
		S882352		12:01
		S882353		16:08
8/23/88	205	S882361	58.67	08:09
		S882362		12:29
		S882363		15:49
8/24/88			56.53	
8/25/88	202	S882381	84.88	08:07
		S882382		10:52
		S882383		14:56

TABLE II

DATA CHANNELS

CHANNEL	DESCRIPTION
0	Number of data points averaged per bin
1	410 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
2	441 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
3	488 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
4	520 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
5	550 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
6	560 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
7	589 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
8	633 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
9	656 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
10	671 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
11	683 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
12	694 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
13	710 nm Downwelling Irradiance ($\mu W/cm^2/nm$)
14	Depth of averaged data (m)
15	Tilt (deg)
16	Roll (deg)
17	410 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
18	441 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
19	488 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
20	520 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
21	550 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
22	633 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
23	656 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
24	683 nm Upwelling Radiance ($\mu W/cm^2/nm/sr$)
25	410 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
26	441 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
27	488 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
28	520 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
29	550 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
30	589 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
31	671 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
32	694 nm Upwelling Irradiance ($\mu W/cm^2/nm$)
33	25 cm Transmissometer (% transmission)
34	Fluorometer (fluorescence units)
35	PAR (quanta x $10^{17}/cm^2/s$)
36	Temperature (deg C)
37	Conductivity (mmho/cm)
38	Salinity (ppt)
39	Density (g/cm^3)
40	410 nm Surface Irradiance ($\mu W/cm^2/nm$)
41	520 nm Surface Irradiance ($\mu W/cm^2/nm$)
42	589 nm Surface Irradiance ($\mu W/cm^2/nm$)
43	683 nm Surface Irradiance ($\mu W/cm^2/nm$)

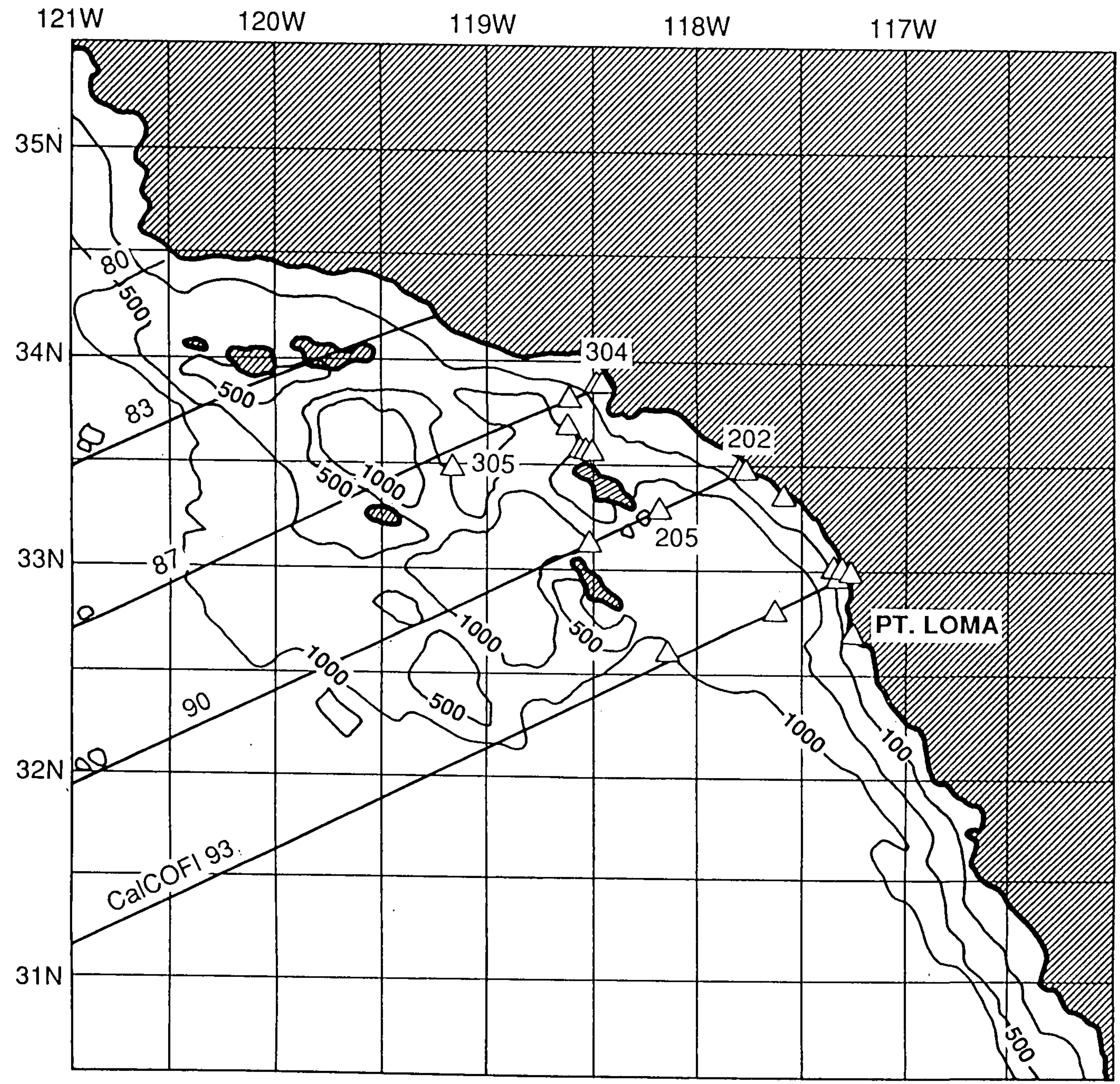

Figure 1. Southern California Bight

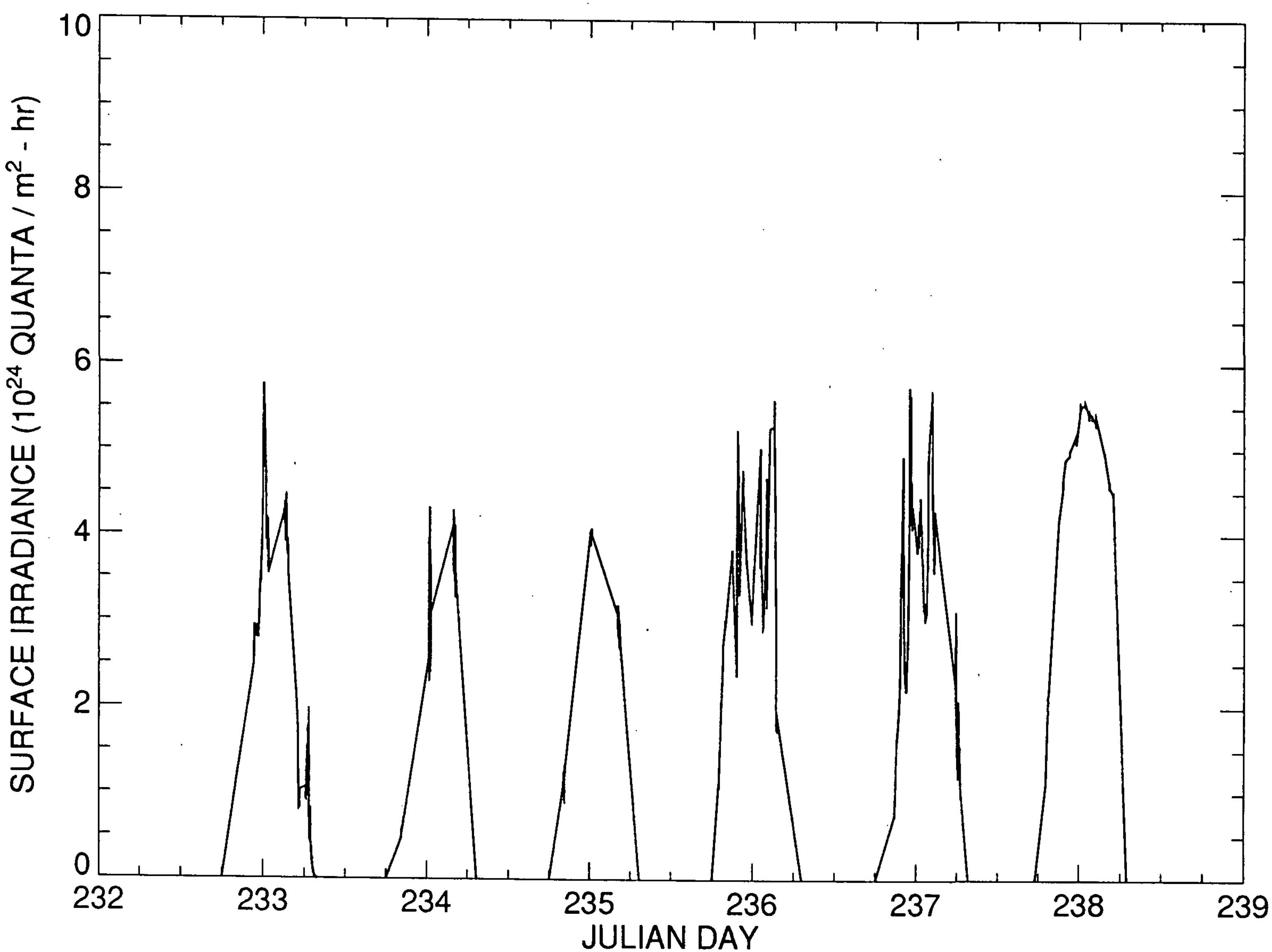

Figure 2. Time Series of Surface Irradiance

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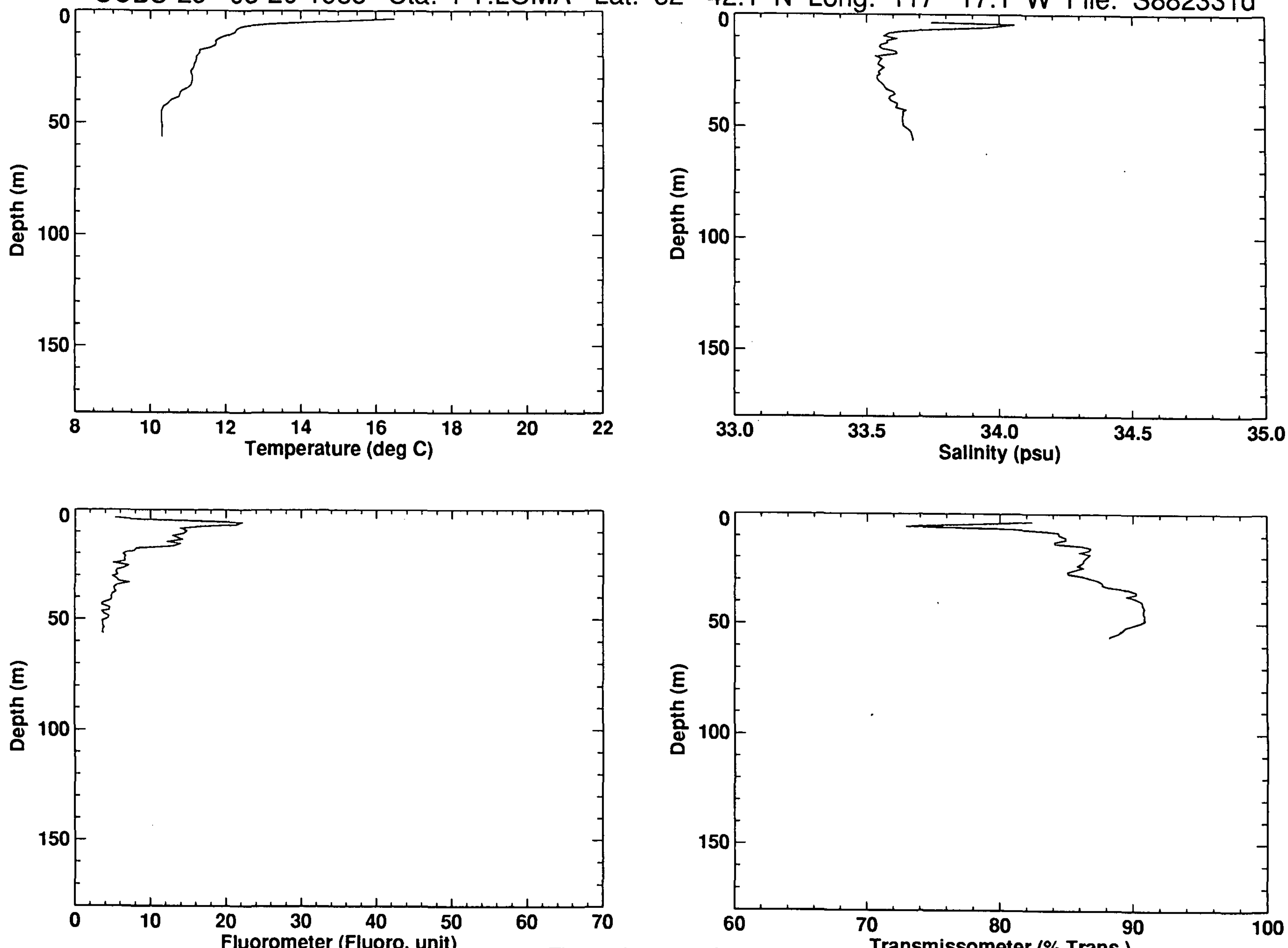

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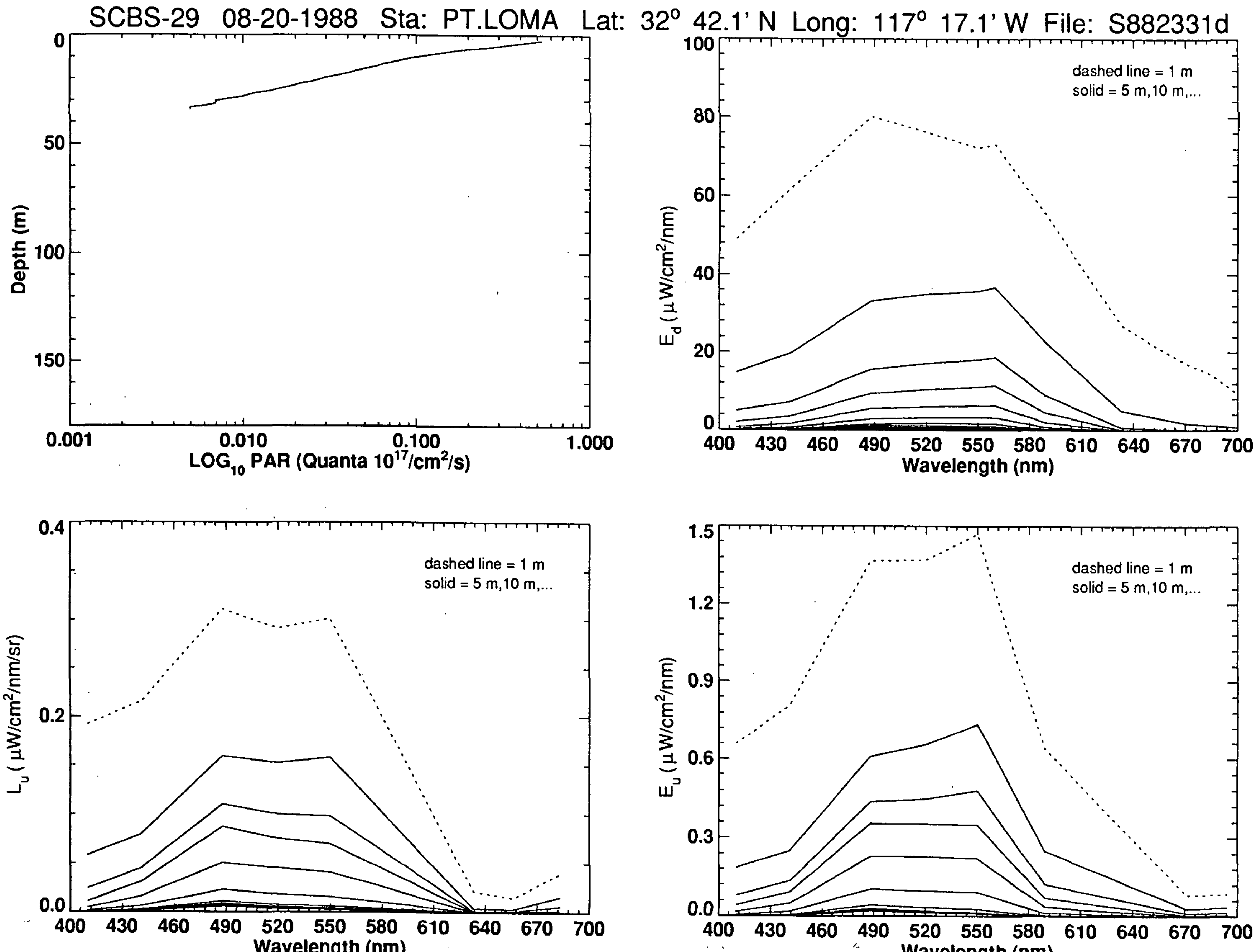

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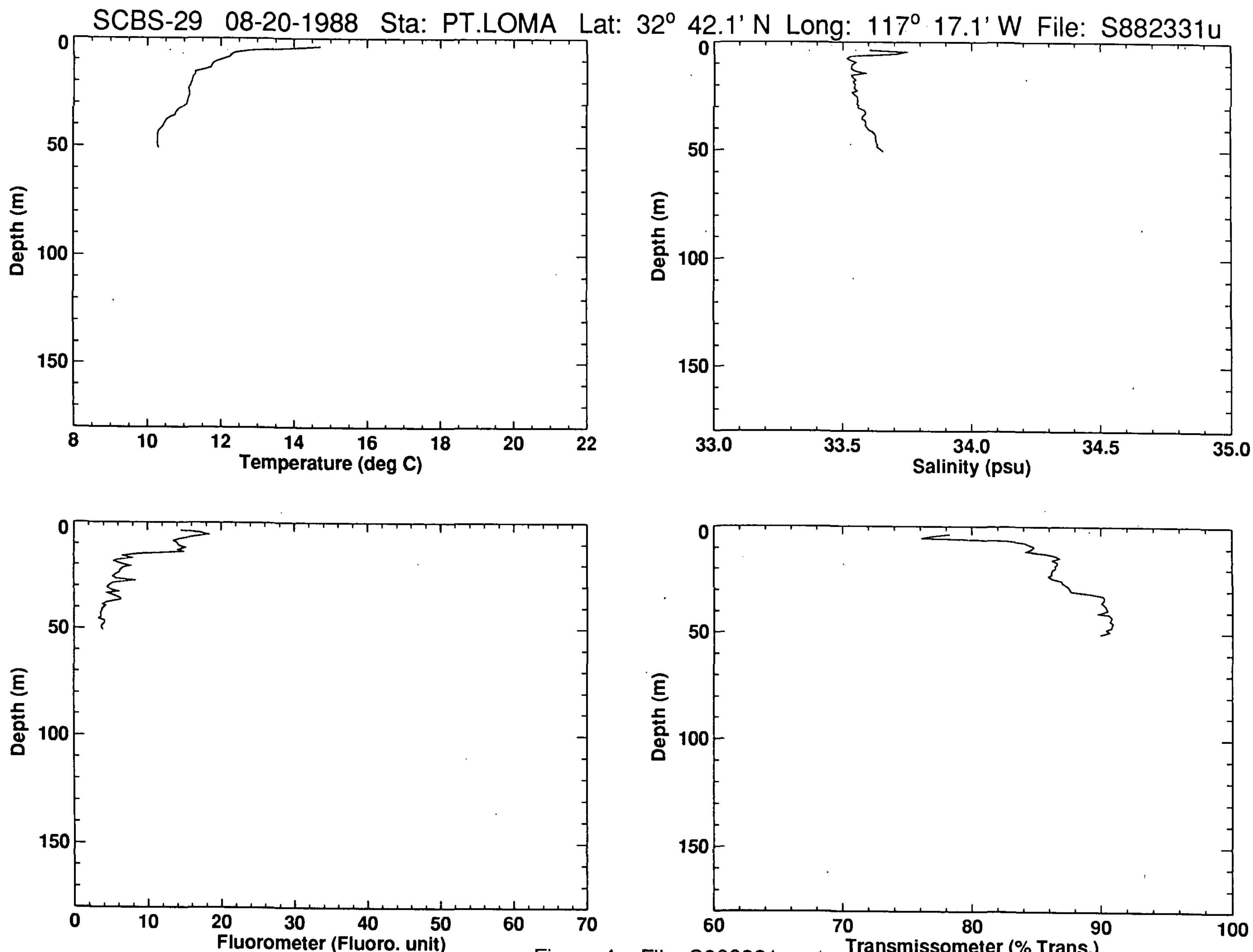

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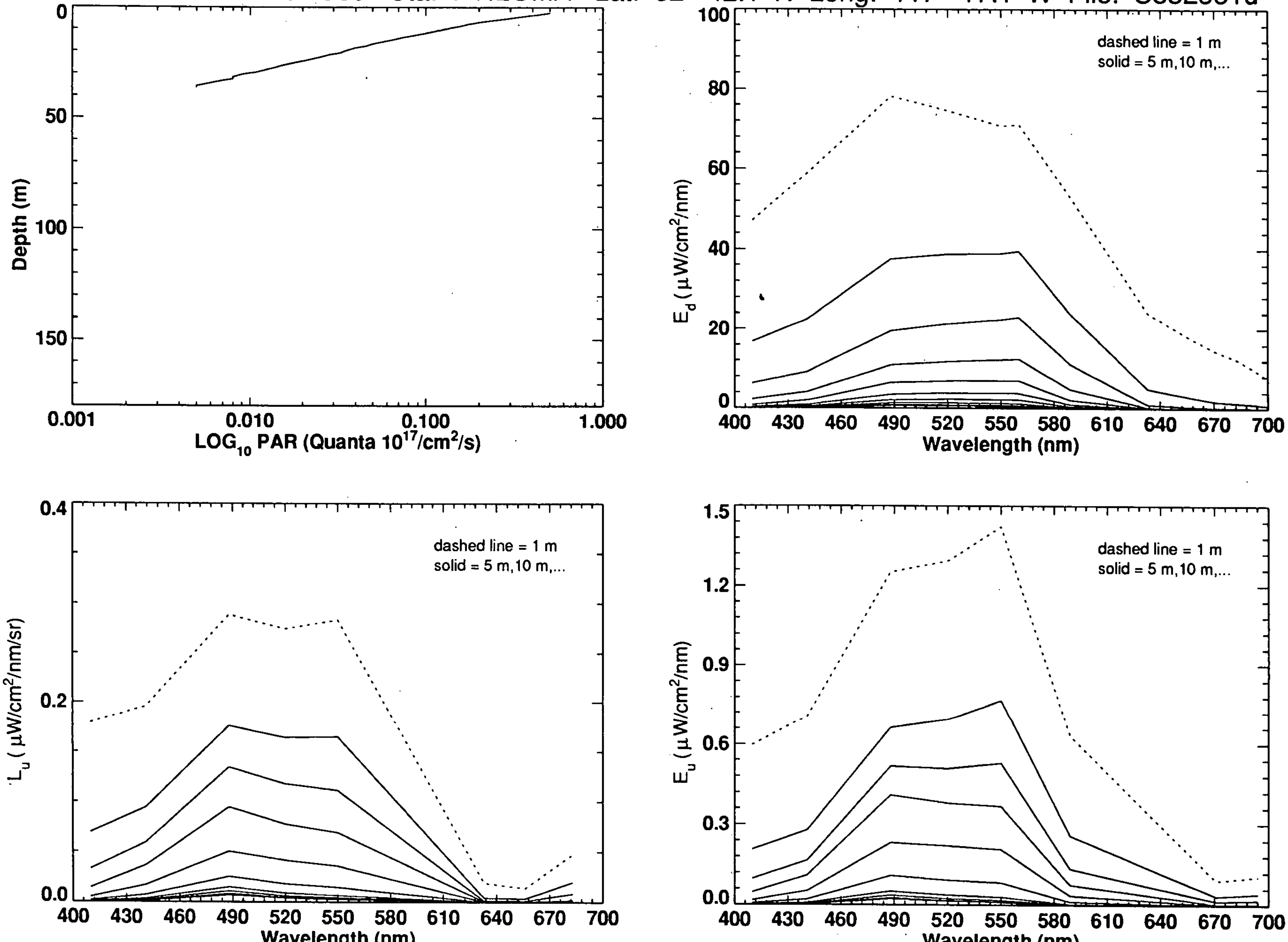

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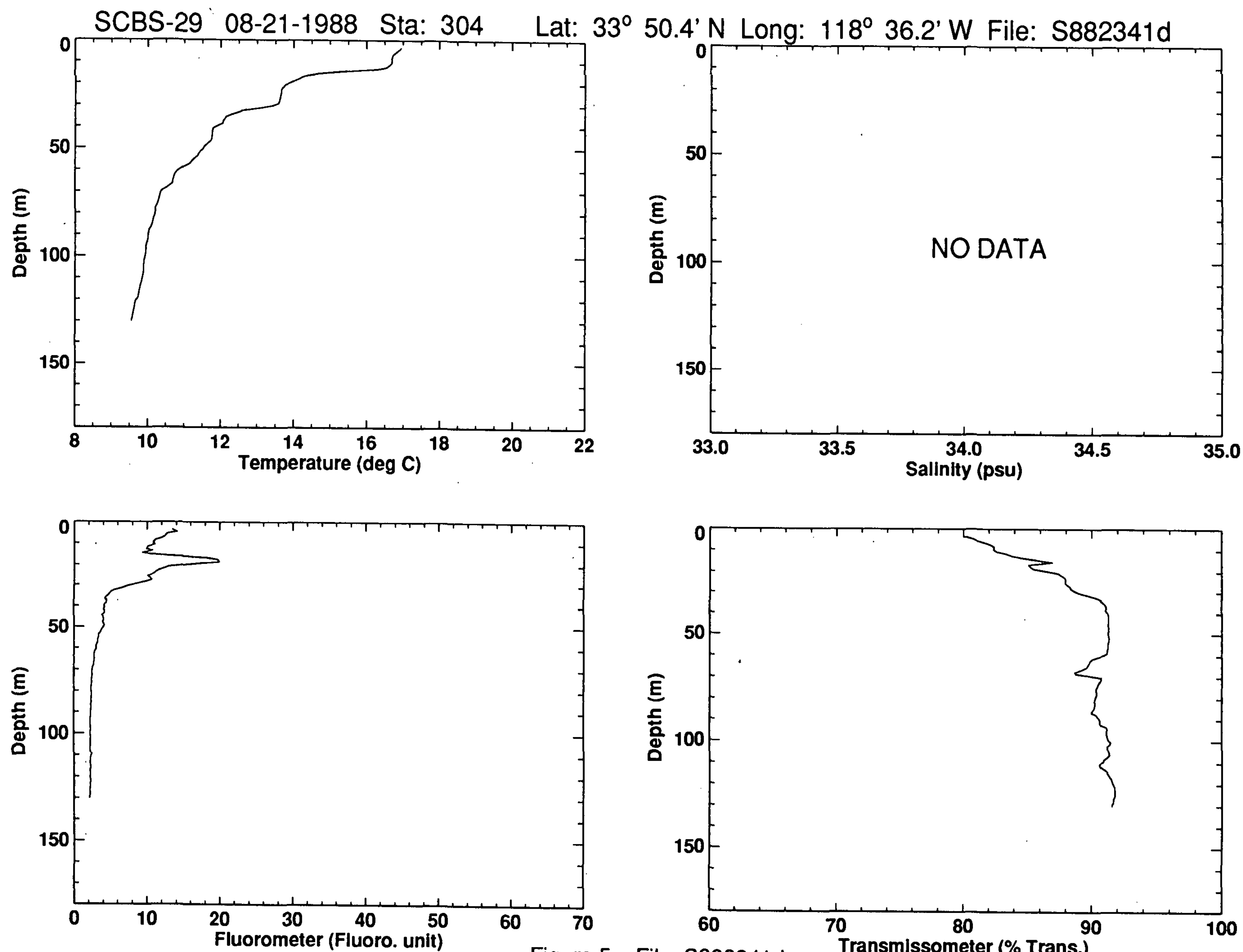

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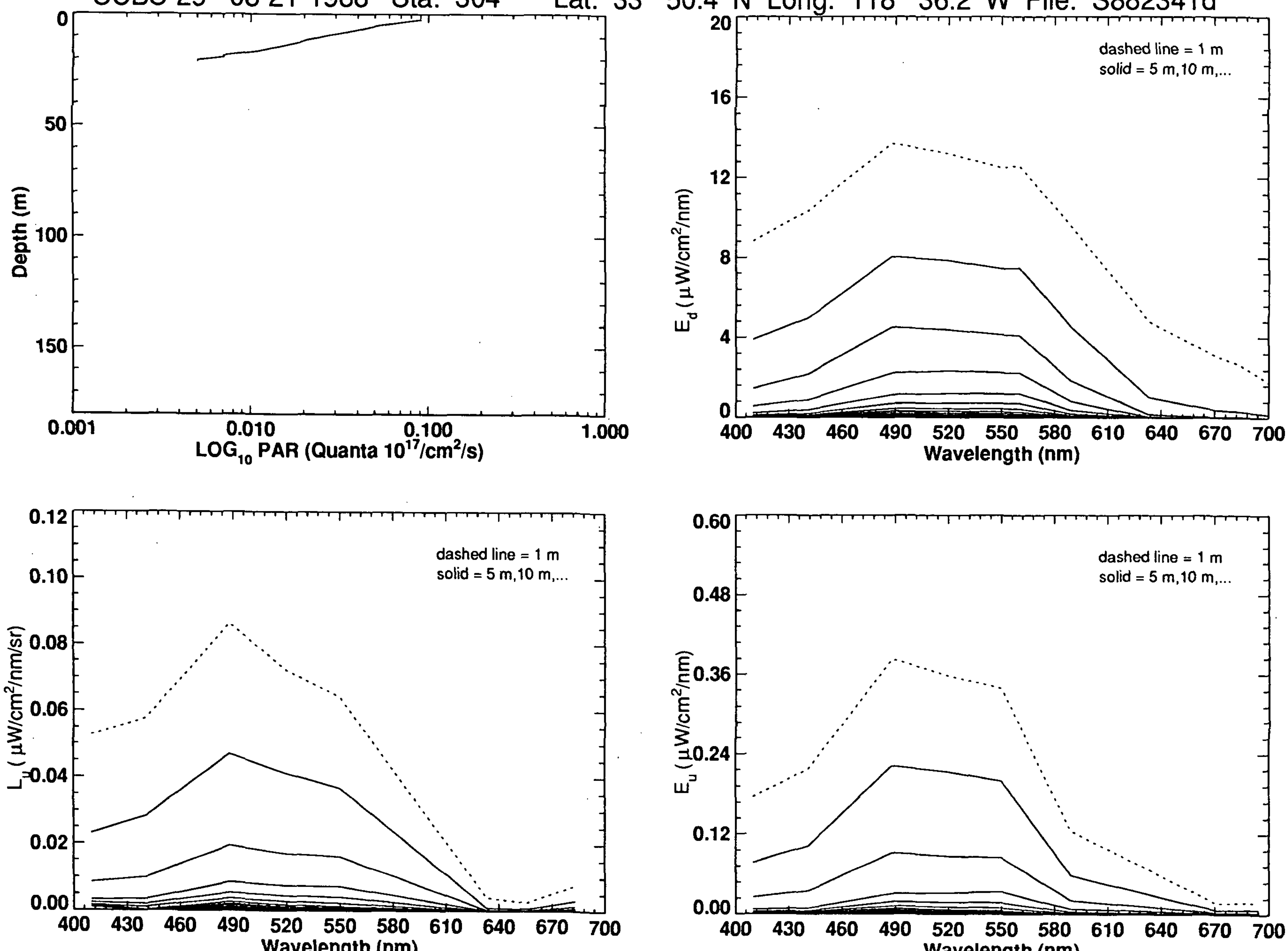

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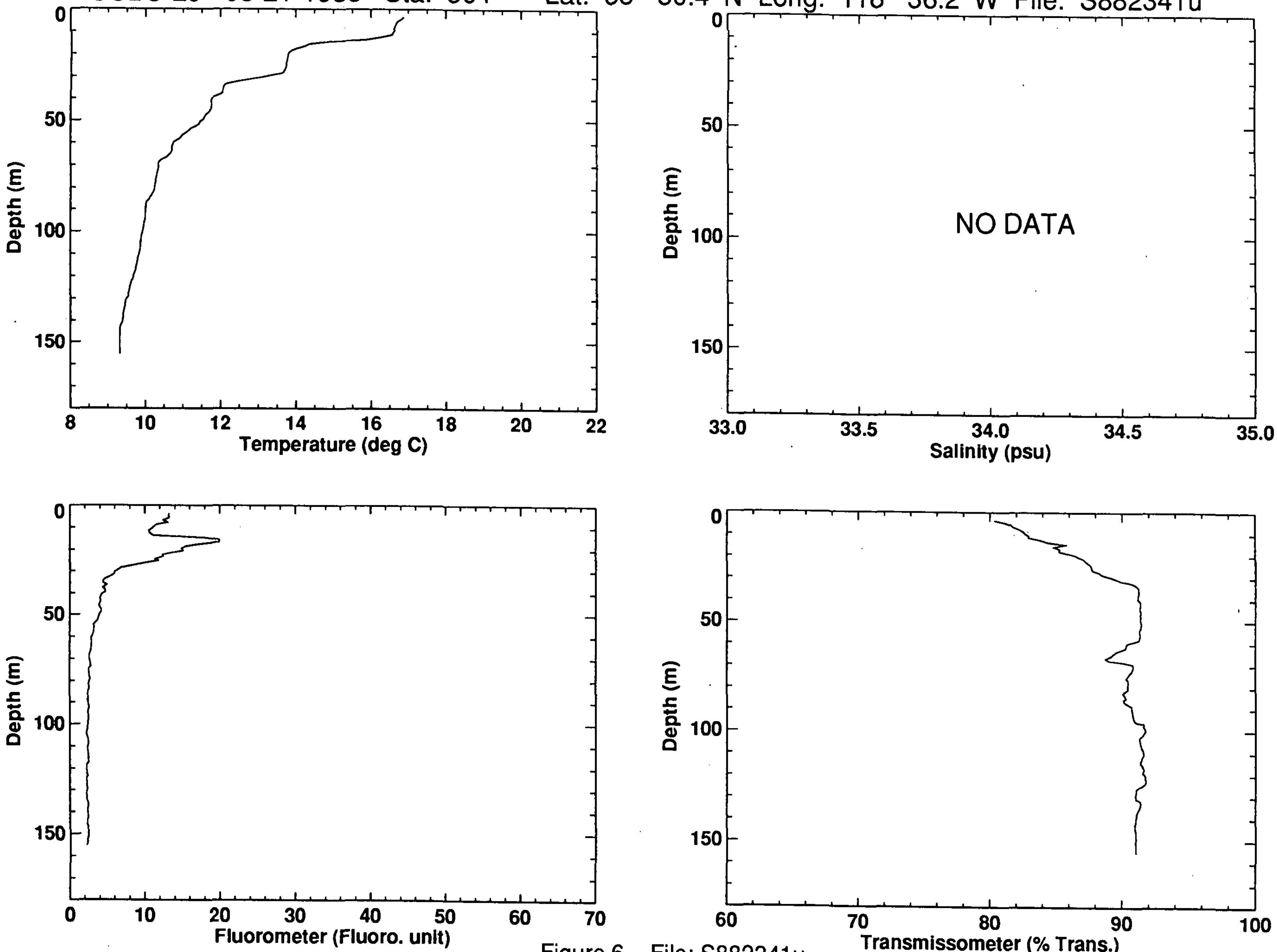

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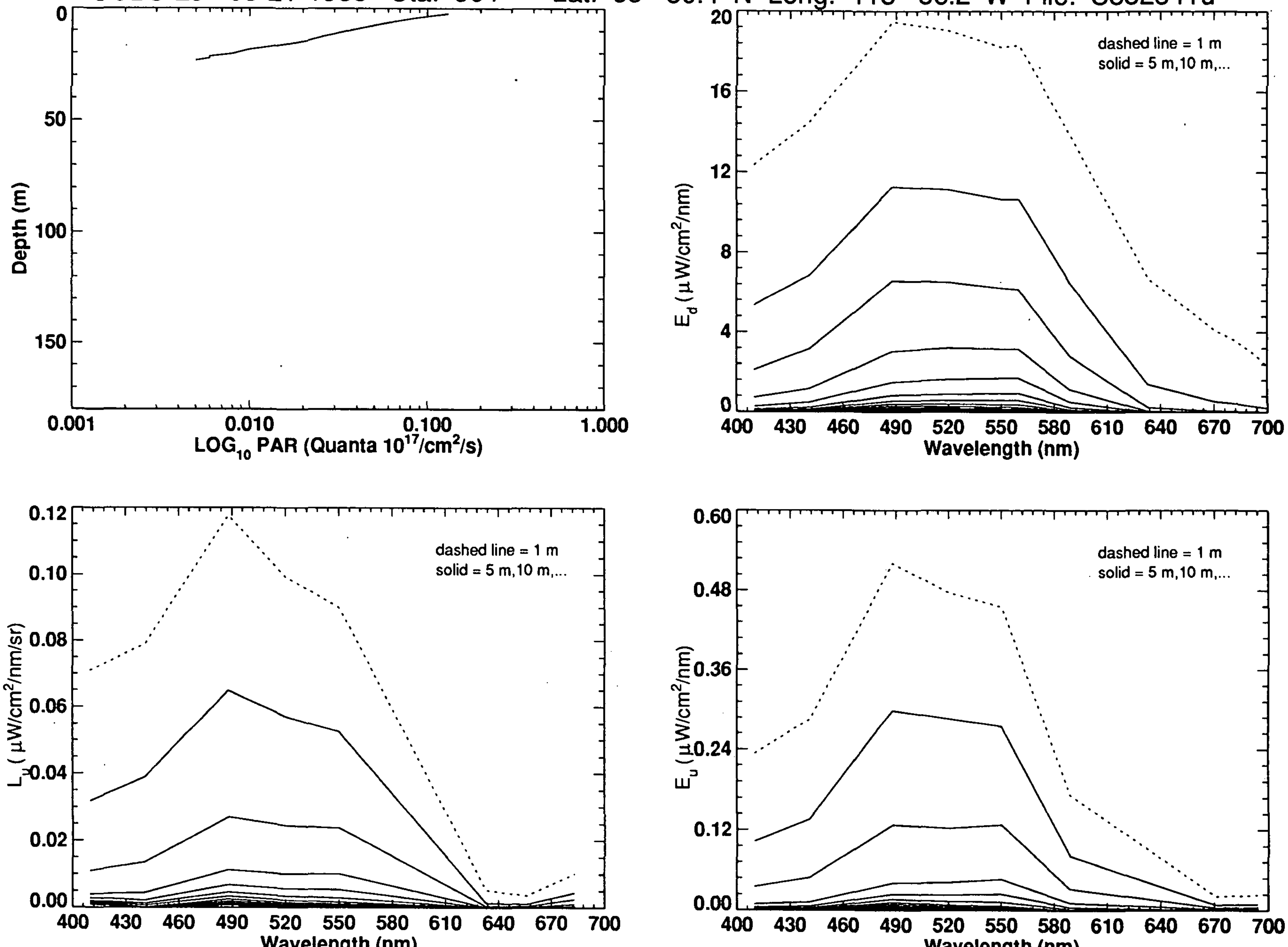

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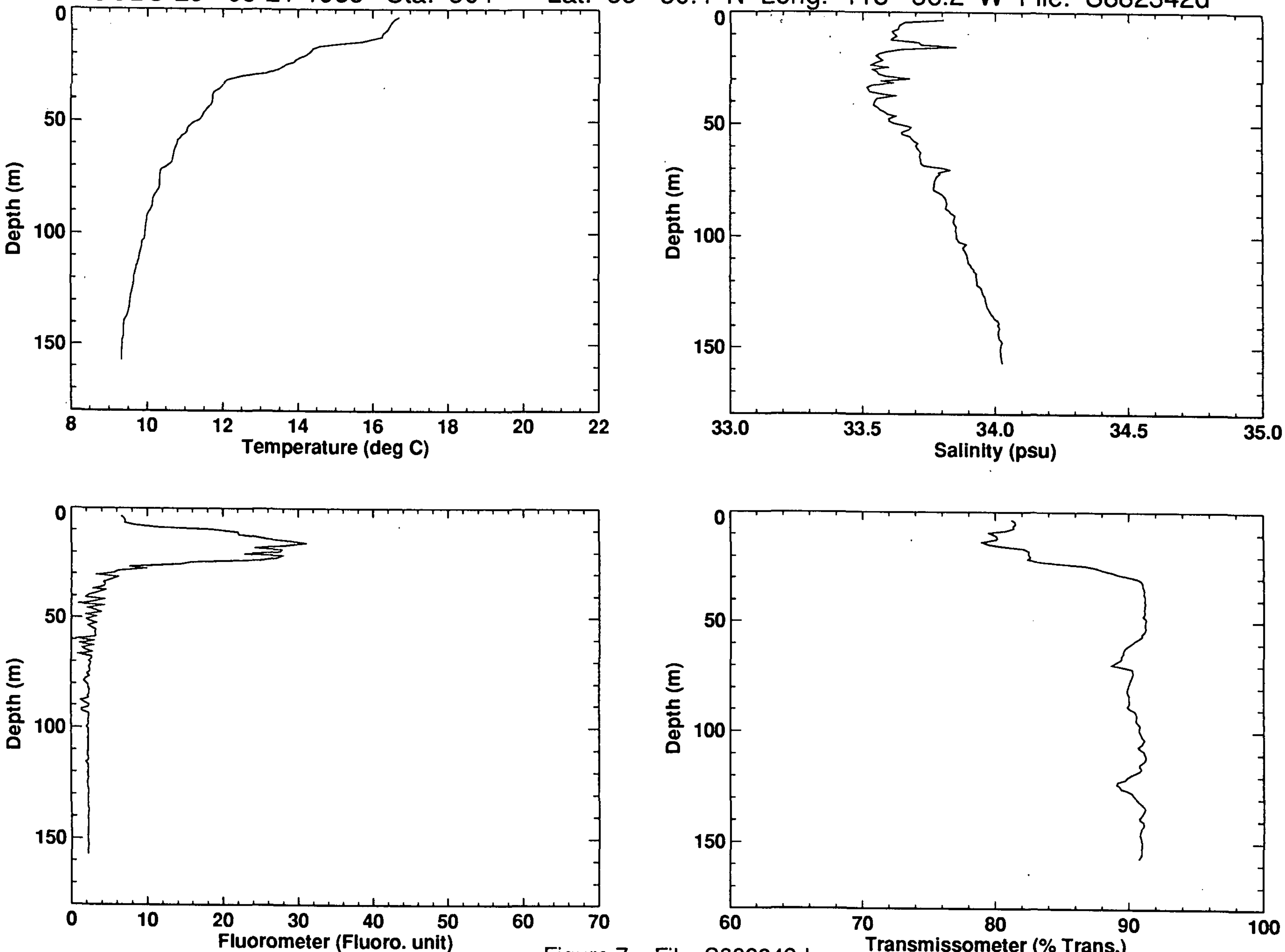

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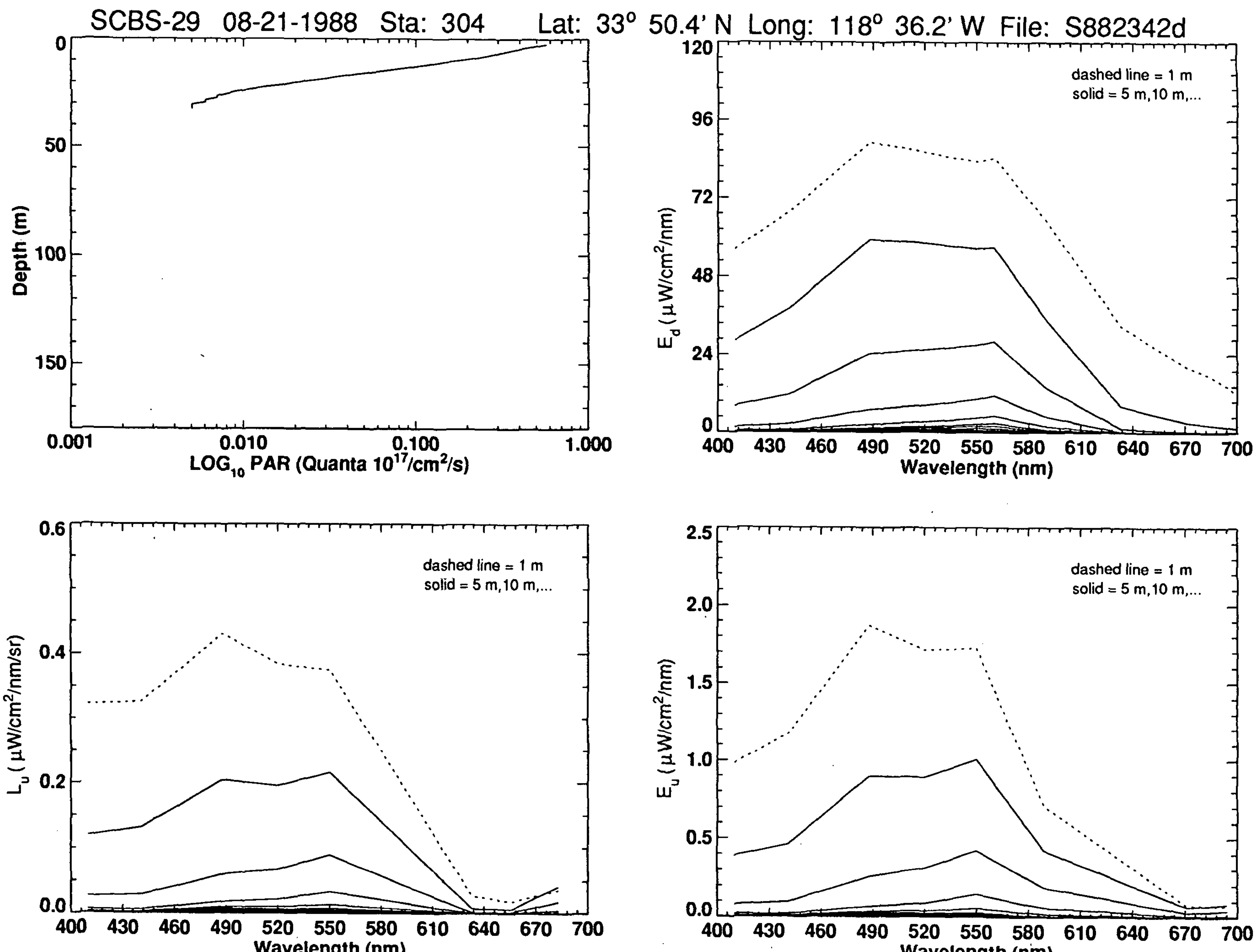

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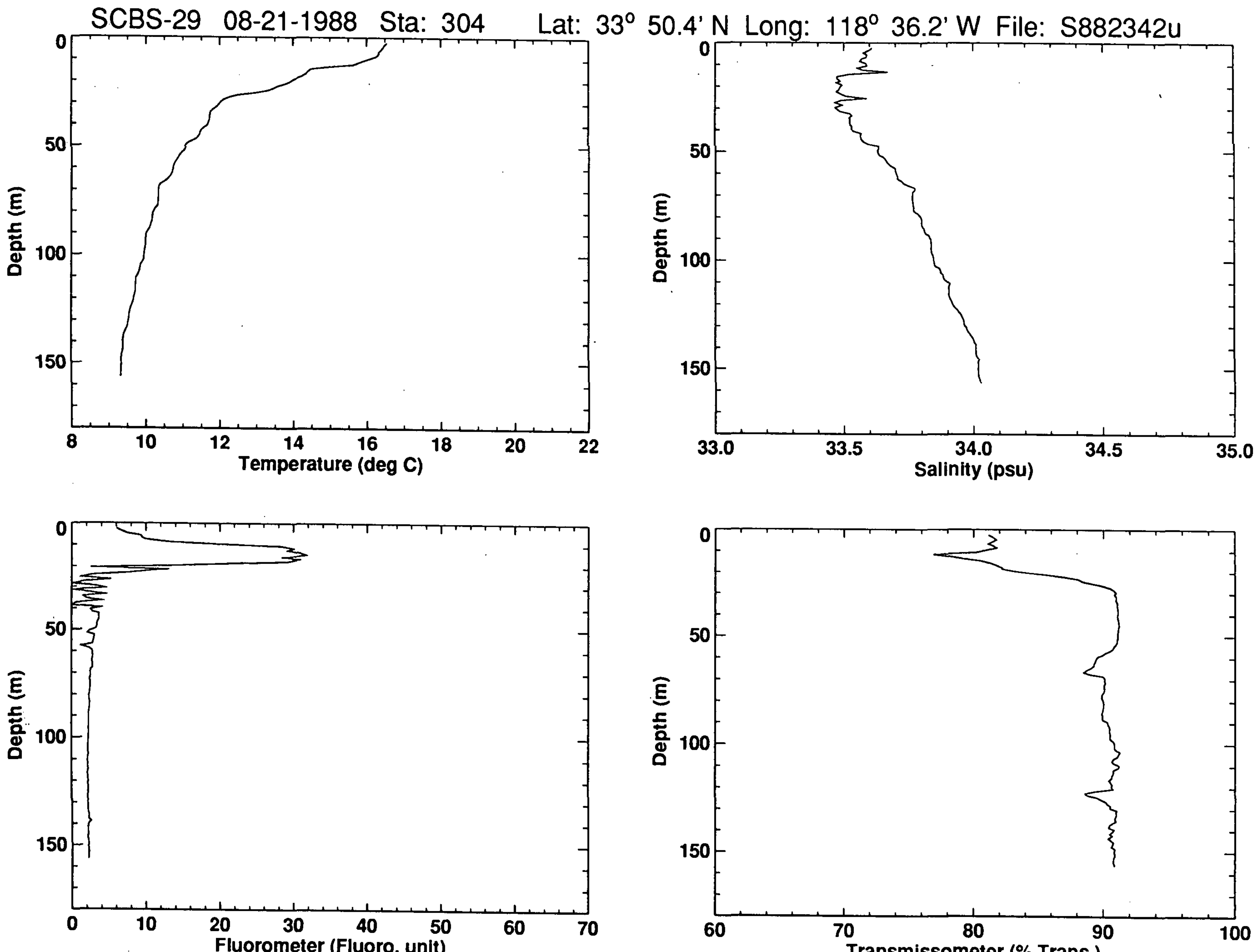

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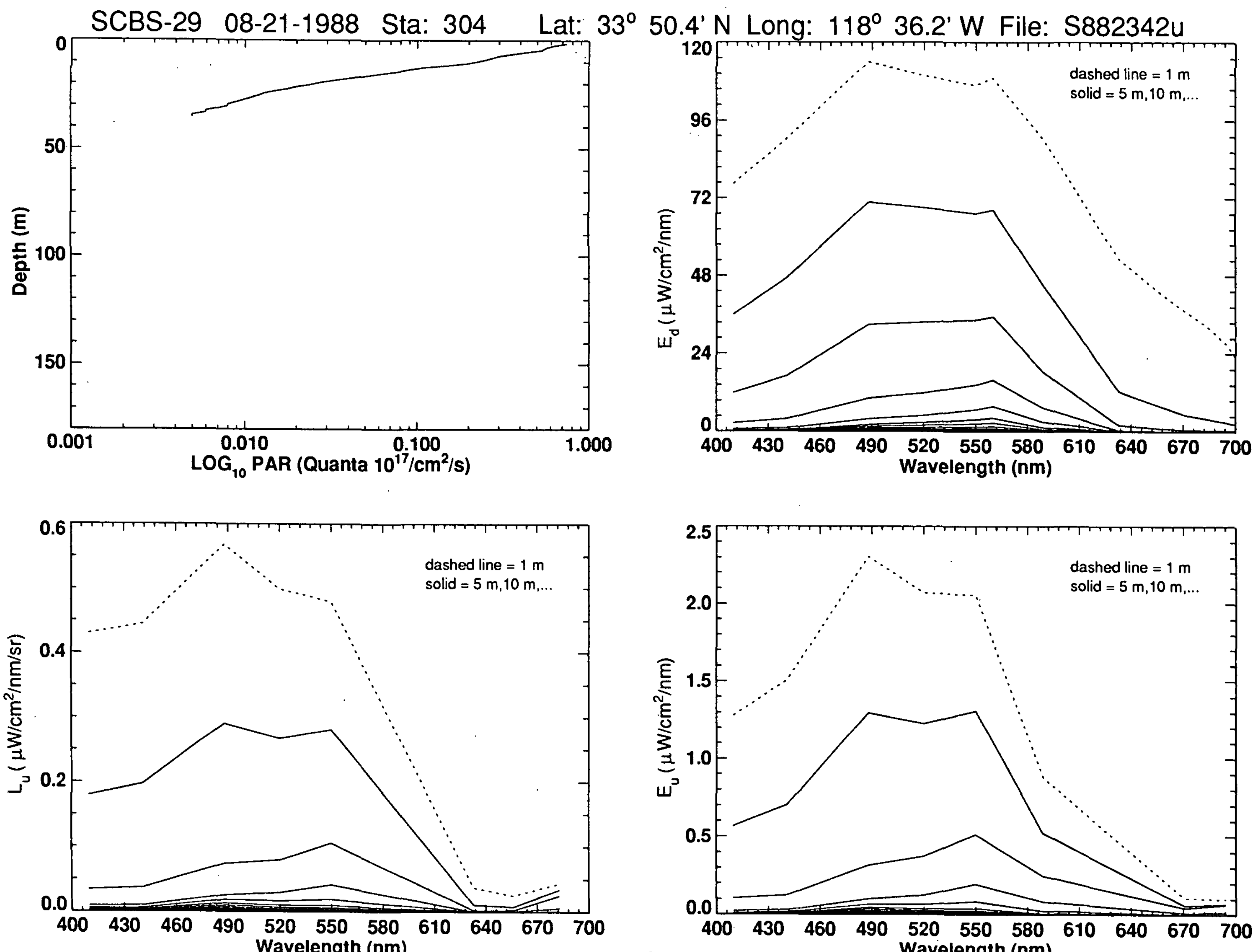

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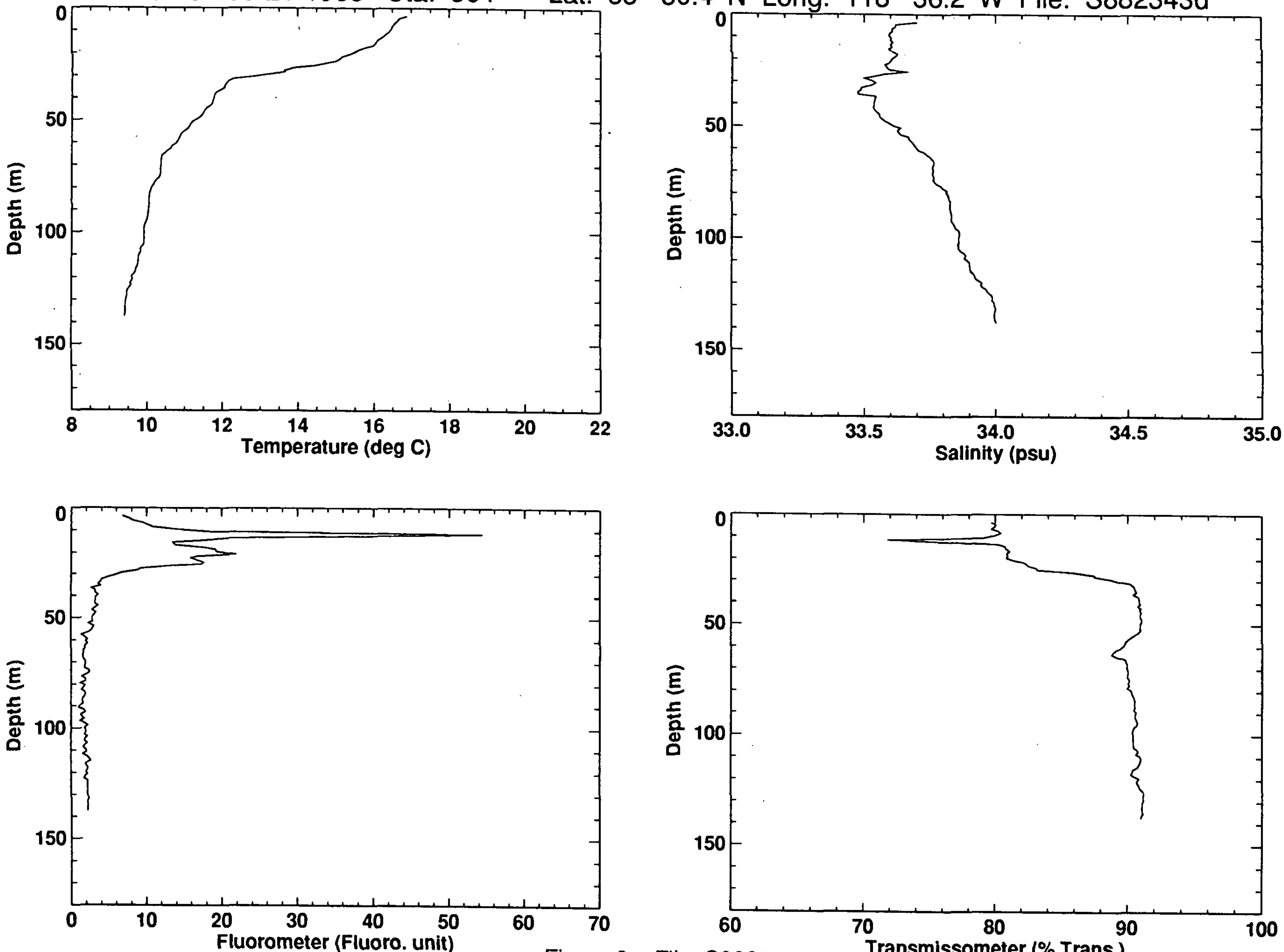

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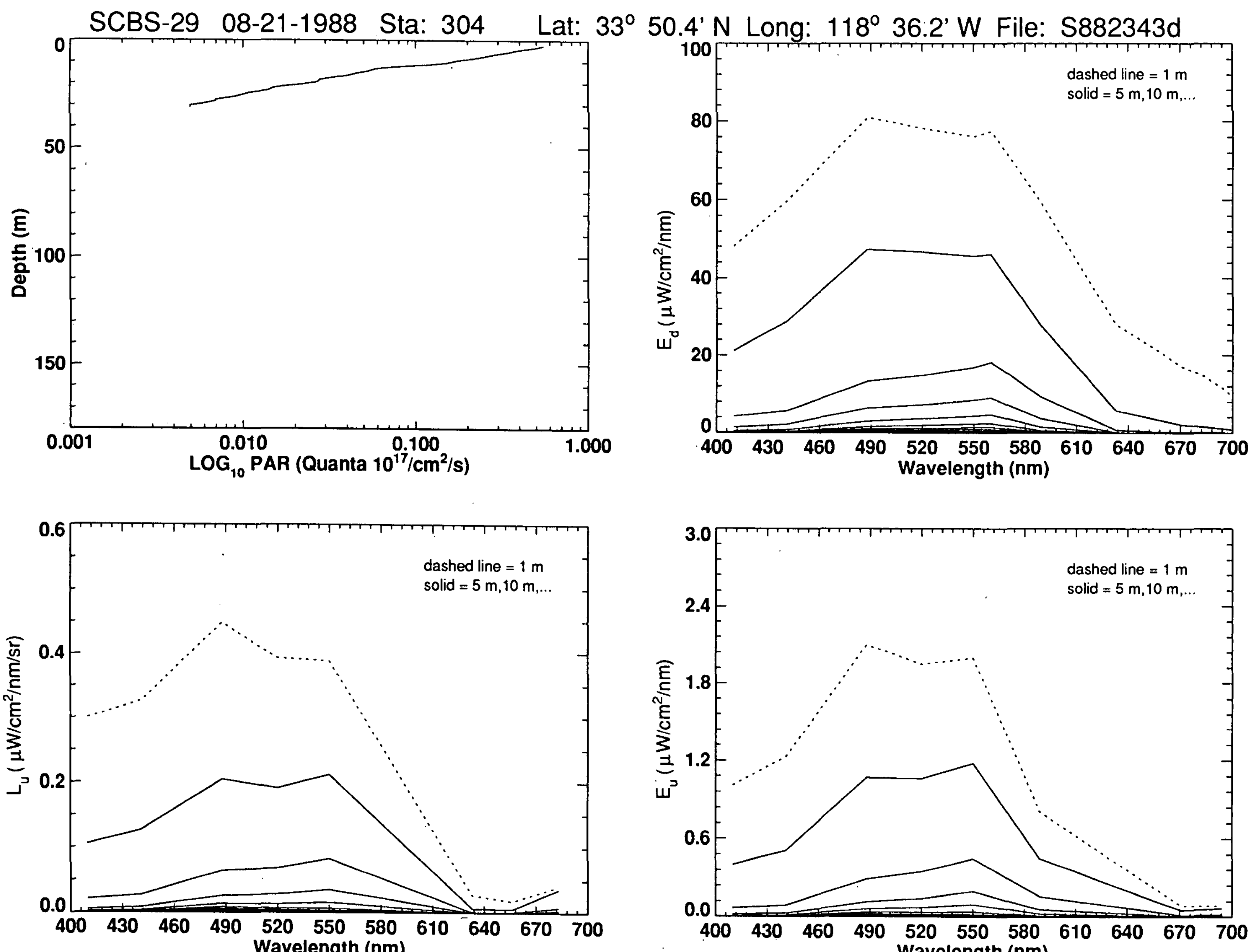

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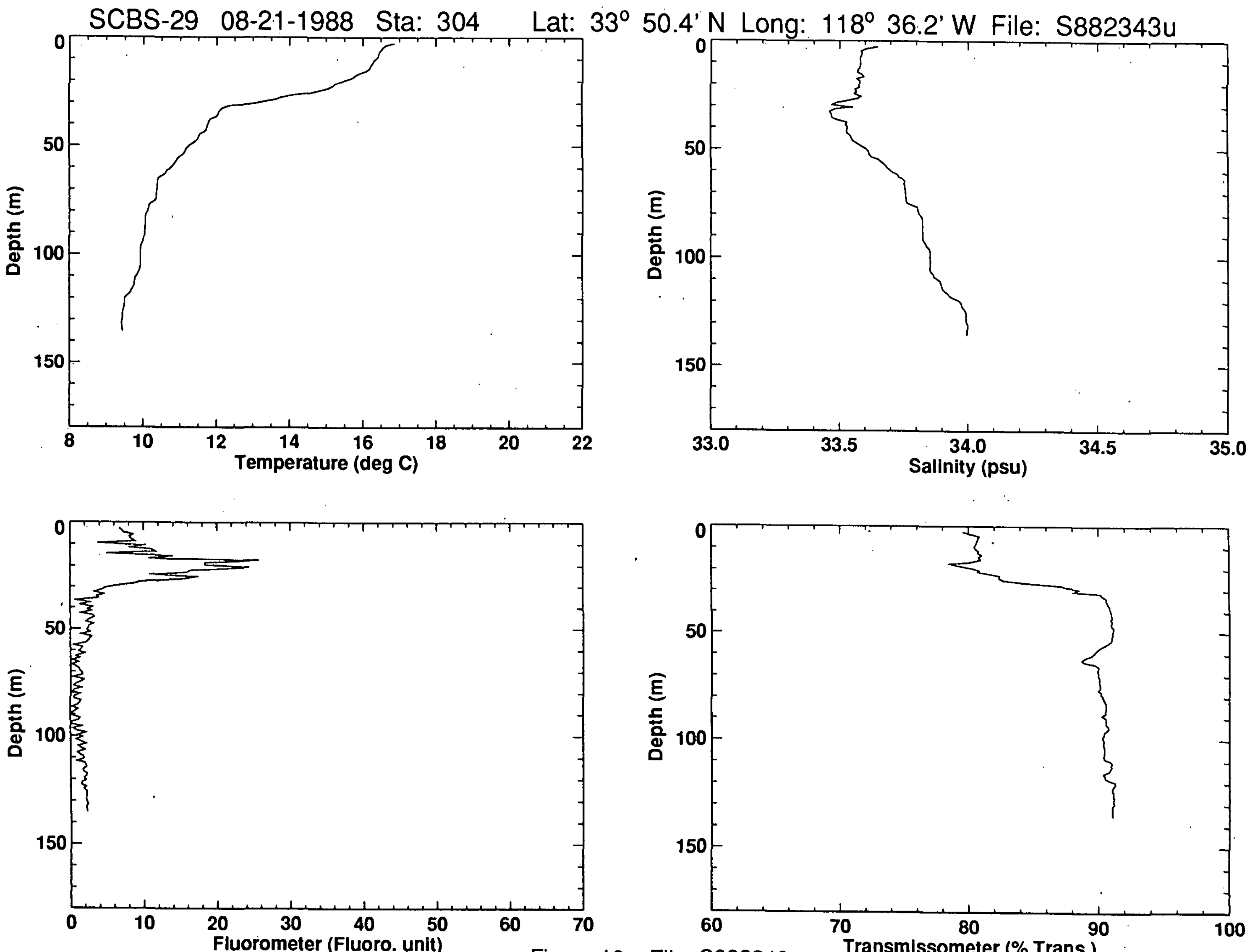

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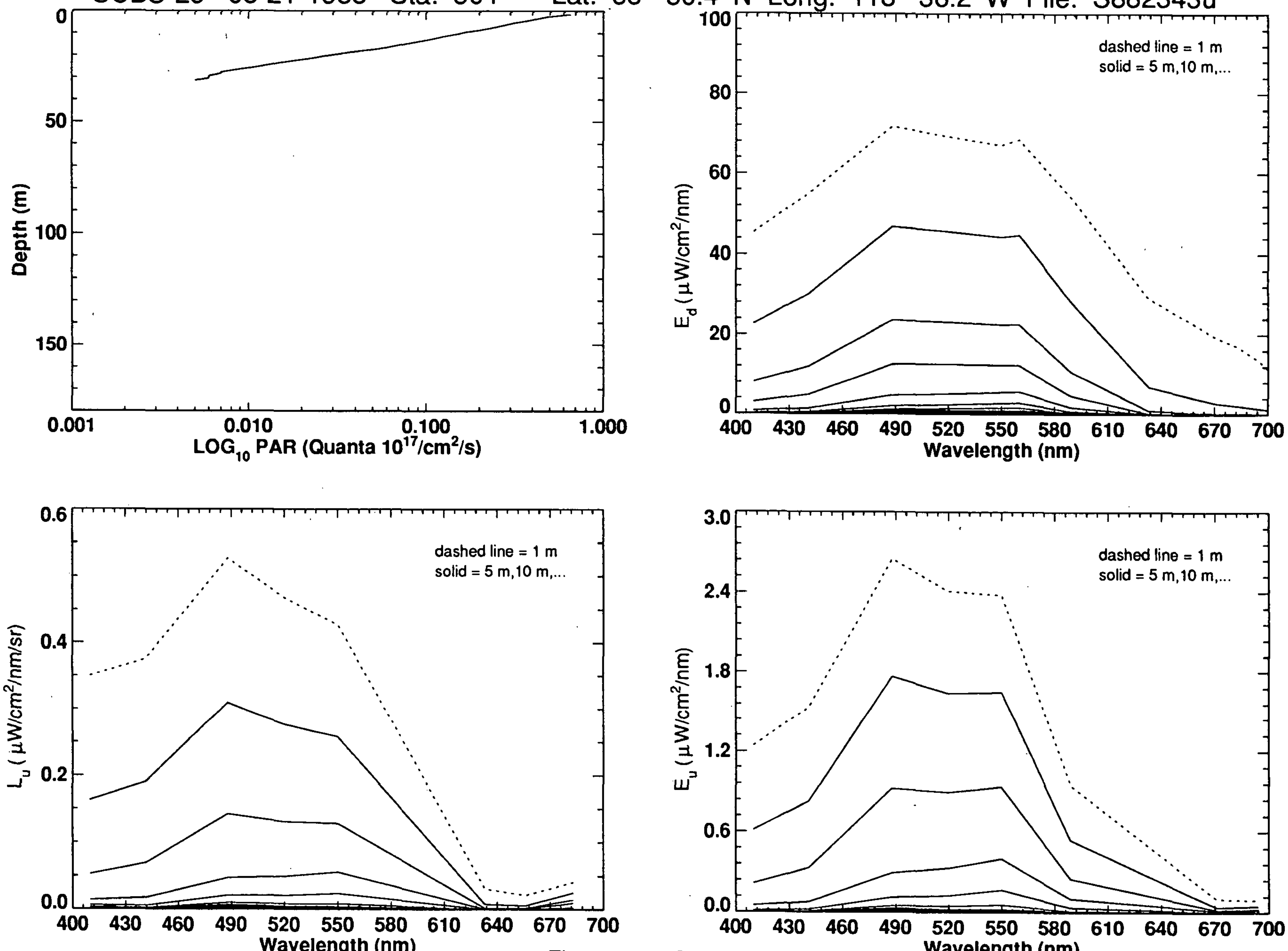

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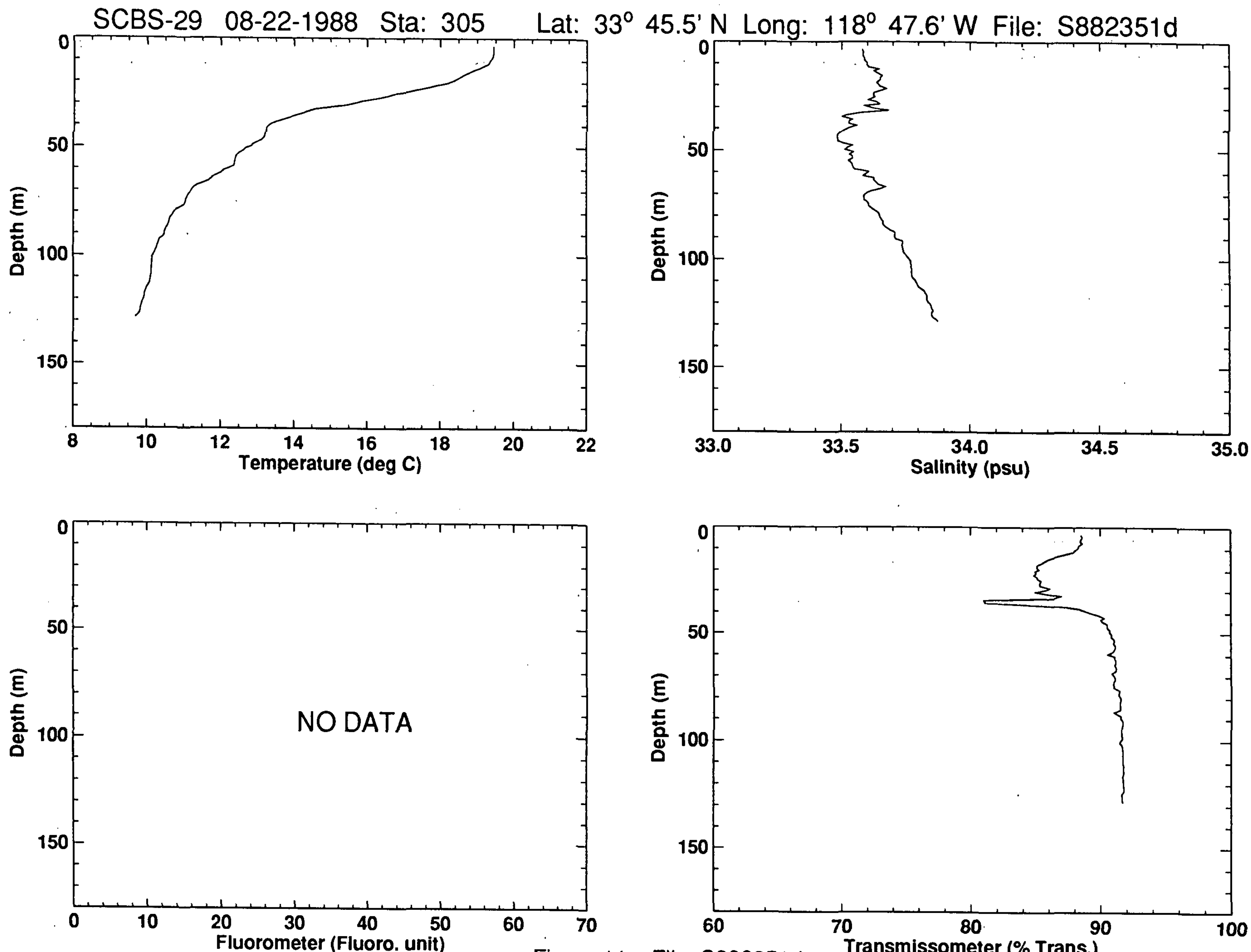

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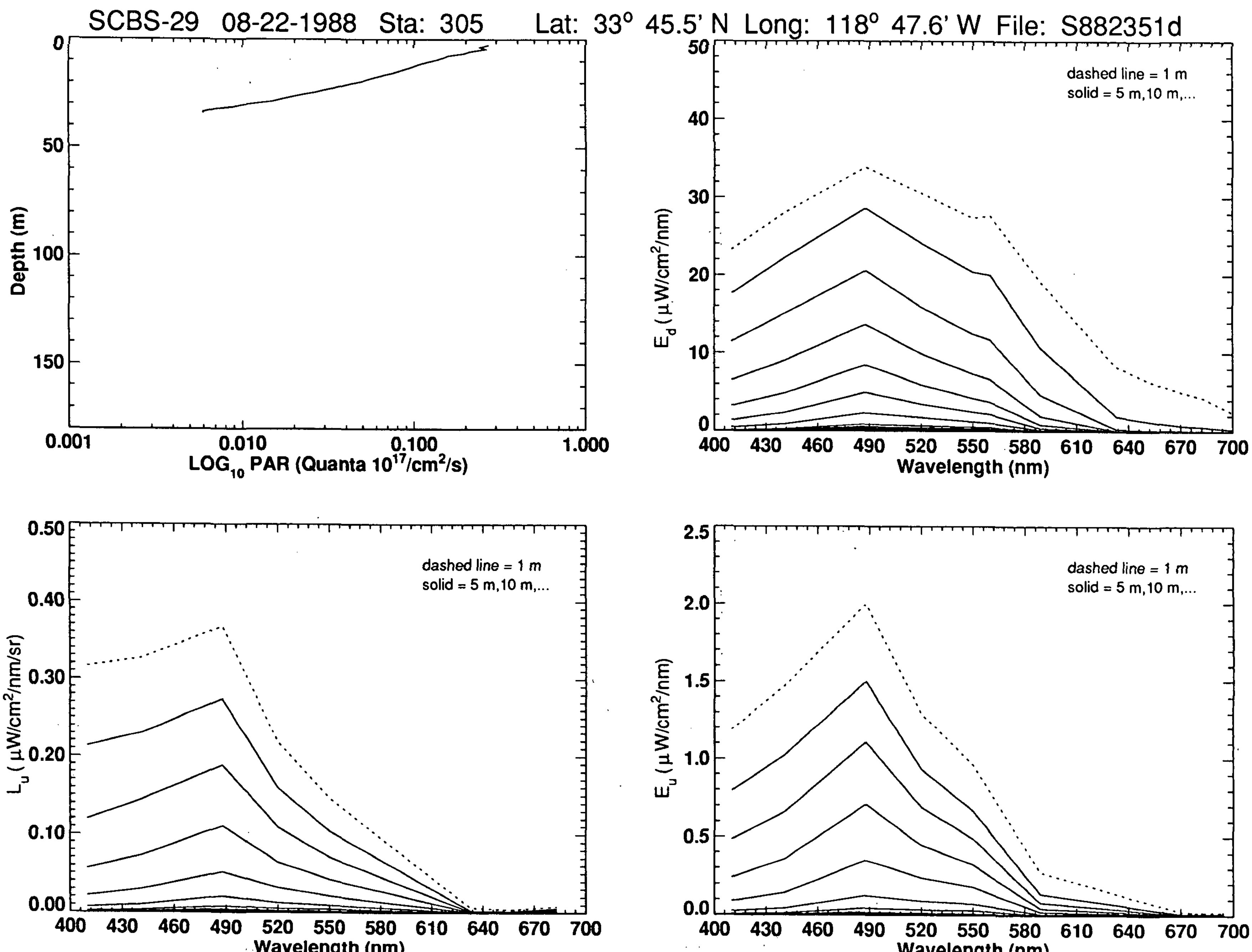

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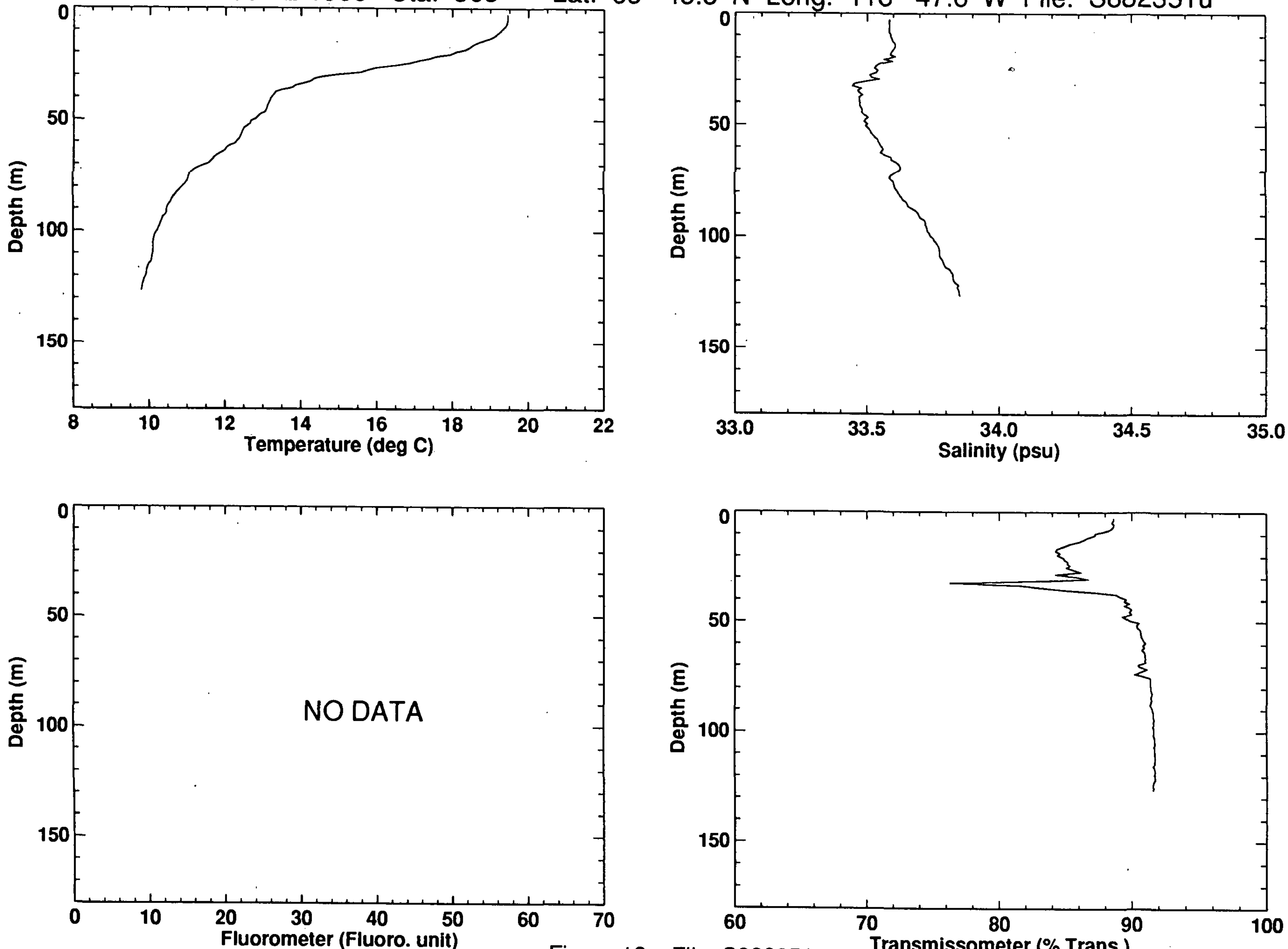

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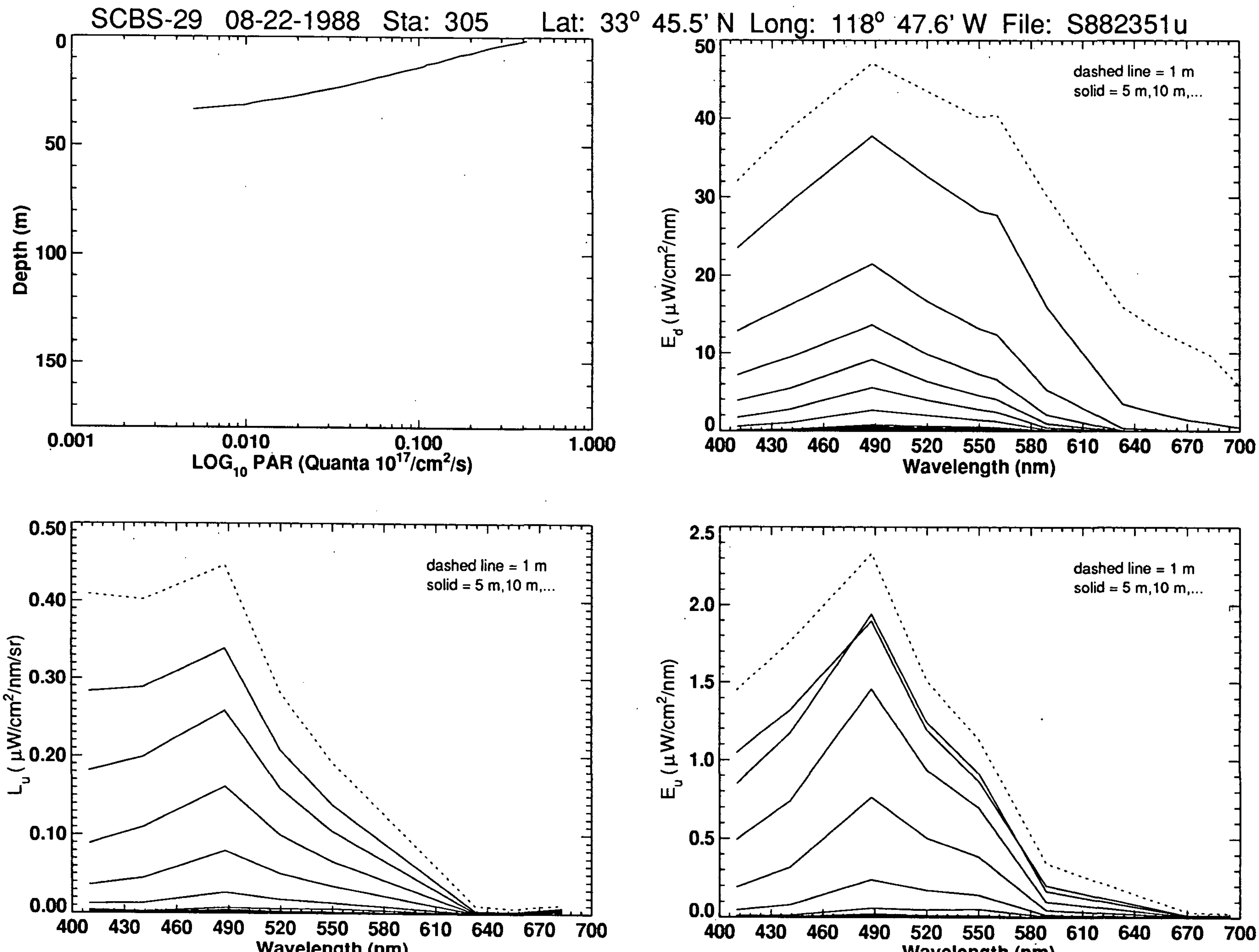

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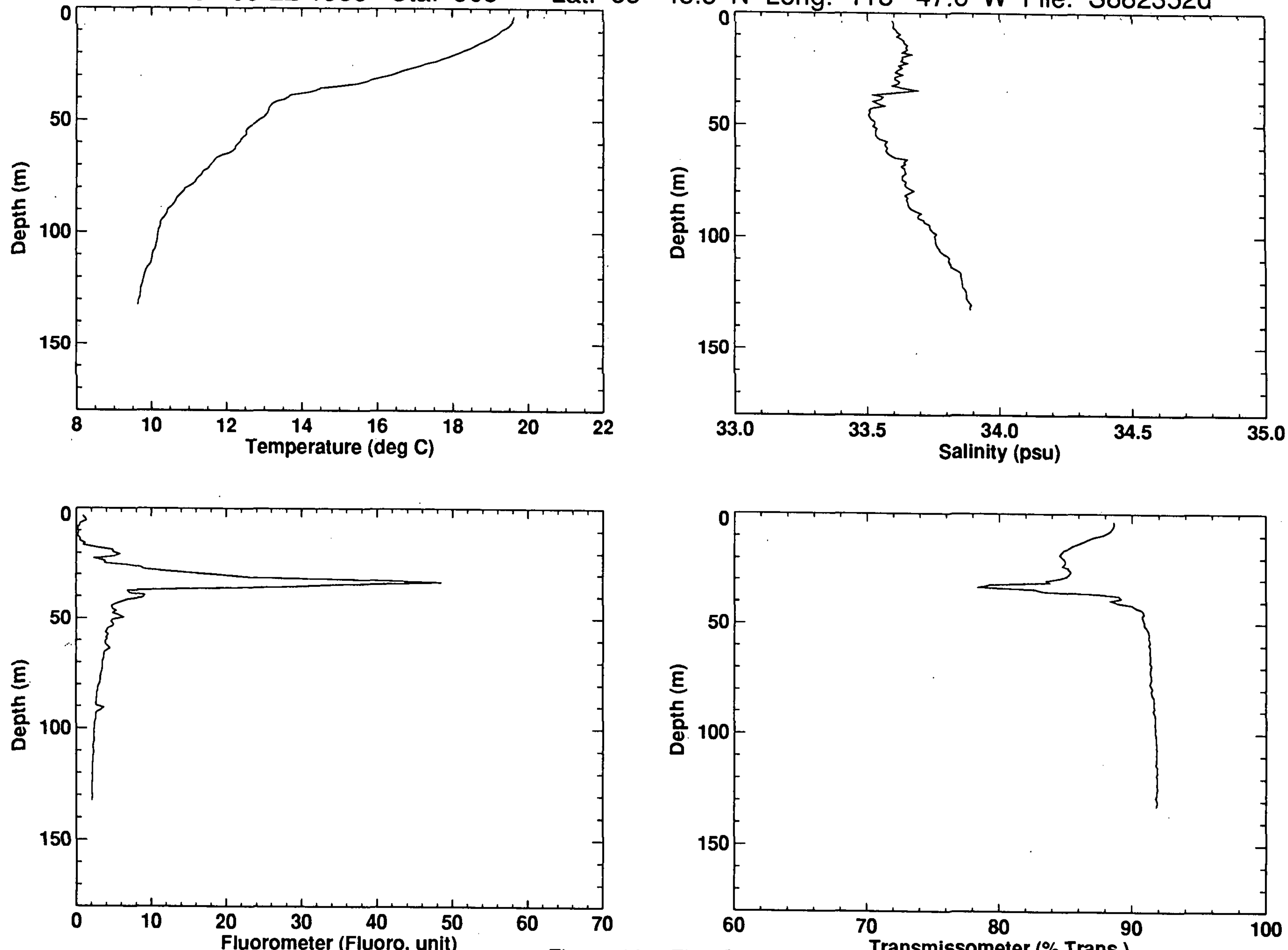

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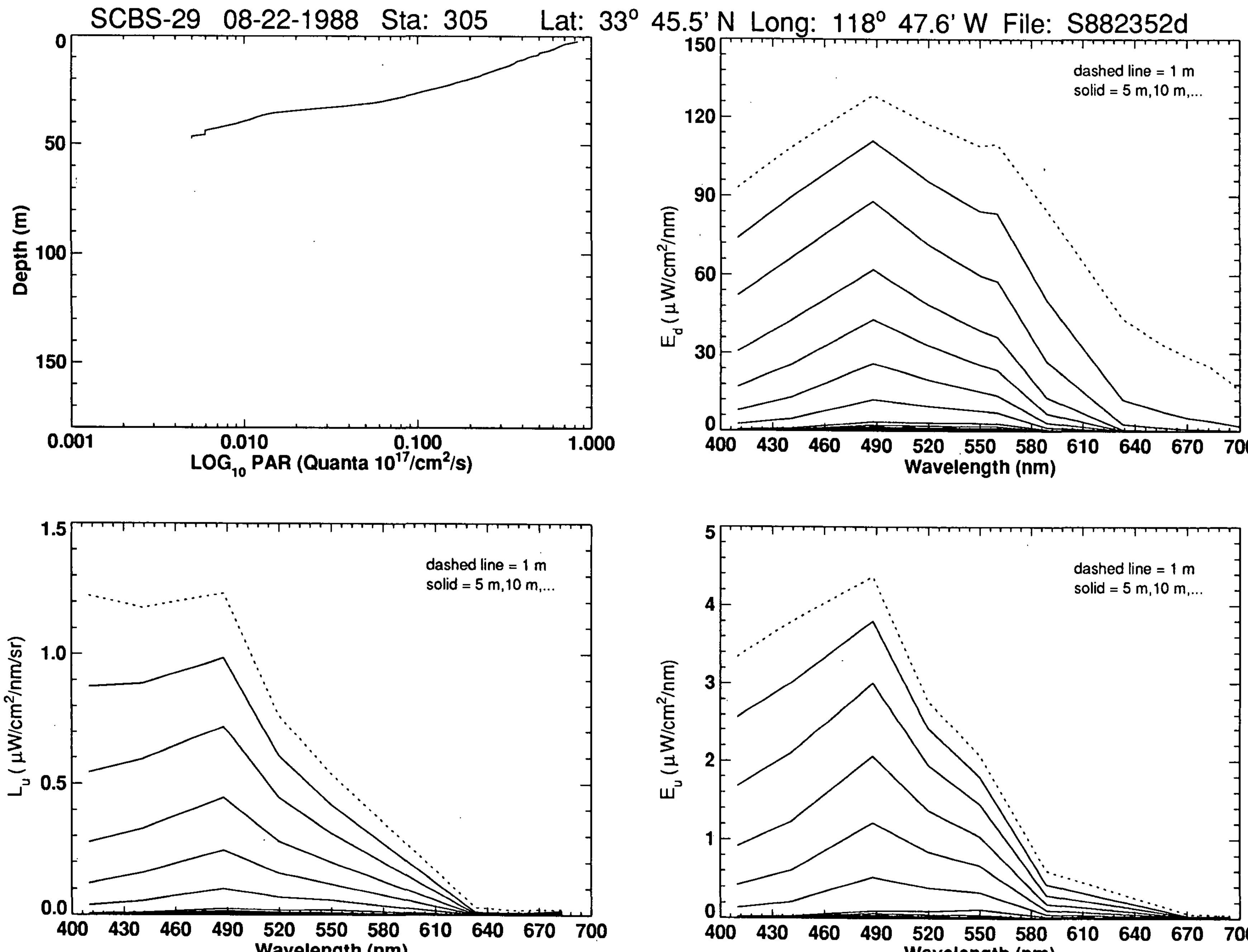

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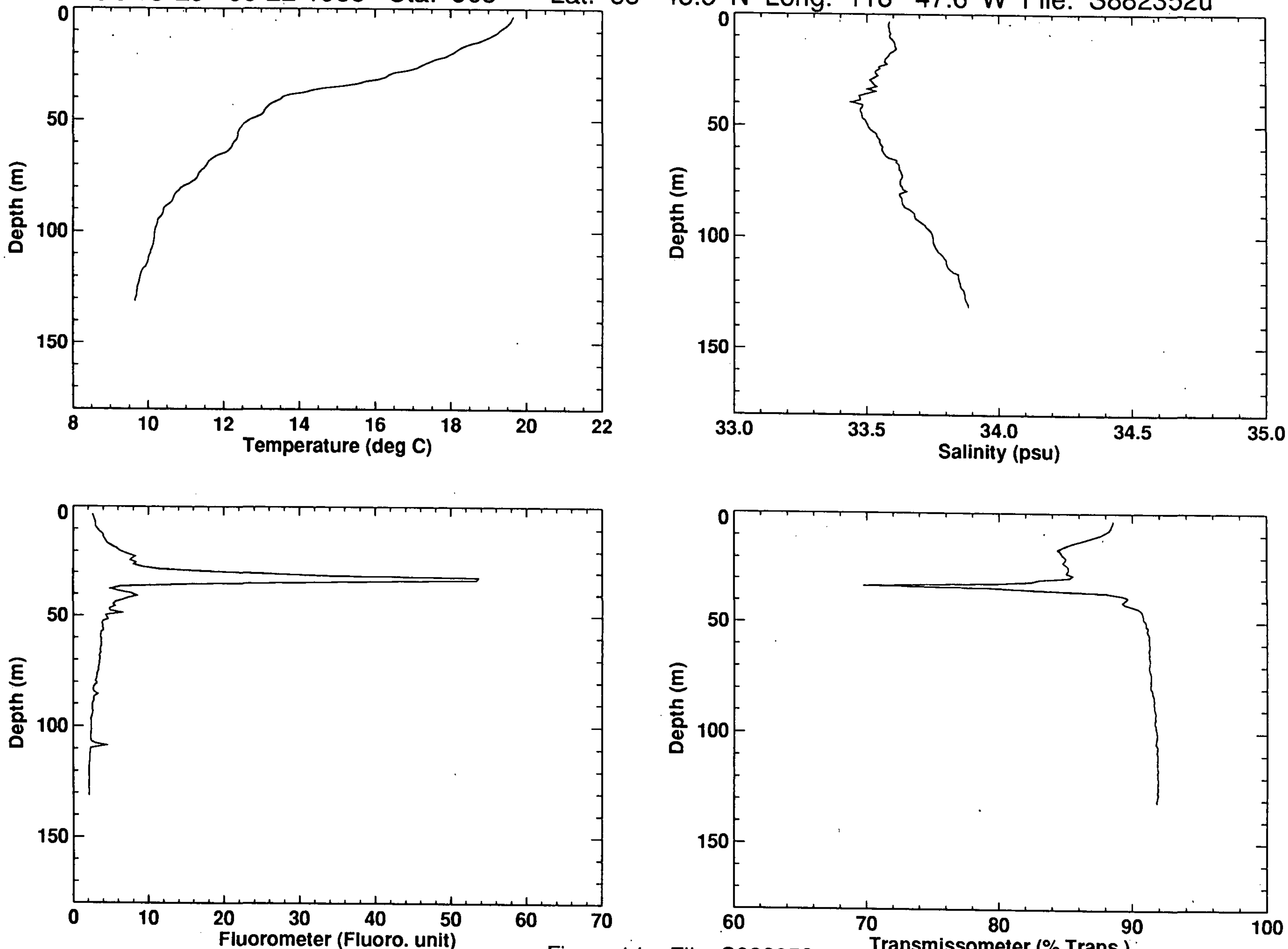

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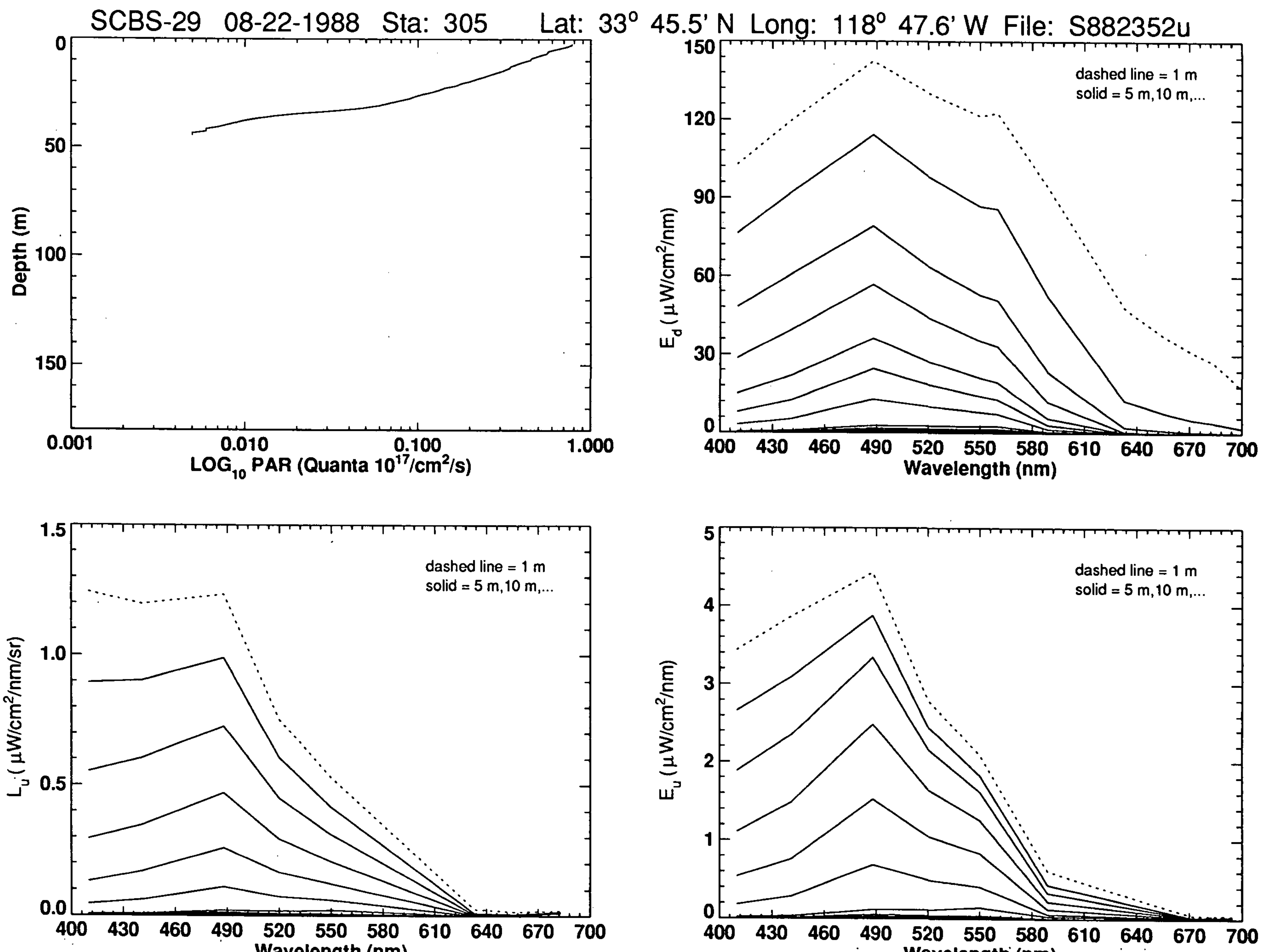

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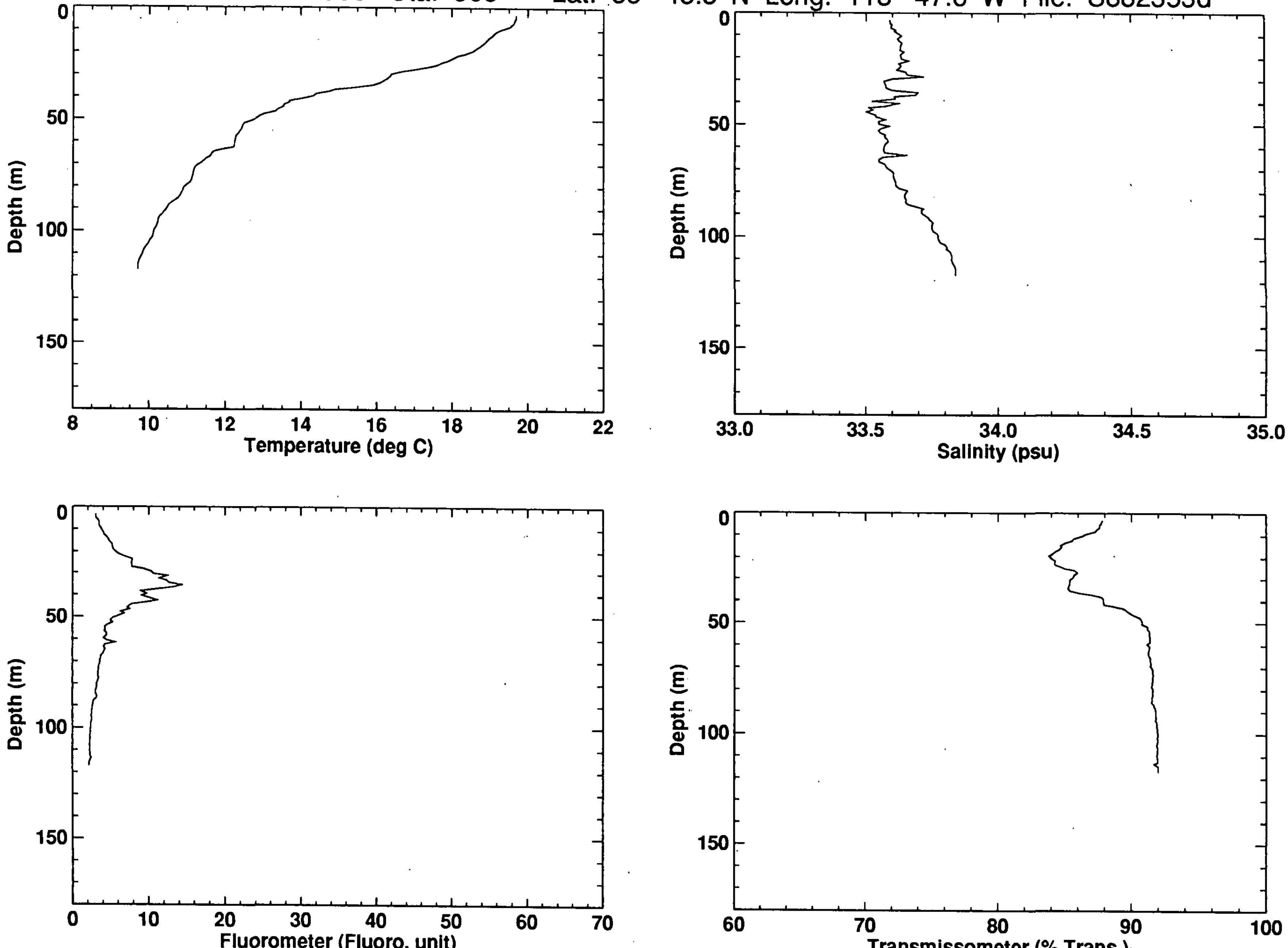

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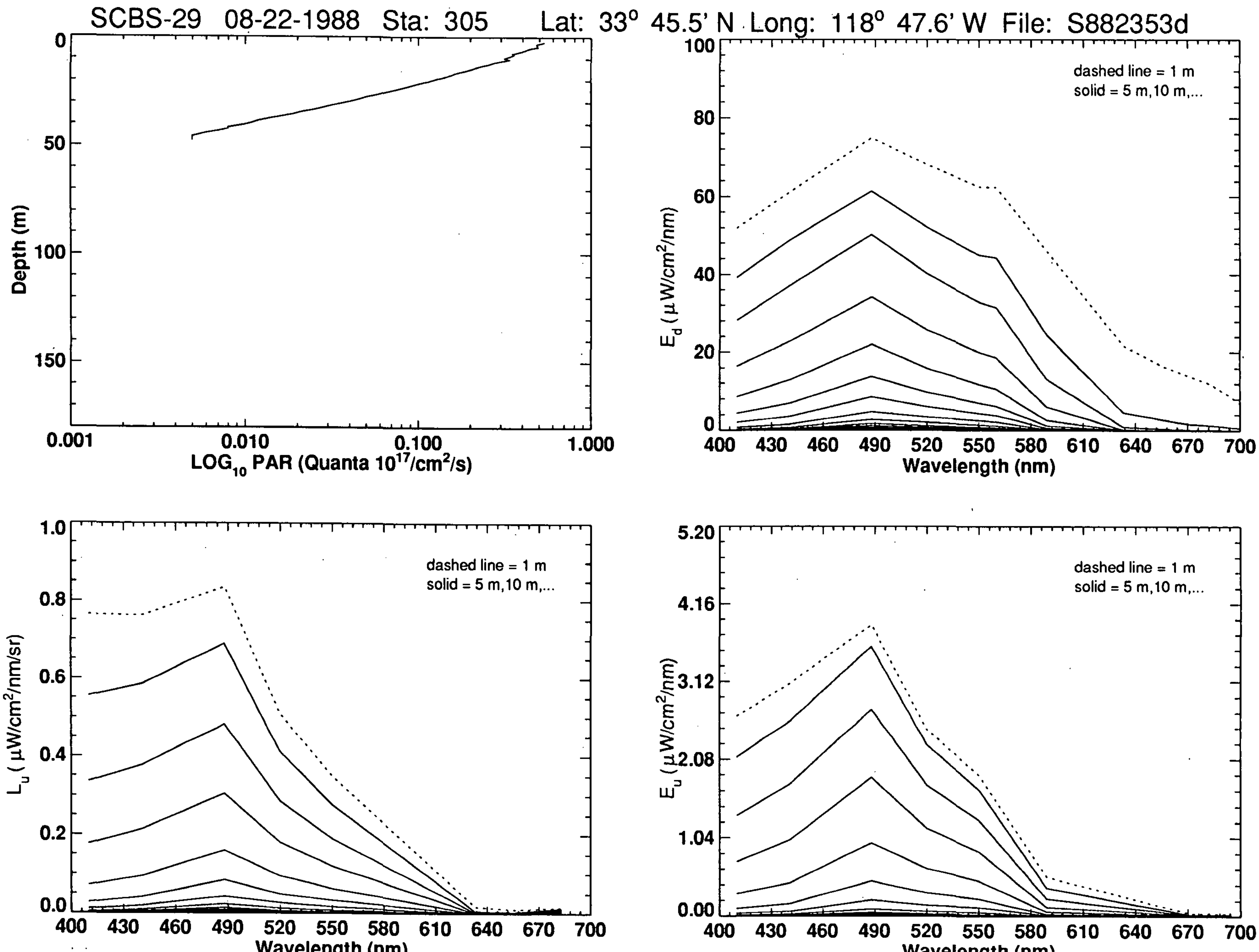

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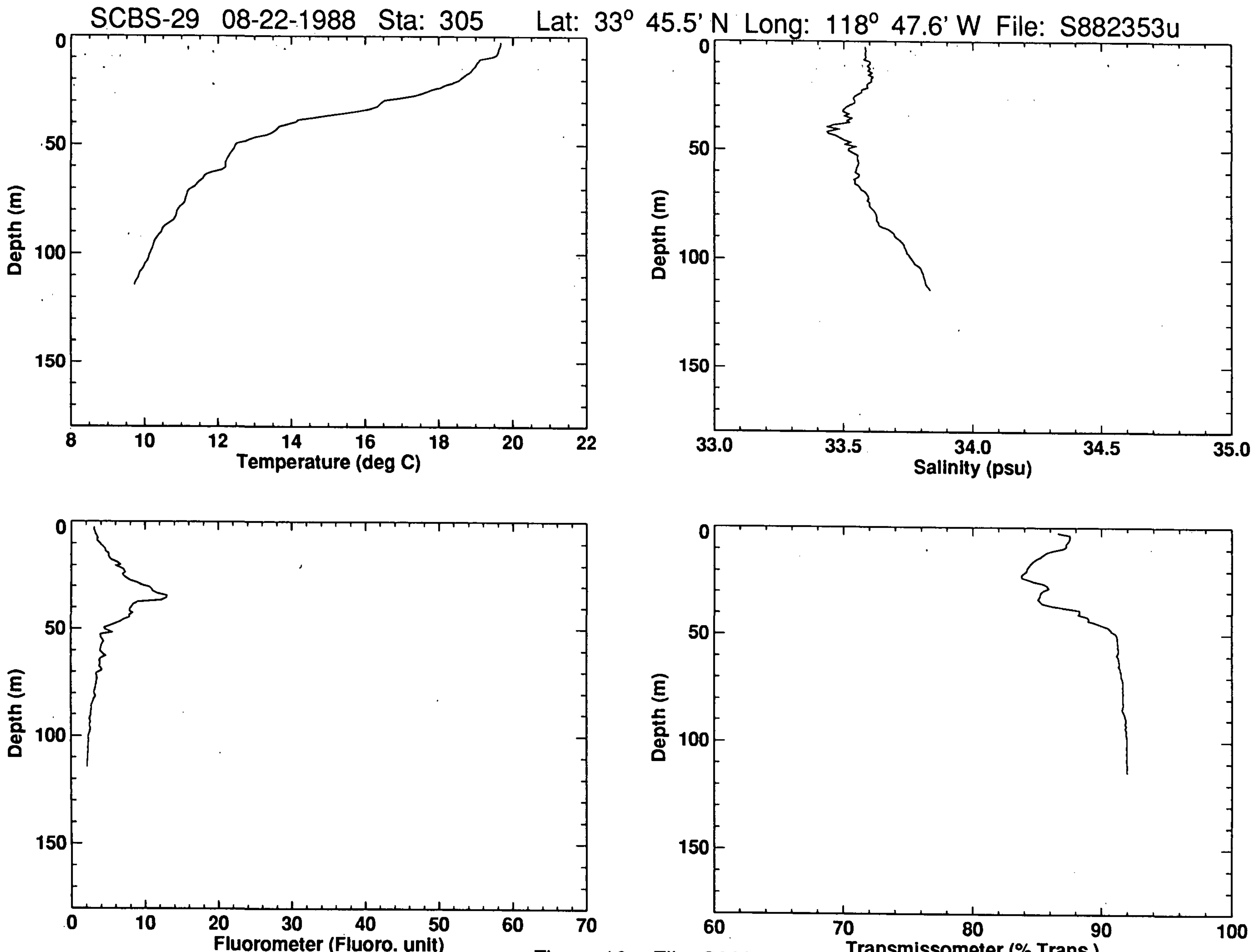

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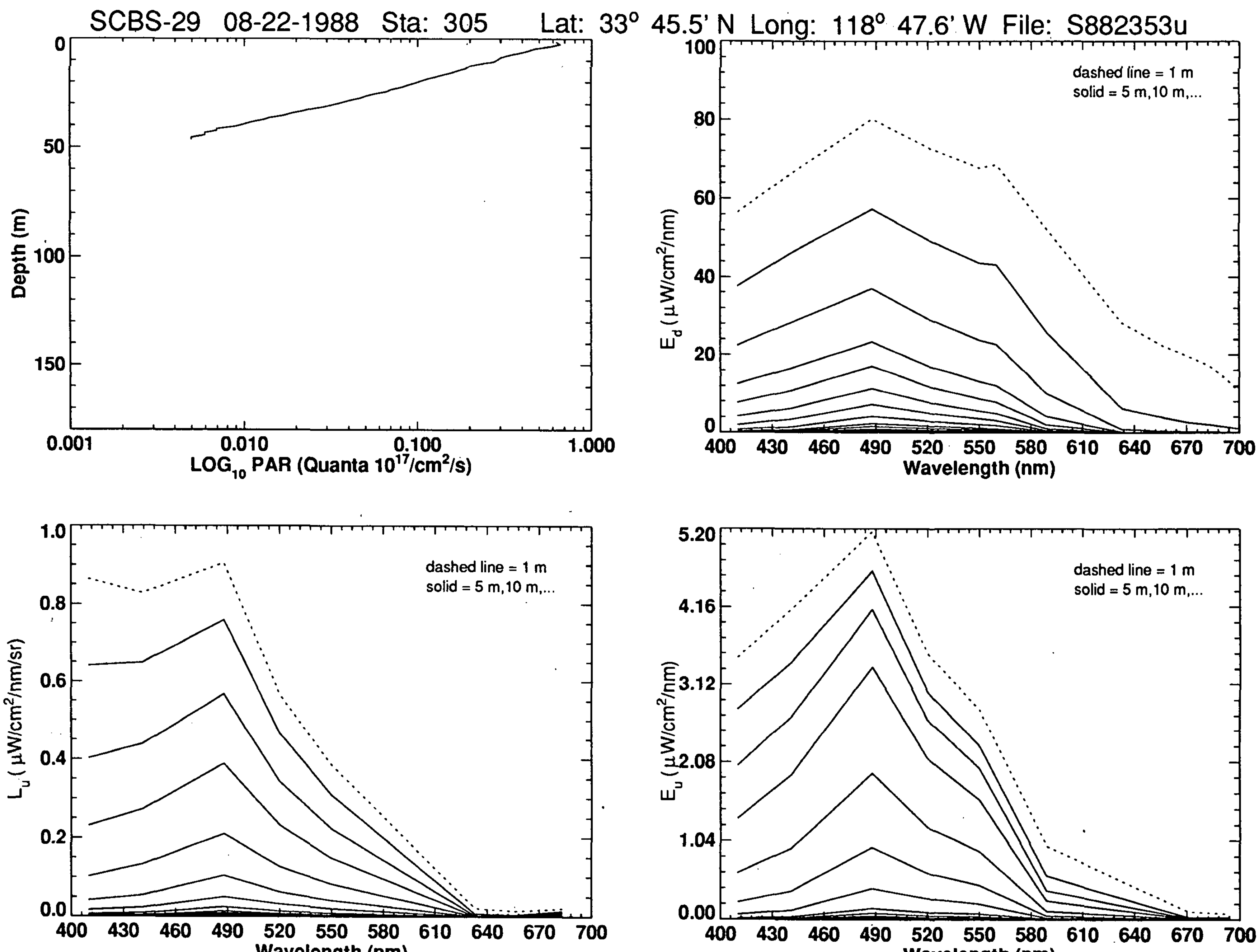

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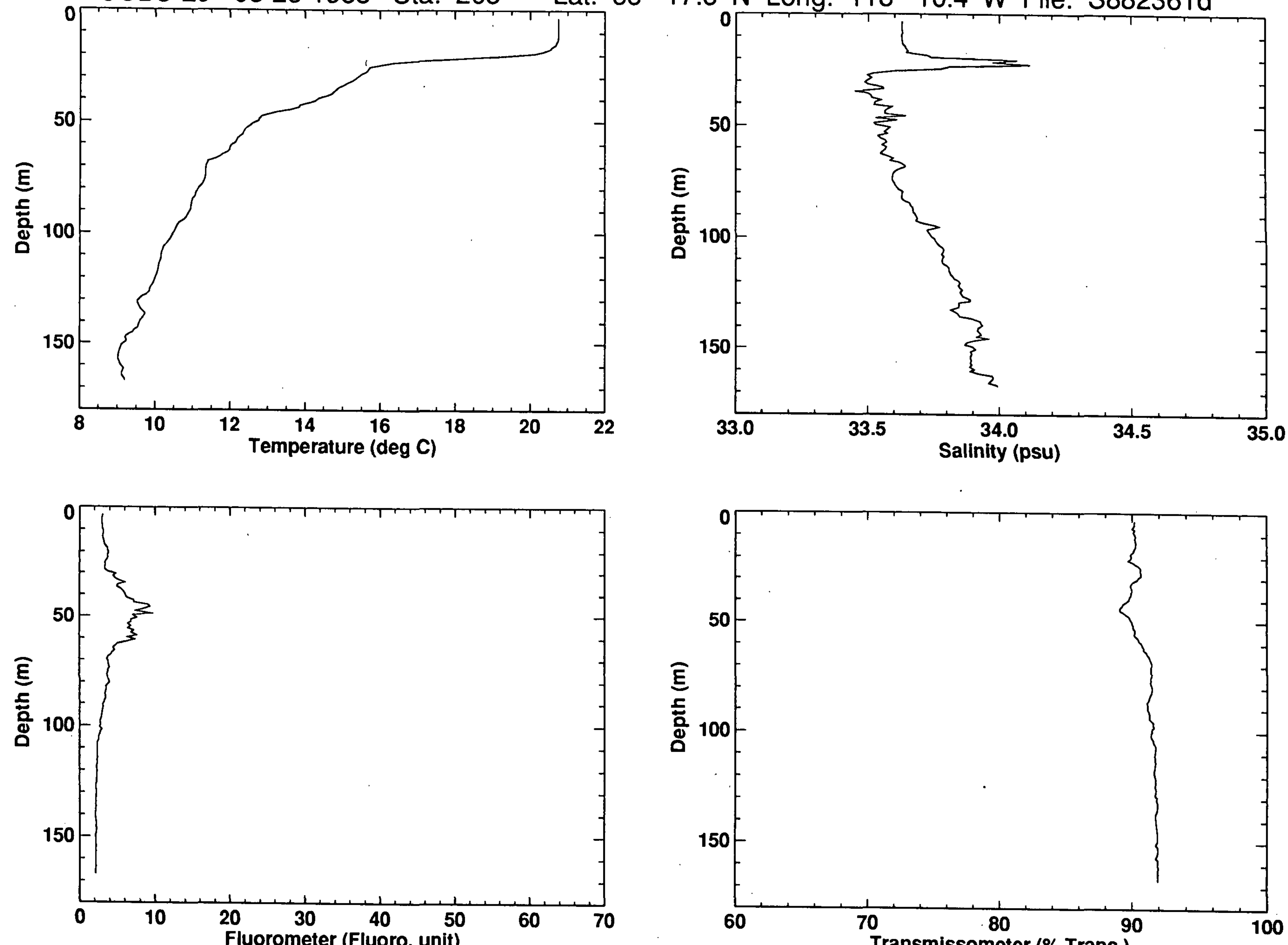

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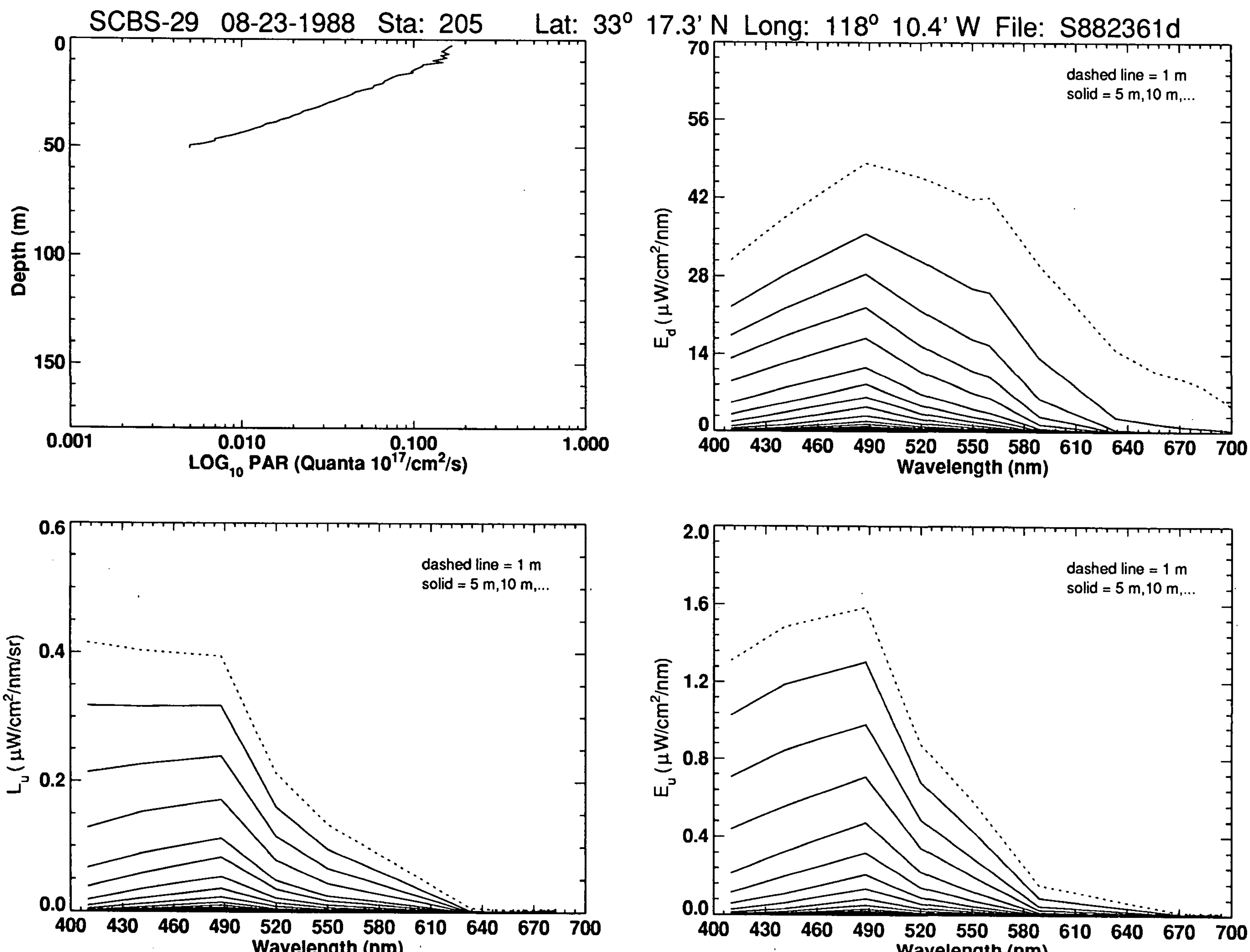


Figure 17. Continued

SCBS-29 08-23-1988 Sta: 205 Lat: 33° 17.3' N Long: 118° 10.4' W File: S882361u

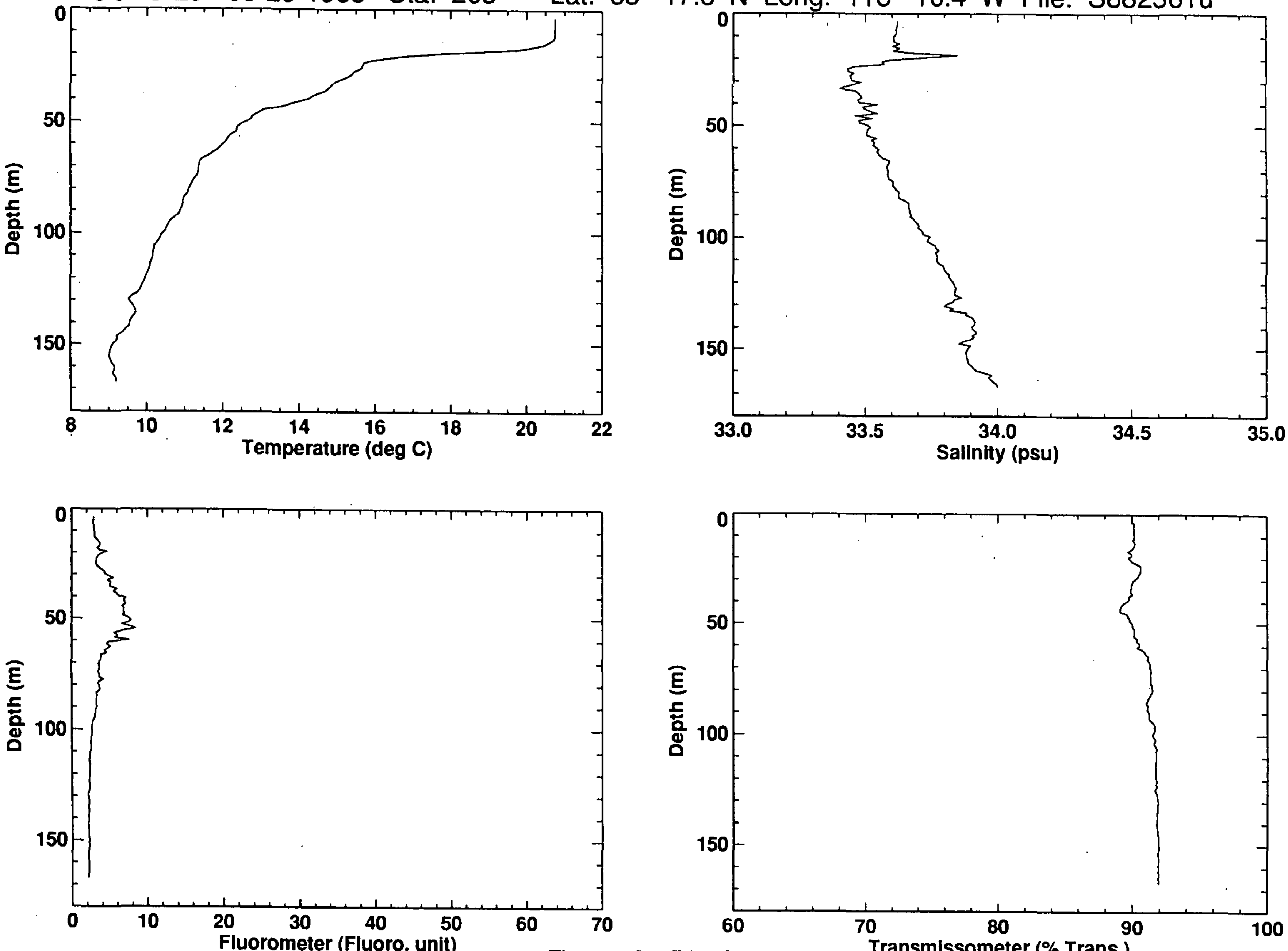


Figure 18. File: S882361u

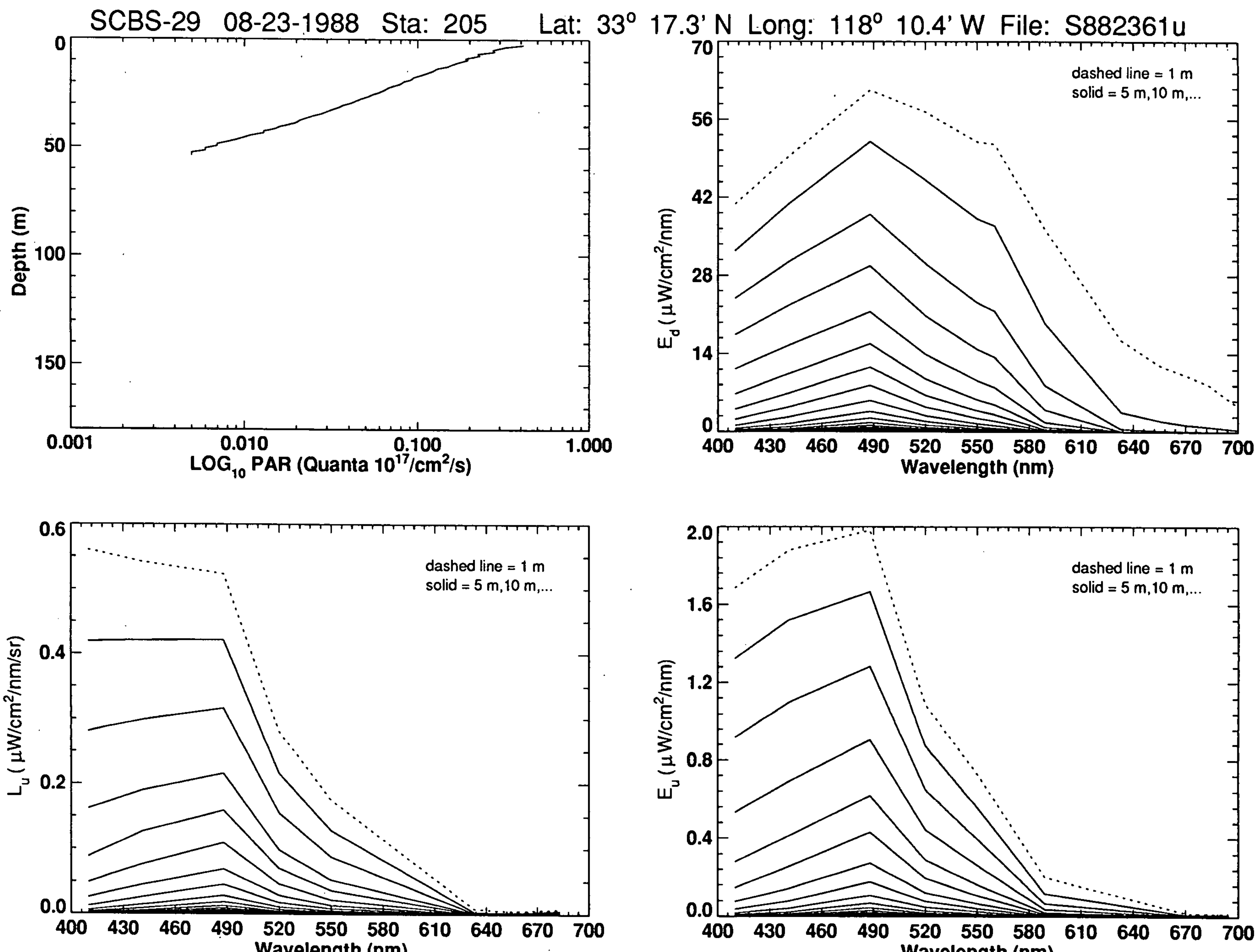


Figure 18. Continued

SCBS-29 08-23-1988 Sta: 205 Lat: 33° 17.3' N Long: 118° 10.4' W File: S882362d

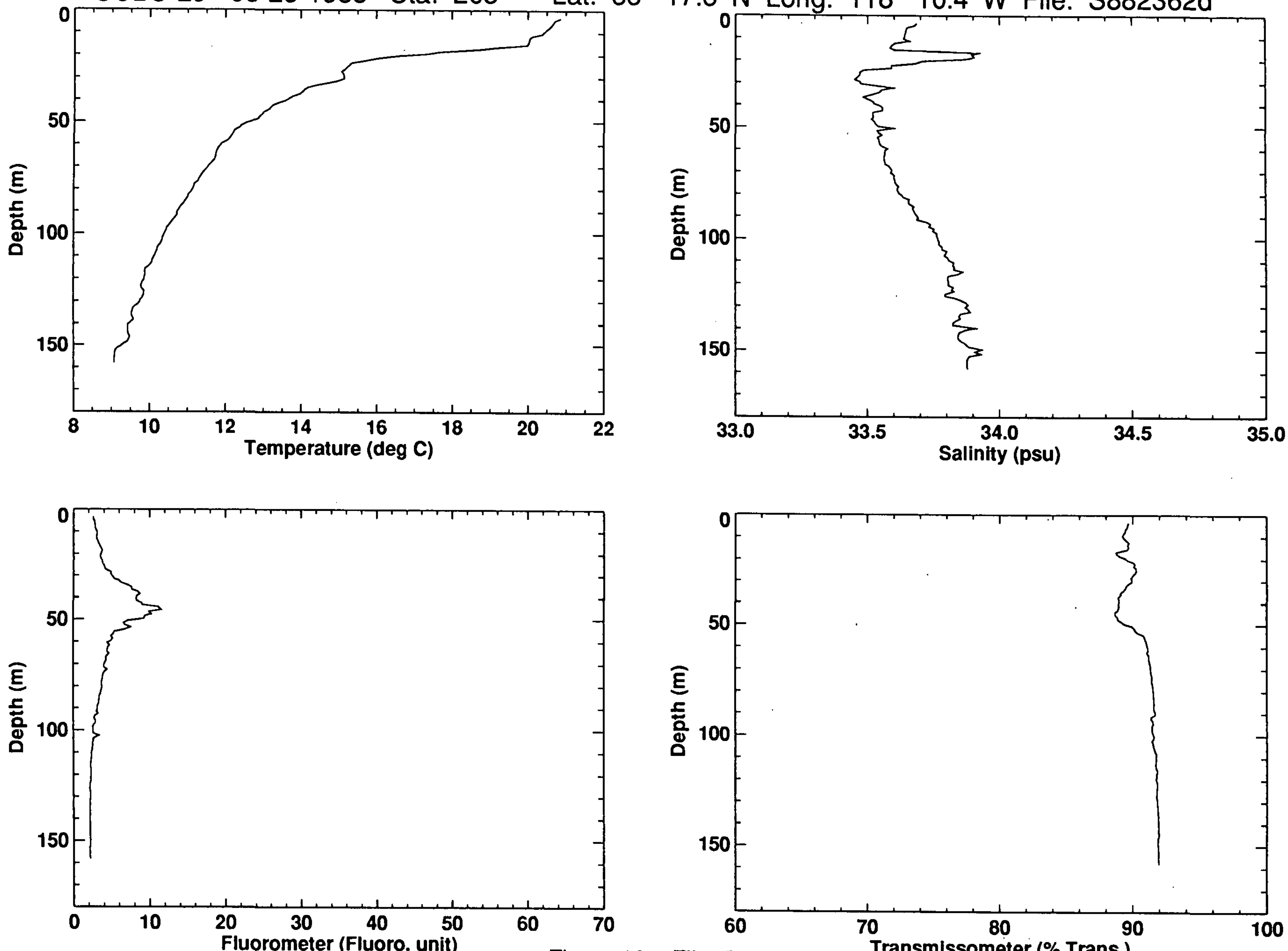


Figure 19. File: S882362d

SCBS-29 08-23-1988 Sta: 205 Lat: 33° 17.3' N Long: 118° 10.4' W File: S882362d

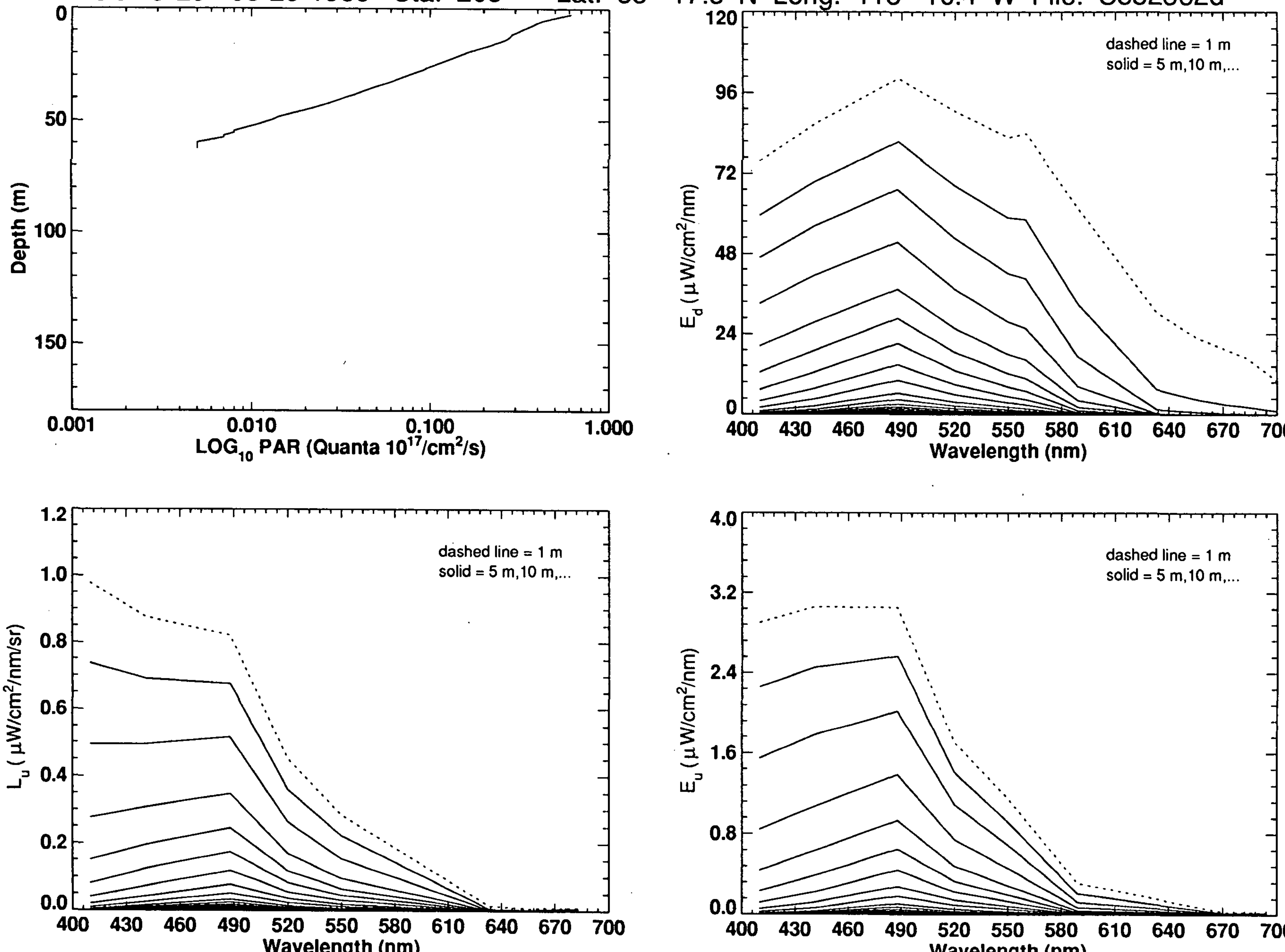
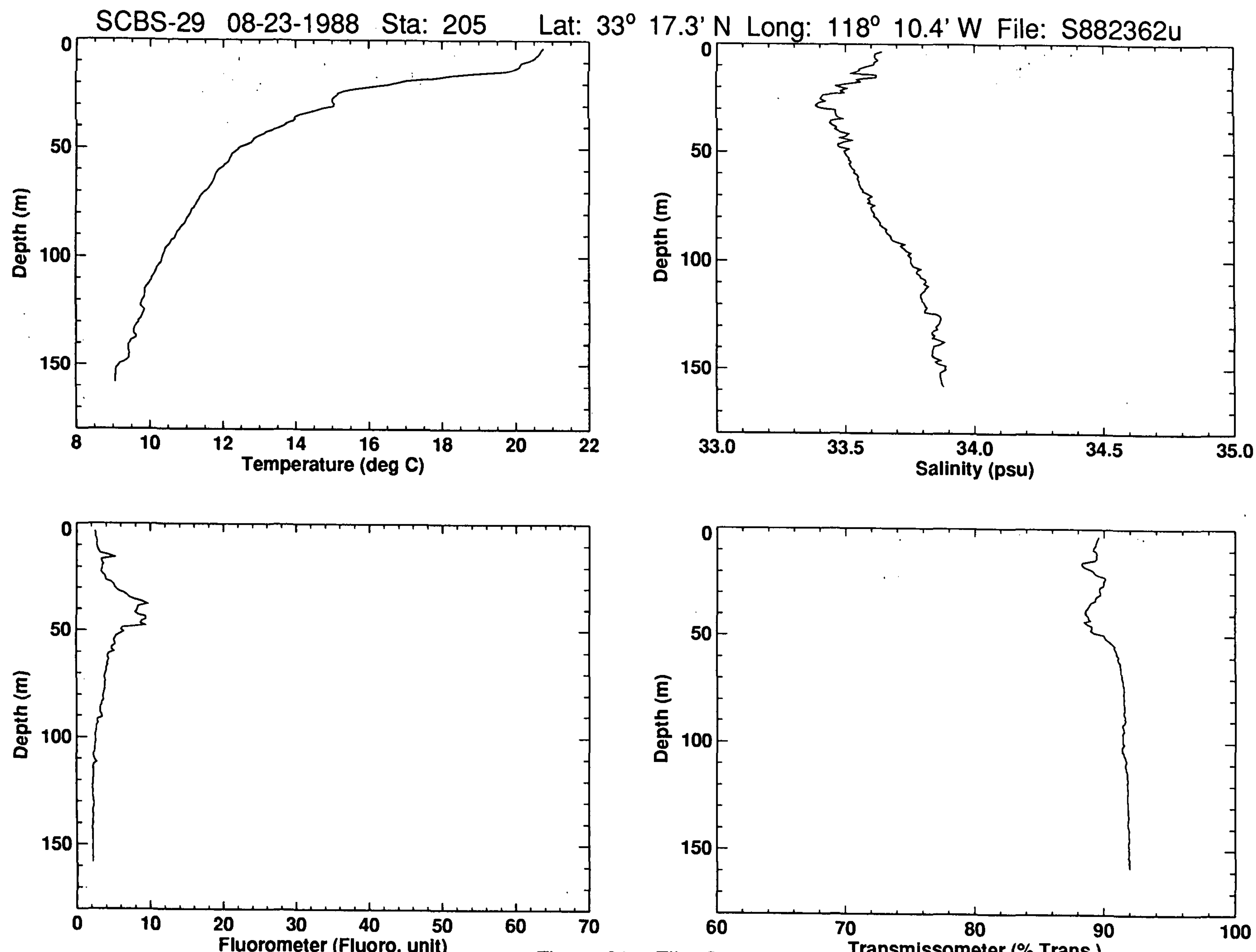


Figure 19. Continued



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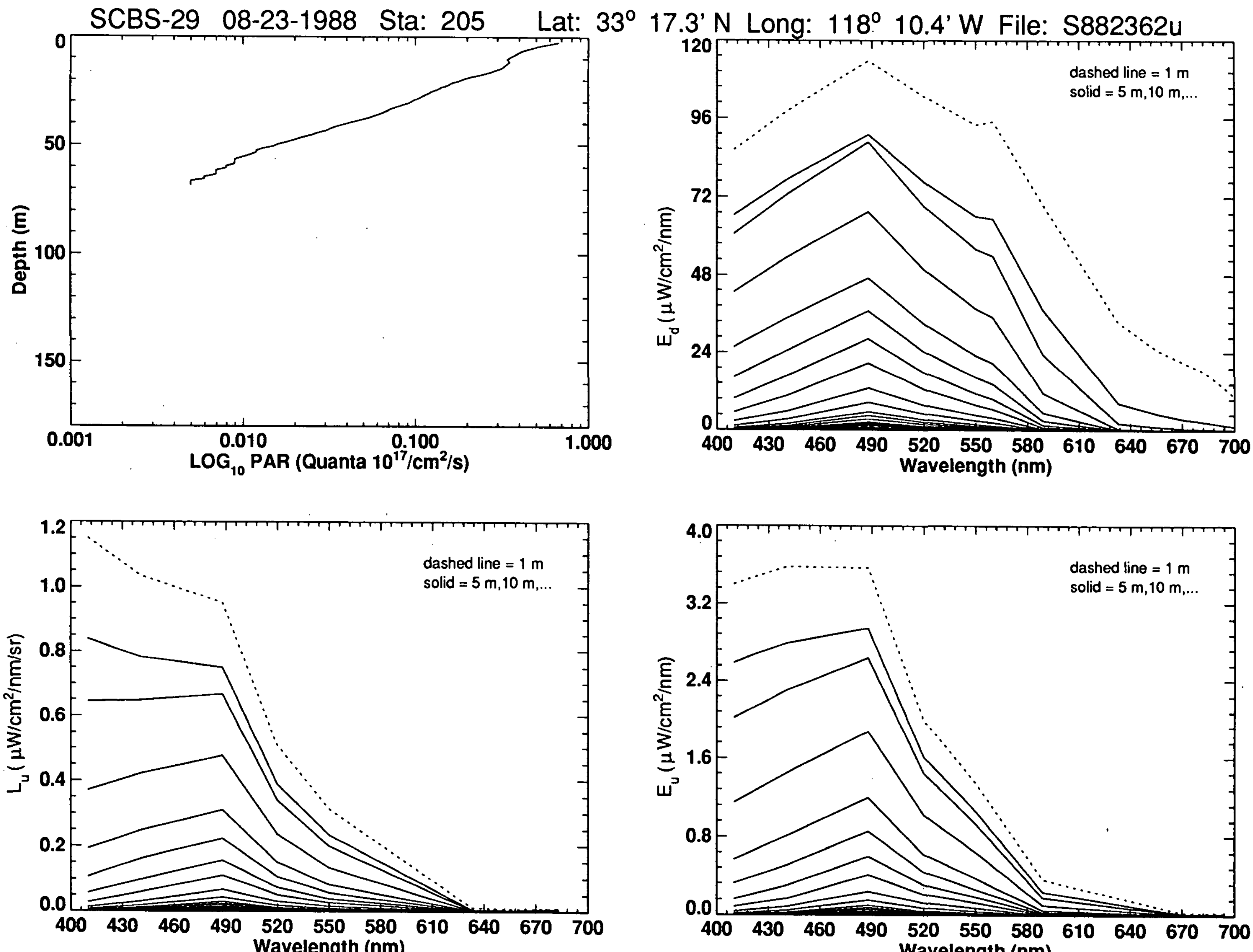
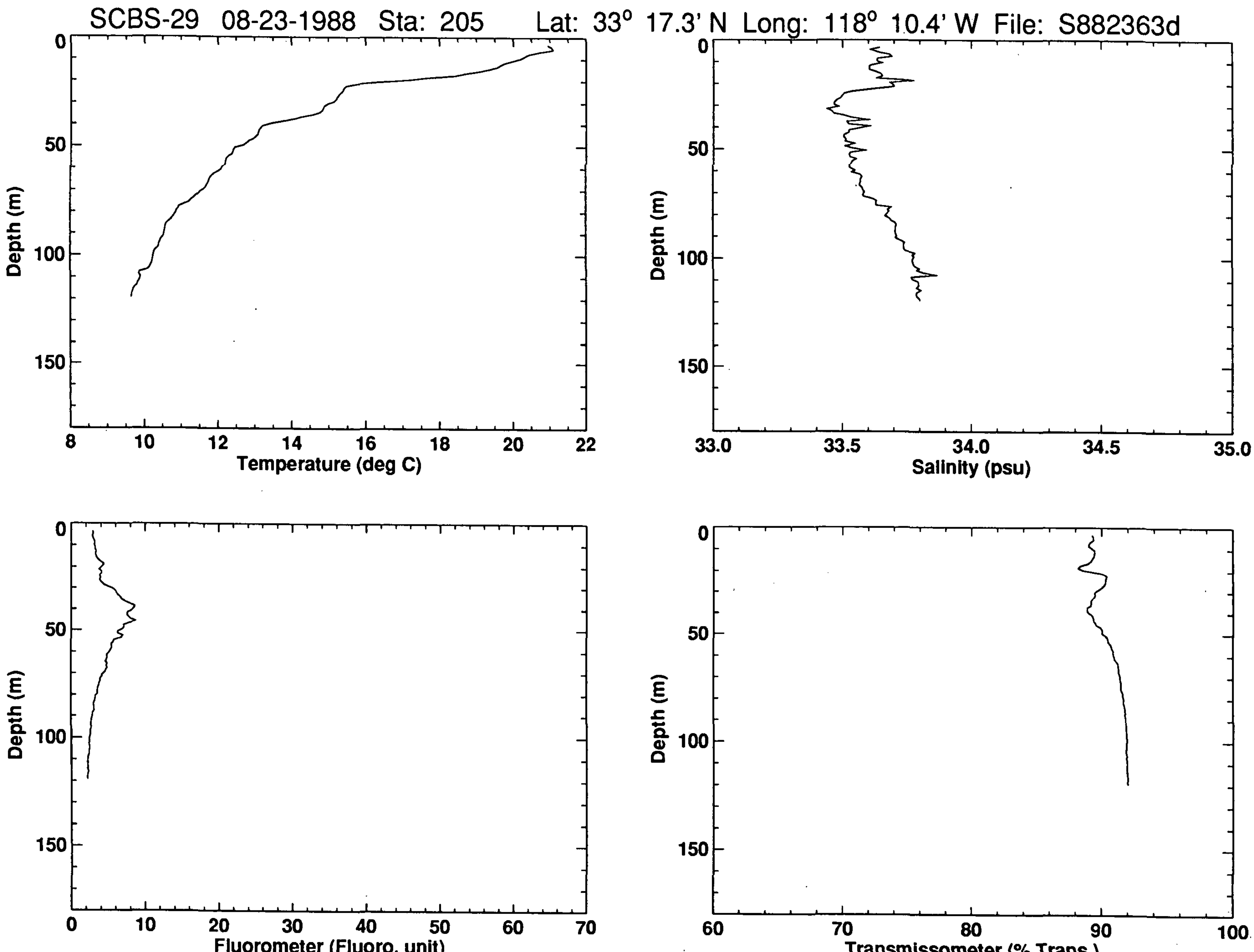


Figure 20. Continued



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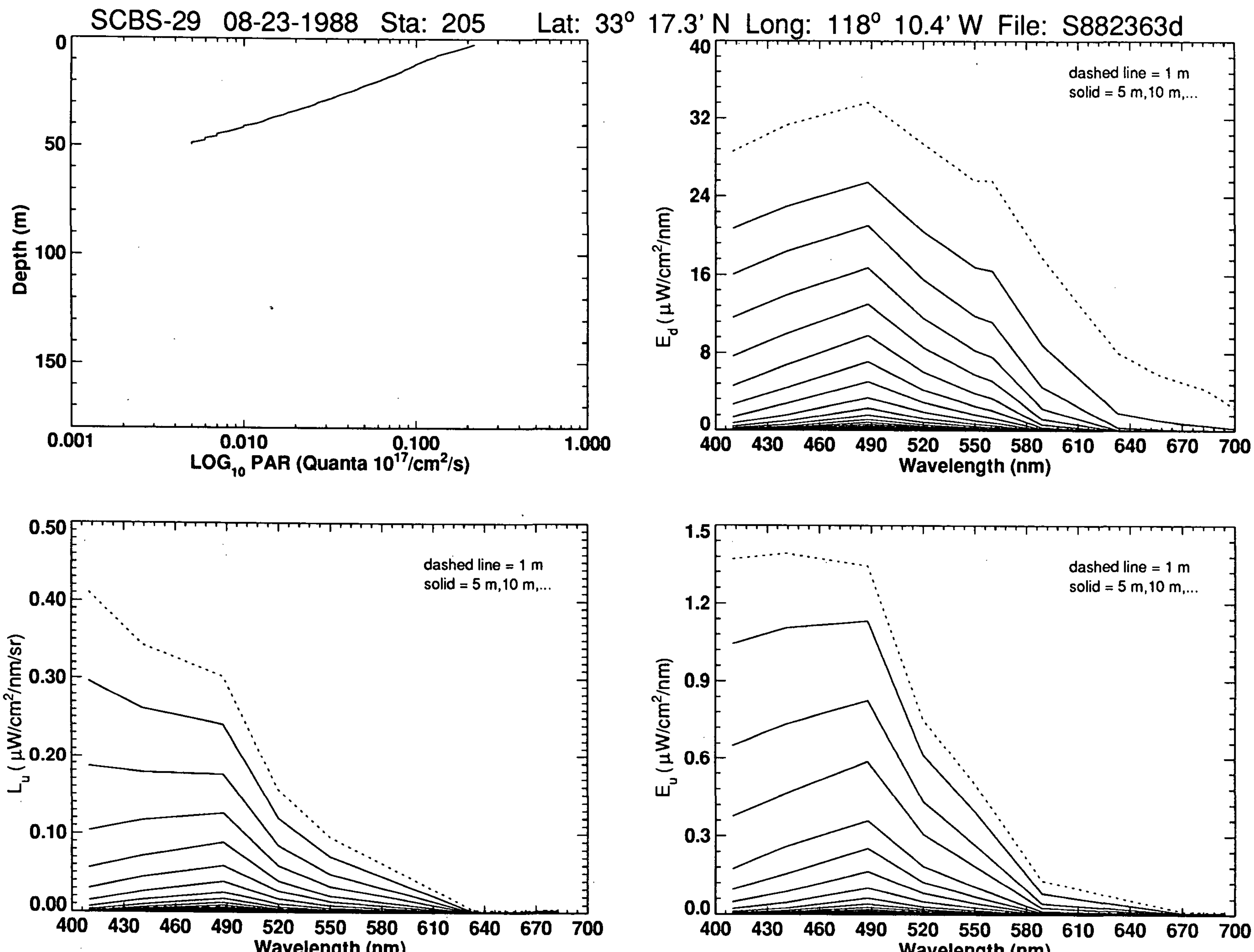


Figure 21. Continued

SCBS-29 08-23-1988 Sta: 205 Lat: 33° 17.3' N Long: 118° 10.4' W File: S882363u

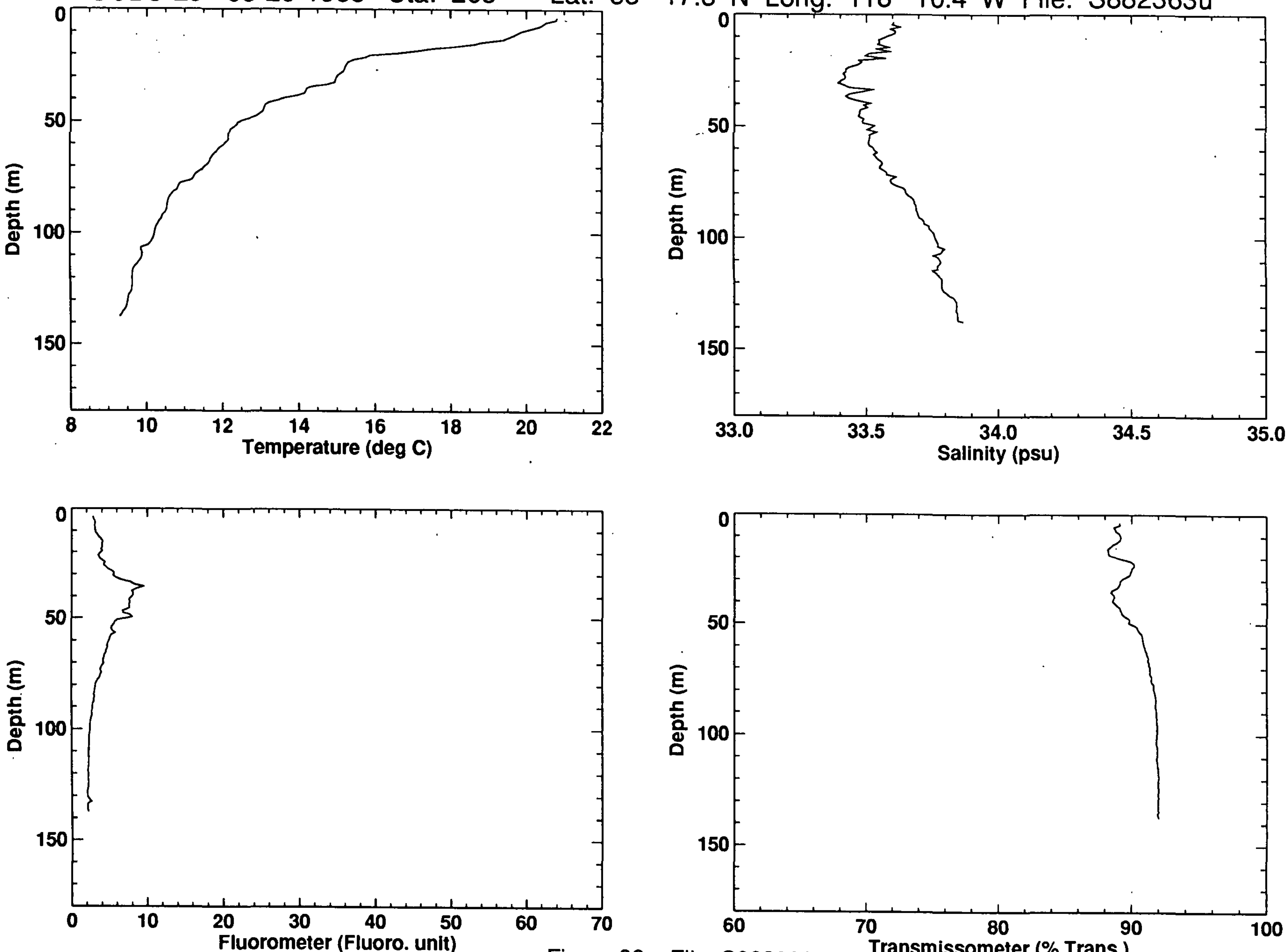


Figure 22. File: S882363u

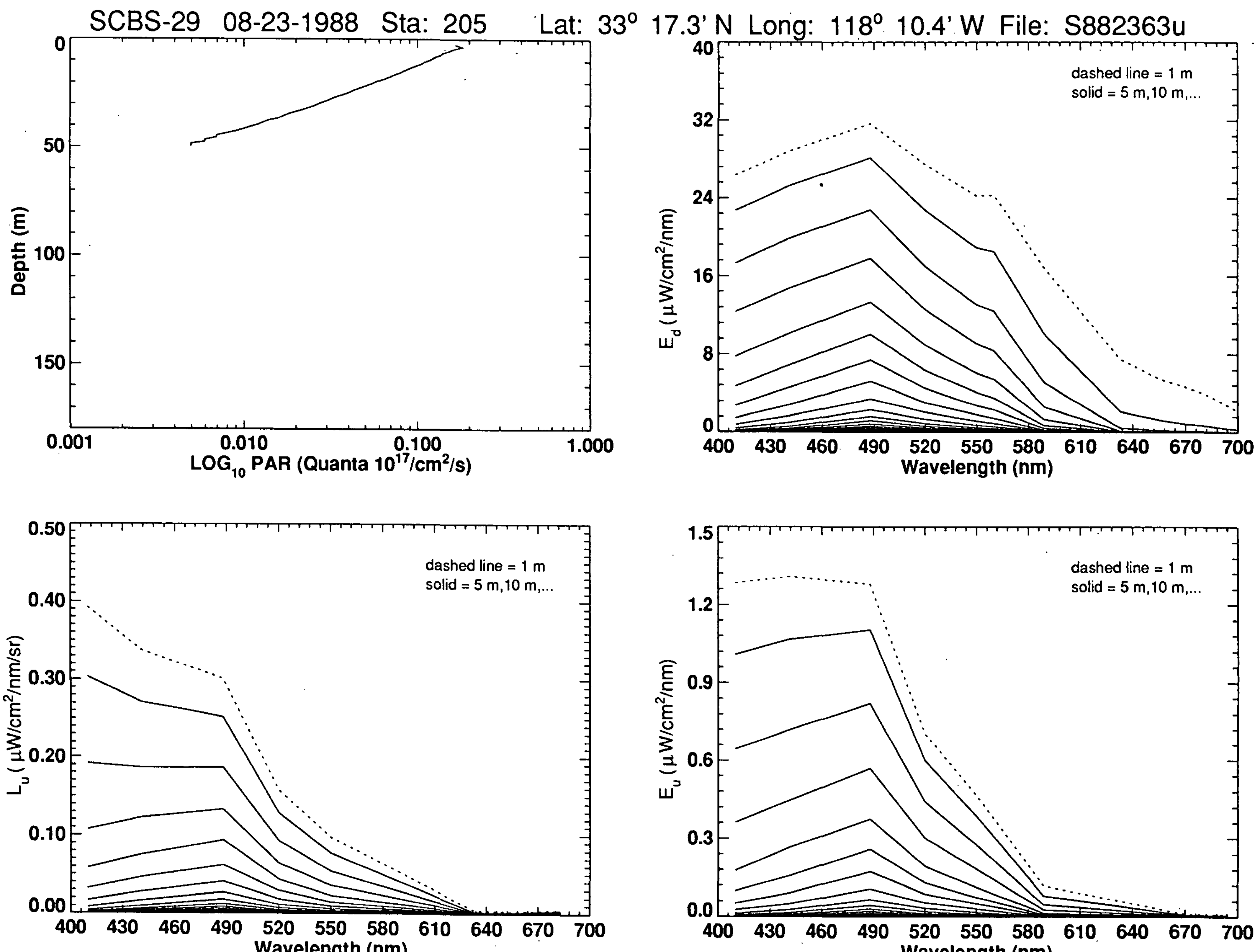


Figure 22. Continued

SCBS-29 08-25-1988 Sta: 202 Lat: 33° 29.0' N Long: 117° 45.5' W File: S882381d

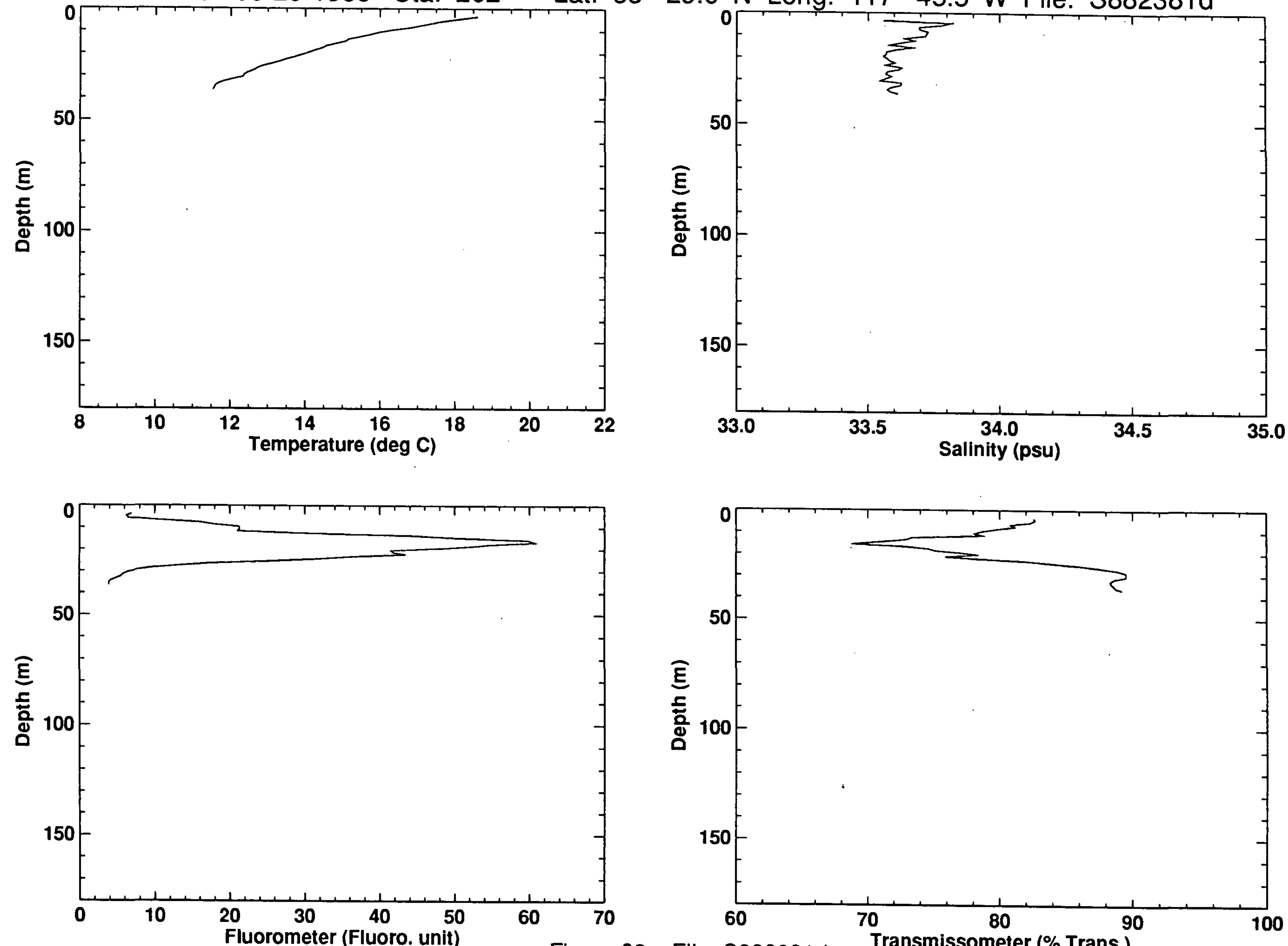


Figure 23. File: S882381d

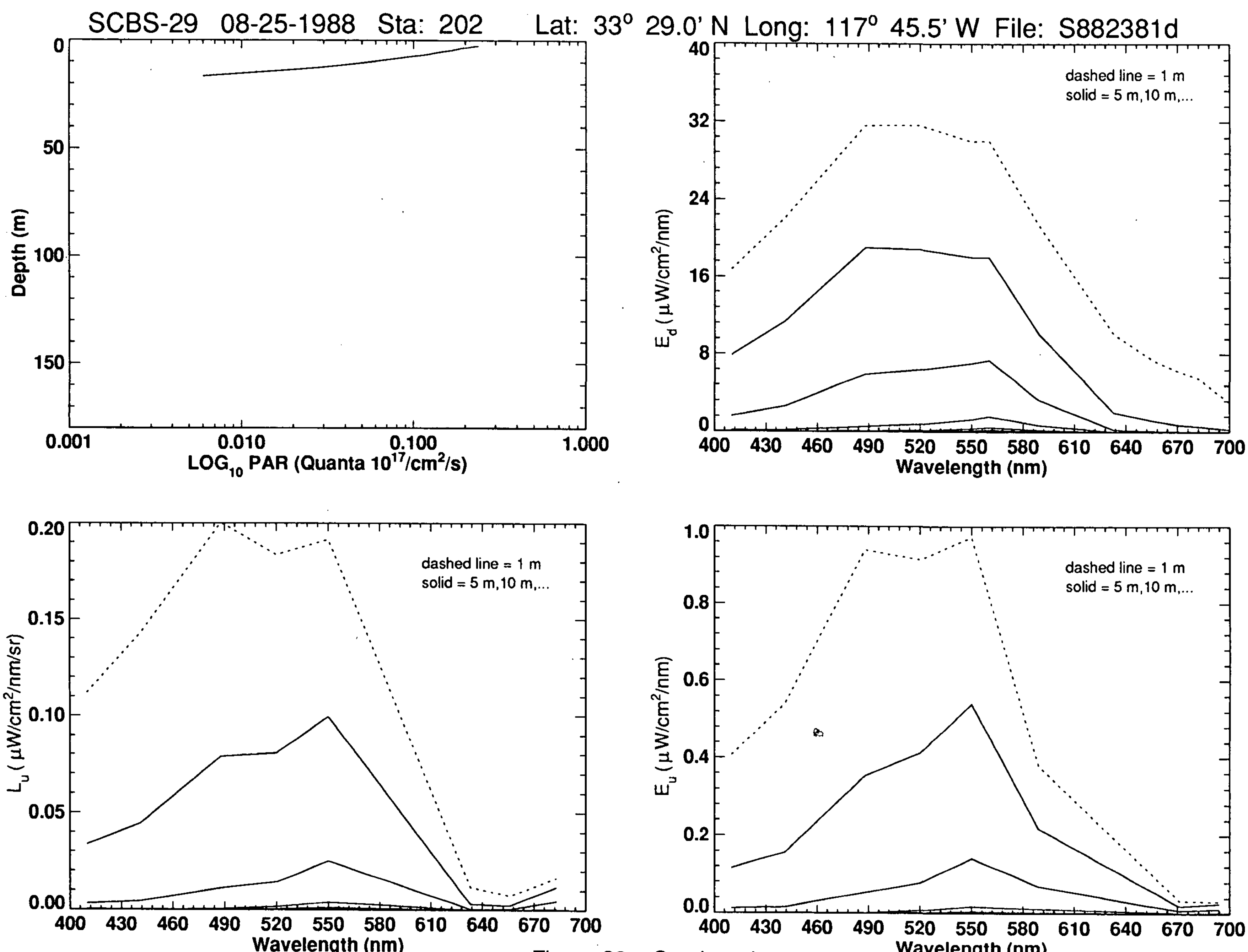
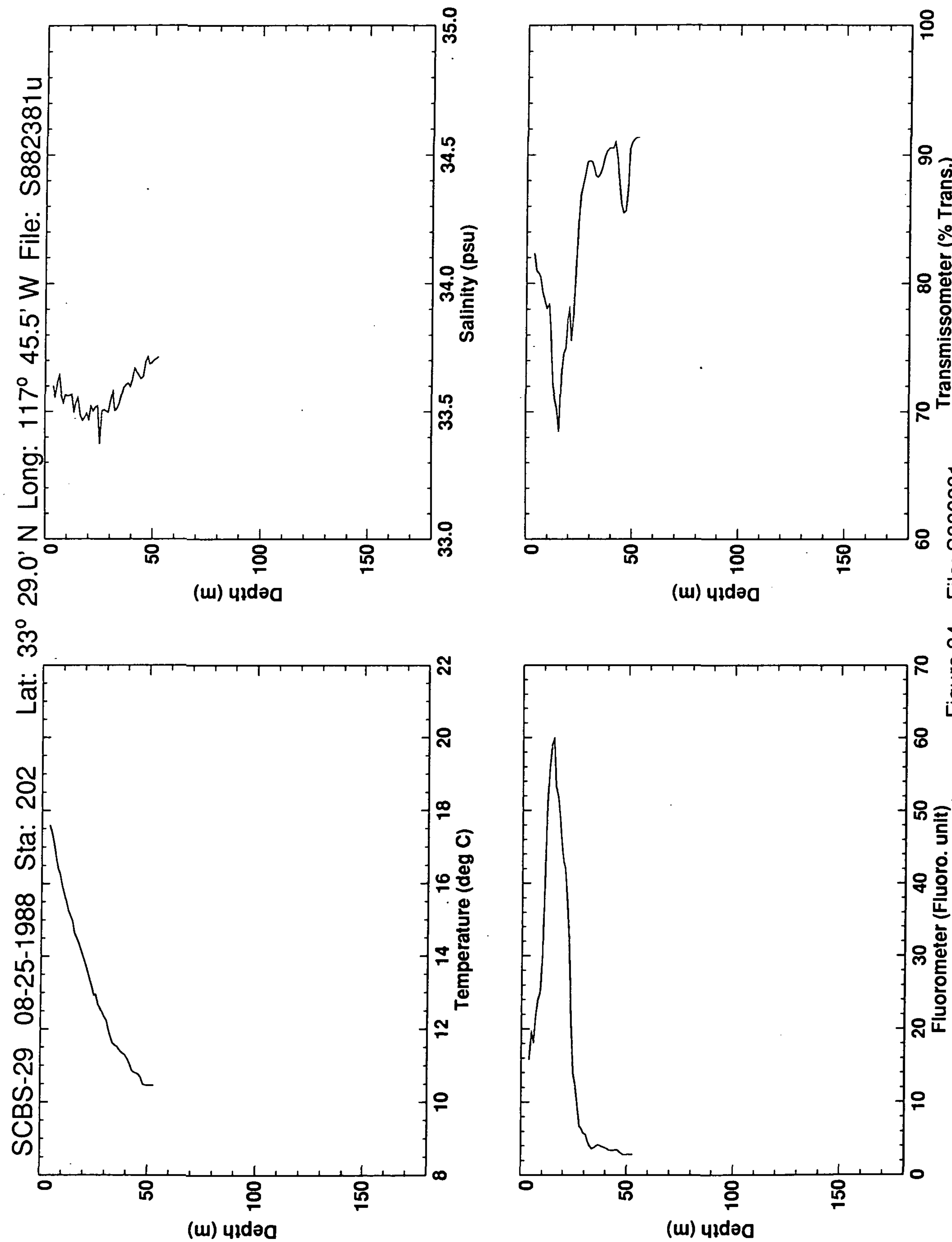


Figure 23. Continued



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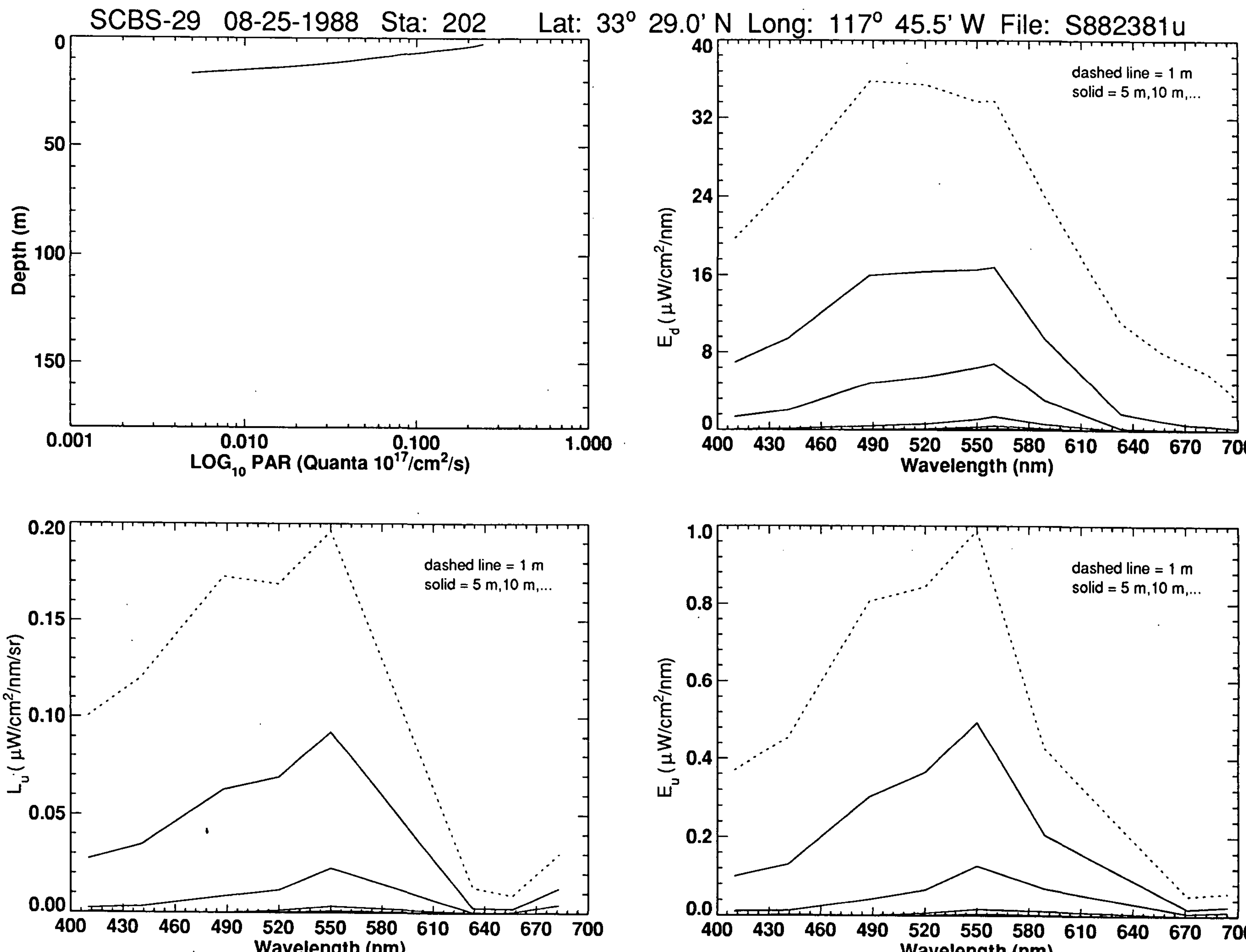


Figure 24. Continued

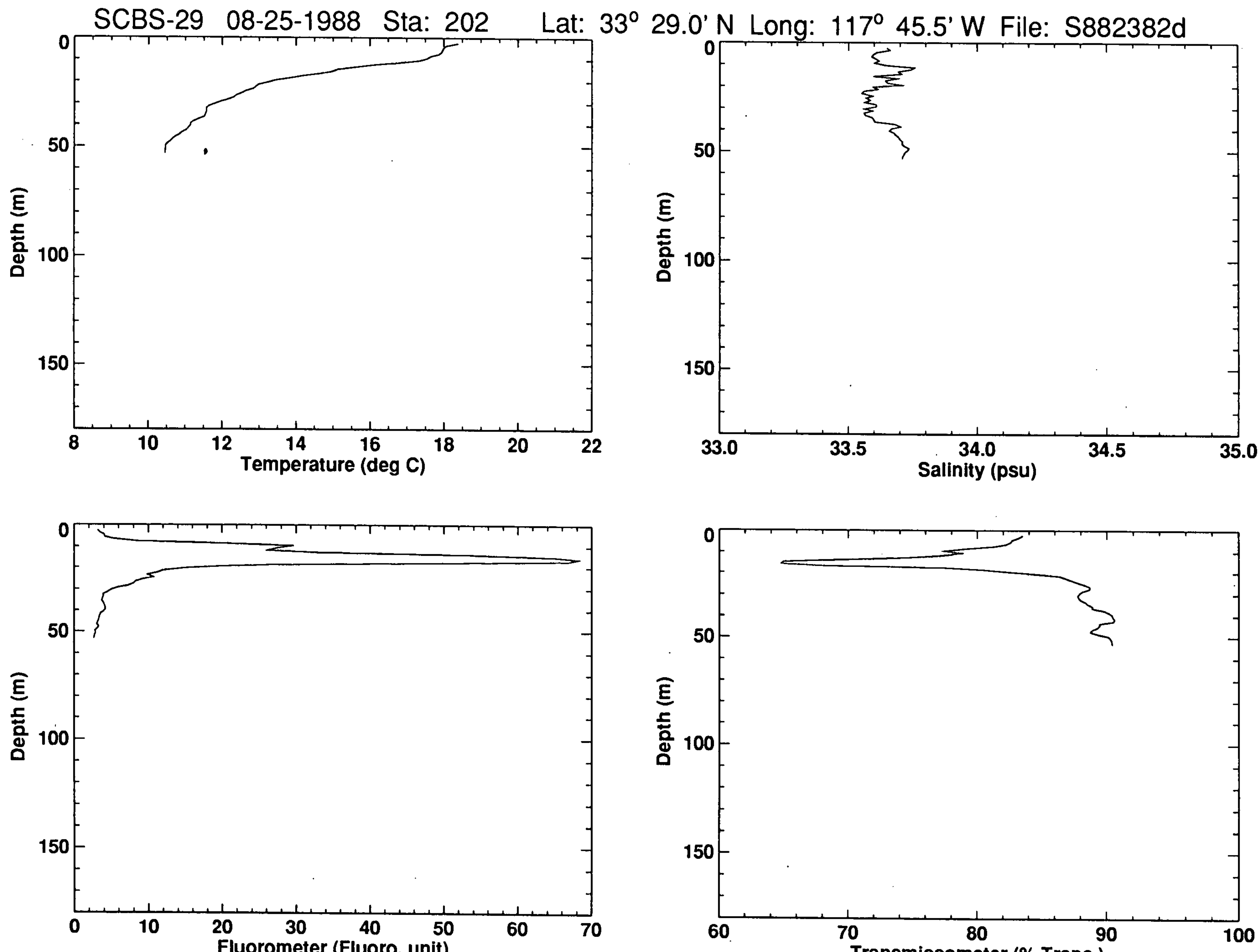


Figure 25. File: S882382d

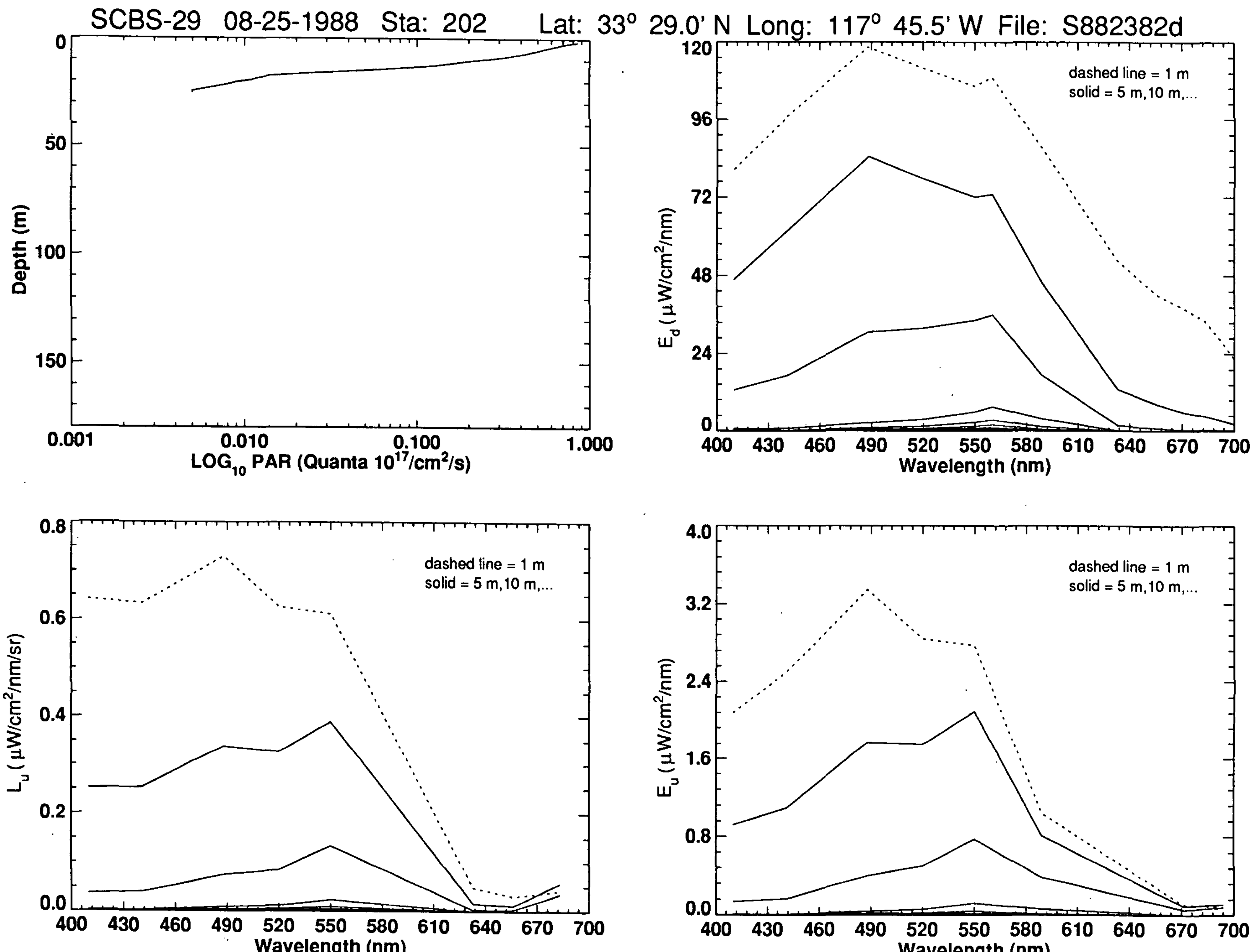


Figure 25. Continued

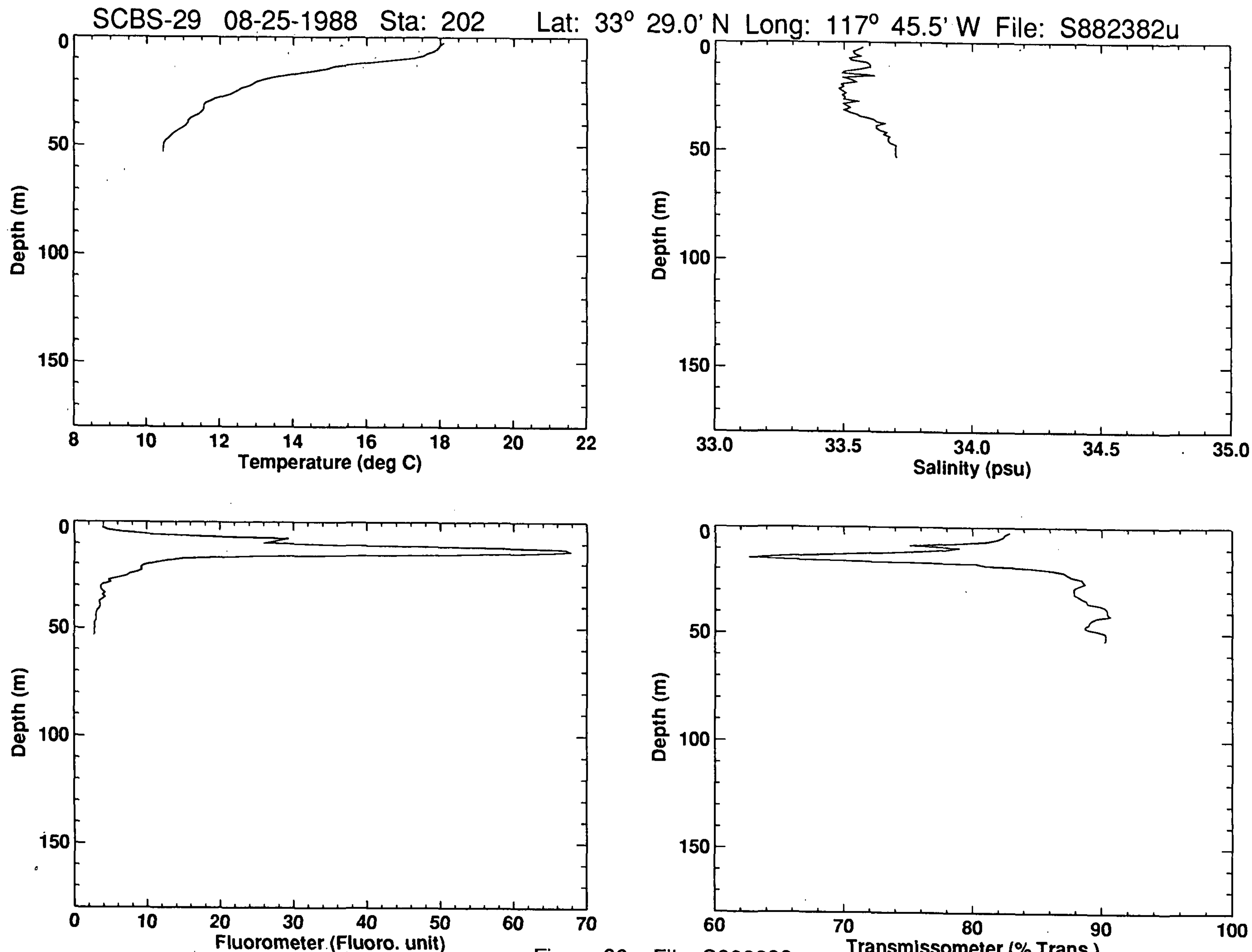


Figure 26. File: S882382u

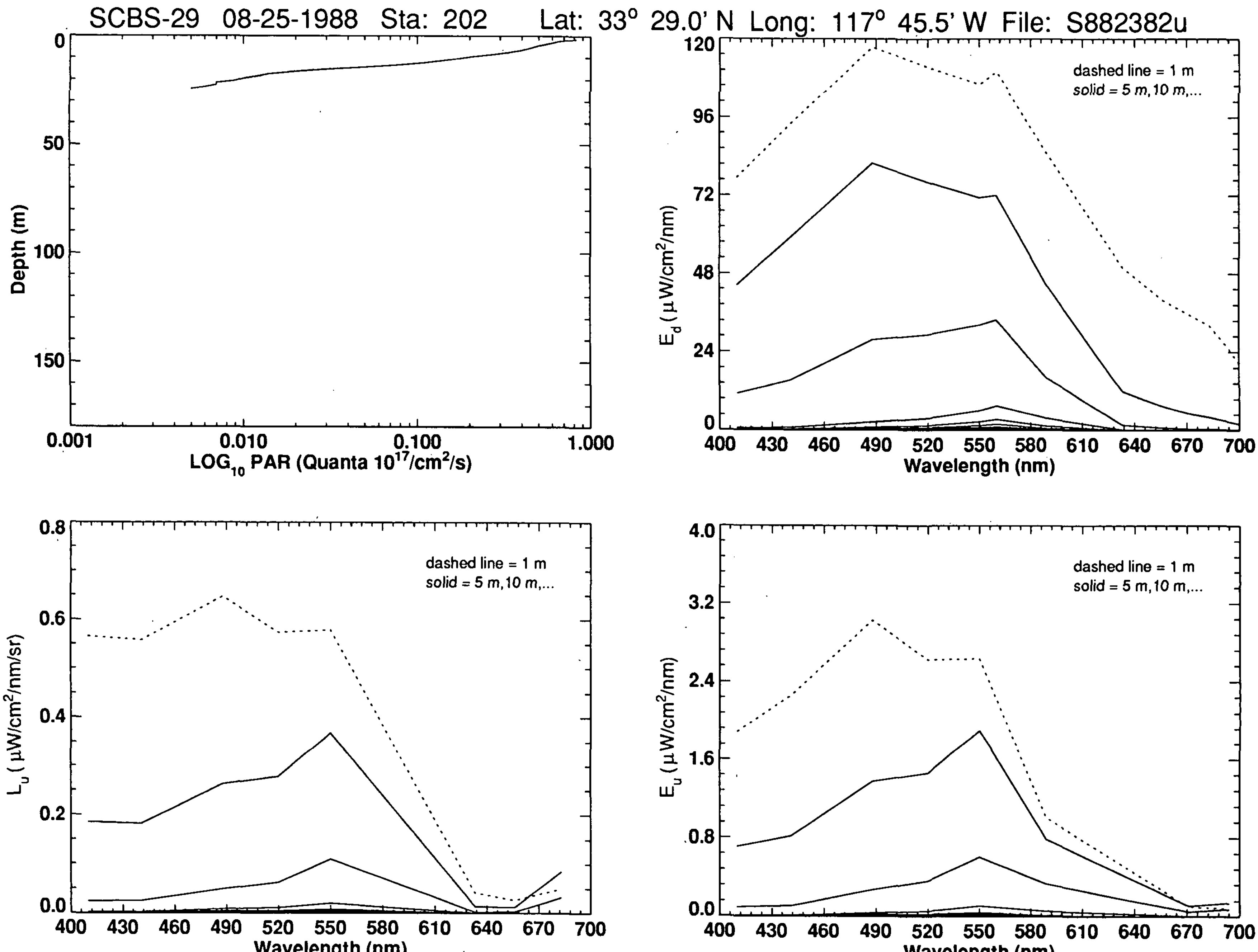


Figure 26. Continued

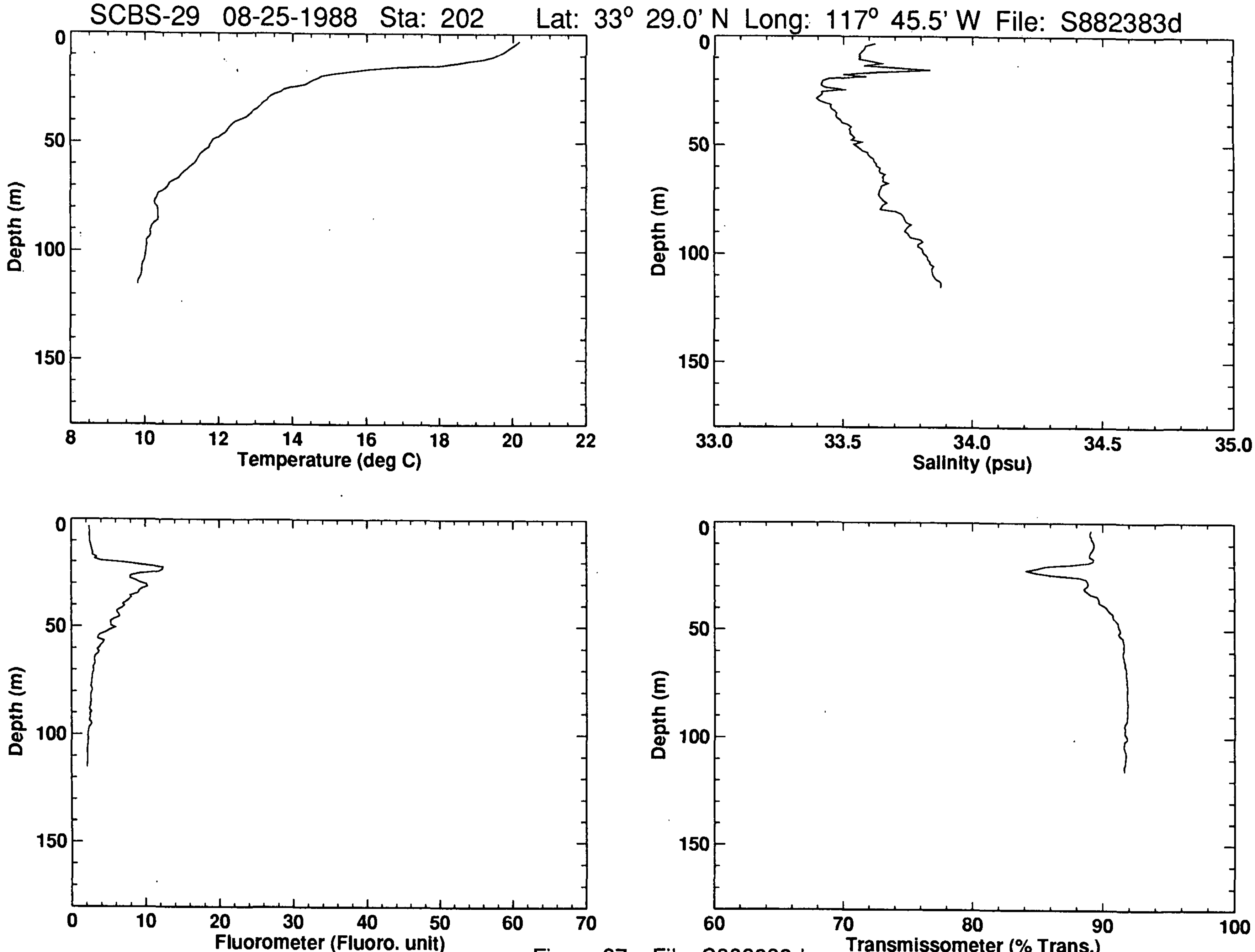


Figure 27. File: S882383d

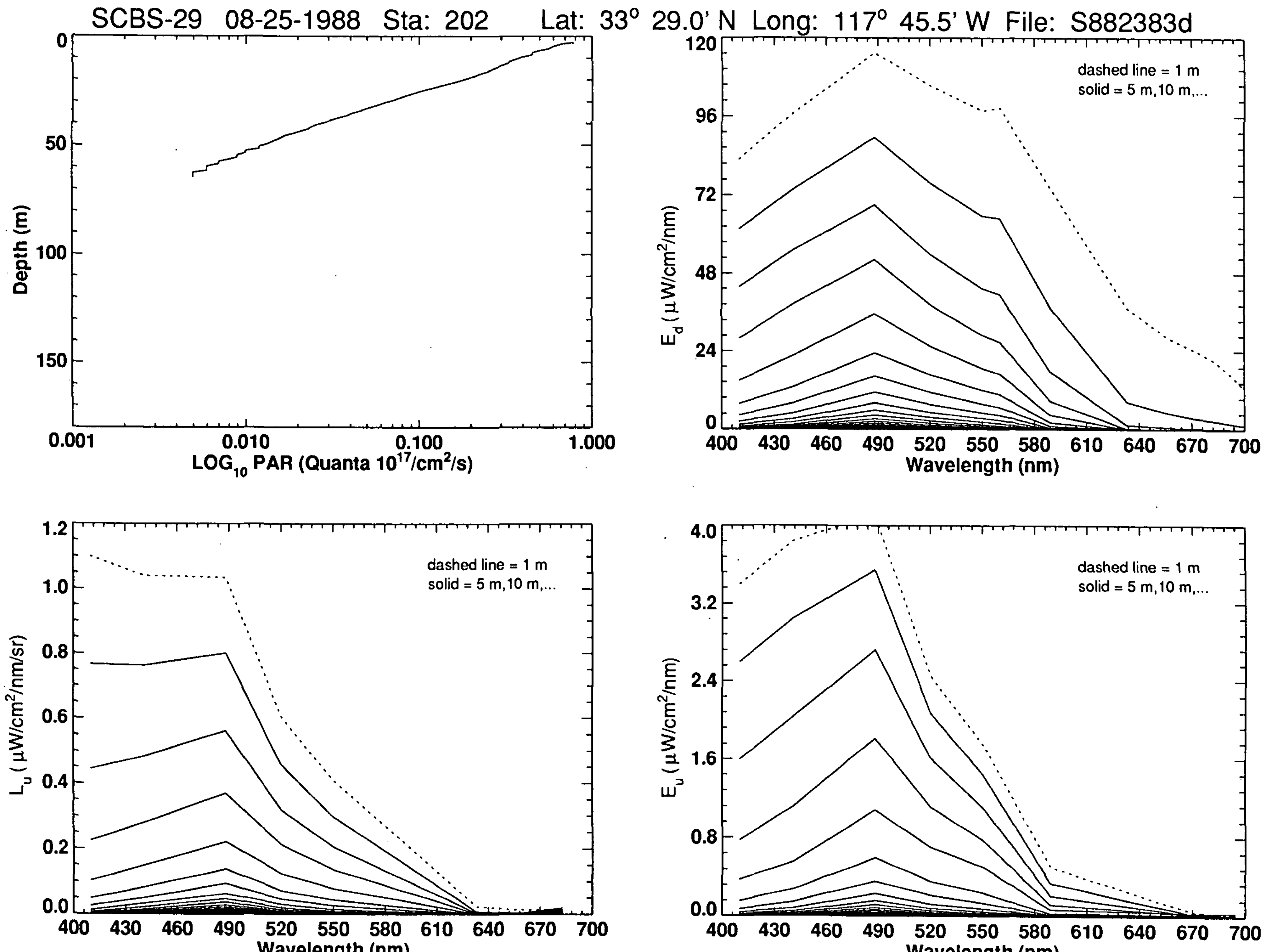
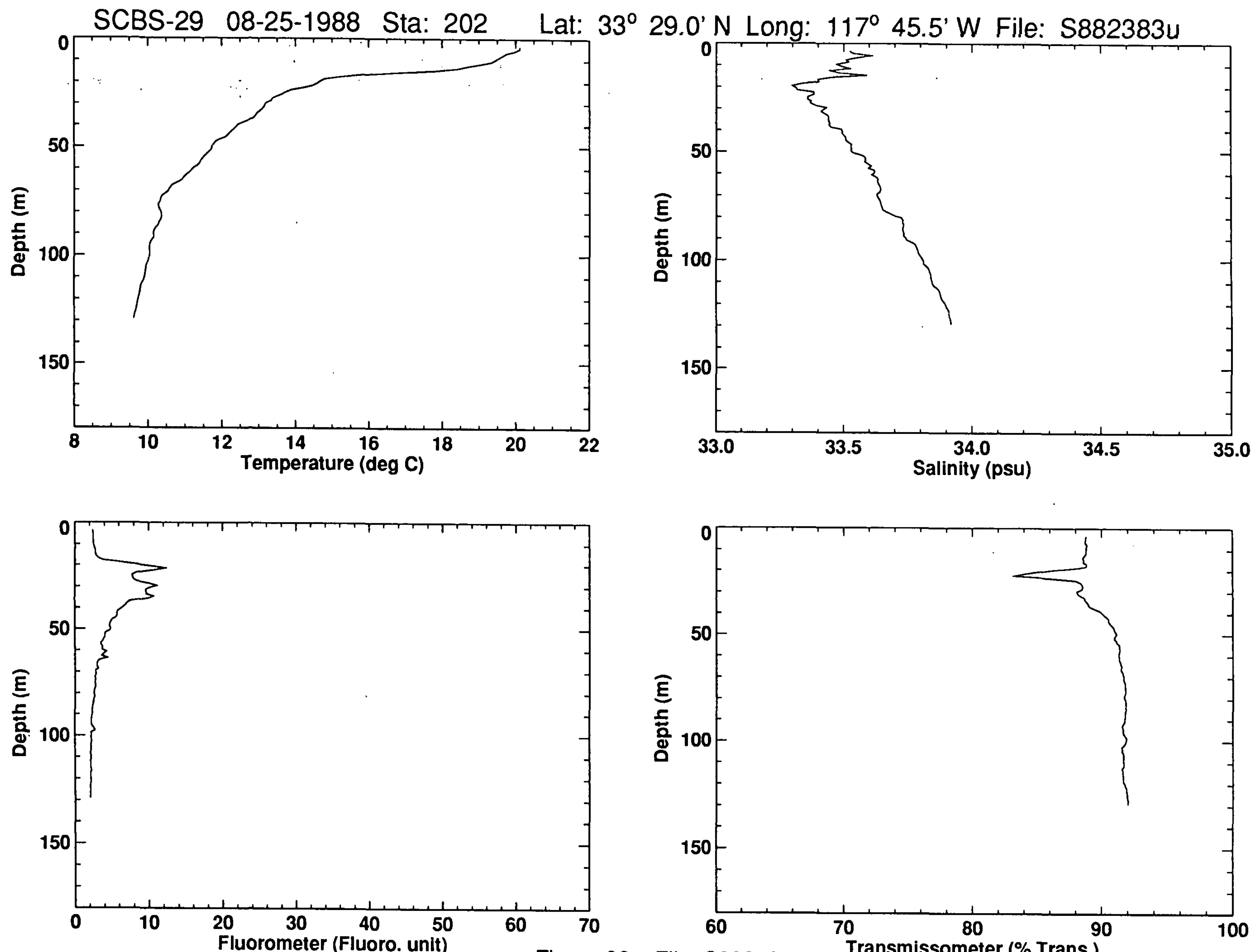


Figure 27. Continued



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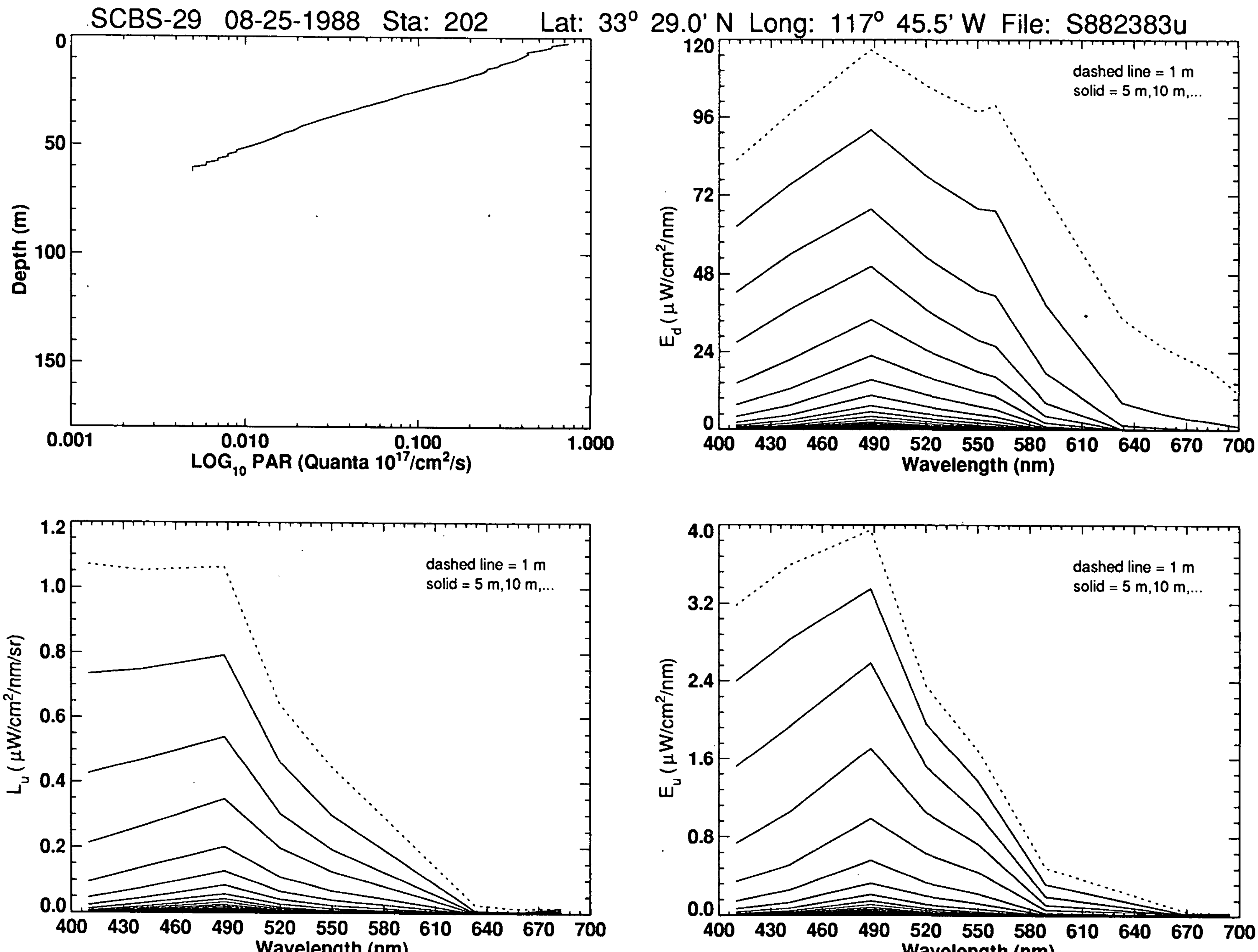

Figure 28. Continued