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Grain Size Distribution of the Surface Sediments Collected During the Lake Michigan Mass Balance and Environmental Mapping and Assessment Programs.

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GRAIN SIZE DISTRIBUTION OF THE SURFACE SEDIMENTS COLLECTED DURING THE LAKE MICHIGAN MASS BALANCE AND THE ENVIRONMENTAL MAPPING AND ASSESSMENT PROGRAMS

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1. INTRODUCTION

The Lake Michigan Mass Balance (LMMB) study, a national demonstration program within EPA, was initiated to develop improved strategies for management and control of toxic chemicals in the coastal environment. The program included measurement and modeling of the transport, fate, and bioaccumulation of four chemicals in Lake Michigan: PCB's (industrial compounds once widely used in a variety of products, banned since 1982), trans-nonachlor (a chlorinated hydrocarbon originally registered as a pesticide in 1948, banned by EPA in 1988), atrazine (the most widely used herbicide in U.S. corn and sorghum production), and mercury (a toxic element which occurs both naturally and anthropogenically). Over 80% of the inventories of PCBs, TNC, and mercury in Lake Michigan are stored in the sediments. Current estimates are that more of these compounds re-enter the water column via sediment-water exchange than via all of the combined external inputs.

The goals of the sediment component of this program were to:

1. Collect a comprehensive set of sediment cores with undisturbed interfaces.
2. Conduct radiochemical analyses to calculate the sediment accumulation and surface mixing rates.
3. Analyze the surface 1 cm of each core for the EPA target compounds, plus nutrients, grain size, and other model-required constituents.
4. Interpolate these data onto the hydrodynamic model (5 km) grid to provide initial conditions, rates, and distributions for the coupled hydrodynamic-sediment-contaminant transport model being developed by the EPA.

In planning the colection of samples, all available prior data (Lineback and Gross, 1972; Wickham et al., 1978; Cahill, 1981; Foster and Coleman, 1992; David Edgington and John Robbins, pers. comm.) were reviewed by a small group of Great Lakes sediment experts to fit the total number of sediment samples within available resources. The sites were selected with a bias toward over-collecting within the regions where modern sediments accumulate. Approximately 30% of the bottom is non-depositional while an additional 40% is considered transitional. It appears that non-depositional and transitional regions serve as temporary repositories for recently introduced particle-associated constituents, including radiotracers, contaminants, and nutrients, but they are very difficult to sample.

The objective of this component of the LMMB program is to accurately estimate the inventory of exchangeable contaminants in the sediments and estimate the rates associated with the cycling of these materials. One major parameter known to control contaminant distribution and transport in sediments is the sediment grain size distribution. This report describes the results of the analyses of grain size distribution in Lake Michigan surface sediments.

2. SEDIMENT SAMPLING

Two major coring cruises were conducted during the LMMB study, August-September, 1995 and May, 1996. The first step in coring protocol on the LMMB cruises was to collect a sediment grab using a PONAR. If the sediment appeared suitable, a box core was collected. Box coring was the preferred technique for obtaining a relatively

undisturbed sample of the sediment-water interface. This technique also allowed for the collection of four replicate sub-cores from the same box allowing for optimal sample handling/processing for various analytical procedures. The cores were approximately 50 cm long and represented decades to over a century of lake history. All four cores were sliced at 1 cm intervals. The first core was used for radionuclides, mercury, porosity, nutrients, carbon, and grain size analyses. The second core was immediately frozen and is being archived at EPA-Grosse Ile. The third and fourth cores taken at 1 cm intervals were combined to provide sufficient material for the analysis of PCB congeners and trans-nonachlor. There were 55 box cores collected during the program (Figure 1). At six sites, where high quality box cores could not be retrieved, gravity cores were collected. The remaining sites were in areas where modern sediments do not accumulate and only PONARs were collected. In all cases, sub-samples for grain size analysis were taken from the upper 1 cm of sediment and stored in a refrigerator until analysis.

In an effort to obtain greater nearshore coverage, the 61 LMMB samples were augmented with 64 PONAR samples collected in July and October, 1994 for the EPA- Environmental Mapping and Assessment (EMAP) program. As for the LMMB samples, sub-samples for grain size analysis were taken from the upper 1 cm of sediment and stored in a refrigerator until analysis.

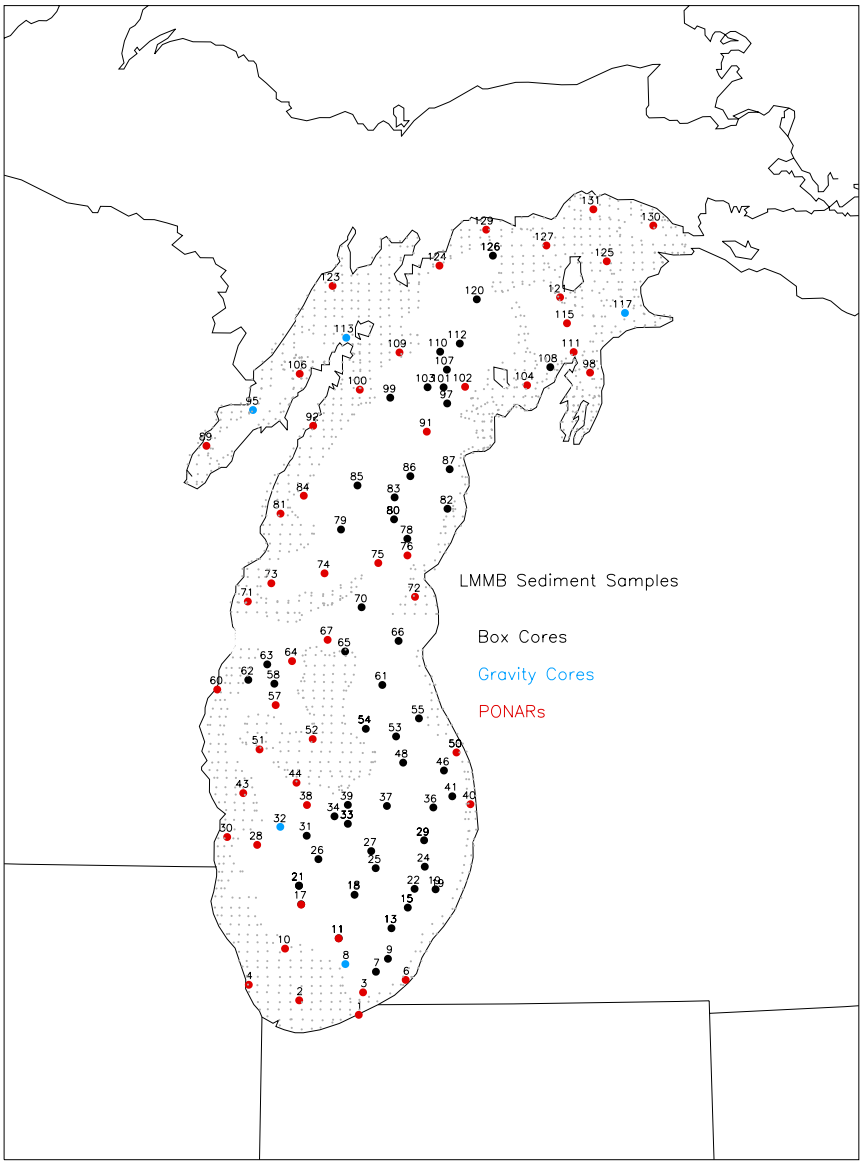

Figure 1. Station numbers and coring locations are shown and color keyed for the collection device. The gray stippled region is the area identified as non-depositional based on the thickness of the gray clay member (Wickham et al., 1978).

3. PARTICLE SIZE DISTRIBUTION MEASUREMENTS

Prior to sub-sampling, the samples were brought to room temperature and manually stirred with an aluminum spatula. Enough dispersant (0.2 % w/v sodium polyphosphate in DI water) was added to cover the solids. A 10 gram aliquot of the sample was sieved through a 2000 μm sieve followed by a 1000 μm sieve. The material that was retained on the sieves was placed into a preweighed, pre-washed, numbered pan. The pan was placed in an oven at 105^0 C and dried overnight. Weights were recorded to the nearest 0.001 gram. The material that passed through the sieve was collected in a Nalgene bottle. All samples were analyzed using a Helium Neon laser beam of 632.8 nm and a Tungsten lamp of 50 w for the measurement (Horiba Instrument Incorporation, LA-900). A one gram sub-sample was introduced to the LA-900 after a blank measurement, and a series of three analyses were performed under specified conditions. The results were displayed on the computer system dedicated to the LA-900 (Tables 1 and 2). All samples were analyzed based on the assumption that the primary sample component was sand (i.e., SiO_2; optical properties of the particles were required). Blanks and standard reference materials were routinely run with the samples. It was not possible to take sub-samples of the <1000 μm portion for replicate analysis of each sample. The two sets of samples (LMMB and EMAP) were run separately with an interval of nearly two years between the analyses. The only difference in the procedures was that the size interval bins were different for the two sample sets; which contributed to the necessity for numerical interpolation (see below).

4. QUALITY ASSURANCE

Approximately 30% of all analyses were blanks, standard reference materials, and field replicates. Based upon the distribution characteristics of the reference materials, the method detection limit was 0.007 μm with a standard error of 10%. The mean percent relative difference for instrumental replicates was less than 10% on Standard Reference Material (0.041, 0.100, and 0.501 μm; Duke Scientific Corporation). Four sets of duplicate samples collected from the same cores (15, 29, 54, and 80) and one from duplicate box cores (32) illustrate the replication achieved (Figure 2) .

5. SIZE INTERPOLATION

Although numerous size intervals were measured (Tables 1 and 2), there were requests from modelers and program principal investigators to provide size distribution information for sizes between measured intervals. Different fitting algorithms were explored and a simple linear interpolation was found to introduce the least imagination into the data spectrum. All data were interpolated, and mass distributions were calculated for each 4 μm interval from 0 to 64 μm (Table 3); selected composites are presented in Table 4.

6. SPATIAL INTERPOLATION

Thousands of sub-samples were distributed to collaborating investigators for analysis of a suite of sediment characteristics (e.g., porosity, grain size) and chemical constituents (e.g., organic carbon, PCBs). After exploring several interpolation approaches, the natural neighbor technique (Watson, 1994) was selected because of its facility with non-uniform datum and maintaining the measured values at the datum points. All sediment data have been interpolated, and calculated concentrations at the mid-point of the approximately 2000 model-grid points have been submitted to the EPA modeling team. Contour plots of both incremental (4 μm) and cumulative particle size distributions are presented in the appendix.

7. DISCUSSION

Present estimates are that $1.8x10^6$ MT of mud and $3.8x10^6$ MT of sand enter the southern basin annually, and that the vast majority of that material comes from bluff erosion (Coleman and Foster, 1994). Depositional basins within the lake receive almost all of the mud and a significant fraction of the sand, although the transport processes are poorly

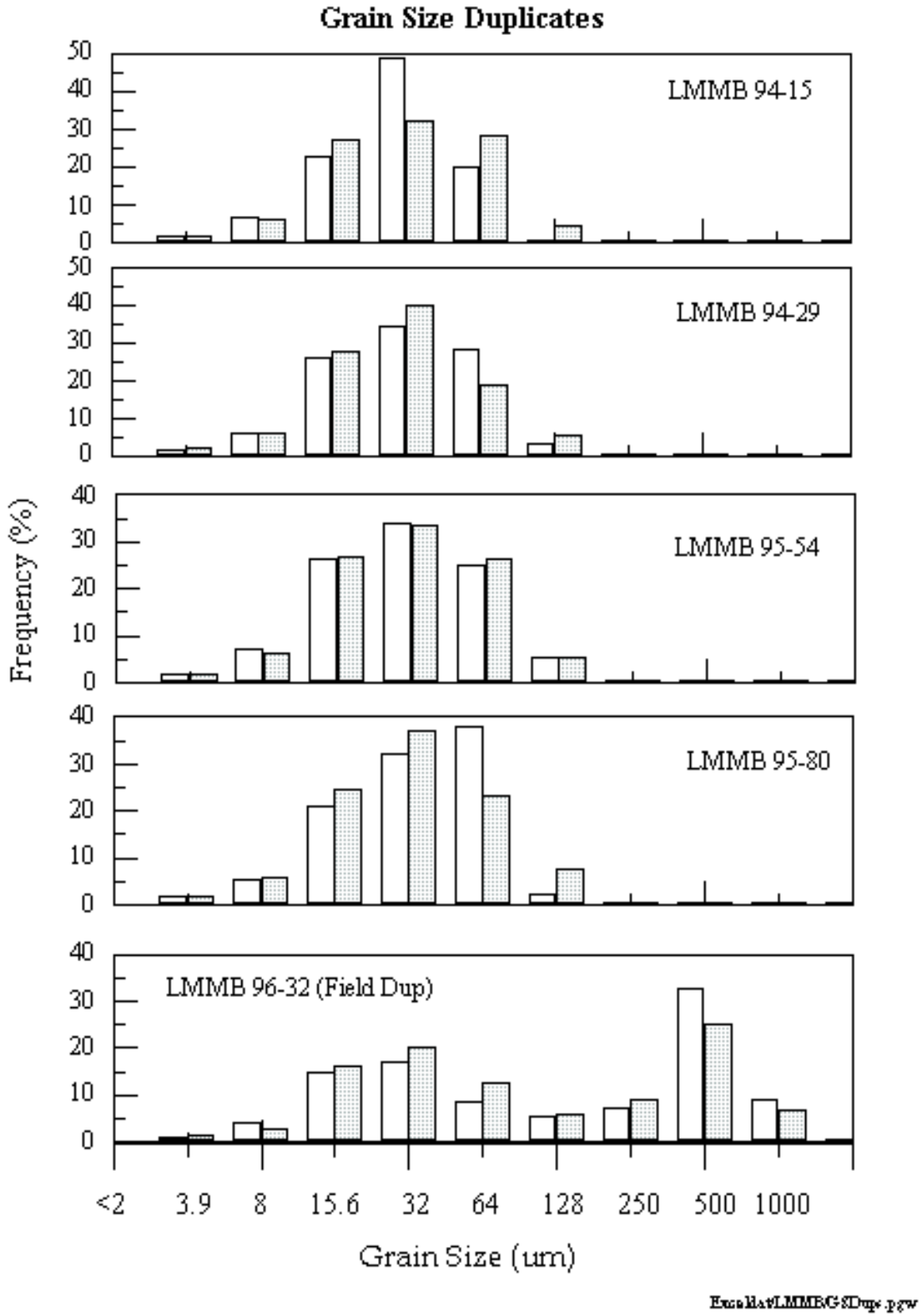

Figure 2. Size distributions for replicate samples.

understood. Radionuclide measurements indicate that active sediment-water exchange occurs via resuspension (Robbins and Eadie, 1991; Eadie et al., 1996) and that it takes an average of over 20 years for materials to reach their final destination (Robbins, pers. comm.).

Although 125 samples were collected from different stations during this effort, it is the 55 box cores collected in the depositional basins that represent the major contribution to our understanding of the sediments. Other sediment collection devices (PONAR, gravity, and shipek) approach the sediment interface during sample collection with a formidable bow wave which can seriously disturb the surface and result in samples biased against remobilizable sediments. At this time the box corer is the best device for collecting relatively undisturbed samples of the interface, and all analyses were conducted on the upper 1 cm of sediment of box cores that were visually inspected for interface quality. If the interface appeared disturbed, then the box was discarded and another collected until an acceptable sample was obtained.

The only earlier, lake-scale, report on sediment grain size distributions (and geochemistry) describes the analyses of 286 sediment samples collected in 1975 (Cahill, 1981). In that program a shipek grab was used and the upper 3 cm of the samples were homogonized prior to analysis. While this procedure was probably adequate for the non-depositional regions of the lake, the samples from the depositional areas were undoubtedly not as undisturbed as the box cores collected in the LMMB program. A synthesis of all 55 LMMB box cores (Figure 3) shows that most of the mass in these depositional samples is between 8 and 32 μm. This distribution is also apparent in the contour plots in the Appendix.

8. ACKNOWLEDGEMENTS

We would like to thank the crews of the *R Vs Shenehon*, *Lake Guardian*, and *Neeskay* along with Tom Nalepa, John Robbins, David Edgington, Nancy Morehead, and Pat Van Hoof for their assistance in sample collection. Eric Stabenau and Dave Schwab assisted with the data reduction and contouring.

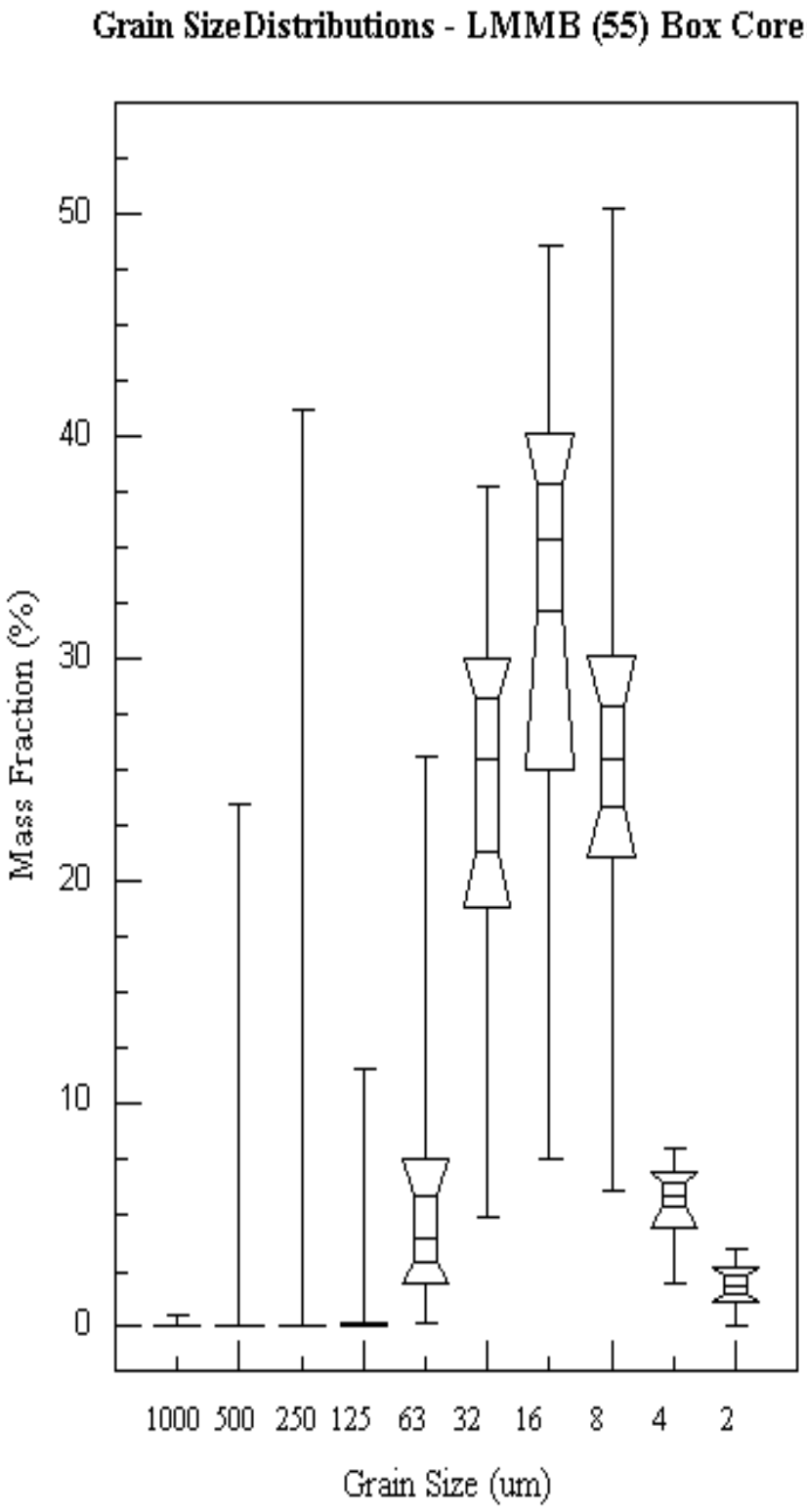

Figure 3. Size distribution of the 0-1 cm interval of the 55 box cores. The symbols represent the range, 10th, 25th, and 50th percentiles of the data.

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TABLES

				Mass (%) in Grain Size Interval									
Station	Lat	Long	Device	>1000um	1000-500	500-250	250-125	125-62.5	62.5-31	31-15.6	15.6-7.8	7.8-3.9um	3.9-2um
3	41.833	-86.907	Ponar	0.0	11.17	68.01	11.50	2.35	1.75	2.31	1.95	0.97	0.0
7	41.943	-86.829	Box Core	0.00	4.27	3.52	11.61	17.52	20.30	19.84	14.24	5.98	2.72
9	42.012	-86.756	Box Core	0.00	0.00	0.00	0.00	6.36	35.23	30.26	21.98	4.64	1.54
11	42.122	-87.054	Box Core	0.0	0.0	0.0	6.45	27.79	29.07	19.85	15.26	1.58	0.0
11	42.121	-87.055	Ponar	0.0	0.88	15.92	14.88	12.04	14.20	20.98	16.25	3.84	1.01
13	42.175	-86.734	Box Core	0.00	0.00	0.00	0.12	9.37	28.93	27.40	26.91	5.61	1.67
15	42.285	-86.634	Box Core	0.00	0.00	0.00	0.00	0.12	20.31	48.53	22.64	6.60	1.80
17	42.303	-87.283	Box Core	0.0	0.0	0.0	1.74	9.47	30.18	26.69	25.72	5.12	1.07
18	42.301	-87.283	Ponar	0.0	0.0	0.0	0.00	4.22	25.89	35.64	27.14	5.07	2.04
18.1	42.354	-86.958	Box Core	0.0	0.0	0.0	0.00	5.38	27.54	37.14	23.79	4.94	1.21
19	42.382	-86.464	Box Core	0.00	0.00	0.00	0.09	5.71	31.22	28.28	26.88	5.91	1.91
21	42.402	-87.297	Box Core	0.0	0.0	0.0	0.0	5.18	20.51	41.67	25.69	5.87	1.09
21.1	42.402	-87.297	Box Core	0.00	0.00	0.00	0.00	3.15	26.93	37.12	25.79	5.59	1.41
22	42.385	-86.592	Box Core	0.00	0.00	0.00	0.00	1.31	19.85	45.10	25.62	6.39	1.73
24	42.503	-86.529	Box Core	0.00	0.00	0.00	0.00	3.00	17.49	41.94	27.72	7.34	2.51
25	42.496	-86.829	Box Core	0.00	0.00	0.00	0.00	3.97	28.95	37.95	23.28	4.64	1.21
26	42.544	-87.179	Box Core	0.00	0.00	0.00	0.00	2.22	25.52	37.62	26.36	6.38	1.91
27	42.587	-86.856	Box Core	0.00	0.00	0.00	0.15	6.07	27.64	36.99	23.21	4.42	1.53
29	42.644	-86.532	Box Core	0.00	0.00	0.00	0.00	3.25	28.42	34.37	26.26	6.02	1.68
30	42.660	-87.738	Ponar	0.17	7.65	49.51	10.44	5.51	6.65	7.08	8.33	2.52	2.14
31	42.669	-87.251	Box Core	0.00	0.00	0.00	0.00	4.14	26.90	36.45	25.58	5.64	1.30
32	42.716	-87.413	Gravity Core	0.0	0.0	0.0	0.0	4.77	27.86	35.53	25.02	5.51	1.32
33	42.733	-86.999	Box Core	0.00	0.00	0.00	0.00	3.42	25.79	39.47	24.45	5.12	1.73
34	42.773	-87.081	Box Core	0.00	0.00	0.00	0.09	5.59	28.35	37.96	21.50	5.32	1.20
36	42.819	-86.474	Box Core	0.00	0.00	0.00	0.00	3.01	18.72	39.75	30.20	5.80	2.52
37	42.828	-86.759	Box Core	0.00	0.00	0.00	0.00	4.56	21.70	35.37	30.14	6.30	1.93
38	42.833	-87.250	Ponar	0.0	0.0	0.0	0.0	5.12	27.44	33.19	26.57	6.10	1.56
39	42.834	-86.999	Box Core	0.00	0.00	0.00	0.00	3.46	21.85	42.63	25.32	5.26	1.48
41	42.878	-86.357	Box Core	0.00	0.00	0.00	0.00	2.78	19.00	38.73	30.74	6.61	2.15
44	42.952	-87.315	Ponar	0.0	18.38	20.52	6.22	6.48	12.06	17.98	13.72	3.77	0.87
46	43.016	-86.407	Box Core	0.00	0.00	0.00	0.08	3.43	17.80	20.12	50.17	6.59	1.80
48.1	43.059	-86.658	Box Core	0.00	0.00	0.00	0.00	3.62	28.54	35.82	25.12	5.70	1.19
50	43.112	-86.329	Ponar	2.01	35.44	49.68	4.54	1.79	1.98	2.40	2.16	0.00	0.00
51	43.129	-87.544	Ponar	0.59	23.46	41.23	10.27	3.80	4.93	7.54	6.13	2.01	0.04
52	43.185	-87.216	Ponar	5.11	86.43	1.09	0.00	0.00	1.41	2.68	2.74	0.55	0.00
53	43.199	-86.701	Box Core	0.0	0.0	0.0	0.0	7.01	20.95	23.99	40.08	6.36	1.62

Table 1. Measured grain size data for the LMMB suface (0-1 cm) sediments.

54	43.240	-86.888	Box Core	0.00	0.00	0.00	0.08	5.53	24.96	34.08	26.23	7.16	1.96
55	43.295	-86.559	Box Core	0.00	0.00	0.00	0.00	2.73	19.54	34.75	34.49	6.12	2.37
57	43.366	-87.446	Ponar	0.0	13.45	27.90	6.53	5.75	8.51	21.68	12.53	3.27	0.38
58	43.480	-87.455	Box Core	0.00	0.00	0.00	0.00	3.48	26.77	37.26	24.75	5.88	1.86
61	43.474	-86.785	Box Core	0.00	0.00	0.00	0.00	2.02	21.00	38.11	29.71	7.02	2.14
62	43.500	-87.617	Box Core	0.00	0.00	0.00	0.66	7.80	27.53	32.89	23.53	5.88	1.72
63	43.583	-87.500	Box Core	0.00	0.00	0.00	0.00	6.01	28.08	31.68	25.69	7.07	1.47
64	43.601	-87.346	Ponar	0.0	0.0	0.0	0.0	1.92	22.56	38.42	27.88	6.88	2.35
65	43.653	-87.016	Box Core	0.00	0.00	0.00	0.00	1.97	30.75	34.33	25.30	5.83	1.81
66	43.709	-86.683	Box Core	0.00	0.00	0.00	0.00	0.87	27.36	34.23	28.50	6.95	2.07
67	43.715	-87.125	Ponar	0.0	4.16	7.85	6.90	13.78	21.90	23.07	17.20	4.08	1.06
70	43.889	-86.913	Box Core	0.00	0.00	0.00	0.00	2.63	22.56	36.05	29.89	6.51	2.36
73	44.016	-87.478	Ponar	0.00	1.47	6.96	12.08	39.22	13.63	13.94	10.37	2.31	0.02
74	44.070	-87.145	Ponar	23.03	60.39	7.84	0.81	0.87	2.03	2.49	1.89	0.65	0.00
75	44.125	-86.808	Ponar	0.00	0.92	4.82	6.45	16.38	25.78	25.94	15.66	3.30	0.75
76	44.165	-86.625	Ponar	0.00	0.00	0.00	0.00	0.29	17.12	37.28	32.66	9.27	3.38
78	44.254	-86.625	Box Core	0.00	0.00	0.00	0.00	3.92	25.85	39.65	21.77	6.31	2.51
79	44.304	-87.042	Box Core	0.00	0.00	0.00	0.00	1.76	29.08	32.83	24.84	7.98	3.52
80	44.358	-86.708	Box Core	0.00	0.00	0.00	0.00	2.09	37.76	32.01	21.11	5.37	1.65
82	44.413	-86.371	Box Core	0.00	0.00	0.00	0.00	3.04	21.63	35.77	29.25	7.58	2.72
83	44.475	-86.704	Box Core	0.00	0.00	0.00	0.15	6.07	27.64	36.99	23.21	4.42	1.53
84	44.484	-87.277	Ponar	0.0	3.16	8.58	10.88	17.18	20.51	23.34	13.58	2.72	0.04
85	44.539	-86.938	Box Core	0.00	0.00	0.00	0.00	5.29	29.94	32.45	24.18	5.85	2.29
86	44.588	-86.604	Box Core	0.00	0.00	0.00	0.00	4.26	33.03	31.45	23.89	5.59	1.78
87	44.624	-86.355	Box Core	0.00	0.00	0.00	0.00	4.04	21.19	38.09	28.35	5.86	2.47
91	44.825	-86.498	Ponar	0.0	0.0	0.0	0.14	3.53	19.28	36.42	30.27	6.76	3.61
97	44.975	-86.367	Box Core	0.00	0.00	0.00	0.00	3.10	24.71	34.54	27.95	6.71	2.99
99	45.007	-86.729	Box Core	0.00	0.00	0.00	0.00	6.33	24.70	35.62	25.77	4.95	2.63
101	45.061	-86.389	Box Core	0.00	0.00	0.00	0.00	3.00	22.88	36.45	28.67	6.16	2.85
102	45.063	-86.252	Ponar	6.33	80.84	0.00	0.00	0.60	3.59	4.57	3.52	0.54	0.00
103	45.062	-86.491	Box Core	0.00	0.00	0.00	0.00	2.87	28.09	35.30	24.24	6.84	2.66
107	45.155	-86.367	Box Core	0.00	0.00	0.00	0.00	4.55	25.41	31.72	28.54	6.98	2.80
108	45.163	-85.707	Box Core	0.00	0.00	0.00	0.00	5.64	28.07	37.13	22.54	5.52	1.10
110	45.251	-86.409	Box Core	0.00	0.00	0.00	0.00	2.86	23.89	40.77	24.72	5.88	1.88
112	45.294	-86.283	Box Core	0.00	0.00	0.00	0.00	6.06	25.39	34.40	26.25	5.80	2.11
115	45.396	-85.595	Ponar	7.02	73.01	0.00	0.00	3.25	6.50	6.68	3.55	0.0	0.0
120	45.529	-86.171	Box Core	0.00	0.00	0.00	0.67	11.54	27.54	35.39	20.41	3.65	0.80
126	45.761	-86.064	Box Core	0.00	0.00	0.00	7.08	25.65	24.73	24.78	15.21	2.56	0.00

Table 1. (Cont.)

				Mass (%) in Grain Size Interval			
Station	Lat	Long	Device	>2000	2000-1000	1000-500	500-300
1	41.713	-86.933	Ponar	0.00	0.03	0.51	1.70
2	41.790	-87.293	Ponar	0.00	14.63	60.48	12.43
4	41.872	-87.598	Ponar	0.00	0.76	2.90	15.57
6	41.899	-86.649	Ponar	1.66	5.11	15.47	23.97
8	41.984	-87.014	Gravity Core	0.00	0.17	0.96	3.28
10	42.066	-87.380	Ponar	6.06	0.13	3.02	13.42
13	42.175	-86.734	Box Core	0.00	0.00	0.41	2.53
19	42.382	-86.464	Box Core	0.00	0.00	0.21	1.27
28	42.619	-87.554	Ponar	0.00	1.17	7.91	25.73
40	42.835	-86.246	Ponar	0.00	0.04	0.28	9.37
43	42.895	-87.642	Ponar	0.52	1.50	8.60	31.10
50	43.112	-86.329	Ponar	0.00	0.10	0.55	4.48
60	43.447	-87.809	Ponar	0.00	0.32	0.78	1.13
71	43.918	-87.624	Ponar	0.00	0.08	2.78	13.19
72	43.944	-86.579	Ponar	0.06	0.51	8.24	48.83
81	44.388	-87.423	Ponar	0.00	0.20	3.36	18.55
89	44.747	-87.895	Ponar	0.05	0.19	0.60	7.87
92	44.857	-87.219	Ponar	0.00	0.00	0.42	53.44
95	44.940	-87.602	Gravity Core	0.00	0.09	0.44	2.36
98	45.131	-85.454	Ponar	0.00	0.05	8.04	47.45
100	45.050	-86.923	Ponar	0.00	0.03	3.60	27.32
104	45.068	-85.857	Ponar	0.00	0.28	12.17	53.88
106	45.134	-87.306	Ponar	0.00	0.63	2.89	18.96
109	45.248	-86.669	Ponar	0.00	0.14	5.01	52.51
111	45.242	-85.556	Ponar	0.00	0.23	8.10	36.96
113	45.327	-87.009	Gravity Core	0.00	0.01	0.47	2.05
117	45.446	-85.222	Gravity Core	0.00	0.32	3.26	18.66
121	45.535	-85.636	Ponar	0.00	0.23	16.50	51.67
123	45.603	-87.097	Ponar	0.00	0.04	1.64	32.01
124	45.710	-86.409	Ponar	0.62	2.47	44.64	40.03
125	45.723	-85.331	Ponar	0.00	0.63	11.25	55.14
127	45.812	-85.718	Ponar	0.00	0.66	4.16	13.16
129	45.900	-86.105	Ponar	0.00	0.13	0.75	7.98
130	45.909	-85.025	Ponar	0.00	0.24	2.82	8.34
131	46.001	-85.410	Ponar	0.00	0.08	0.38	1.54

Table 2. Measured grain size data for the EMAP surface (0-1 cm) sediments.

Mass (%) in Grain Size Interval							
300-150	150-75	60-70u	50-60u	40-50u	30-40u	20-30u	10-20u
50.96	36.34	1.27	0.57	0.83	0.41	0.19	1.60
5.92	0.66	0.22	0.31	0.62	0.25	0.00	1.15
49.72	19.89	0.62	0.73	0.88	0.00	0.61	3.94
34.04	13.41	0.54	0.21	0.03	0.17	0.51	1.25
10.42	12.91	0.00	9.54	4.43	6.75	0.53	3.06
43.48	17.70	1.37	1.57	0.87	0.04	0.78	3.81
6.77	5.55	0.00	6.55	5.20	5.65	3.30	12.15
2.85	1.79	0.34	1.69	8.39	3.63	22.75	23.06
31.16	6.94	0.69	0.00	1.69	0.27	1.82	7.14
69.98	14.75	0.00	0.00	0.00	0.00	0.00	0.28
41.09	2.91	0.61	0.19	1.54	0.34	1.40	3.40
20.35	58.75	0.65	0.95	0.45	0.25	2.13	2.84
20.79	72.83	0.00	0.27	0.08	0.03	0.51	0.61
38.94	26.74	1.77	0.30	1.91	0.97	2.84	4.29
33.97	0.24	0.00	0.26	0.00	0.00	0.19	1.78
44.06	14.39	0.35	0.32	0.52	0.19	2.53	5.76
38.54	41.31	1.08	0.92	1.51	0.00	0.00	2.31
37.97	2.77	0.00	0.00	0.00	0.03	0.13	2.53
10.98	32.02	3.39	0.97	2.74	3.46	8.82	20.00
30.29	1.53	0.66	0.86	1.47	0.00	1.44	2.36
40.01	11.37	0.17	1.18	3.15	0.00	0.32	3.15
19.17	0.45	0.29	0.70	0.46	0.76	0.76	3.07
45.84	21.71	0.75	0.95	0.78	0.14	0.64	2.51
33.04	1.08	0.40	0.43	0.49	0.00	0.89	2.60
37.59	5.03	0.47	0.42	0.79	0.51	0.03	2.96
20.37	50.38	2.24	0.23	0.98	6.13	6.52	6.69
24.23	5.76	4.84	1.89	2.58	1.85	5.24	14.67
19.13	1.42	0.49	0.30	0.75	0.29	1.08	2.58
60.50	2.21	0.00	0.18	0.13	0.00	0.00	0.80
4.34	0.21	0.00	0.12	0.86	0.00	0.00	1.49
29.23	0.23	0.28	0.00	0.00	0.00	0.02	0.90
25.58	30.86	1.36	1.55	2.44	0.00	1.19	8.92
73.76	13.09	0.18	0.04	0.11	0.00	0.00	1.14
14.09	48.55	3.31	1.38	1.32	4.33	3.40	4.40
5.21	38.94	1.63	2.66	6.59	0.00	3.82	21.85

Table 2. Continued.

	Mass (%) in Grain Size Interval						
Station	9-10u	8-9u	7-8u	6-7u	5-6u	4-5u	3-4u
1	0.23	0.23	0.28	0.33	0.34	0.42	0.59
2	0.16	0.12	0.15	0.14	0.21	0.33	0.40
4	0.44	0.23	0.43	0.42	0.42	0.38	0.44
6	0.17	0.15	0.18	0.25	0.28	0.34	0.42
8	21.22	2.14	2.38	2.43	2.34	2.38	2.34
10	0.47	0.44	0.55	0.58	0.72	0.78	0.95
13	24.26	2.32	2.46	2.63	2.49	2.54	2.60
19	3.10	2.91	2.82	2.44	2.50	2.38	3.10
28	0.84	1.18	1.23	1.09	1.35	1.50	1.81
40	1.09	0.17	0.17	0.20	0.20	0.33	0.43
43	0.47	0.40	0.52	0.48	0.62	0.64	0.77
50	0.36	0.43	0.50	0.54	0.58	0.65	0.89
60	0.23	0.08	0.12	0.22	0.36	0.32	0.31
71	0.51	0.49	0.49	0.46	0.47	0.48	0.61
72	0.30	0.29	0.27	0.40	0.41	0.64	0.76
81	0.71	0.98	0.58	0.64	0.82	0.98	1.06
89	0.38	0.33	0.39	0.48	0.49	0.59	0.65
92	0.46	0.01	0.11	0.09	0.29	0.46	0.26
95	2.65	2.36	2.24	1.84	1.42	1.15	0.97
98	0.43	0.41	0.46	0.56	0.67	0.72	0.75
100	0.49	0.57	0.68	0.65	0.79	1.01	1.23
104	0.56	0.49	0.69	0.64	0.78	0.91	1.00
106	0.35	0.39	0.40	0.46	0.41	0.45	0.50
109	0.40	0.38	0.40	0.40	0.38	0.39	0.31
111	0.42	0.42	0.52	0.58	0.67	0.79	0.89
113	0.57	0.61	0.48	0.47	0.40	0.38	0.25
117	1.62	1.64	1.82	1.59	1.45	1.67	1.67
121	0.42	0.46	0.53	0.59	0.58	0.67	0.68
123	0.23	0.11	0.19	0.18	0.25	0.27	0.24
124	0.33	0.30	0.40	0.42	0.51	0.60	0.65
125	0.25	0.13	0.11	0.15	0.26	0.26	0.32
127	1.06	1.25	1.21	1.22	1.17	1.08	0.88
129	0.25	0.22	0.37	0.32	0.22	0.27	0.28
130	0.65	0.65	0.81	0.75	0.81	0.90	0.88
131	2.24	2.44	2.48	2.33	1.90	1.56	1.18

Table 2. Continued.

Mass (%) in Grain Size Interval							
2-3u	1-2u	0.9-1u	0.8-0.9u	0.7-0.8u	0.6-0.7u	0.5-0.6u	0.4-0.5u
0.73	1.03	0.16	0.15	0.14	0.13	0.14	0.17
0.48	0.65	0.07	0.05	0.10	0.05	0.09	0.09
0.44	0.58	0.07	0.06	0.06	0.03	0.06	0.06
0.58	0.66	0.07	0.08	0.05	0.05	0.05	0.06
2.65	3.01	3.85	0.34	0.46	0.31	0.34	0.34
1.01	1.21	0.18	0.09	0.12	0.06	0.11	0.11
2.57	2.77	3.53	0.51	0.37	0.37	0.34	0.31
3.69	5.07	0.56	0.84	0.47	0.53	0.44	0.59
1.92	2.49	0.20	0.30	0.21	0.18	0.20	0.23
0.49	0.66	0.76	0.09	0.11	0.07	0.05	0.09
0.84	1.15	0.08	0.09	0.10	0.06	0.10	0.10
1.08	1.62	0.24	0.28	0.13	0.23	0.17	0.14
0.30	0.35	0.03	0.04	0.02	0.04	0.07	0.06
0.80	0.96	0.10	0.15	0.09	0.09	0.10	0.10
0.93	1.00	0.14	0.10	0.07	0.09	0.08	0.09
1.28	1.37	0.19	0.19	0.05	0.08	0.15	0.13
0.74	0.80	0.06	0.12	0.06	0.08	0.06	0.07
0.24	0.31	0.03	0.02	0.03	0.02	0.01	0.01
0.87	0.49	0.09	0.05	0.04	0.05	0.05	0.05
0.72	0.69	0.08	0.03	0.07	0.03	0.04	0.04
1.31	1.70	0.14	0.15	0.17	0.12	0.14	0.12
1.04	1.15	0.11	0.11	0.07	0.07	0.07	0.07
0.42	0.46	0.05	0.04	0.04	0.03	0.04	0.04
0.26	0.28	0.03	0.02	0.01	0.01	0.01	0.02
0.98	1.02	0.06	0.08	0.10	0.04	0.06	0.06
0.26	0.26	0.03	0.02	0.03	0.03	0.03	0.02
1.61	2.05	0.16	0.13	0.19	0.16	0.14	0.16
0.61	0.63	0.06	0.01	0.06	0.04	0.05	0.04
0.34	0.35	0.03	0.01	0.02	0.07	0.02	0.04
0.73	0.74	0.06	0.06	0.07	0.09	0.05	0.05
0.25	0.21	0.03	0.04	0.01	0.01	0.02	0.01
0.84	0.79	0.09	0.07	0.07	0.04	0.07	0.07
0.30	0.32	0.03	0.02	0.02	0.03	0.04	0.04
0.87	0.88	0.09	0.05	0.08	0.06	0.06	0.06
1.42	0.92	0.14	0.09	0.07	0.05	0.09	0.07

Table 2. Continued.

	Mass (%) in Grain Size Interval					
Station	0.3-0.4u	0.2-0.3u	0.1-0.2u	0.09-0.10u	0.08-0.09u	<0.08u
1	0.16	0.18	0.15	0.01	0.01	0.03
2	0.07	0.07	0.07	0.00	0.00	0.01
4	0.05	0.05	0.07	0.00	0.01	0.05
6	0.05	0.05	0.05	0.00	0.00	0.06
8	0.34	0.36	0.36	0.24	0.00	0.00
10	0.10	0.09	0.10	0.01	0.01	0.08
13	0.31	0.34	0.31	0.37	0.00	0.00
19	0.59	0.69	0.72	0.09	0.06	0.41
28	0.18	0.20	0.19	0.02	0.03	0.12
40	0.06	0.05	0.03	0.09	0.01	0.01
43	0.10	0.09	0.10	0.01	0.01	0.06
50	0.17	0.19	0.17	0.02	0.02	0.11
60	0.05	0.05	0.00	0.00	0.00	0.00
71	0.08	0.09	0.07	0.01	0.01	0.00
72	0.08	0.08	0.10	0.01	0.00	0.06
81	0.12	0.13	0.13	0.01	0.01	0.17
89	0.06	0.08	0.08	0.01	0.01	0.08
92	0.03	0.03	0.08	0.02	0.00	0.19
95	0.05	0.05	0.05	0.00	0.00	0.22
98	0.04	0.03	0.04	0.00	0.00	0.05
100	0.11	0.11	0.13	0.01	0.00	0.09
104	0.06	0.06	0.07	0.00	0.00	0.07
106	0.04	0.04	0.04	0.00	0.00	0.01
109	0.02	0.02	0.02	0.00	0.00	0.02
111	0.06	0.06	0.05	0.00	0.00	0.02
113	0.03	0.03	0.03	0.00	0.00	0.02
117	0.13	0.11	0.14	0.00	0.00	0.25
121	0.03	0.03	0.04	0.00	0.00	0.03
123	0.03	0.04	0.05	0.01	0.00	0.02
124	0.04	0.06	0.04	0.00	0.00	0.05
125	0.03	0.04	0.05	0.01	0.00	0.13
127	0.07	0.07	0.04	0.00	0.00	0.05
129	0.03	0.04	0.01	0.00	0.00	0.00
130	0.06	0.05	0.05	0.00	0.00	0.05
131	0.09	0.09	0.07	0.00	0.00	0.05

Table 2. Continued.

			Mass distribution (%)						
Station	Lat	Long	0-4 um	4-8um	8-12um	12-16um	16-20um	20-24um	24-28um
1	41.713	-86.933	0.012	0.025	0.041	0.089	0.132	0.155	0.163
2	41.79	-87.293	0.006	0.012	0.020	0.046	0.067	0.077	0.078
3	41.833	-86.906	0.014	0.068	0.132	0.197	0.255	0.309	0.362
4	41.872	-87.598	0.007	0.019	0.046	0.142	0.229	0.277	0.294
6	41.899	-86.649	0.007	0.014	0.022	0.050	0.077	0.097	0.110
7	41.943	-86.829	0.343	1.798	3.752	5.887	8.040	10.209	12.350
8	41.984	-87.014	0.129	0.374	1.820	2.502	2.738	2.870	3.002
9	42.014	-86.75	0.983	7.689	16.929	27.285	38.203	49.656	60.230
10	42.066	-87.38	0.017	0.039	0.071	0.176	0.274	0.330	0.355
11	42.122	-87.054	0.210	1.543	3.299	5.056	6.604	7.948	9.197
11	42.122	-87.054	0.247	2.760	6.160	10.138	14.696	19.823	25.127
13	42.175	-86.734	1.187	9.059	18.067	27.222	36.550	46.035	54.854
13	42.176	-86.733	0.203	0.599	3.307	5.569	7.051	7.978	8.555
15	42.285	-86.633	1.693	11.901	30.240	49.383	64.217	74.778	82.815
15	42.285	-86.633	1.430	10.703	22.305	34.155	45.509	56.351	66.003
17	42.303	-87.283	0.989	7.800	15.697	23.885	32.429	41.312	49.623
18	42.359	-86.956	1.311	10.820	23.579	36.529	48.198	58.583	67.583
18	42.354	-86.958	1.138	9.202	21.223	33.937	45.465	55.805	64.830
19	42.367	-86.443	1.320	9.803	19.689	29.926	40.518	51.441	61.472
19	42.382	-86.464	0.451	1.132	2.727	7.805	13.909	19.979	25.435
21	42.402	-87.296	1.403	10.877	25.292	39.849	51.592	60.543	67.836
21	42.402	-87.296	1.368	10.674	23.833	37.467	49.747	60.671	70.081
22	42.385	-86.591	1.687	12.530	29.844	47.401	61.172	71.189	78.964
24	42.503	-86.529	1.911	13.347	29.901	46.107	58.655	67.580	74.508
25	42.496	-86.829	1.108	9.200	21.609	34.907	47.072	58.099	67.695
26	42.544	-87.179	1.585	11.594	25.619	39.978	52.648	63.630	72.952
27	42.587	-86.856	1.031	8.689	20.283	32.611	43.817	53.897	62.731
28	42.619	-87.554	0.028	0.067	0.123	0.298	0.465	0.567	0.618
29	42.641	-86.533	1.436	10.720	23.072	35.864	47.872	59.084	68.930
29	42.643	-86.532	1.451	11.522	25.876	39.978	51.221	59.631	66.455
30	42.66	-87.738	0.059	0.344	0.633	0.905	1.171	1.431	1.684
31	42.67	-87.251	1.333	10.316	22.932	36.007	47.847	58.449	67.648
32	42.713	-87.409	1.271	9.824	21.811	34.348	45.918	56.514	65.814
33	42.733	-86.999	1.273	10.221	23.836	38.063	50.479	61.087	70.085
33	42.733	-86.999	1.088	8.800	19.944	31.903	43.287	54.084	63.703
34	42.773	-87.081	1.128	8.452	20.176	32.892	44.447	54.840	63.923
36	42.818	-86.486	1.676	13.606	29.617	44.999	57.269	66.451	73.776
37	42.828	-86.759	1.626	12.565	26.204	39.349	50.611	60.000	67.953
38	42.834	-87.25	1.398	10.388	22.004	33.899	45.065	55.491	64.729
39	42.834	-86.999	1.352	11.020	26.123	41.556	54.139	63.891	71.813
40	42.835	-86.246	0.007	0.013	0.035	0.048	0.054	0.056	0.056
41	42.879	-86.357	1.834	14.054	29.960	45.149	57.390	66.707	74.194
43	42.895	-87.641	0.010	0.024	0.047	0.117	0.187	0.238	0.270
44	42.953	-87.315	0.096	0.650	1.381	2.115	2.760	3.317	3.816
46	43.016	-86.407	2.412	21.709	35.319	44.626	53.557	62.102	69.750
48	43.059	-86.662	1.328	10.135	22.497	35.469	47.502	58.587	68.284
50	43.112	-86.329	0.002	0.044	0.097	0.149	0.198	0.243	0.288
50	43.112	-86.329	0.022	0.047	0.081	0.185	0.302	0.406	0.491
51	43.13	-87.544	0.032	0.199	0.410	0.617	0.798	0.953	1.094
52	43.186	-87.215	0.006	0.043	0.086	0.124	0.155	0.179	0.199
53	43.199	-86.701	1.788	15.062	26.394	35.656	44.506	52.938	60.605
54	43.241	-86.889	1.577	10.683	22.657	34.794	45.757	55.545	64.100
54	43.241	-86.889	1.482	10.609	22.376	34.323	45.352	55.458	64.367
55	43.294	-86.559	1.855	15.277	30.612	44.638	56.363	65.800	73.594
57	43.366	-87.446	0.087	0.638	1.506	2.375	3.037	3.497	3.871
58	43.48	-87.455	1.395	10.363	23.366	36.948	49.146	59.957	69.270
60	43.447	-87.809	0.007	0.018	0.029	0.052	0.077	0.100	0.120

Table 3. Linearly interpolated particle size distributions. (Reads across page then down on following pgs.)

28-32um	32-36um	36-40um	40-44um	44-48um	48-52um	52-56um	56-60um	GT 60um
0.174	0.189	0.209	0.235	0.264	0.290	0.312	0.341	99.620
0.081	0.088	0.097	0.111	0.127	0.140	0.149	0.157	99.836
0.418	0.477	0.540	0.605	0.675	0.764	0.876	1.011	98.832
0.303	0.305	0.313	0.332	0.357	0.381	0.404	0.424	99.556
0.119	0.124	0.127	0.129	0.131	0.134	0.139	0.147	99.841
14.439	16.477	18.463	20.398	22.281	24.111	25.887	27.610	70.721
3.380	4.003	4.626	5.153	5.674	6.397	7.310	7.994	91.716
69.148	76.410	82.015	85.963	88.366	90.313	92.083	93.674	4.914
0.369	0.373	0.383	0.404	0.436	0.478	0.528	0.579	99.373
10.413	11.595	12.743	13.858	14.944	16.041	17.159	18.299	80.540
30.390	35.612	40.794	45.934	51.012	55.813	60.283	64.422	31.770
62.553	69.133	74.593	78.933	82.219	85.084	87.691	90.039	7.872
9.259	10.104	10.969	11.805	12.645	13.568	14.558	15.273	84.424
89.290	94.204	97.557	99.349	99.697	99.747	99.793	99.835	0.128
74.089	80.610	85.566	88.957	90.889	92.414	93.799	95.045	3.848
56.863	63.031	68.127	72.152	75.170	77.829	80.292	82.560	15.369
75.140	81.254	85.925	89.153	91.035	92.536	93.899	95.125	3.786
72.470	78.724	83.593	87.077	89.267	91.063	92.696	94.163	4.533
69.936	76.834	82.166	85.931	88.235	90.109	91.814	93.351	5.281
28.915	30.450	31.800	33.656	35.663	36.994	37.631	37.971	61.832
74.096	79.324	83.519	86.681	88.876	90.738	92.430	93.951	4.698
77.891	84.099	88.706	91.712	93.230	94.363	95.393	96.319	2.859
85.330	90.289	93.840	95.982	96.818	97.351	97.835	98.270	1.344
80.339	85.070	88.703	91.238	92.748	93.962	95.065	96.057	3.063
75.701	82.115	86.938	90.170	91.921	93.274	94.502	95.607	3.412
80.627	86.657	91.041	93.779	94.989	95.827	96.590	97.275	2.117
70.255	76.467	81.367	84.957	87.320	89.294	91.092	92.715	5.839
0.649	0.663	0.684	0.723	0.767	0.792	0.798	0.804	99.181
77.096	83.581	88.385	91.509	93.070	94.230	95.284	96.232	2.927
72.381	77.407	81.535	84.765	87.149	89.213	91.091	92.783	5.711
1.930	2.168	2.398	2.621	2.837	3.066	3.311	3.572	96.151
75.353	81.566	86.286	89.513	91.349	92.797	94.112	95.296	3.654
73.638	79.987	84.862	88.261	90.285	91.911	93.389	94.717	4.103
77.583	83.580	88.076	91.072	92.671	93.898	95.013	96.015	3.095
71.817	78.428	83.535	87.138	89.337	91.122	92.744	94.202	4.503
71.615	77.917	82.828	86.348	88.570	90.397	92.059	93.558	5.109
79.924	84.893	88.683	91.296	92.810	94.013	95.107	96.090	3.037
74.709	80.269	84.633	87.801	89.850	91.549	93.093	94.481	4.287
72.532	78.901	83.834	87.332	89.491	91.250	92.849	94.286	4.438
78.457	83.823	87.910	90.719	92.337	93.620	94.785	95.833	3.237
0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	99.944
80.453	85.485	89.290	91.868	93.302	94.424	95.442	96.358	2.829
0.292	0.304	0.322	0.352	0.386	0.408	0.417	0.425	99.563
4.273	4.687	5.060	5.390	5.680	5.962	6.244	6.524	93.197
76.219	81.510	85.622	88.556	90.390	91.894	93.263	94.499	4.400
76.352	82.790	87.600	90.780	92.444	93.709	94.858	95.891	3.191
0.331	0.374	0.416	0.457	0.498	0.543	0.593	0.648	99.291
0.544	0.564	0.578	0.596	0.618	0.649	0.689	0.728	99.240
1.230	1.361	1.485	1.604	1.718	1.844	1.987	2.146	97.679
0.215	0.226	0.235	0.239	0.239	0.239	0.239	0.239	99.761
67.316	73.070	77.869	81.711	84.650	87.220	89.554	91.653	6.483
71.388	77.410	82.165	85.655	87.960	89.887	91.640	93.219	5.374
71.930	78.147	83.017	86.541	88.807	90.680	92.383	93.913	4.728
80.100	85.317	89.246	91.887	93.328	94.445	95.460	96.372	2.818
4.223	4.553	4.862	5.148	5.415	5.680	5.948	6.219	93.507
77.024	83.220	87.858	90.937	92.566	93.811	94.941	95.958	3.140
0.131	0.135	0.137	0.139	0.144	0.151	0.162	0.170	99.827

Table 3. (Cont.)

Station	Lat	Long	0-4 um	4-8um	8-12um	12-16um	16-20um	20-24um	24-28um
61	43.474	-86.785	1.885	13.777	29.376	44.536	57.138	67.197	75.426
62	43.5	-87.617	1.178	8.445	18.482	29.058	39.024	48.373	56.772
63	43.583	-87.499	1.486	10.010	20.857	32.067	42.831	53.136	62.387
64	43.601	-87.346	1.792	12.866	28.030	43.134	55.914	66.380	75.036
65	43.653	-87.016	1.406	10.482	22.831	35.912	48.516	60.624	71.306
66	43.709	-86.682	1.786	12.736	26.512	40.405	53.304	65.198	75.484
67	43.715	-87.126	0.255	1.876	4.063	6.398	8.692	10.944	13.089
70	43.888	-86.913	1.748	13.200	27.703	41.813	53.972	64.186	72.766
71	43.918	-87.624	0.012	0.028	0.064	0.183	0.313	0.423	0.513
72	43.944	-86.579	0.009	0.018	0.028	0.059	0.086	0.100	0.104
73	44.017	-87.475	0.140	1.086	2.367	3.743	5.109	6.471	8.114
74	44.069	-87.146	0.006	0.038	0.079	0.121	0.161	0.198	0.232
75	44.124	-86.807	0.308	2.492	5.872	9.681	13.482	17.271	20.902
76	44.166	-86.624	2.715	17.596	35.618	52.288	65.501	75.282	82.902
78	44.254	-86.625	1.408	9.559	22.781	36.915	49.240	59.762	68.705
79	44.305	-87.041	1.850	11.287	23.731	36.805	49.357	61.369	71.944
80	44.358	-86.708	1.157	8.292	18.661	30.566	43.176	56.453	68.538
80	44.358	-86.708	1.273	9.562	21.569	33.868	44.485	53.427	61.143
81	44.388	-87.423	0.018	0.041	0.088	0.232	0.379	0.486	0.556
82	44.413	-86.371	1.933	13.288	27.693	41.694	53.640	63.539	71.830
83	44.474	-86.705	1.031	8.689	20.283	32.611	43.817	53.897	62.731
84	44.481	-87.277	0.169	1.434	3.441	5.667	7.798	9.835	11.802
85	44.539	-86.937	1.296	9.338	20.181	31.699	42.909	53.795	63.573
86	44.588	-86.604	1.235	9.097	19.589	30.973	42.549	54.291	64.943
87	44.624	-86.355	1.553	12.160	26.547	40.700	52.497	61.952	69.795
89	44.747	-87.895	0.013	0.030	0.053	0.122	0.180	0.204	0.205
91	44.825	-86.049	1.846	13.575	28.389	42.495	54.093	63.202	70.675
92	44.857	-87.219	0.003	0.007	0.021	0.063	0.099	0.116	0.119
95	44.94	-87.602	0.035	0.162	0.553	1.800	3.060	3.980	4.613
97	44.975	-86.367	1.699	12.117	25.463	38.780	50.723	61.291	70.382
98	45.131	-85.454	0.008	0.021	0.036	0.079	0.125	0.162	0.190
99	45.007	-86.729	1.225	9.934	21.987	34.279	45.200	54.751	63.062
100	45.05	-86.923	0.017	0.039	0.064	0.135	0.198	0.230	0.238
101	45.061	-86.389	1.648	12.520	26.751	40.785	52.888	63.067	71.638
102	45.063	-86.252	0.006	0.059	0.130	0.203	0.270	0.332	0.386
103	45.062	-86.491	1.573	10.508	23.106	36.386	48.699	60.037	69.923
104	45.069	-85.857	0.011	0.026	0.046	0.099	0.148	0.178	0.195
106	45.134	-87.306	0.007	0.019	0.039	0.098	0.154	0.188	0.205
107	45.155	-86.367	1.678	11.750	23.833	35.780	46.880	57.125	66.154
108	45.163	-85.707	1.183	8.842	20.582	33.171	44.655	55.032	64.122
109	45.248	-86.669	0.003	0.011	0.026	0.070	0.112	0.141	0.158
110	45.251	-86.409	1.452	10.927	25.472	40.515	53.237	63.649	72.295
111	45.242	-85.556	0.011	0.026	0.045	0.102	0.151	0.172	0.175
112	45.294	-86.284	1.352	10.231	22.067	34.103	45.003	54.764	63.323
113	45.327	-87.009	0.007	0.029	0.105	0.384	0.722	1.057	1.388
115	45.396	-85.595	0.003	0.063	0.168	0.288	0.407	0.525	0.635
117	45.446	-85.222	0.034	0.101	0.246	0.734	1.216	1.544	1.746
120	45.529	-86.171	0.735	6.539	15.823	25.924	35.223	43.719	51.397
121	45.534	-85.636	0.007	0.019	0.034	0.078	0.122	0.154	0.175
123	45.603	-87.097	0.003	0.008	0.015	0.030	0.043	0.048	0.048
124	45.71	-86.409	0.007	0.017	0.028	0.054	0.076	0.085	0.086
125	45.723	-85.331	0.003	0.007	0.013	0.027	0.039	0.045	0.045
126	45.761	-86.064	0.328	3.025	7.183	11.856	16.526	21.193	25.879
126	45.761	-86.064	1.273	9.562	21.569	33.868	44.485	53.427	61.143
127	45.812	-85.718	0.017	0.061	0.148	0.424	0.675	0.807	0.850
129	45.9	-86.105	0.004	0.013	0.024	0.051	0.074	0.083	0.084
130	45.909	-85.025	0.020	0.057	0.111	0.276	0.462	0.629	0.789
131	46.001	-85.41	0.055	0.231	0.673	2.180	3.571	4.348	4.653

Table 3. Continued.

28-32um	32-36um	36-40um	40-44um	44-48um	48-52um	52-56um	56-60um	GT 60um
82.218	87.573	91.492	93.974	95.121	95.937	96.679	97.347	2.061
64.035	70.162	75.153	79.008	81.797	84.211	86.424	88.436	9.753
70.254	76.737	81.837	85.553	87.975	89.988	91.816	93.461	5.079
82.161	87.753	91.813	94.341	95.447	96.209	96.902	97.524	1.923
80.049	86.852	91.715	94.639	95.765	96.474	97.118	97.697	1.789
83.830	90.236	94.703	97.230	97.961	98.302	98.612	98.891	0.861
15.090	16.946	18.660	20.229	21.661	23.017	24.314	25.552	73.271
79.885	85.544	89.742	92.479	93.857	94.886	95.820	96.660	2.594
0.577	0.617	0.659	0.714	0.772	0.809	0.826	0.852	99.103
0.106	0.106	0.106	0.106	0.107	0.109	0.114	0.118	99.881
10.197	12.720	15.682	19.084	22.875	26.564	30.024	33.257	63.738
0.262	0.289	0.312	0.331	0.348	0.363	0.378	0.394	99.591
24.294	27.447	30.361	33.036	35.480	37.779	39.954	42.006	56.066
89.060	93.756	96.991	98.765	99.185	99.322	99.446	99.557	0.344
76.193	82.226	86.804	89.926	91.693	93.083	94.347	95.483	3.509
80.592	87.311	92.102	94.964	96.038	96.701	97.304	97.846	1.673
78.405	86.056	91.488	94.704	95.864	96.556	97.185	97.751	1.747
67.878	73.632	78.406	82.200	85.069	87.568	89.839	91.881	6.306
0.597	0.611	0.620	0.634	0.649	0.662	0.672	0.682	99.308
78.751	84.305	88.490	91.306	92.849	94.046	95.134	96.111	3.020
70.255	76.467	81.367	84.957	87.320	89.294	91.092	92.715	5.839
13.713	15.568	17.366	19.107	20.793	22.426	24.006	25.535	72.989
71.811	78.509	83.667	87.286	89.469	91.232	92.833	94.273	4.448
73.810	80.892	86.190	89.704	91.557	92.970	94.254	95.409	3.566
76.425	81.843	86.050	89.044	90.906	92.429	93.812	95.055	3.841
0.205	0.206	0.223	0.261	0.312	0.356	0.391	0.426	99.536
76.981	82.121	86.094	88.901	90.620	92.020	93.298	94.453	4.515
0.121	0.122	0.122	0.122	0.122	0.122	0.122	0.122	99.878
5.077	5.383	5.630	5.854	6.047	6.188	6.279	6.409	93.388
77.943	83.974	88.475	91.446	92.993	94.166	95.231	96.190	2.960
0.205	0.209	0.219	0.242	0.272	0.297	0.317	0.334	99.650
70.202	76.172	80.973	84.603	87.136	89.289	91.245	93.005	5.433
0.243	0.245	0.271	0.332	0.412	0.471	0.509	0.533	99.455
78.777	84.483	88.757	91.598	93.107	94.261	95.309	96.252	2.911
0.431	0.468	0.496	0.515	0.527	0.536	0.545	0.552	99.441
78.095	84.555	89.301	92.334	93.775	94.817	95.763	96.615	2.629
0.211	0.227	0.241	0.252	0.263	0.275	0.289	0.301	99.691
0.217	0.222	0.232	0.249	0.272	0.297	0.323	0.349	99.628
73.765	79.960	84.738	88.099	90.138	91.789	93.289	94.637	4.165
71.828	78.148	83.084	86.635	88.892	90.752	92.441	93.960	4.691
0.167	0.169	0.172	0.179	0.189	0.198	0.207	0.216	99.776
79.475	85.189	89.437	92.219	93.638	94.703	95.671	96.541	2.687
0.181	0.192	0.206	0.223	0.240	0.254	0.265	0.275	99.714
70.645	76.731	81.579	85.191	87.645	89.713	91.592	93.282	5.218
1.711	2.022	2.255	2.382	2.431	2.462	2.479	2.522	97.394
0.736	0.826	0.907	0.977	1.037	1.091	1.140	1.185	98.776
1.890	1.981	2.066	2.162	2.264	2.355	2.438	2.552	97.286
58.247	64.270	69.464	73.831	77.412	80.615	83.542	86.195	11.426
0.189	0.197	0.206	0.219	0.233	0.244	0.251	0.259	99.732
0.048	0.048	0.049	0.051	0.054	0.058	0.062	0.065	99.934
0.086	0.086	0.091	0.104	0.120	0.131	0.135	0.136	99.863
0.045	0.046	0.046	0.046	0.046	0.046	0.046	0.047	99.949
30.595	35.341	40.117	44.923	49.735	54.312	58.592	62.575	33.739
67.878	73.632	78.406	82.200	85.069	87.568	89.839	91.881	6.306
0.872	0.879	0.907	0.973	1.061	1.136	1.199	1.256	98.690
0.084	0.084	0.085	0.087	0.090	0.092	0.093	0.096	99.900
0.964	1.154	1.309	1.409	1.471	1.532	1.596	1.685	98.191
4.814	4.857	5.028	5.423	5.938	6.330	6.591	6.790	93.045

Table 3. Continued.

				Grain Size Composites (% mass)								
Station	Lat	Long	Device	> 500um	60-500	30-60	8-30	2-8	< 60	< 30	< 8	< 2um
1	41.713	-86.933	Ponar	0.54	90.27	1.81	2.24	2.68	9.19	7.38	5.13	2.45
2	41.790	-87.293	Ponar	75.12	19.23	1.19	1.44	1.72	5.66	4.47	3.03	1.32
3	41.833	-86.907	Ponar	0.00	90.67	2.35	4.06	2.92	9.33	6.97	2.92	0.00
4	41.872	-87.598	Ponar	3.66	85.81	1.61	5.23	2.54	10.53	8.92	3.69	1.15
6	41.899	-86.649	Ponar	22.24	71.97	0.41	2.09	2.05	5.79	5.38	3.29	1.24
7	41.943	-86.829	Box Core	0.00	19.40	17.52	40.14	20.22	80.60	63.08	22.94	2.72
8	41.984	-87.014	Gravity Core	1.13	26.60	20.72	26.96	14.53	72.15	51.43	24.47	9.95
9	42.012	-86.756	Box Core	0.00	0.00	6.36	65.49	26.61	100.00	93.64	28.15	1.54
10	42.066	-87.380	Ponar	9.21	75.97	2.48	5.49	4.59	14.82	12.34	6.85	2.26
11	42.122	-87.054	Box Core	0.00	6.45	27.79	48.92	16.84	93.55	65.76	16.84	0.00
11	42.121	-87.055	Ponar	0.00	31.68	12.04	35.19	20.08	68.32	56.28	21.09	1.01
13	42.175	-86.734	Box Core	0.41	14.85	17.40	42.03	15.28	84.23	66.83	24.80	9.52
15	42.285	-86.634	Box Core	0.00	0.00	0.12	68.84	29.24	100.00	99.88	31.04	1.80
17	42.303	-87.283	Box Core	0.00	1.74	9.47	56.87	30.84	98.26	88.78	31.91	1.07
18	42.301	-87.283	Ponar	0.00	0.00	4.22	61.53	32.21	100.00	95.78	34.25	2.04
18.1	42.354	-86.958	Box Core	0.00	0.00	5.38	64.68	28.72	100.00	94.62	29.93	1.21
19	42.382	-86.464	Box Core	0.21	6.26	13.71	51.82	16.93	93.53	79.83	28.01	11.08
21	42.402	-87.297	Box Core	0.00	0.00	5.18	62.18	31.56	100.00	94.82	32.64	1.09
21.1	42.402	-87.297	Box Core	0.00	0.00	3.15	64.05	31.38	100.00	96.85	32.80	1.41
22	42.385	-86.592	Box Core	0.00	0.00	1.31	64.95	32.01	100.00	98.69	33.73	1.73
24	42.503	-86.529	Box Core	0.00	0.00	3.00	59.43	35.06	100.00	97.00	37.57	2.51
25	42.496	-86.829	Box Core	0.00	0.00	3.97	66.90	27.92	100.00	96.03	29.13	1.21
26	42.544	-87.179	Box Core	0.00	0.00	2.22	63.14	32.73	100.00	97.78	34.64	1.91
27	42.587	-86.856	Box Core	0.00	0.15	6.07	64.63	27.63	99.85	93.78	29.15	1.53
28	42.619	-87.554	Ponar	9.08	64.52	1.96	10.99	8.91	26.40	24.44	13.45	4.54
29	42.644	-86.532	Box Core	0.00	0.00	3.25	62.80	32.27	100.00	96.75	33.95	1.68
30	42.660	-87.738	Ponar	0.17	67.60	5.51	13.72	10.85	32.23	26.72	12.99	2.14
31	42.669	-87.251	Box Core	0.00	0.00	4.14	63.35	31.22	100.00	95.86	32.51	1.30
32	42.716	-87.413	Gravity Core	0.00	0.00	4.77	63.39	30.53	100.00	95.23	31.85	1.32
33	42.733	-86.999	Box Core	0.00	0.00	3.42	65.27	29.57	99.99	96.57	31.30	1.73
34	42.773	-87.081	Box Core	0.00	0.09	5.59	66.31	26.82	99.92	94.32	28.02	1.20
36	42.819	-86.474	Box Core	0.00	0.00	3.01	58.48	36.00	100.00	96.99	38.52	2.52
37	42.828	-86.759	Box Core	0.00	0.00	4.56	57.07	36.44	100.00	95.44	38.37	1.93
38	42.833	-87.250	Ponar	0.00	0.00	5.12	60.64	32.67	100.00	94.88	34.24	1.56
39	42.834	-86.999	Box Core	0.00	0.00	3.46	64.48	30.59	100.00	96.54	32.06	1.48
40	42.835	-86.246	Ponar	0.32	94.10	0.00	1.54	1.83	5.44	5.44	3.91	2.08
41	42.878	-86.357	Box Core	0.00	0.00	2.78	57.73	37.34	100.00	97.22	39.49	2.15
43	42.895	-87.642	Ponar	10.62	75.71	2.08	5.67	3.87	13.67	11.59	5.92	2.06
44	42.952	-87.315	Ponar	0.00	45.12	6.48	30.04	17.49	54.88	48.40	18.37	0.87
46	43.016	-86.407	Box Core	0.00	0.08	3.43	37.92	56.77	99.92	96.50	58.57	1.80

Table 4. Composite grain size distributions.

Table 4. (Cont.)

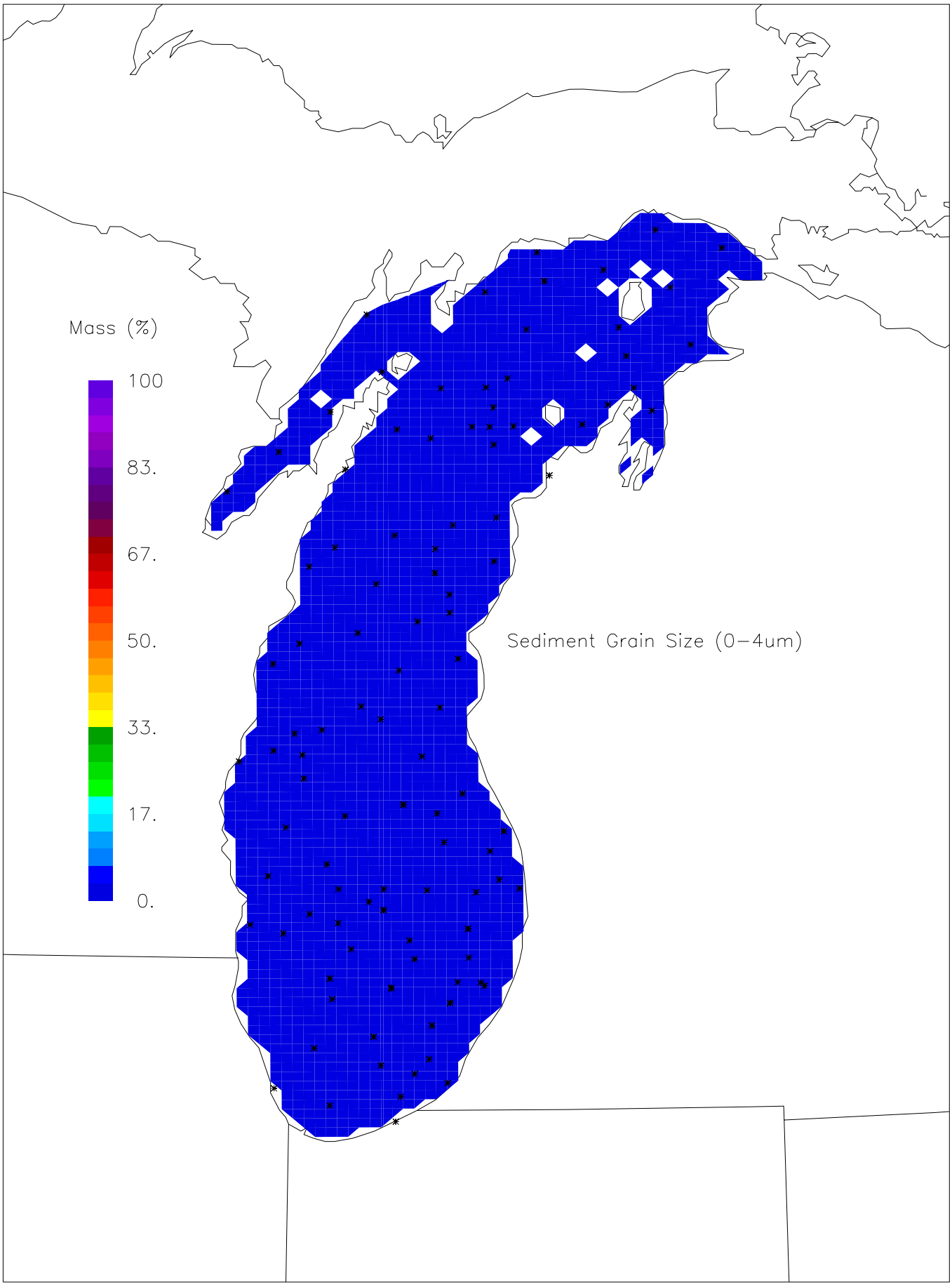
Station	Lat	Long	Device	> 500um	60-500	30-60	8-30	2-8	< 60	< 30	< 8	< 2um
48.1	43.059	-86.658	Box Core	0.00	0.00	3.62	64.36	30.82	100.00	96.38	32.02	1.19
50	43.112	-86.329	Ponar	0.65	84.23	1.66	5.75	4.24	15.12	13.46	7.71	3.47
51	43.129	-87.544	Ponar	0.59	74.96	3.80	12.47	8.13	24.45	20.65	8.18	0.04
52	43.185	-87.216	Ponar	5.11	87.52	0.00	4.08	3.29	7.37	7.37	3.29	0.00
53	43.199	-86.701	Box Core	0.00	0.00	7.01	44.94	46.44	100.00	92.99	48.05	1.62
54	43.240	-86.888	Box Core	0.00	0.08	5.53	59.04	33.38	99.92	94.39	35.35	1.96
55	43.295	-86.559	Box Core	0.00	0.00	2.73	54.30	40.60	100.00	97.27	42.98	2.37
57	43.366	-87.446	Ponar	0.00	47.88	5.75	30.19	15.80	52.12	46.36	16.18	0.38
58	43.480	-87.455	Box Core	0.00	0.00	3.48	64.03	30.63	100.00	96.52	32.49	1.86
60	43.447	-87.809	Ponar	1.09	94.75	0.38	1.43	1.64	4.15	3.78	2.35	0.71
61	43.474	-86.785	Box Core	0.00	0.00	2.02	59.11	36.73	100.00	97.98	38.87	2.14
62	43.500	-87.617	Box Core	0.00	0.66	7.80	60.42	29.41	99.34	91.54	31.13	1.72
63	43.583	-87.500	Box Core	0.00	0.00	6.01	59.76	32.76	100.00	93.99	34.23	1.47
64	43.601	-87.346	Ponar	0.00	0.00	1.92	60.97	34.75	100.00	98.08	37.10	2.35
65	43.653	-87.016	Box Core	0.00	0.00	1.97	65.09	31.13	100.00	98.03	32.94	1.81
66	43.709	-86.683	Box Core	0.00	0.00	0.87	61.60	35.45	100.00	99.13	37.53	2.07
67	43.715	-87.125	Ponar	0.00	18.91	13.78	44.97	21.28	81.09	67.31	22.34	1.06
70	43.889	-86.913	Box Core	0.00	0.00	2.63	58.61	36.40	100.00	97.37	38.76	2.36
71	43.918	-87.624	Ponar	2.86	80.63	3.18	8.12	3.30	16.43	13.25	5.13	1.83
72	43.944	-86.579	Ponar	8.82	83.04	0.26	2.56	3.41	8.14	7.88	5.32	1.92
73	44.016	-87.478	Ponar	0.00	20.51	39.22	27.57	12.68	79.49	40.27	12.70	0.02
74	44.070	-87.145	Ponar	23.03	69.03	0.87	4.52	2.54	7.94	7.06	2.54	0.00
75	44.125	-86.808	Ponar	0.00	12.20	16.38	51.71	18.96	87.80	71.42	19.70	0.75
76	44.165	-86.625	Ponar	0.00	0.00	0.29	54.40	41.92	100.00	99.71	45.30	3.38
78	44.254	-86.625	Box Core	0.00	0.00	3.92	65.50	28.07	100.00	96.08	30.58	2.51
79	44.304	-87.042	Box Core	0.00	0.00	1.76	61.90	32.82	100.00	98.24	36.34	3.52
80	44.358	-86.708	Box Core	0.00	0.00	2.09	69.78	26.49	100.00	97.91	28.14	1.65
80.1	44.358	-86.708	Box Core	0.00	0.00	7.51	60.20	30.30	100.00	92.49	32.29	1.99
81	44.388	-87.423	Ponar	3.57	77.34	1.04	9.97	5.37	19.09	18.05	8.08	2.71
82	44.413	-86.371	Box Core	0.00	0.00	3.04	57.40	36.84	100.00	96.96	39.56	2.72
83	44.475	-86.704	Box Core	0.00	0.15	6.07	64.63	27.63	99.85	93.78	29.15	1.53
84	44.484	-87.277	Ponar	0.00	22.62	17.18	43.85	16.30	77.38	60.20	16.34	0.04
85	44.539	-86.938	Box Core	0.00	0.00	5.29	62.39	30.03	100.00	94.71	32.32	2.29
86	44.588	-86.604	Box Core	0.00	0.00	4.26	64.48	29.47	100.00	95.74	31.26	1.78
87	44.624	-86.355	Box Core	0.00	0.00	4.04	59.29	34.21	100.00	95.96	36.68	2.47
89	44.747	-87.895	Ponar	0.85	88.80	2.43	3.02	3.34	10.36	7.93	4.91	1.58
91	44.825	-86.498	Ponar	0.00	0.14	3.53	55.70	37.03	99.86	96.33	40.64	3.61
92	44.857	-87.219	Ponar	0.42	94.19	0.03	3.14	1.44	5.39	5.36	2.22	0.78
95	44.940	-87.602	Gravity Core	0.53	48.75	7.18	33.84	8.50	50.72	43.54	9.70	1.21

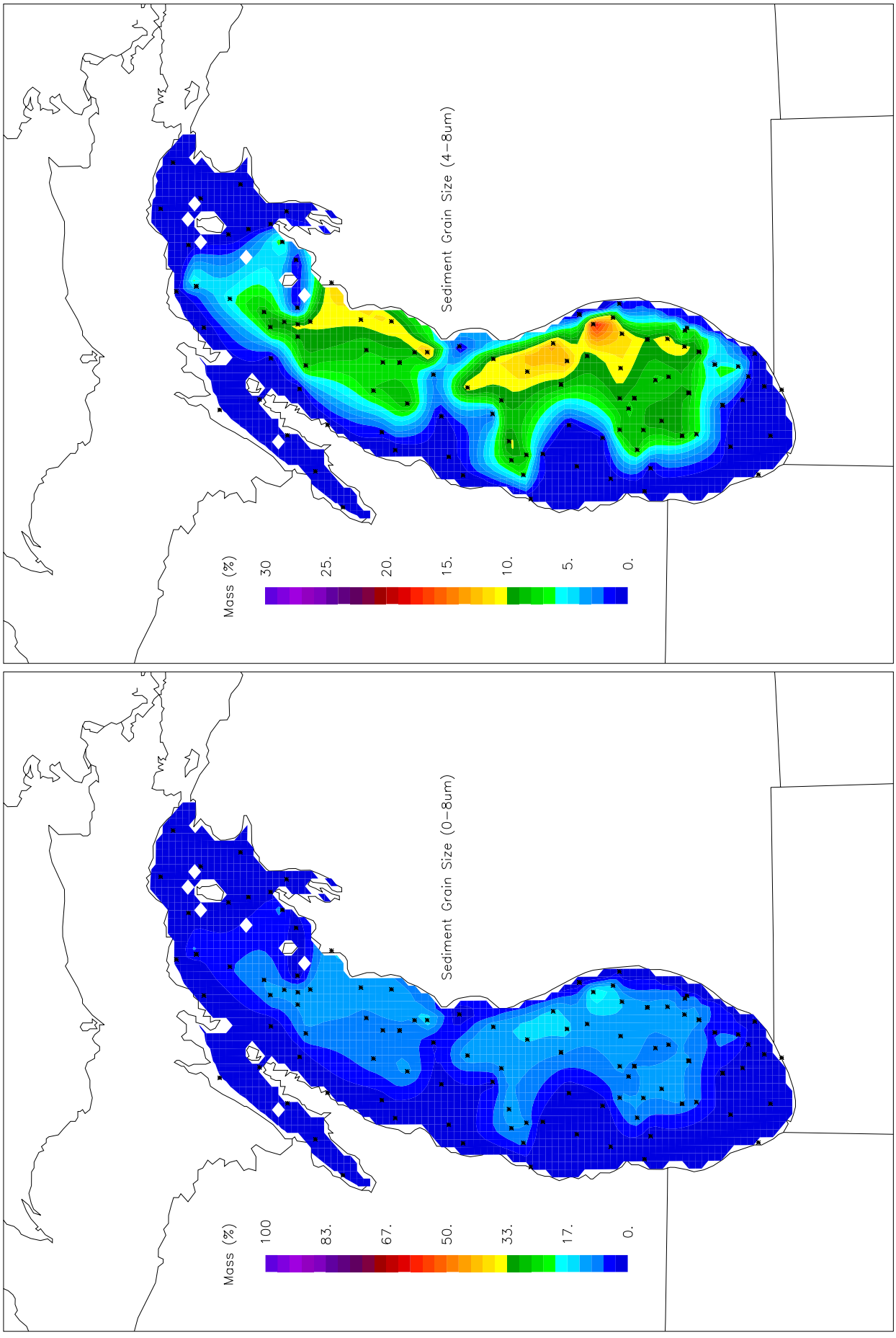
Station	Lat	Long	Device	> 500um	60-500	30-60	8-30	2-8	< 60	< 30	< 8	< 2um
97	44.975	-86.367	Box Core	0.00	0.00	3.10	59.25	34.66	100.00	96.90	37.65	2.99
98	45.131	-85.454	Ponar	8.09	79.92	2.33	4.64	3.88	11.98	9.65	5.01	1.13
99	45.007	-86.729	Box Core	0.00	0.00	6.33	60.32	30.72	100.00	93.67	33.35	2.63
100	45.050	-86.923	Ponar	3.63	78.87	4.32	4.53	5.66	17.51	13.18	8.65	2.99
101	45.061	-86.389	Box Core	0.00	0.00	3.00	59.33	34.82	100.00	97.00	37.68	2.85
102	45.063	-86.252	Ponar	6.33	80.84	0.60	8.15	4.07	12.82	12.22	4.07	0.00
103	45.062	-86.491	Box Core	0.00	0.00	2.87	63.39	31.08	100.00	97.13	33.74	2.66
104	45.068	-85.857	Ponar	12.45	73.79	1.92	4.87	5.07	13.76	11.83	6.96	1.90
106	45.134	-87.306	Ponar	3.52	87.26	1.86	3.89	2.64	9.22	7.35	3.47	0.83
107	45.155	-86.367	Box Core	0.00	0.00	4.55	57.13	35.52	100.00	95.45	38.32	2.80
108	45.163	-85.707	Box Core	0.00	0.00	5.64	65.20	28.06	100.00	94.36	29.16	1.10
109	45.248	-86.669	Ponar	5.15	87.02	0.92	4.29	2.15	7.82	6.91	2.62	0.47
110	45.251	-86.409	Box Core	0.00	0.00	2.86	64.66	30.60	100.00	97.14	32.48	1.88
111	45.242	-85.556	Ponar	8.33	80.06	1.72	3.84	4.43	11.61	9.89	6.05	1.62
112	45.294	-86.283	Box Core	0.00	0.00	6.06	59.80	32.04	100.00	93.95	34.15	2.11
113	45.327	-87.009	Gravity Core	0.49	75.05	7.34	14.38	2.24	24.47	17.12	2.74	0.50
115	45.396	-85.595	Ponar	7.02	73.01	3.25	13.18	3.55	19.98	16.73	3.55	0.00
117	45.446	-85.222	Gravity Core	3.58	53.49	6.32	23.17	9.81	42.93	36.61	13.44	3.63
120	45.529	-86.171	Box Core	0.00	0.67	11.54	62.93	24.06	99.33	87.79	24.86	0.80
121	45.535	-85.636	Ponar	16.73	72.71	1.35	4.54	3.67	10.55	9.21	4.67	1.00
123	45.603	-87.097	Ponar	1.68	94.73	0.32	1.13	1.47	3.59	3.28	2.15	0.68
124	45.710	-86.409	Ponar	47.73	44.58	0.97	2.12	3.30	7.69	6.72	4.60	1.30
125	45.723	-85.331	Ponar	11.88	84.89	0.00	1.29	1.35	3.23	3.23	1.94	0.59
126	45.761	-86.064	Box Core	0.00	7.08	25.65	49.51	17.77	92.92	67.27	17.77	0.00
127	45.812	-85.718	Ponar	4.82	70.95	3.99	12.42	6.40	24.23	20.24	7.82	1.42
129	45.900	-86.105	Ponar	0.88	95.01	0.15	1.61	1.77	4.11	3.96	2.35	0.58
130	45.909	-85.025	Ponar	3.06	74.28	7.04	9.10	5.03	22.66	15.62	6.53	1.50
131	46.001	-85.410	Ponar	0.46	47.33	9.24	30.35	10.88	52.22	42.97	12.62	1.74

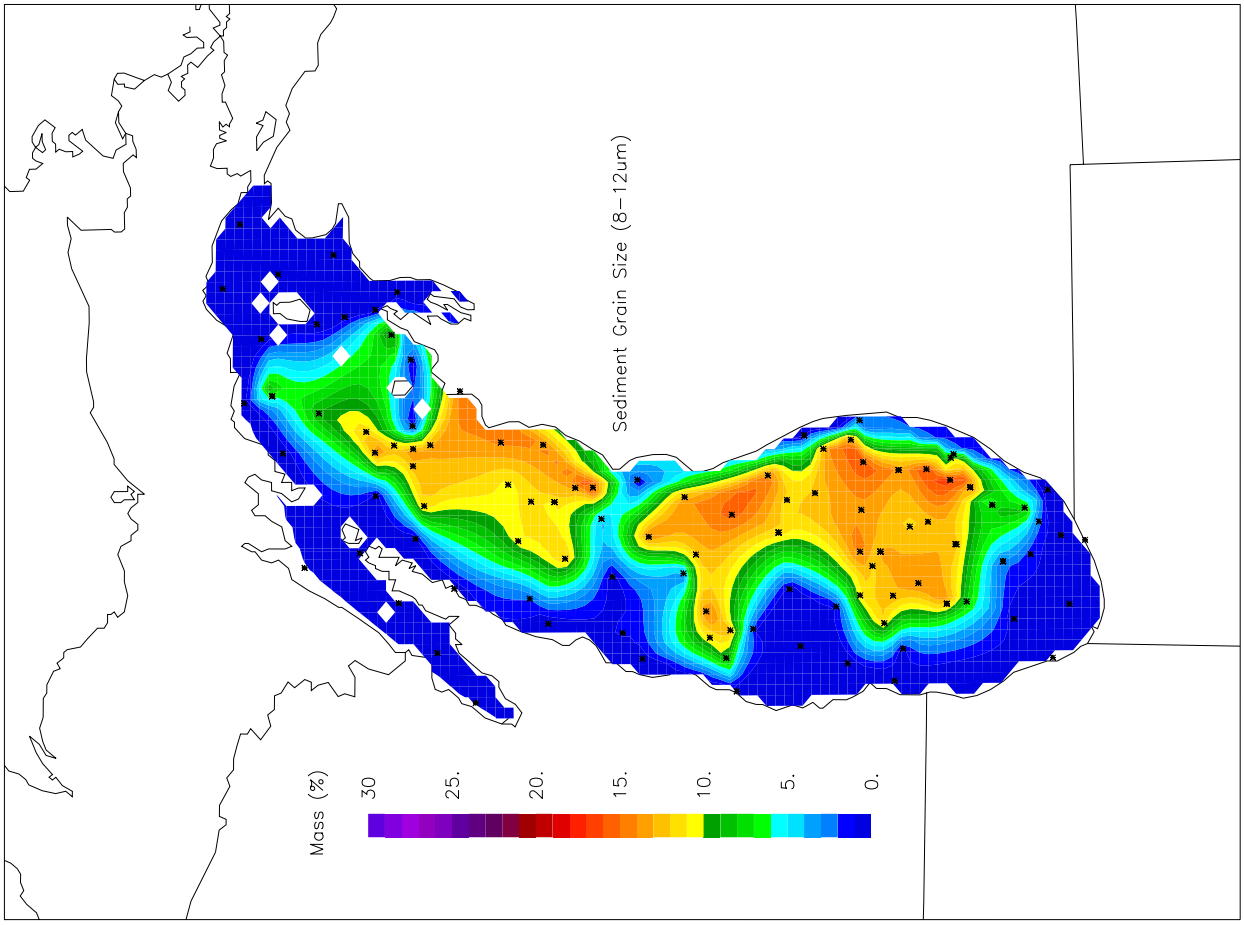
Table 4. Continued.

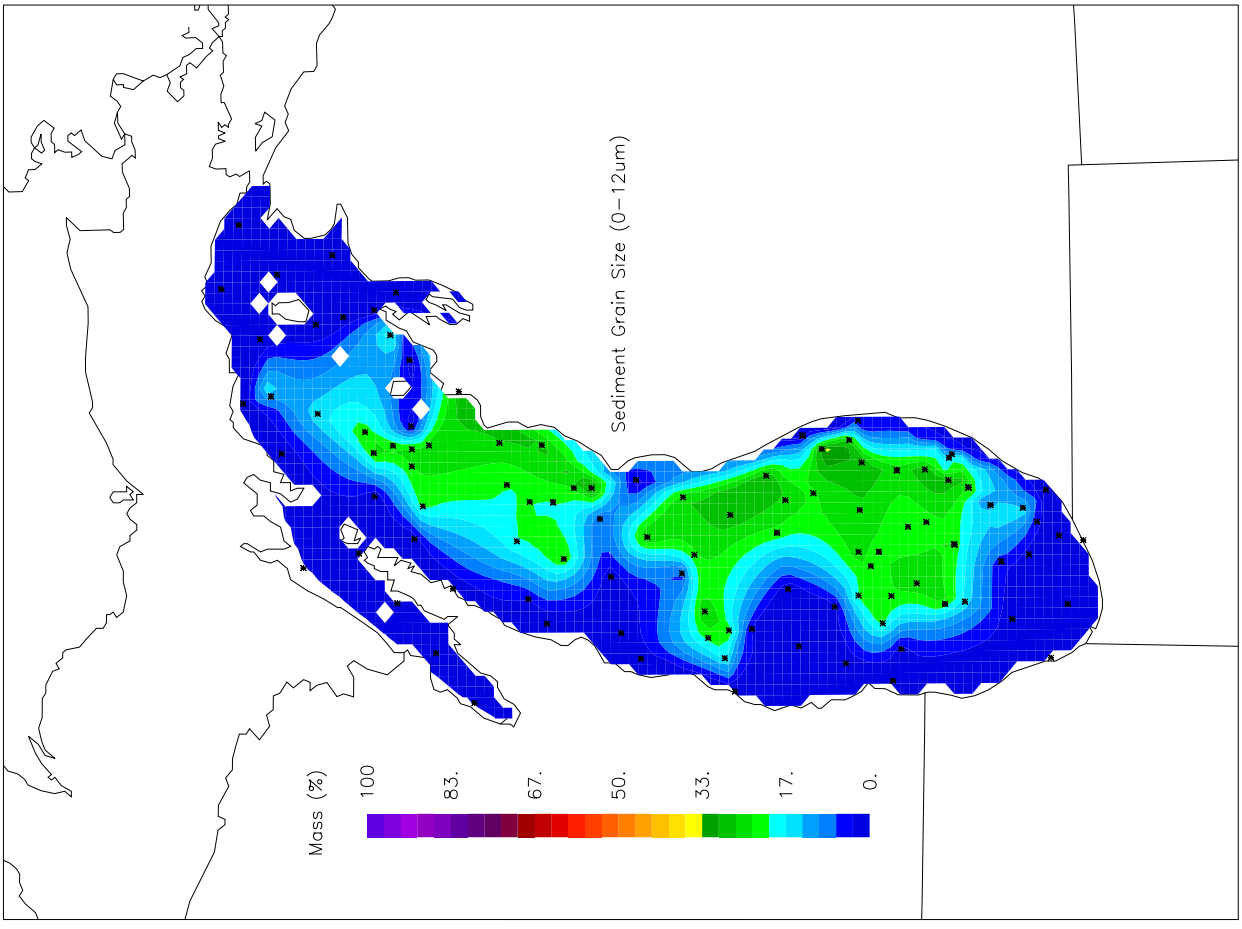
APPENDIX
Contour Plots

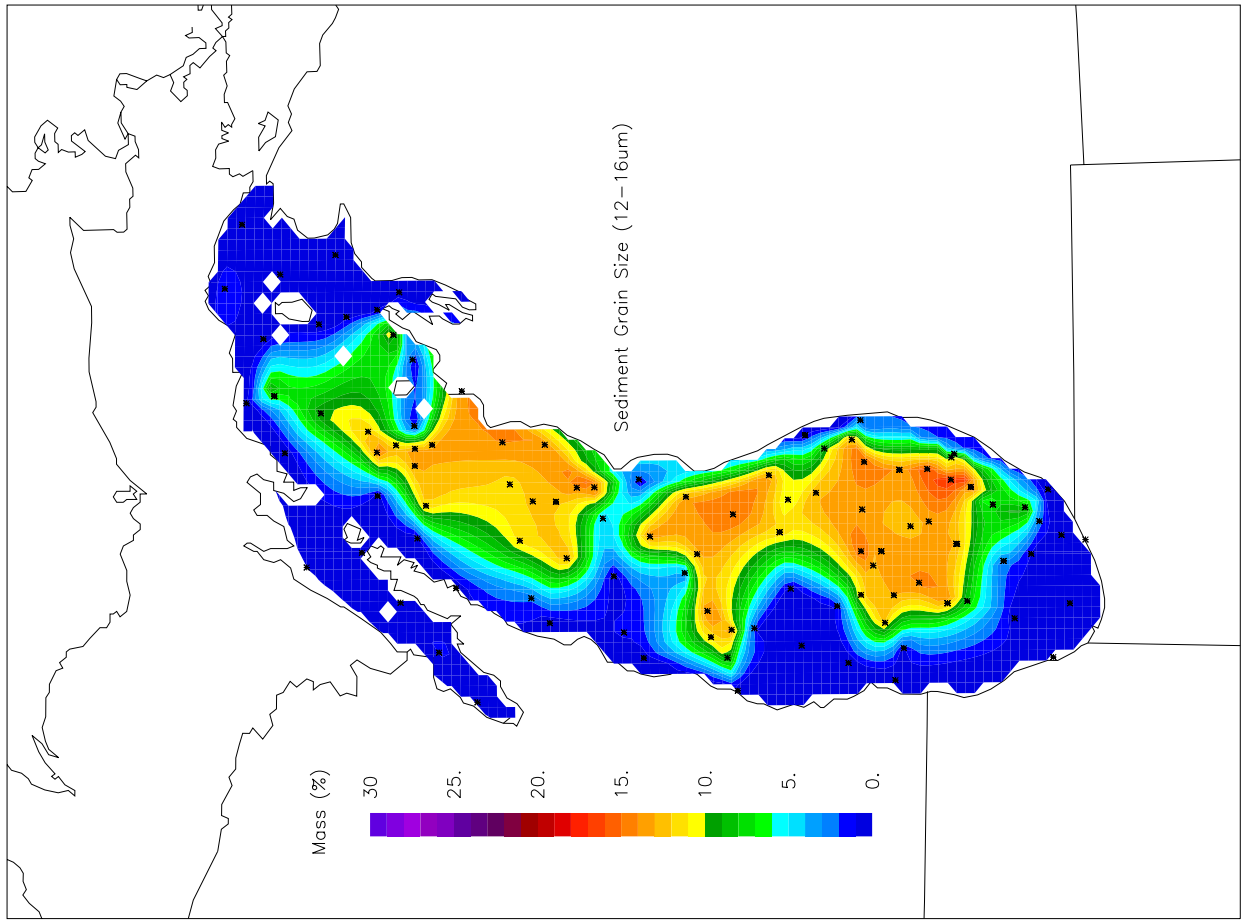
Surface sediment particle size contour plots in 4 μm increments (symbols represent sample locations), paired with surface sediment cumulative particle size contour plots.

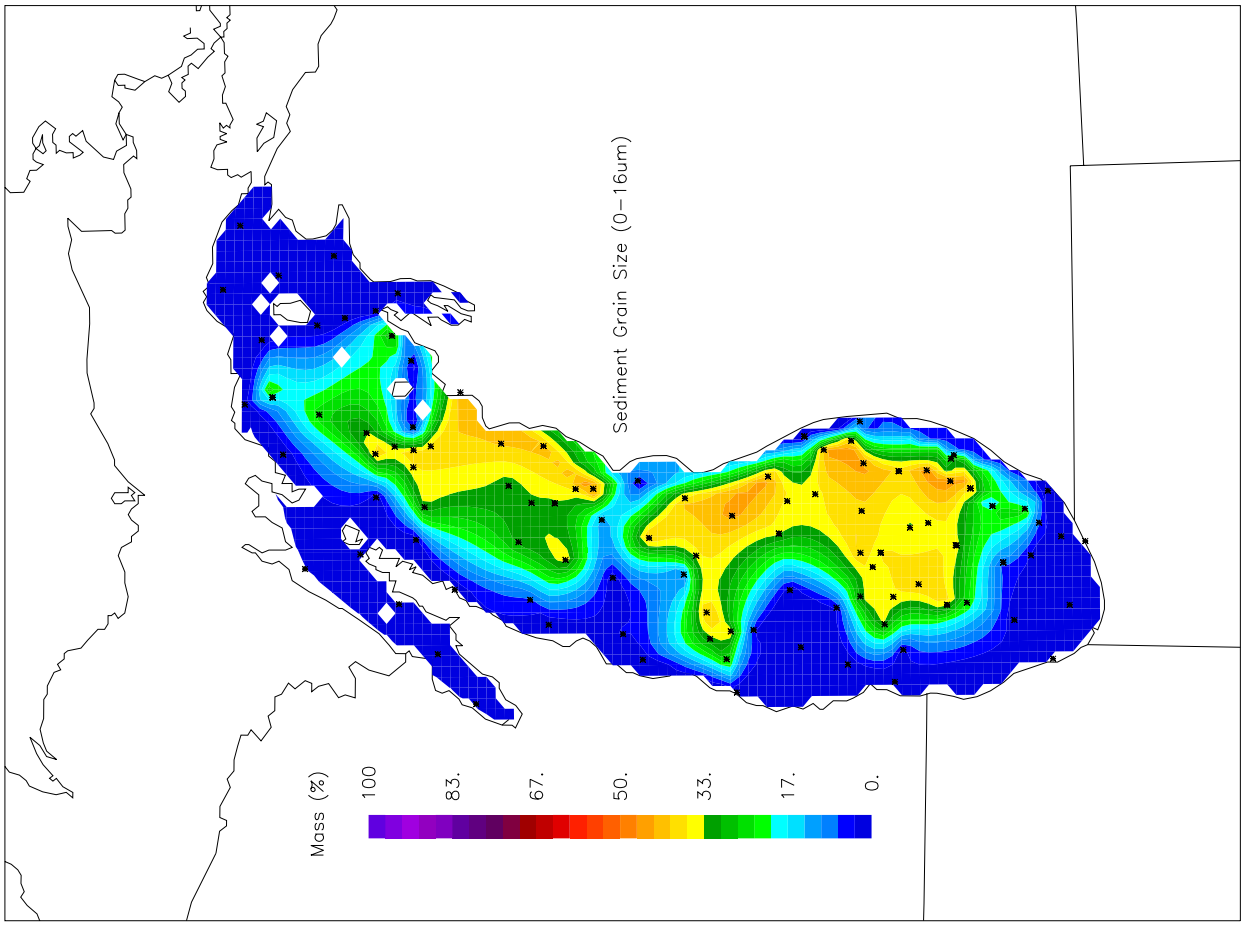

Mass (%)
100
83.
67.
50.
33.
17.
0.
Sediment Grain Size (0–4um)

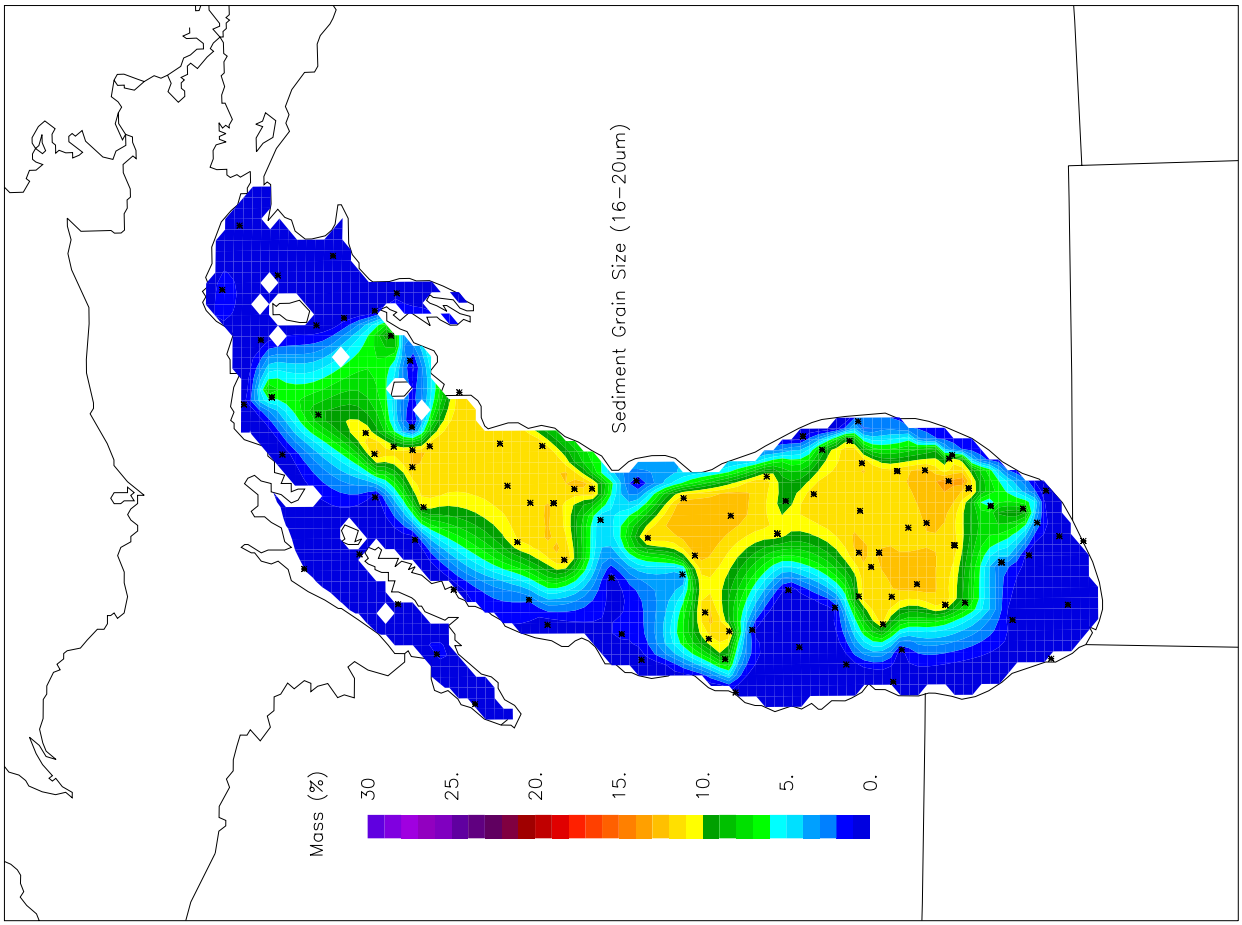

Sediment Grain Size (4-8um)
Mass (%)
30
25.
20.
15.
10.
5.
0.
Sediment Grain Size (0-8um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

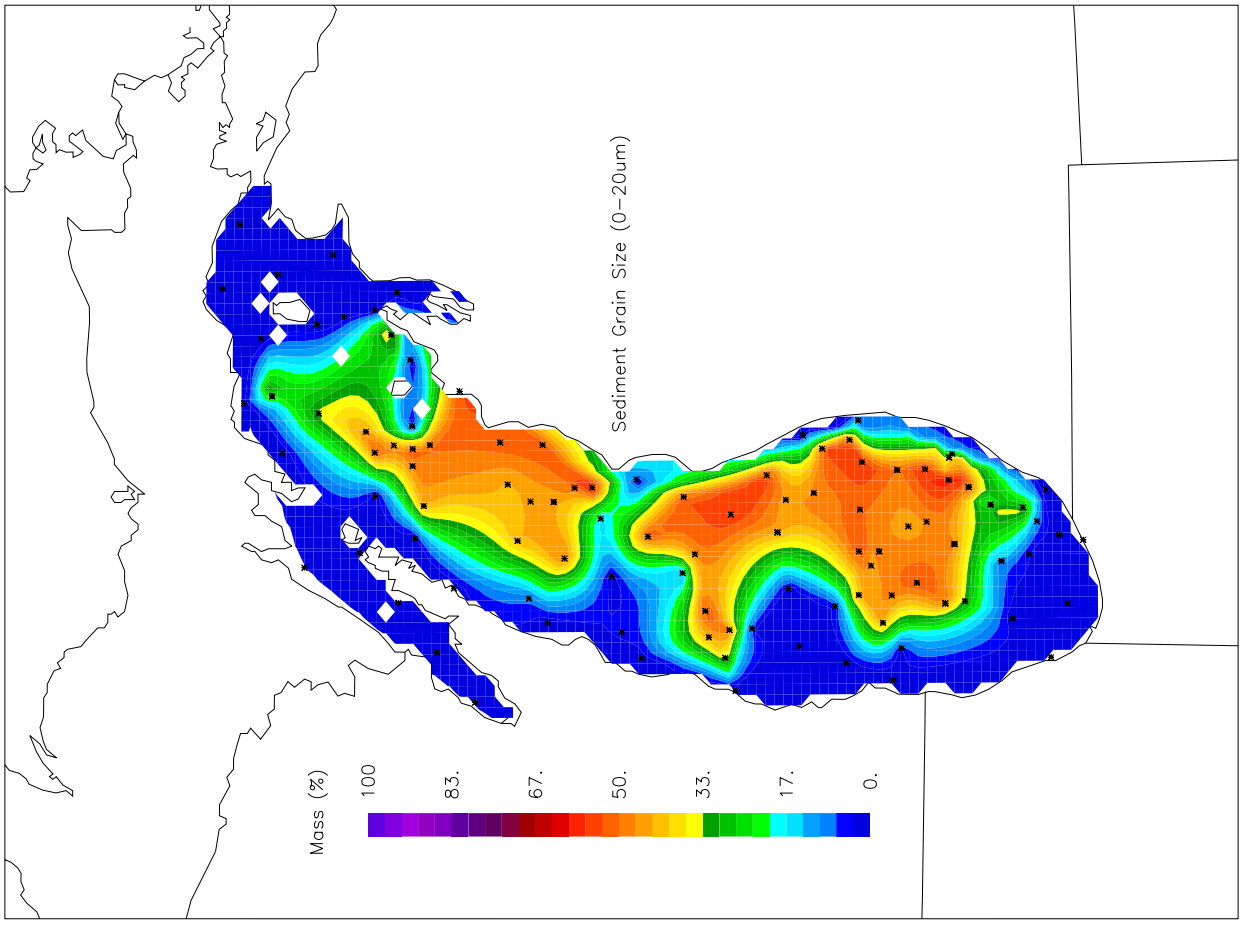

Sediment Grain Size (8-12um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

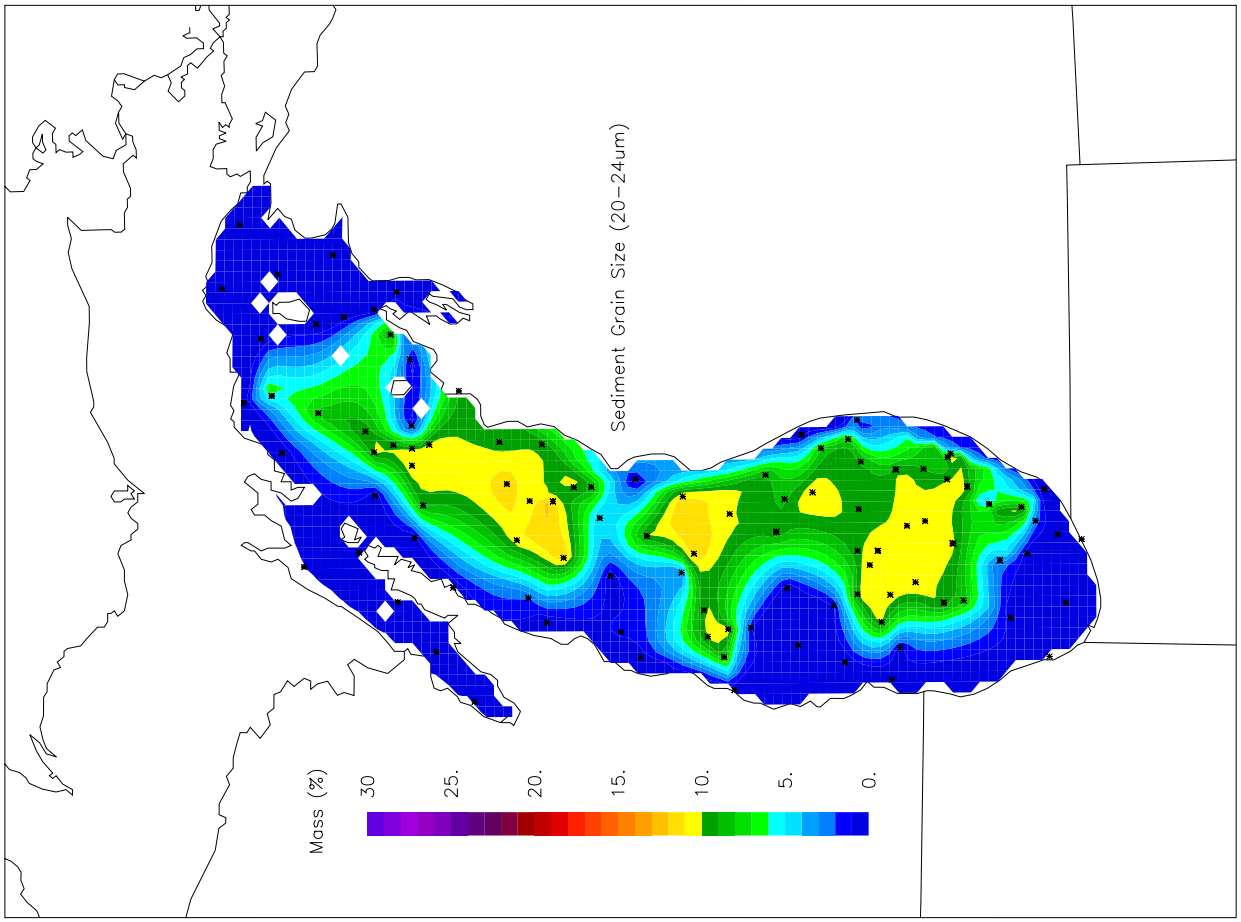

Sediment Grain Size (0-12um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

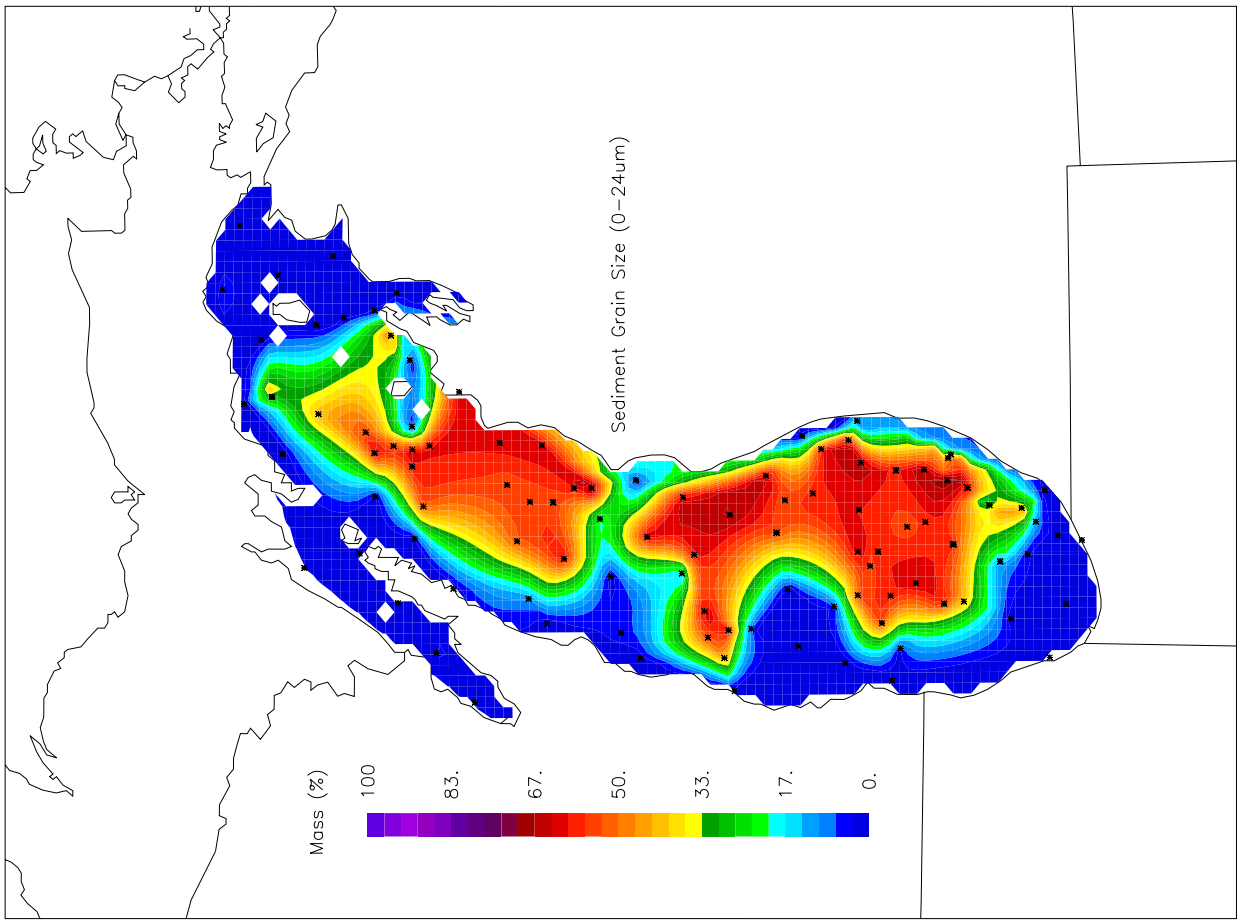

Sediment Grain Size (12–16um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

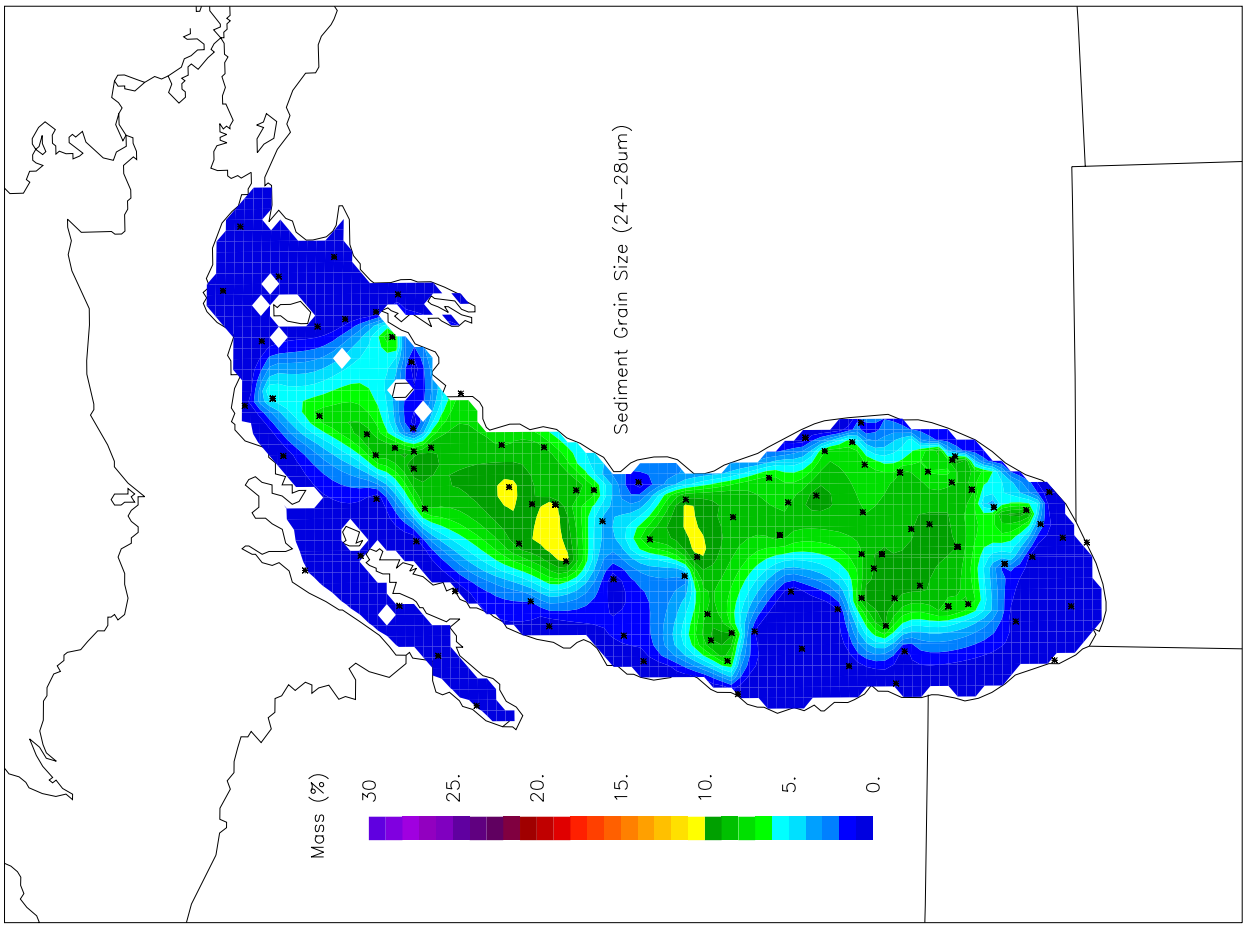

Sediment Grain Size (0–16um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

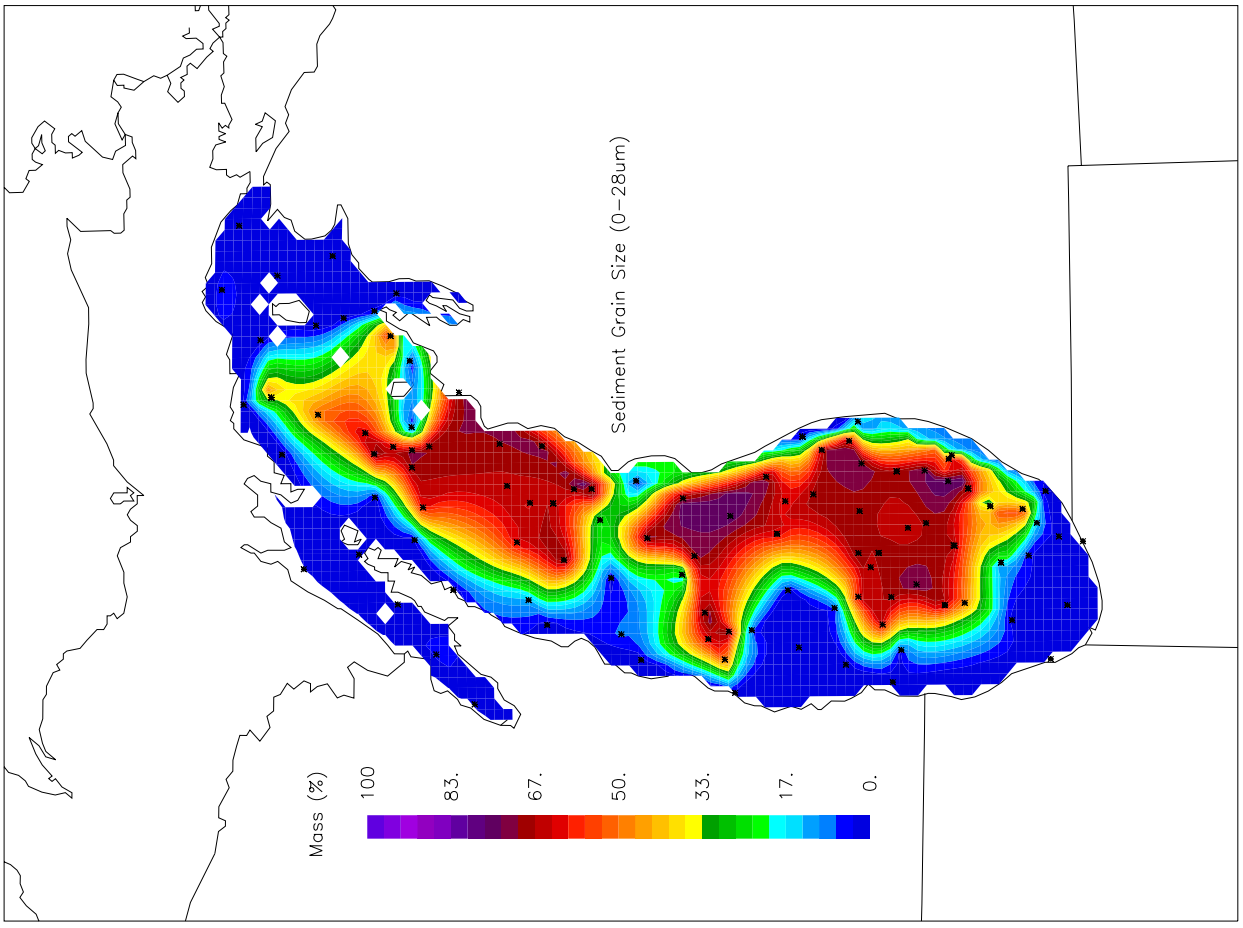

Sediment Grain Size (16–20um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

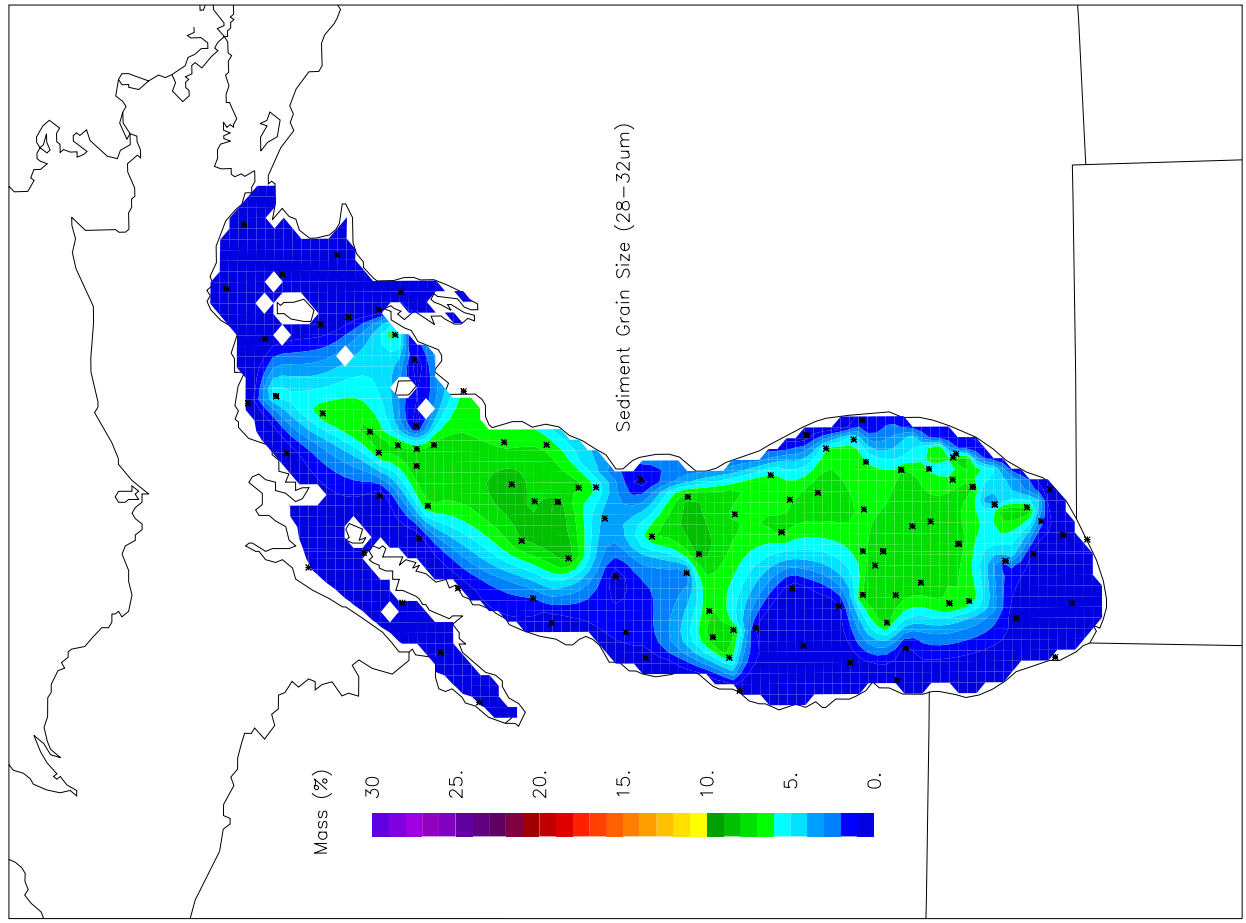

Sediment Grain Size (0–20um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

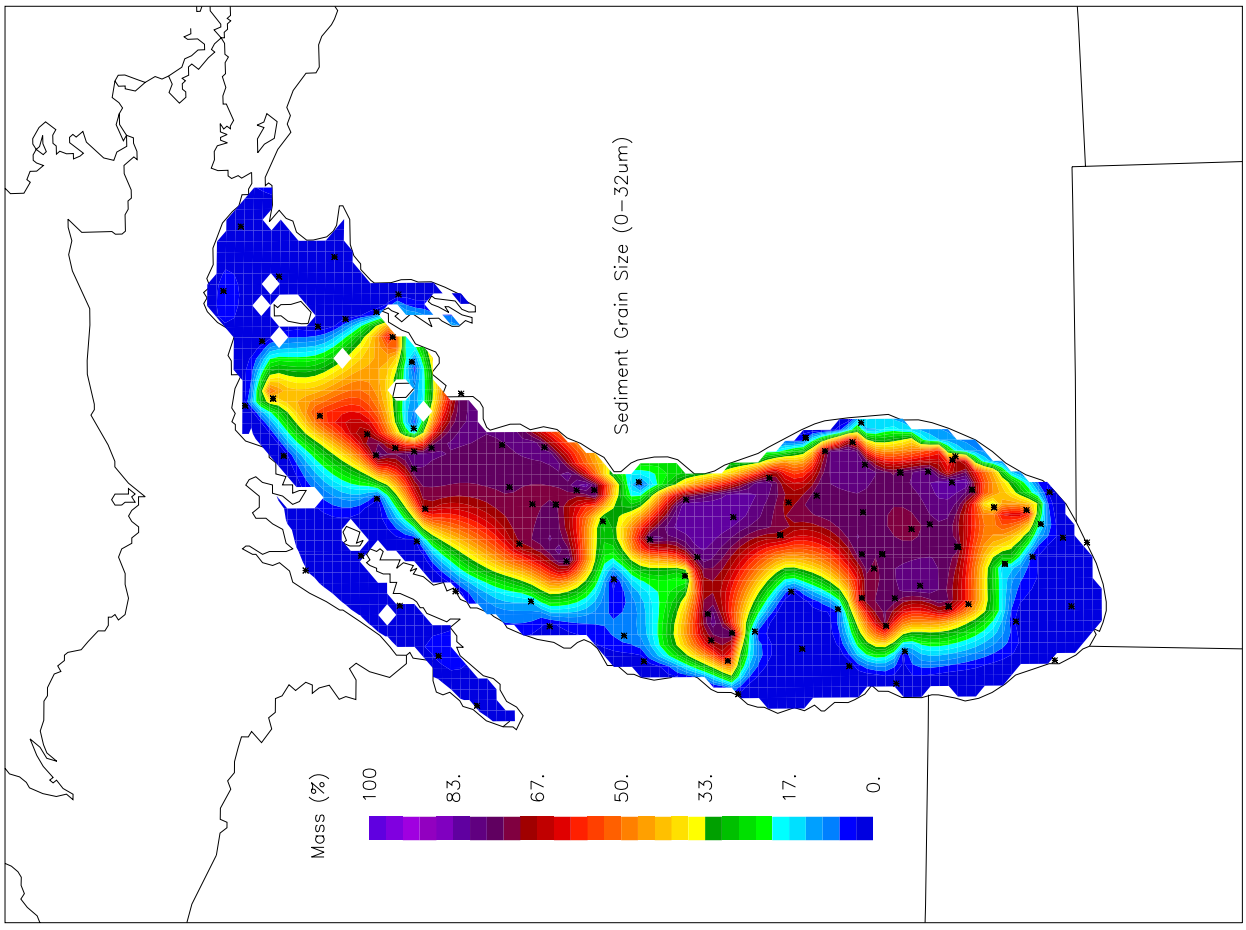

Sediment Grain Size (20-24um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

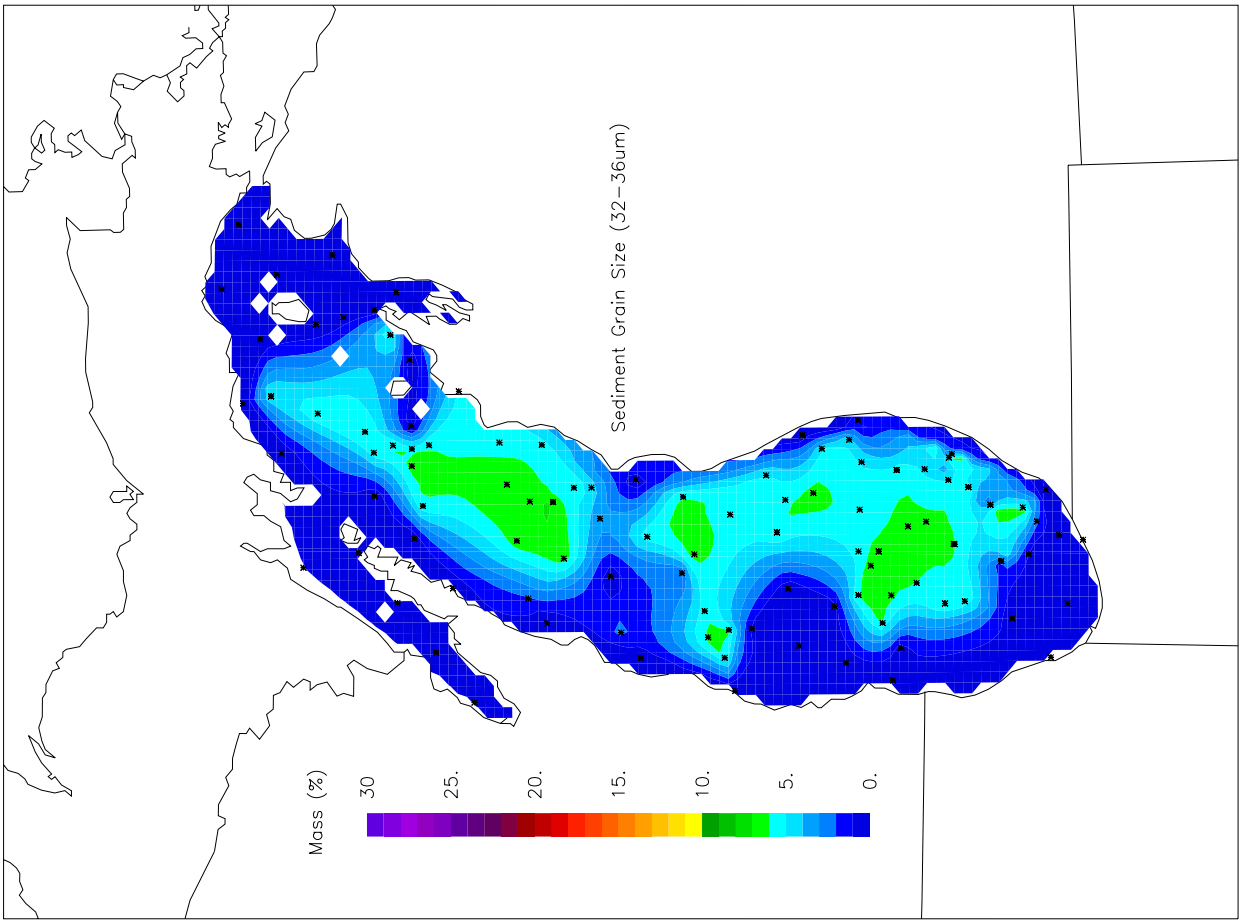

Sediment Grain Size (0-24um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

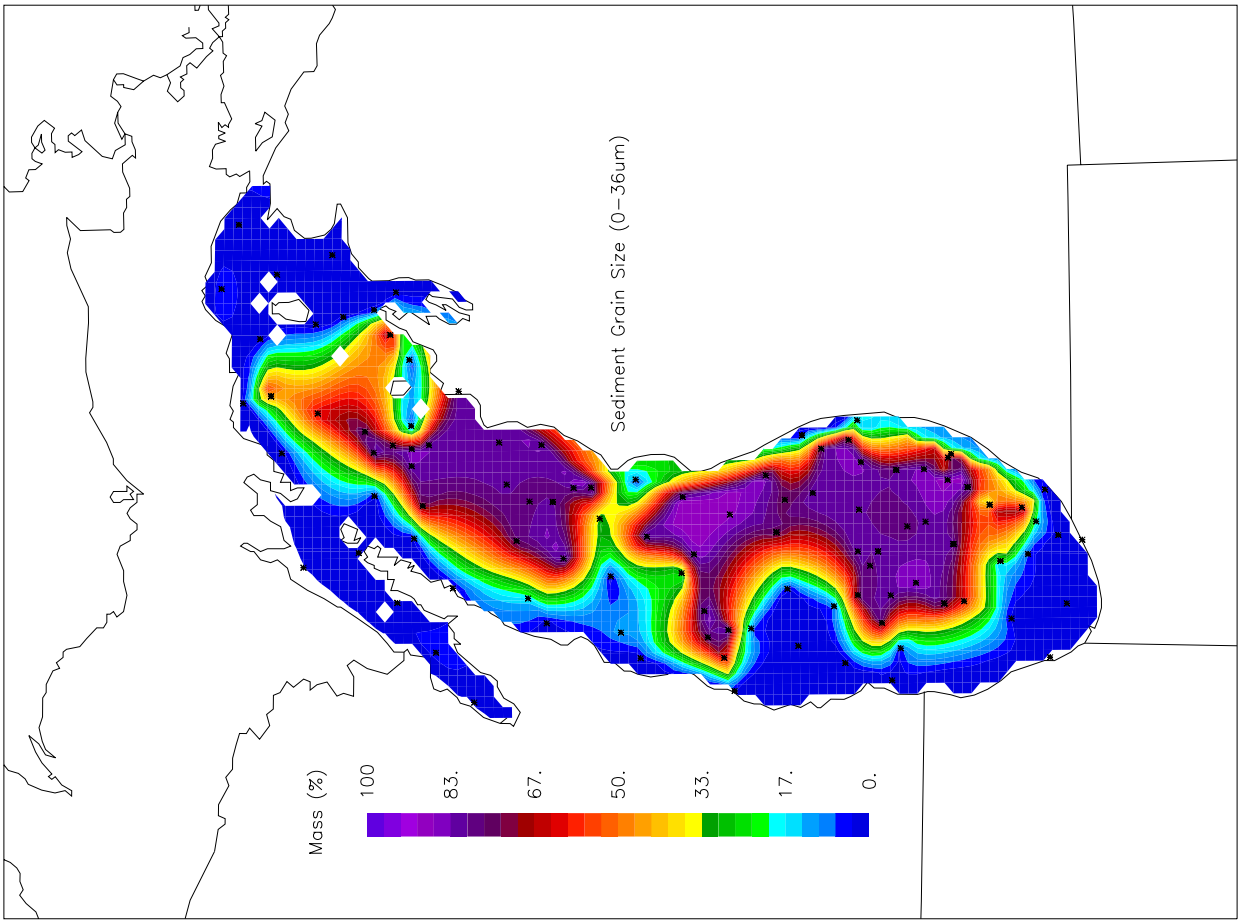

Sediment Grain Size (24-28um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

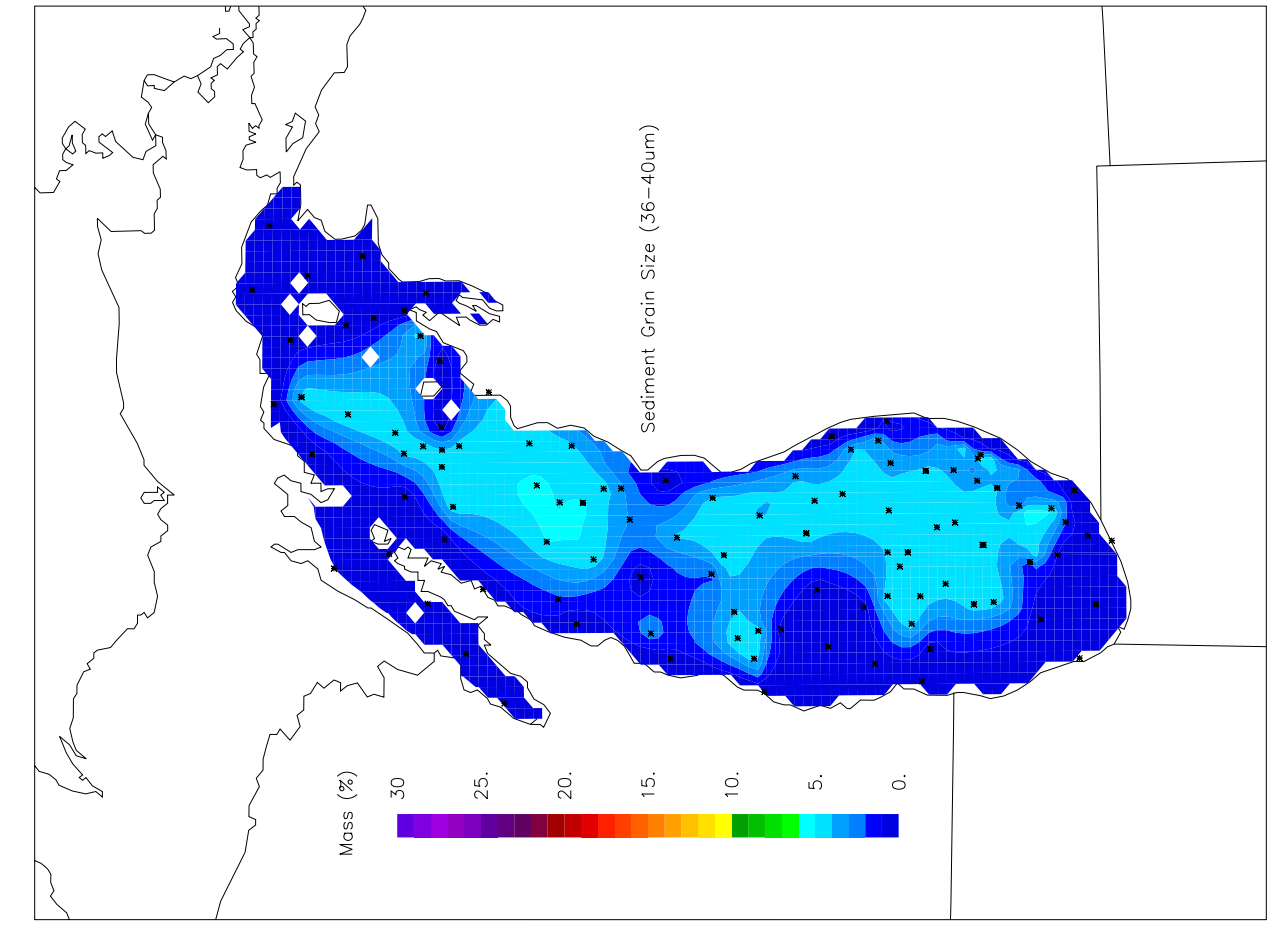

Sediment Grain Size (0-28um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

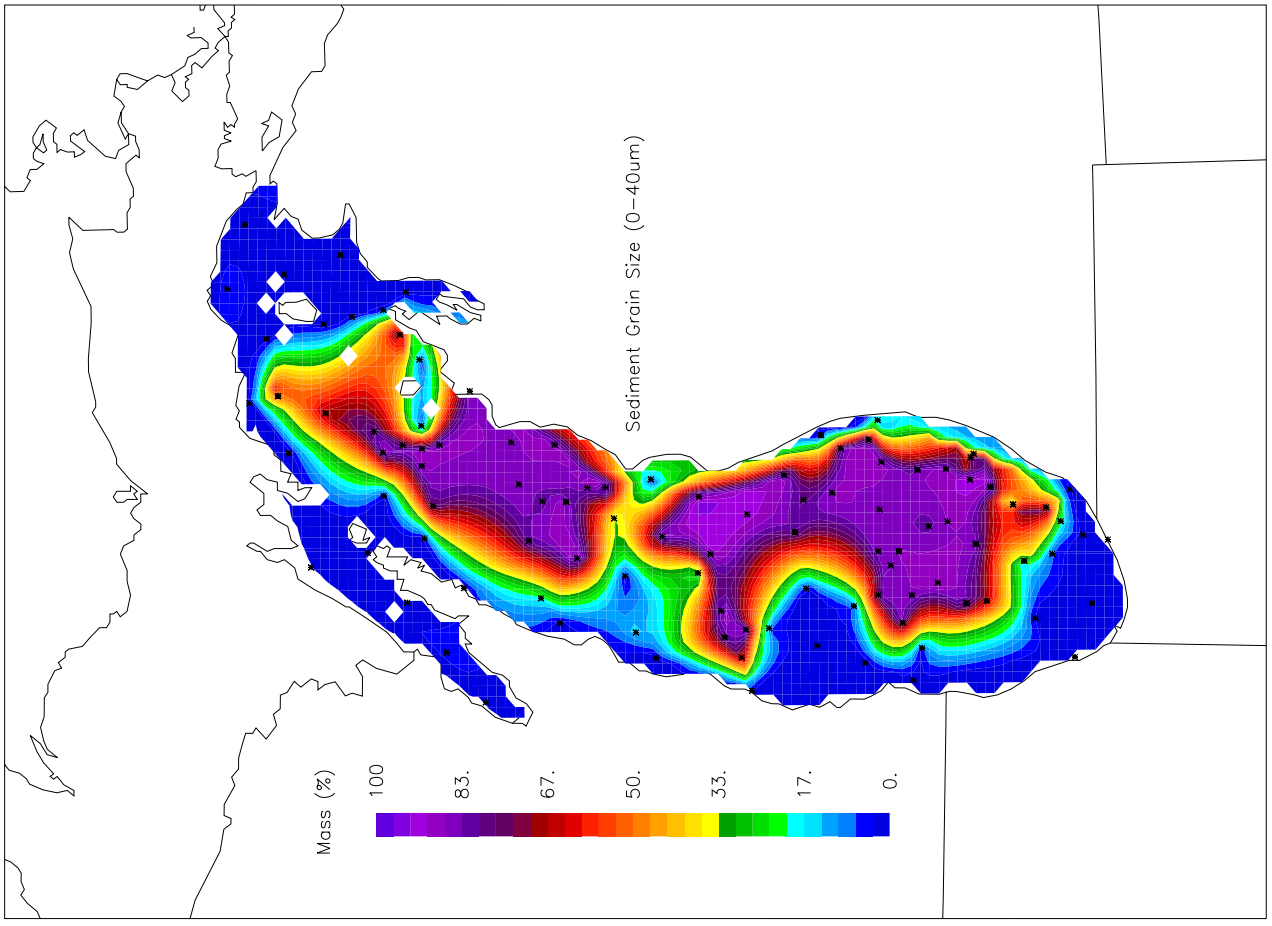

Sediment Grain Size (28–32um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

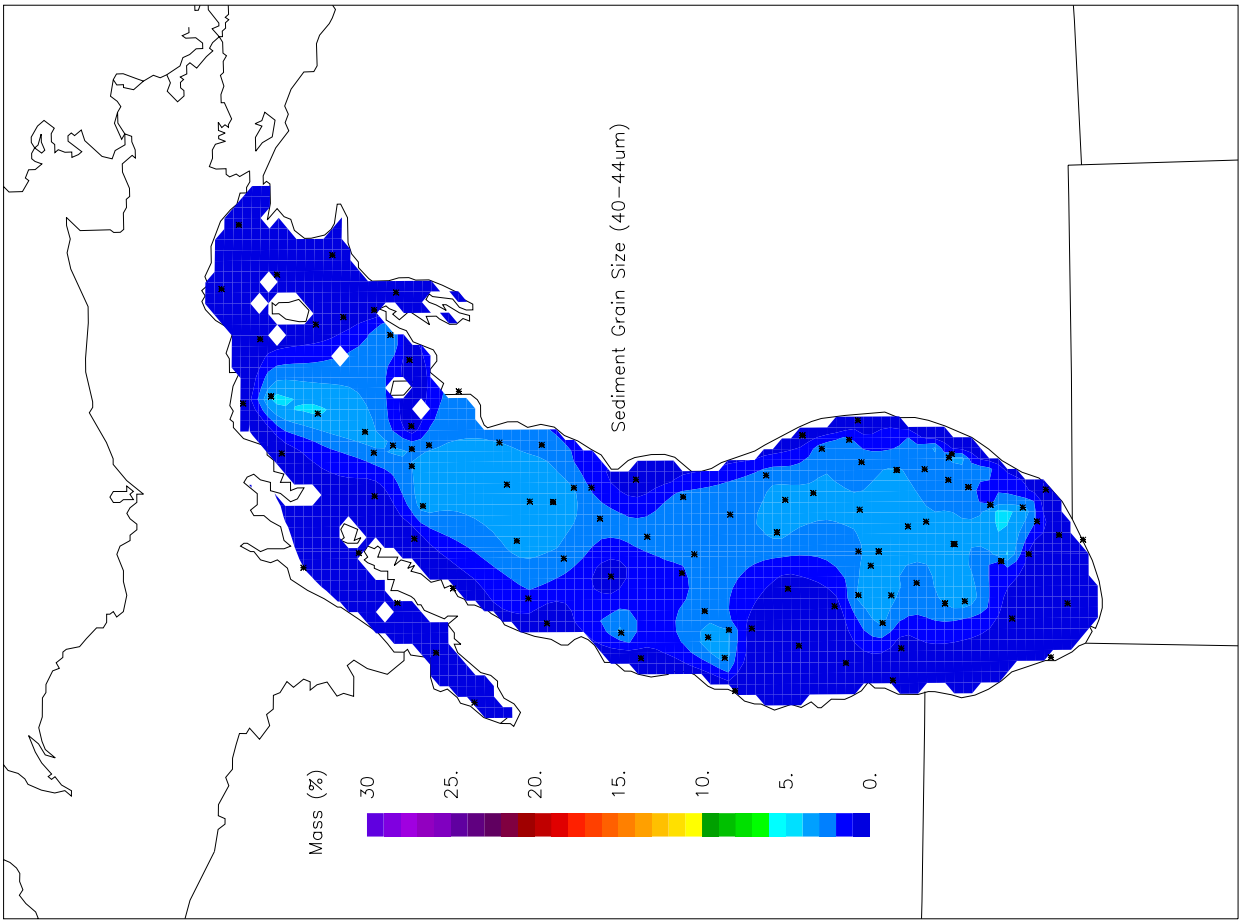

Sediment Grain Size (0–32um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

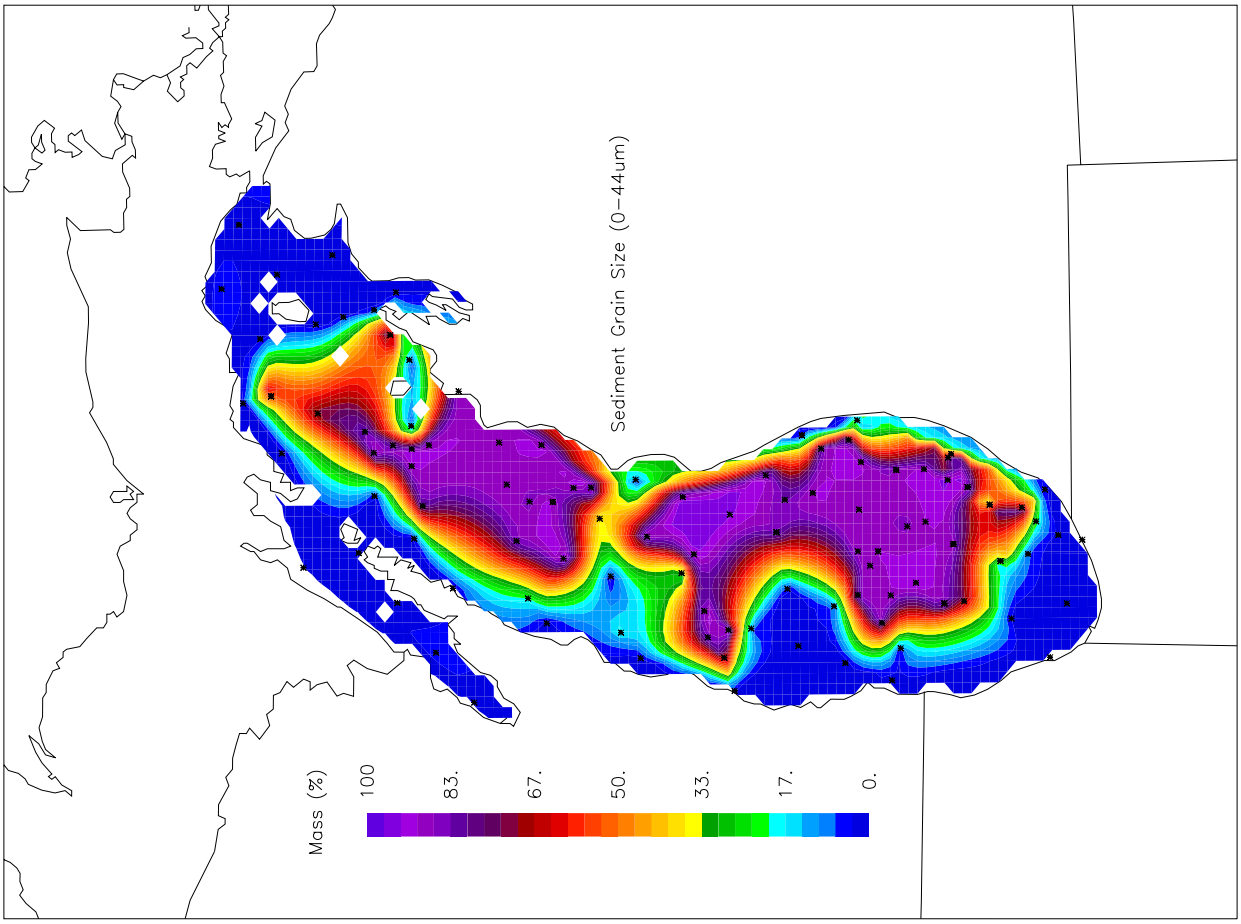

Sediment Grain Size (32–36um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

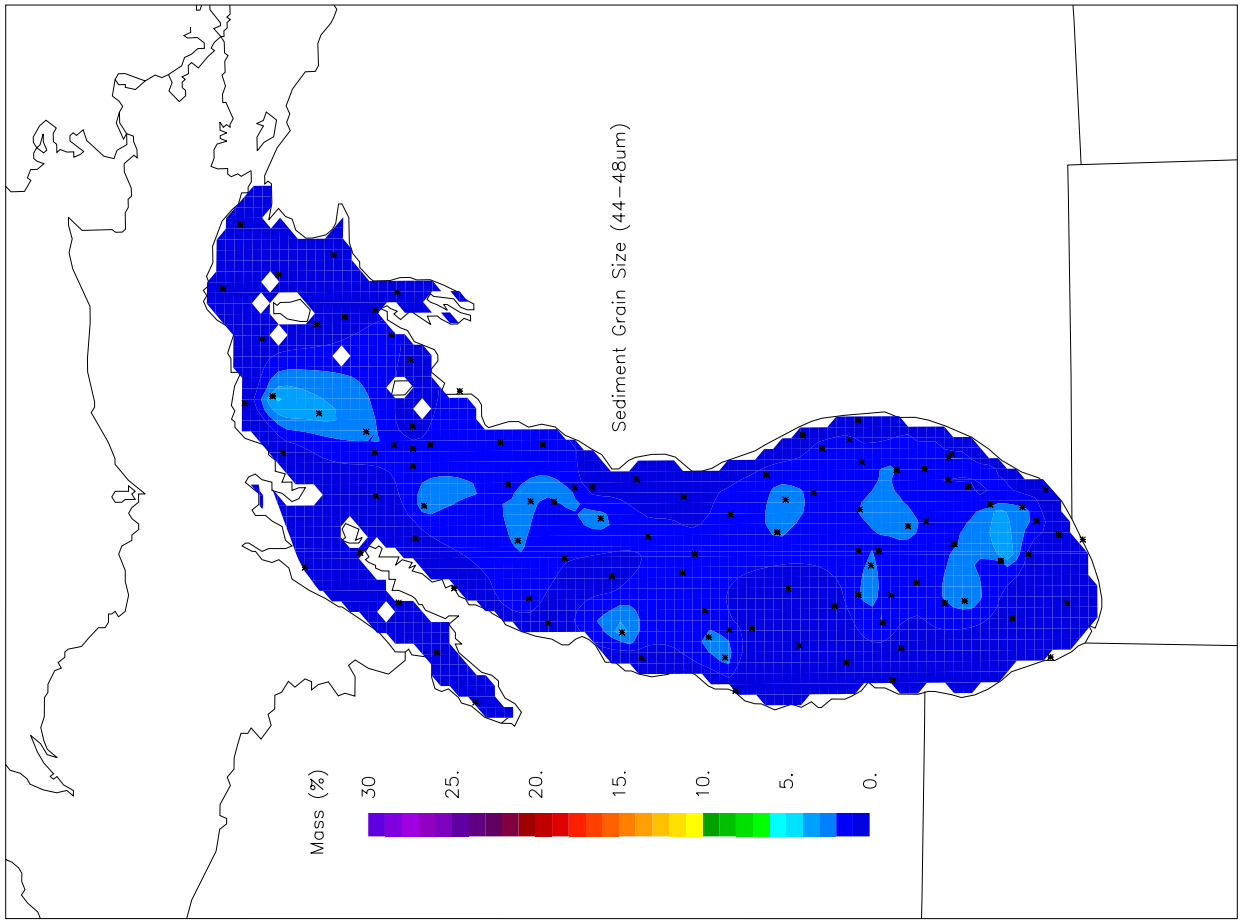

Sediment Grain Size (0–36um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

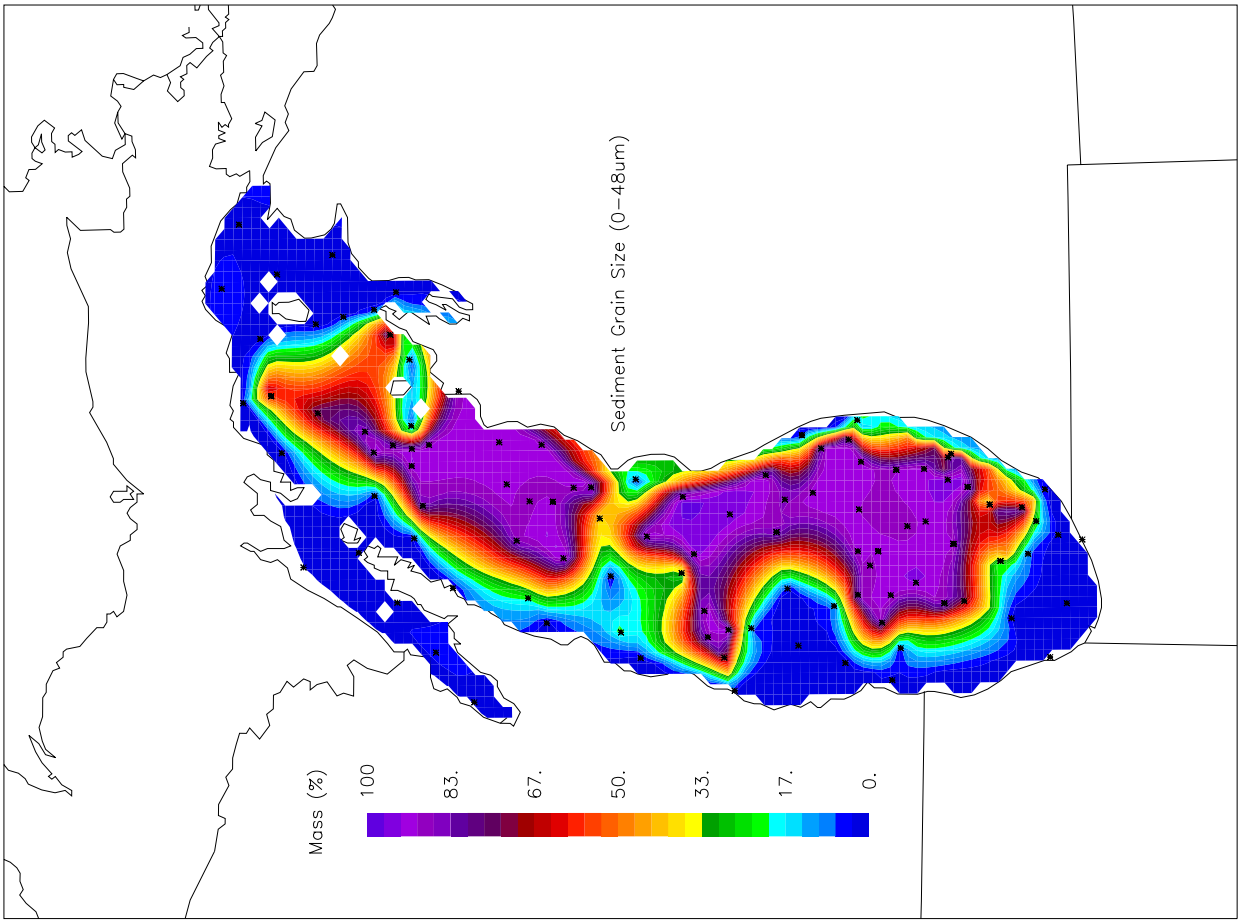

Sediment Grain Size (36-40um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

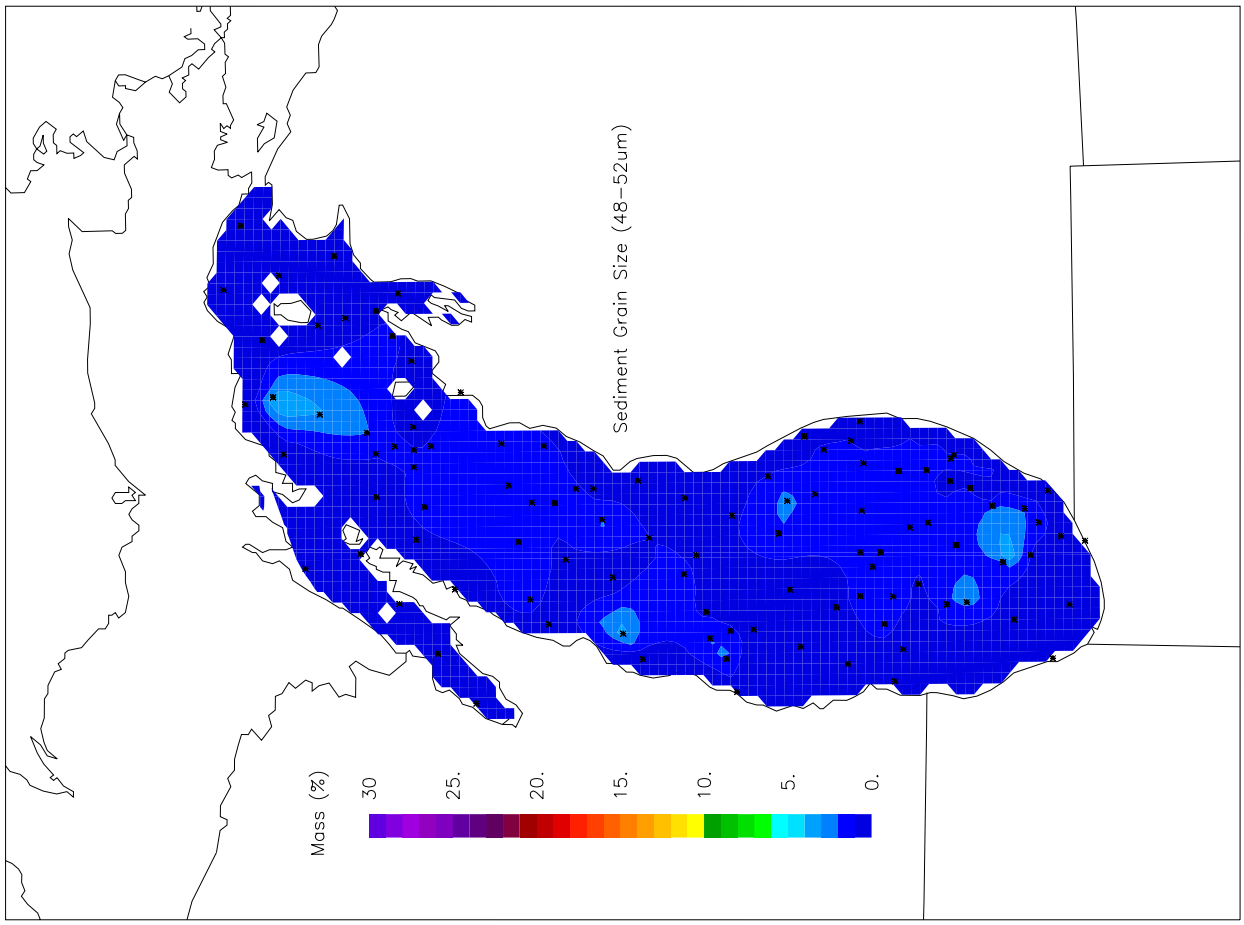

Sediment Grain Size (0-40um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

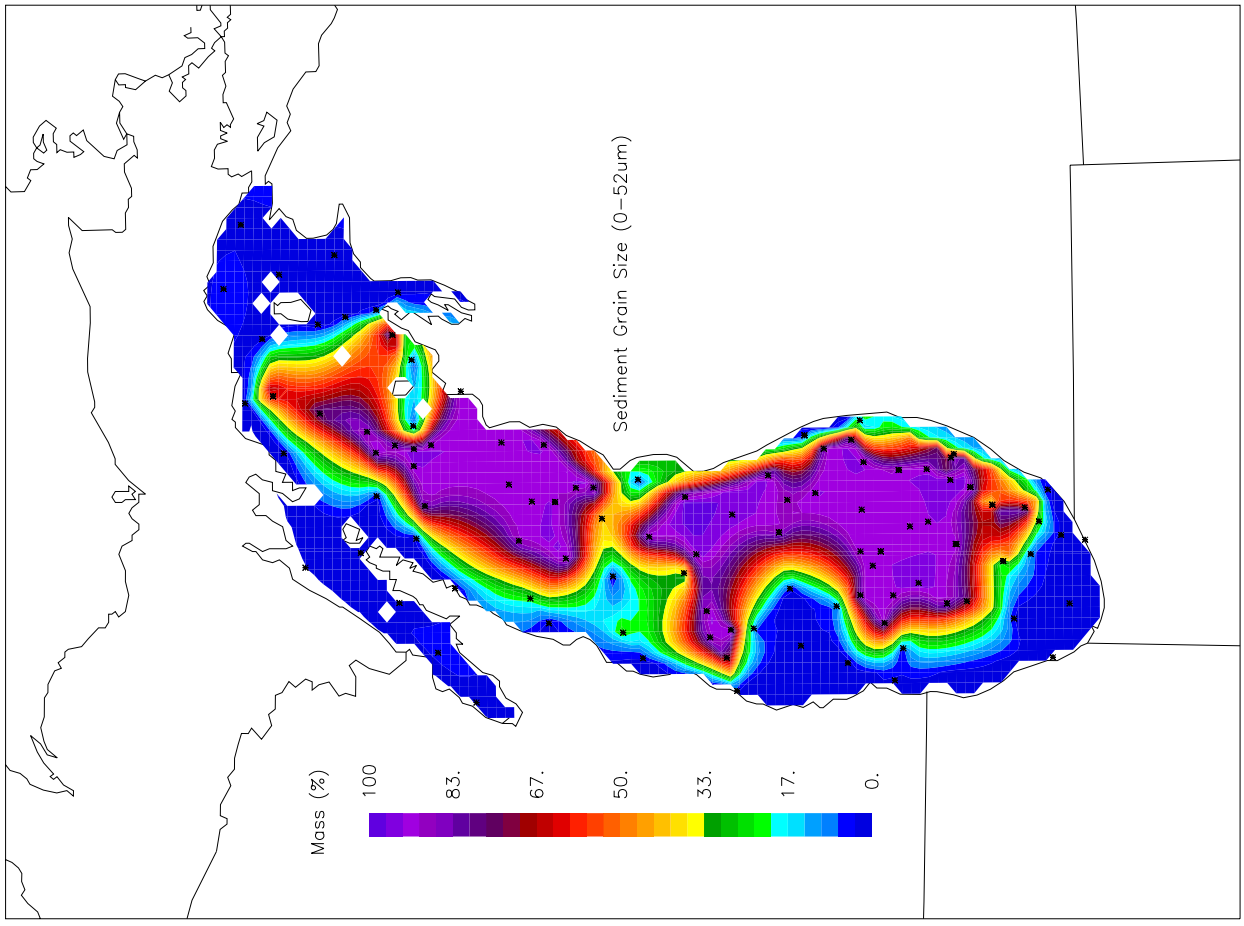

Sediment Grain Size (40–44um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

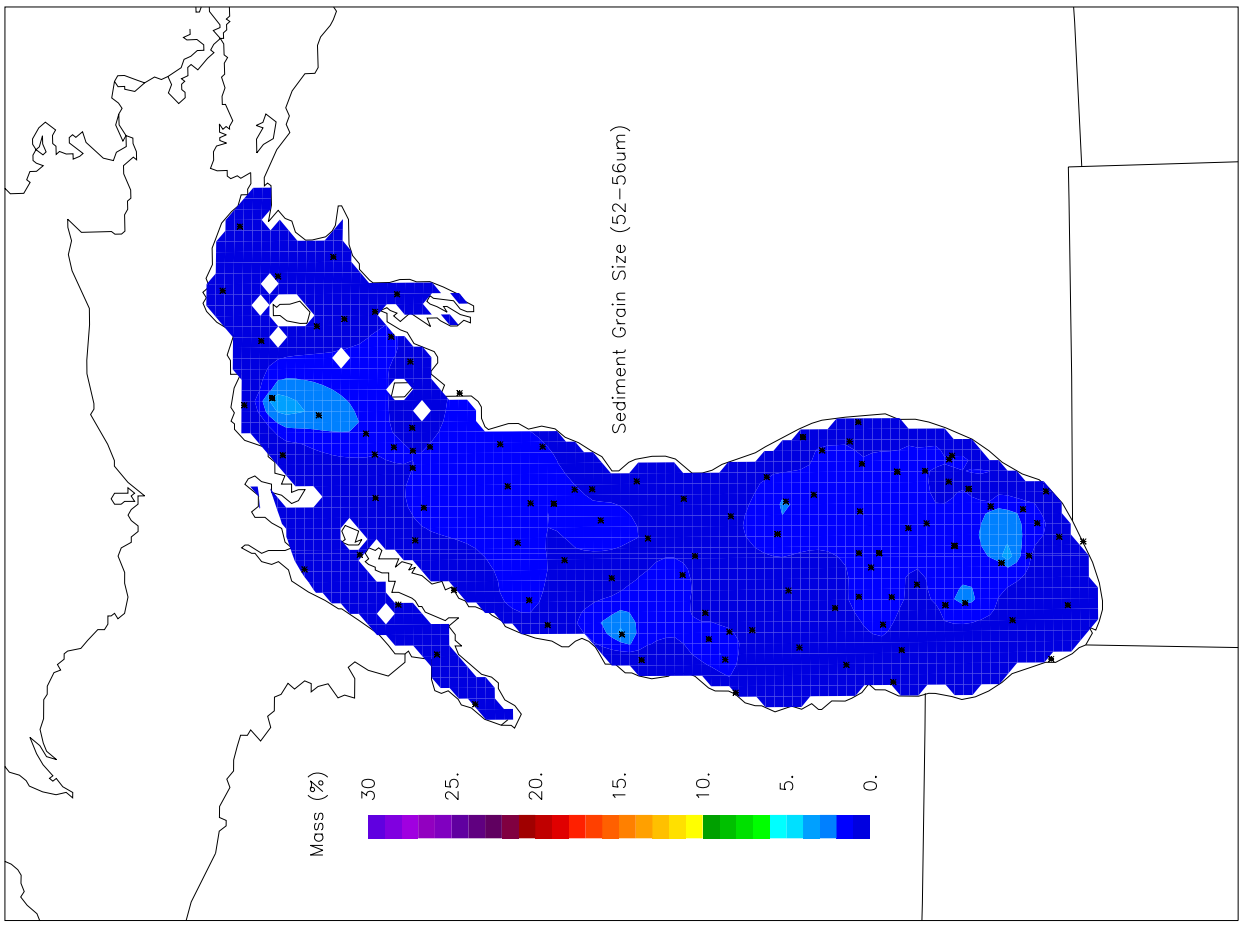

Sediment Grain Size (0–44um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

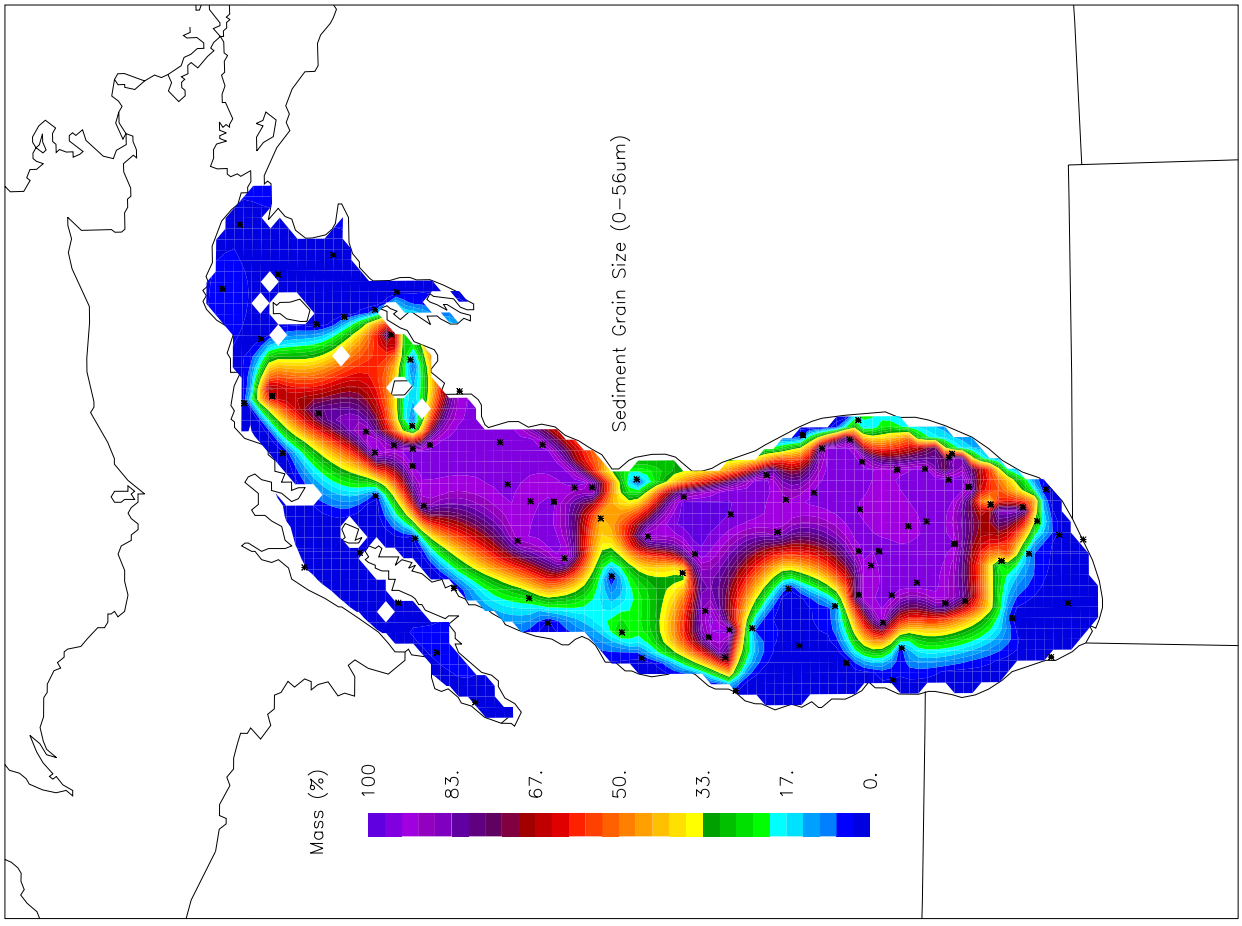

Sediment Grain Size (44-48um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

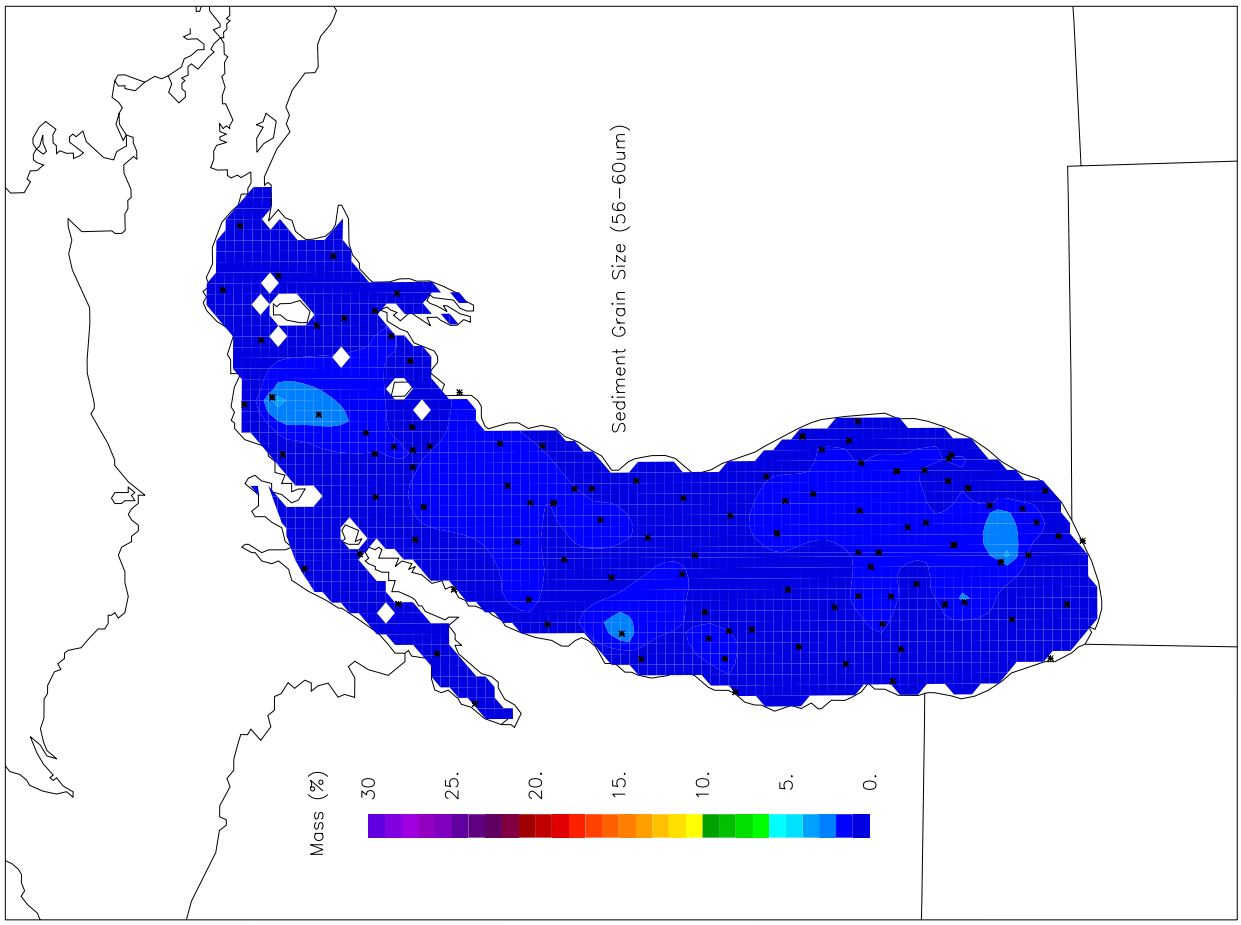

Sediment Grain Size (0-48um)
Mass (%)
100
83.
67.
50.
33.
17.
0.

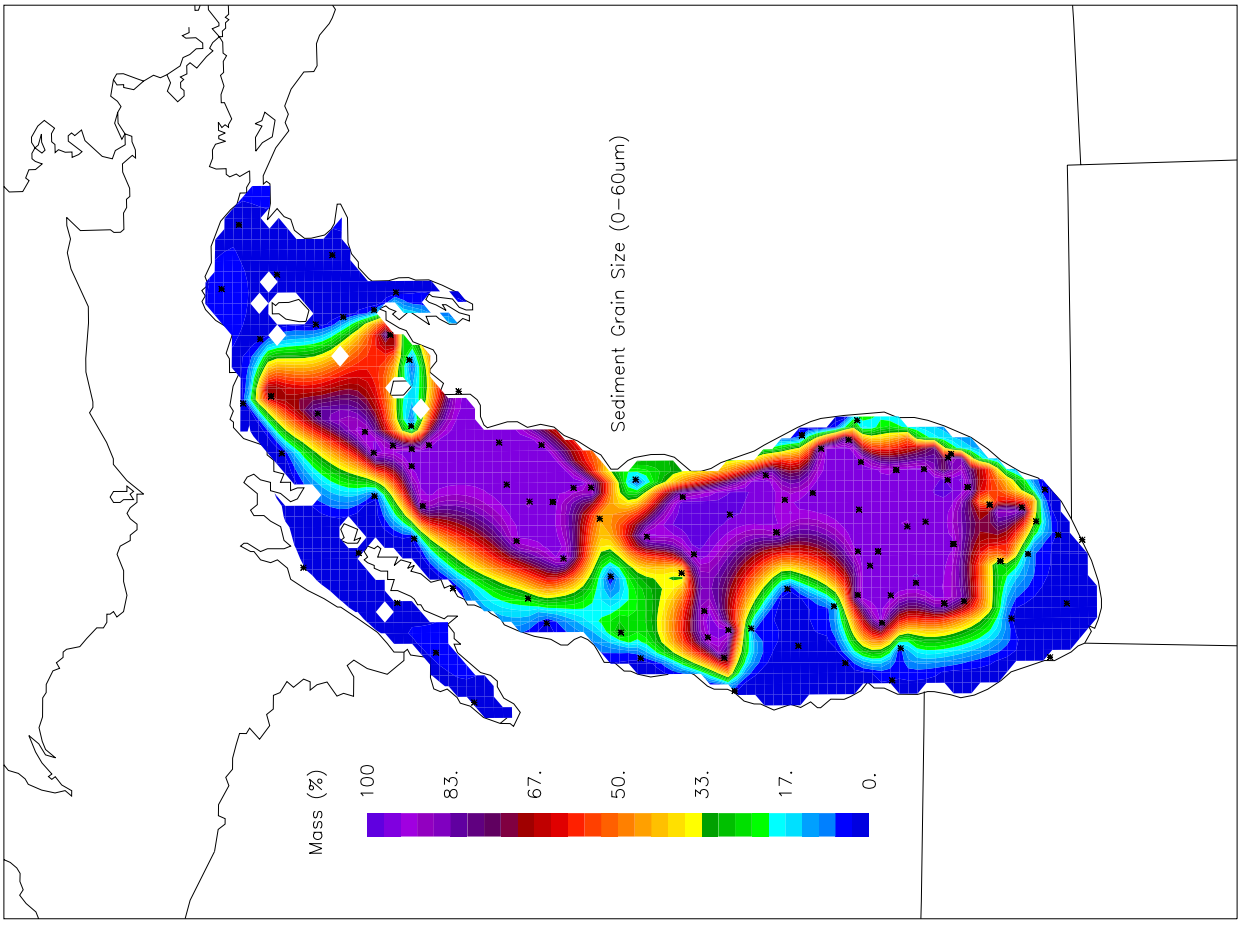

Sediment Grain Size (48-52um)
Mass (%)
30
25.
20.
15.
10.
5.
0.

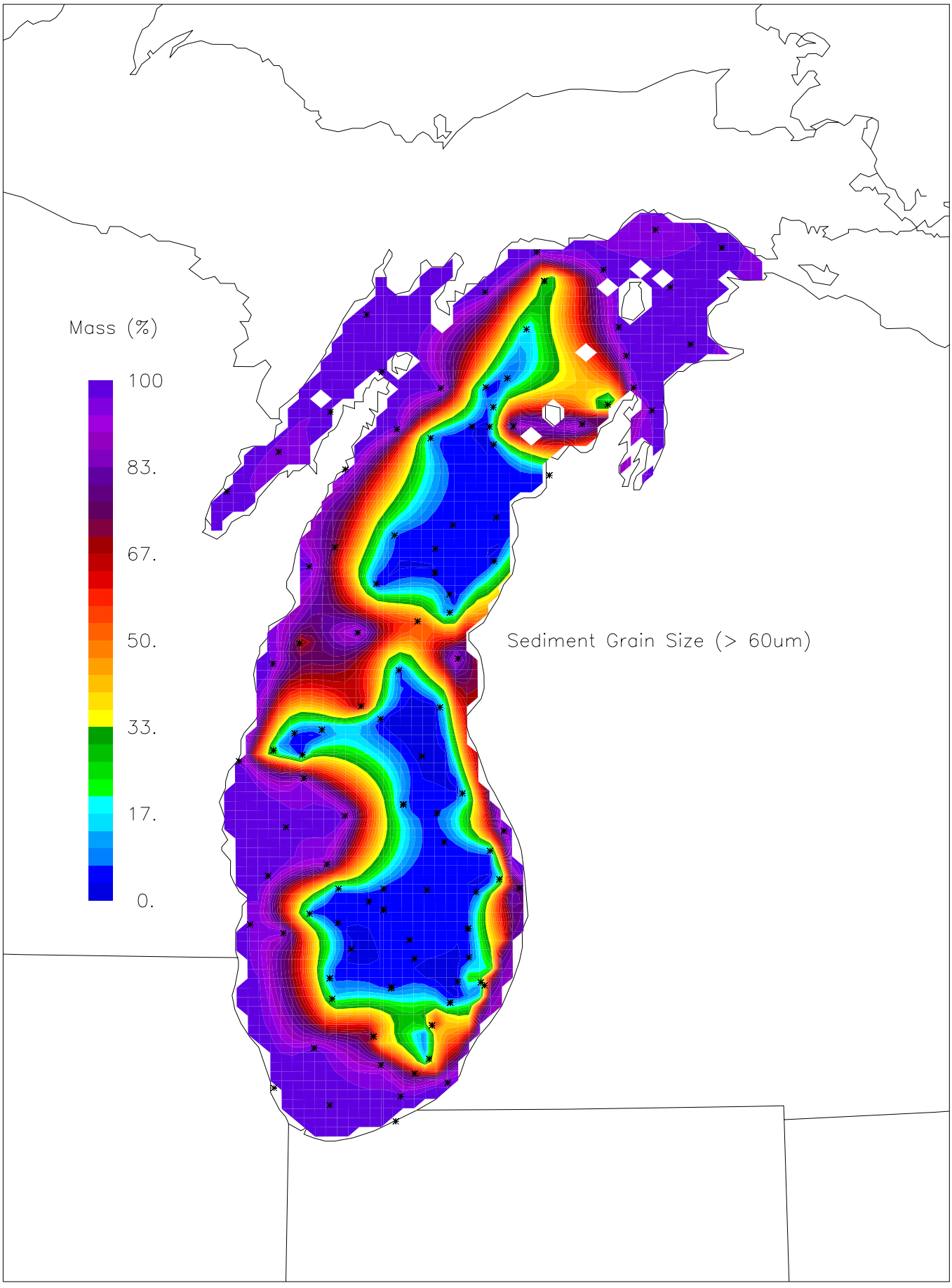

Sediment Grain Size (0-52um)
Mass (%)
100
83.
67.
50.
33.
17.
0.


Sediment Grain Size (52-56um)
Mass (%)
30
25.
20.
15.
10.
5.
0.


Sediment Grain Size (0-56um)
Mass (%)
100
83.
67.
50.
33.
17.
0.


Sediment Grain Size (56-60um)
Mass (%)
30
25.
20.
15.
10.
5.
0.


Sediment Grain Size (0-60um)
Mass (%)
100
83.
67.
50.
33.
17.
0.


Mass (%)
100
83.
67.
50.
33.
17.
0.
Sediment Grain Size (> 60um)