COSR - 122.6481 km, 37.7827 kit, pg 3 North-South Velocity Time Series	
	Total
01-Apr-2015 06-Apr-2015 12-Apr-2015 18-Apr-2015 24-Apr-2015 30-Apr-2015	
With the second se	Tidal
01-Apr-2015 06-Apr-2015 12-Apr-2015 18-Apr-2015 24-Apr-2015 30-Apr-2015	
	Residual
01-Apr-2015 06-Apr-2015 12-Apr-2015 18-Apr-2015 24-Apr-2015 30-Apr-2015	

SFBC, -122.47411 lan, 37.85631 kat, pg 3 East-West Velocity Time Series
-100
50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
90 00 00 00 00 00 00 00 00 00 00 00 00 0



SeaTides





10.9515 8.8518 4.0832 -0.0244 -4.8711 11.1342 -5.1078 -3.3010 -4.5192 -3.8836 -6.2462 -6.2462 -6.2462 -1.6662 -0.7929 9.1441 -6.2462 -0.7929 9.1441 -6.2458 -8.7388 -8.7388 -8.7388 -12.3306 -13.9471 -14.3153 -2.3306 -1.43583 -2.33266 -1.6982 -0.61858 -4.8201 -5.8156 -4.8201 -5.8156 -6.1471 5.3580 5.0552 5.0552 3.3561 5.0552 3.3561 6.3691 3.3561 4.4653 5.3263 5.3263 5.0354 6.5042 5.3263 3.0354 6.5042 4.6520 5.3263 3.1034 4.6520 5.3263 3.1034 4.6520 5.1385 5.1385 5.1385 5.1397 4.2637 4.2637 4.32637 4.32637 4.32637 5.3071 5.3075

2.0765 13.6554 16.5609 11.7058 5.6751 14.9898

 $\begin{array}{c} 1.14400\\ 1.144007\\ 1.149467\\ 1.149467\\ 1.149467\\ 1.149467\\ 1.149467\\ 1.159467\\ 1.15567\\ 1.15766\\ 1.15557\\ 1.15766\\ 1.15557\\ 1.155567\\ 1.155567\\ 1.15168\\ 1.155667\\ 1.15567\\ 1$ a 13.1288 14.7289 13.097761 7.0548 11.4962 12.3002 13.6156 12.4664 13.0470 15.2826 12.4664 13.0470 15.2826 5.8257 5.6450 4.46682 5.8257 7.5000 6.5738 5.8257 7.2076 6.6740 7.2076 8.4600



	1	2	3	4	5	6	7	8
1	33.4672	6.1471	10.9515	5.8942	151.3718	13.5846	154.4920	13.1288
2	29.5069	5.3580	8.8518	6.2829	132.1184	14.9462	144.9457	14.7289
3	26.8163	5.3667	4.0832	5.7953	115.2860	13.7196	138.5585	13.0977
4	26.2235	5.0552	-0.0244	4.6783	88.5122	10.1893	135.6535	11.8093
5	27.9358	4.8090	-4.8711	3.9113	71.8853	7.7235	138.7169	9.7761
6	32.0932	3.3561	-8.2821	3.0988	66.9408	5.9635	143.6354	7.0548
7	29.6728	3.1443	-11.1342	2.6979	64.6576	7.0184	145.0107	8.4296
8	33.8194	6.3691	-5.1078	3.9113	19.4529	8.2185	153.4554	11.4962
9	43.3370	8.4463	-3.3010	4.4111	13.9889	5.7954	150.4686	12.2302
10	34,4441	4.1455	-4.5192	4.4802	28.9075	6.7437	157.1795	6.6620
11	21.7558	2.9980	-3.8836	3.5225	39.1839	10.2993	167.4075	10.7091
12	6,7644	2,4350	-6.2462	2.6215	97.2090	108.4115	157.5965	91.3269
13	12.4373	5.3263	-1.6062	2.3722	2.9136	12.1141	300.4635	23.6156
14	22.2518	5.0354	-0.7929	3.5694	15.6511	9.2714	310.1974	13.0470
15	30.7365	6.2525	9.1441	7.0495	131.1358	14.4276	149.1454	15.2826
16	30,5015	6.5942	6.9066	7.0262	120.9458	13.4584	146.0787	12,4464
17	29.8545	5.7280	3.4567	6.6204	100.8616	11.3856	142.4284	10.0810
18	31.7890	4.6520	0.1622	4.1407	87.3095	8.2854	142.5467	9,4650
19	32.0894	4.0810	-4.5388	3.2328	69.4634	5.9229	143.8104	6.7738
20	36.3220	3.1034	-8.7198	2.4945	64,7939	4.2786	147.6272	5.1640
21	37.9955	2.3297	-12.3306	2.6444	61.8728	4.1232	148.4335	4.8688
22	44.0983	3,6730	-13.9471	3.9449	55.5402	5.5046	151.9929	5.8257
23	49.0256	5.1986	-14.3153	5.0272	47.7557	6.2490	156.8507	6.9136
24	56.0665	6.3979	-12.9969	6.3597	37.1354	6.9999	163.1875	7.5500
25	57.7384	6.7081	-8.7082	5.9223	29.1563	6.4989	163.5279	7.2076
26	52.0765	5.3071	-5.0164	5.1741	24.0572	6.5312	163.2335	6.8740
27	33.6554	4.2637	-3.3726	3.9269	28.9589	7.1784	165.4134	7.4622
28	26.5609	4.3224	-1.6982	4.0134	36.7865	8.3594	167.0592	8.4600
29	11.7058	4.5639	-0.6185	3.7467	29.7451	17.8553	174.4749	24.2544
30	5.6751	3.8952	1.4858	3.2445	176.8298	41.4716	350.7241	48.1190
31	34.9898	6.3797	4.8201	8.6092	114.0660	14.2939	148.1899	11.802.8
32	33.6458	5.9310	5.8156	7.3678	104.5508	13.9650	148.4420	9.8185
33	33.0505	5.6906	3.5554	5.2985	96.1028	11.2862	146.4195	9.7084



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days	30.00				2	29
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1.0	inc aim	r nha anha	107		13	12
.45	133.23 33.	17 64.23 31.5	3.4		14	- 22
-18	138.02 59.	26 72.88 52.5	1.6		15	30
. 22	171.77 44	03 130.92 00.0 28 340 38 44 5			16	30
.61	164.00 105.	38 7.09 180.9	1.1		1.7	20
-38	168.55 22.	69 342.02 21.5	24			
-57	181.89 72.	72 188.58 55.4	8,76		18	31
-26	05.71 34	53 344.05 51.2 46 232.65 37.5			19	32
.01	139.50 48.	68 319.03 62.0	1.3		20	36
-15	162.93 21.	25 350.22 9.1	56		22	27
- 32	38.91 69.	48 165.07 133.4	8,46		4.4	
- 66	96.27 17.	68 200.61 103.2	0.45		22	- 44
-12	79.54 21.	41 312.67 78.7	4.70		23	45
- 68	188 82 25	27 245 28 84 1	0.55		24	
122	56 36 16	55 768 78 86 8			24	24

, x tre	16- B								
448.578	9 vari	(xp)= 313	.1185	var(xre	a)= 128.3	555			
var prei	ficted/v	var origi	inal= 72.						
, x tre	10- B								
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*** p.e.	auton/s	ar uray.							
naraneti	ers with	1556 CT	estinat	105					
rep	mator	emai	minor	enin	inc	einc	pha spha	sor	
0020219	18.614	5.729	-8.924	5.45	133.23	33.17	64.23 31.52	3.4	
8357864	4.183	3.278	-8.283	3.18	138.82	59-26	72.88 52.58	1.6	
0372185	3.828	2.693	-8.122	2.99	49.85	76.03	156.92 88.82	1.3	
0307307	7.209	3,268	-3.550	3.33	171.77	44.28	349.38 44.58	5	
0402505	2.362	2,247	-1.745	2.61	164.00	105.38	7.09 189.95	1.1	
8417887	16.684	3.397	-9.799	3.38	164.55	22-69	342.02 21.53	24	
8432929	2.487	2,854	0.029	2.57	181.89	72.72	188.58 95.46	8.76	
8448388	6.388	4,838	-1.434	4.52	184.81	58.53	344.85 51.24	2.7	
0463430	10.975	4.510	-4.955	4.56	95.71	34.45	232.65 37.56	5.9	
4729992	4,745	4.287	-0.253	4.81	139.54	48.68	319.03 62.00	1.1	
#885114	18.879	2.51/	4.057	7-15	162-93	21-25	354-22 9-12	56	
0033333	2.00/	4.250	-1-767	3.34	20.71	07.40	103-0/ 133-43	0.40	
0000/30	0.072	9.031	0.45/	2.00	20.27	17.00	208.01 103.29	0.40	
1 34 34 31	1.744			1.50	100.00		242.07 70.77		
1222824	2,921	2 001	-8.041	1.42	188 82	26 22	245 28 81 12	0 55	
1251141	3.291	3,934	-8.312	1.36	56.35	16.55	268.29 86.93	8.7	
1105105	6.122	4.291	8.015	1.11	99.81	8.65	138.32 48.52	2.2	
1610220	4,025	4,127	-8.640	1.01	98.29	12.04	45.05 55.92	8.95	
1639447	8.767	2.896	0.196	1.51	12.09	41.22	134.35 151.89	8.87	
1666667	8.888	3.054	0.624	1-25	148.42	32.37	213.57 194.79	8.87	
2028035	5.593	2.955	-1.031	1.49	87.88	14.48	305.58 33.88	3.6	
2804474	3.228	3,000	-0.704	1.42	93.69	29.18	263.64 63.26	1.2	
2488221	2.094	2,737	0.286	0.94	101.04	17.14	258.58 63.47	1.1	
2415342	2.944	2.935	0.662	1-22	109.55	24.77	133.43 67.27	1	
2443561	0.552	1,956	0.232	0.91	93.54	38.88	78.49 195.47	0.00	
2471781	2.132	2.958	-8.222	0.55	92.86	19.83	87.32 93.24	0.53	
2833349	1.683	1.876	e.218	w.75	94.61	22.47	110.40 98.68	8.73	
3128456	1.992	2.113	8.8/4	1.05	113.77	24.67	215.0/ /3.0/	8.89	



13 MHz

CTD

ΗZ

Hokkaido

Tsugaru Strait

North Pacific Ocean

Image Landsat

Honshu

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth



t_tide: Publically available tidal anaysis tool

Classical tidal harmonic analysis including error estimates in MATLAB using T_TIDE $\stackrel{\leftrightarrow}{\sim}$

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Received 24 September 2001; received in revised form 13 February 2002; accepted 28 February 2002

t_tide requirements

- MATLAB or Fortran
- PC or Mac
- Timeseries, scalar or vector



Tide Gauge (generates scalar timeseries of water pressure or elevation) http://www.oco.noaa.gov/tideGauges.html



Combined velocity vector data from two or more SeaSondes

SeaTides requirements

- Compiled SeaTides
- Mac
- Timeseries, tuv files

SeaTides Components

- 1. tuv file conversion
- 2. tidal ellipse
- 3. total, tidal, residual timeseries
- 4. converts tidal and residual timeseries into tuv

SeaTides tuv file conversion

TOTL_MUTU_2015_04_03_0730.tuv 42.0°N



DTOTL_MUTU	2015_04_03_073).tuv 42.0° N			
Longitude L (deg) 141.2553650 41 141.2912267 41 141.3270883 41 141.3629500 41 141.2194439 41 141.2553204 41 141.2911969 41 141.3270735 41 141.3629500 41 141.3988265 41 141.3988265 41 141.293844 41 141.2552757 41 141.2911671 41 141.3270586 41 141.3629500 41 141.3988414 41 141.3629500 41 141.3988414 41 141.4347329 41 141.1834185 41 141.2193247 41 141.2552310 41	atitude U comp (deg) (cm/s) .3766071 14.326 .3766351 17.980 .3766519 19.335 .3766575 23.687 .4035798 10.710 .4036191 13.004 .4036472 17.121 .4036640 21.285 .4036640 21.285 .4036640 36.825 .4036696 29.675 .4036640 36.825 .4305412 16.522 .4305917 17.557 .4306310 19.178 .4306591 23.339 .4306759 29.478 .4306816 35.972 .4306759 29.478 .4306591 59.211 .4574911 19.822 .4575529 22.570 .4576035 24.714 .4576428 31.651	V comp (cm/s) -30.928 -38.601 -40.436 -21.850 -18.488 -24.181 -26.907 -23.870 -12.578 -0.121 -9.754 -12.457 -19.281 -16.957 -12.856 -3.382 1 146 4.339 -3.335 -3.566 -5.604 -15.932	ESAN CHAT CHAT		gebco.net ngdc.noaa.gov
			141.0 [°] E	141.5 [°] E	142.0 [°] E

TOTL_MUTU_2015_04_03_0730.tuv 42.0° N			
Longitude Latitude U comp V comp (deg) (deg) (cm/s) (cm/s) 141.2553650 41.3766071 14.326 -30.928 141.2912267 41.3766351 17.980 -38.601 141.3270883 41.3766519 19.335 -40.436 141.3629500 41.3766575 23.687 -21.850 141.2194439 41.4035798 10.710 -18.488 141.2553204 41.4036191 13.004 -24.181 141.2911969 41.4036472 17.121 -26.907 141.3270735 41.4036640 21.285 -23.870 141.3629500 41.4036640 29.675 -12.578 141.3988265 41.4036640 36.825 -0.121 141.1834931 41.4305412 16.522 -9.754 141.2193844 41.4305917 17.557 -12.457 141.2252757 41.4306310 19.178 -19.281 141.2911671 41.4306591 23.339 -16.957 141.3270586 41.4306591 23.339 -16.957 141.3270586 41.4306591 29.478 -12.856 141.3629500 41.4306816 35.972 -3.382 141.3988414 41.4306591 59.211 4.339 141.1475124 41.4574911 19.822 -3.335 141.1834185 41.4575529 22.570 -3.566 141.2193247 41.4576035 24.714 -5.604 141.255210 41.4576428 31.651 -15.932	ESAN OHAT		
	141.0° E	141.5° E	gebco.net ngdc.noaa.gov 142.0 E

TOTL_MUTU_2015_04_01_1330.tuv TOTL_MUTU_2015_04_01_1400.tuv TOTL_MUTU_2015_04_01_1430.tuv TOTL_MUTU_2015_04_01_1500.tuv TOTL_MUTU_2015_04_01_1530.tuv TOTL_MUTU_2015_04_01_1600.tuv TOTL_MUTU_2015_04_01_1630.tuv TOTL_MUTU_2015_04_01_1700.tuv TOTL_MUTU_2015_04_01_1730.tuv TOTL_MUTU_2015_04_01_1800.tuv TOTL_MUTU_2015_04_01_1830.tuv TOTL_MUTU_2015_04_01_1900.tuv TOTL_MUTU_2015_04_01_1930.tuv TOTL_MUTU_2015_04_01_2000.tuv TOTL_MUTU_2015_04_01_2030.tuv TOTL_MUTU_2015_04_01_2100.tuv TOTL_MUTU_2015_04_01_2130.tuv TOTL_MUTU_2015_04_01_2200.tuv TOTL_MUTU_2015_04_01_2230.tuv TOTL_MUTU_2015_04_01_2300.tuv TOTL_MUTU_2015_04_01_2330.tuv TOTL_MUTU_2015_04_02_0000.tuv TOTL_MUTU_2015_04_02_0030.tuv TOTL_MUTU_2015_04_02_0100.tuv TOTL_MUTU_2015_04_02_0130.tuv TOTL_MUTU_2015_04_02_0200.tuv TOTL_MUTU_2015_04_02_0230.tuv TOTL_MUTU_2015_04_02_0300.tuv TOTL_MUTU_2015_04_02_0330.tuv TOTL_MUTU_2015_04_02_0400.tuv TOTL_MUTU_2015_04_02_0430.tuv TOTL_MUTU_2015_04_02_0500.tuv TOTL_MUTU_2015_04_02_0530.tuv TOTL_MUTU_2015_04_02_0600.tuv TOTL_MUTU_2015_04_02_0630.tuv TOTL_MUTU_2015_04_02_0700.tuv TOTL_MUTU_2015_04_02_0730.tuv TOTL_MUTU_2015_04_02_0800.tuv TOTL_MUTU_2015_04_02_0830.tuv TOTL_MUTU_2015_04_02_0900.tuv TOTL_MUTU_2015_04_02_0930.tuv TOTL_MUTU_2015_04_02_1000.tuv TOTL_MUTU_2015_04_02_1030.tuv TOTL_MUTU_2015_04_02_1100.tuv TOTL_MUTU_2015_04_02_1130.tuv TOTL_MUTU_2015_04_02_1200.tuv TOTL_MUTU_2015_04_02_1230.tuv TOTL_MUTU_2015_04_02_1300.tuv TOTL_MUTU_2015_04_02_1330.tuv TOTL_MUTU_2015_04_02_1400.tuv TOTL_MUTU_2015_04_02_1430.tuv TOTL_MUTU_2015_04_02_1500.tuv TOTL_MUTU_2015_04_02_1530.tuv TOTL_MUTU_2015_04_02_1600.tuv TOTL_MUTU_2015_04_02_1630.tuv TOTL_MUTU_2015_04_02_1700.tuv TOTL_MUTU_2015_04_02_1730.tuv

TOTE_MOTO_2015_04_01_1300.tuv



TOTL_MUTU_2015_04_01_1330.tuv TOTL_MUTU_2015_04_01_1400.tuv TOTL_MUTU_2015_04_01_1430.tuv TOTL_MUTU_2015_04_01_1500.tuv TOTL_MUTU_2015_04_01_1530.tuv TOTL_MUTU_2015_04_01_1600.tuv TOTL_MUTU_2015_04_01_1630.tuv TOTL_MUTU_2015_04_01_1700.tuv TOTL_MUTU_2015_04_01_1730.tuv TOTL_MUTU_2015_04_01_1800.tuv TOTL_MUTU_2015_04_01_1830.tuv TOTL_MUTU_2015_04_01_1900.tuv TOTL_MUTU_2015_04_01_1930.tuv TOTL_MUTU_2015_04_01_2000.tuv TOTL_MUTU_2015_04_01_2030.tuv TOTL_MUTU_2015_04_01_2100.tuv TOTL_MUTU_2015_04_01_2130.tuv TOTL_MUTU_2015_04_01_2200.tuv TOTL_MUTU_2015_04_01_2230.tuv TOTL_MUTU_2015_04_01_2300.tuv TOTL_MUTU_2015_04_01_2330.tuv TOTL_MUTU_2015_04_02_0000.tuv TOTL_MUTU_2015_04_02_0030.tuv TOTL_MUTU_2015_04_02_0100.tuv TOTL_MUTU_2015_04_02_0130.tuv TOTL_MUTU_2015_04_02_0200.tuv TOTL_MUTU_2015_04_02_0230.tuv TOTL_MUTU_2015_04_02_0300.tuv TOTL_MUTU_2015_04_02_0330.tuv TOTL_MUTU_2015_04_02_0400.tuv TOTL_MUTU_2015_04_02_0430.tuv TOTL_MUTU_2015_04_02_0500.tuv TOTL_MUTU_2015_04_02_0530.tuv TOTL_MUTU_2015_04_02_0600.tuv TOTL_MUTU_2015_04_02_0630.tuv TOTL_MUTU_2015_04_02_0700.tuv TOTL_MUTU_2015_04_02_0730.tuv TOTL_MUTU_2015_04_02_0800.tuv TOTL_MUTU_2015_04_02_0830.tuv TOTL_MUTU_2015_04_02_0900.tuv TOTL_MUTU_2015_04_02_0930.tuv TOTL_MUTU_2015_04_02_1000.tuv TOTL_MUTU_2015_04_02_1030.tuv TOTL_MUTU_2015_04_02_1100.tuv TOTL_MUTU_2015_04_02_1130.tuv TOTL_MUTU_2015_04_02_1200.tuv TOTL_MUTU_2015_04_02_1230.tuv TOTL_MUTU_2015_04_02_1300.tuv TOTL_MUTU_2015_04_02_1330.tuv TOTL_MUTU_2015_04_02_1400.tuv TOTL_MUTU_2015_04_02_1430.tuv TOTL_MUTU_2015_04_02_1500.tuv TOTL_MUTU_2015_04_02_1530.tuv TOTL_MUTU_2015_04_02_1600.tuv TOTL_MUTU_2015_04_02_1630.tuv TOTL_MUTU_2015_04_02_1700.tuv TOTL_MUTU_2015_04_02_1730.tuv

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3D Timeseries Matrix

Longitude (deg) -122.6142265	Latitude (deg) 37.7286336	U comp (cm/s) -14.864	V comp (cm/s) 46.364	Range (km) 4.4716 4.47716 4.4716	Bearing (km) 206.6	Time (Julian Days) 735948.04166 735948.08333 735948.12500 735948.16667 735948.20833 735948.20833 735948.25000 735948.04166 735948.04166 735948.04166 735948.12500 735948.12500 735948.12500 735948.20833 735948.20833 735948.20833 735948.20833 735948.20833 735948.25000 735948.04166 735948.08333 735948.25000 735948.12500 735948.20833 735948.20833 735948.25000 735948.04166 735948.04166 735948.04166 735948.04166

Filtered 3D Timeseries Matrix

removes pages (grid points) with < 50% coverage



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SeaTides Components

- 1. tuv file conversion
- 2. tidal ellipse
- 3. total, tidal, residual timeseries
- 4. converts tidal and residual timeseries into tuv

SeaTides Tidal Ellipse Plots



Tidal Transport through the Tsugaru Strait - Part I: Characteristics of the Major Tidal Flow and its Residual Current

Quang-Hung Luu^{1,2*}, Kosuke Ito^{1,3}, Yoichi Ishikawa¹, and Toshiyuki Awaji¹

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Received 19 October 2011; Revised 5 December 2011; Accepted 20 December 2011 © KSO, KORDI and Springer 2011



- Kyoto University Ocean General Circulation Model
- M2 dominant in elevation
- K1 dominant in velocity





SeaTides Figure Names













SeaTides Components

- 1. tuv file conversion
- 2. tidal ellipse
- 3. total, tidal, residual timeseries
- 4. converts total, tidal, and residual timeseries into tuv

TOTL

TOTL_MUTU_2015_04_01_00_00_00.tuv TOTL_MUTU_2015_04_01_01_00_00.tuv TOTL_MUTU_2015_04_01_02_00_00.tuv TOTL_MUTU_2015_04_01_03_00_00.tuv TOTL_MUTU_2015_04_01_04_00_00.tuv TOTL_MUTU_2015_04_01_05_00_00.tuv TOTL_MUTU_2015_04_01_06_00_00.tuv TOTL_MUTU_2015_04_01_06_00_00.tuv

TIDL

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RSDL

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Total Signal



Tidal Signal



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¹Department of Geophysics, Kyoto University, Kyoto 606-8502, Japan ²Department of Mathematics, Vietnam National University, Hanoi, Vietnam ³Department of Atmospheric Sciences, Taiwan National University, Taipei 10617, Taiwan



Residual Signal



residual vector tuv files

RSDL_MUTU_2015_04_01_04_00_00.tuv RSDL_MUTU_2015_04_01_05_00_00.tuv RSDL_MUTU_2015_04_01_06_00_00.tuv RSDL_MUTU_2015_04_01_07_00_00.tuv RSDL_MUTU_2015_04_01_08_00_00.tuv RSDL_MUTU_2015_04_01_09_00_00.tuv RSDL_MUTU_2015_04_01_10_00_00.tuv RSDL_MUTU_2015_04_01_11_00_00.tuv RSDL_MUTU_2015_04_01_12_00_00.tuv RSDL_MUTU_2015_04_01_13_00_00.tuv RSDL_MUTU_2015_04_01_14_00_00.tuv RSDL_MUTU_2015_04_01_15_00_00.tuv RSDL_MUTU_2015_04_01_16_00_00.tuv RSDL_MUTU_2015_04_01_17_00_00.tuv RSDL_MUTU_2015_04_01_18_00_00.tuv RSDL_MUTU_2015_04_01_19_00_00.tuv RSDL_MUTU_2015_04_01_20_00_00.tuv RSDL_MUTU_2015_04_01_21_00_00.tuv RSDL_MUTU_2015_04_01_22_00_00.tuv RSDL_MUTU_2015_04_01_23_00_00.tuv RSDL_MUTU_2015_04_02_00_00_00.tuv RSDL_MUTU_2015_04_02_01_00_00.tuv RSDL_MUTU_2015_04_02_02_00_00.tuv RSDL_MUTU_2015_04_02_03_00_00.tuv



Hokkaido

North Pacific Ocean

Tsugaru Strait

OHAT I 3 MHz

13 MHz

[^] CTD 28-29 July 2014

13 MHz

4 m depth 7 m depth 18 m depth

Image Landsat

Honshu

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

spiciness Spicy (warm, salty) > 0



1.8

Bland (cool, fresh) < 0</p>

spiciness Spicy (warm, salty) > 0



Bland (cool, fresh) < 0</p>





Seasonal Variations of Water System Distribution and Flow Patterns in the Southern Sea Area of Hokkaido, Japan

ANA LUISA ROSA¹*, YUTAKA ISODA¹, KAZUYUKI UEHARA² and TOMOKAZU AIKI¹

¹Graduate School of Fisheries Sciences, Hokkaido University, Minato-cho, Hakodate 041-8611, Japan ²Fisheries Research Agency, Fukuura, Kanazawa-ku, Yokohama 236-8648, Japan

(Received 12 June 2006; in revised form 13 January 2007; accepted 19 February 2007)



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(TW) Tsugaru Warm Current (S-TW) Tsugaru Warm Current, surface mode (S-OW) Oyashio water system, surface mode

28-29 July 2014 Upper Level Depth ~ 4 m



28-29 July 2014 Middle Level Depth ~ 7 m



28-29 July 2014 Lower Level Depth ~ 18 m





(TW) Tsugaru Warm Current (S-TW) Tsugaru Warm Current, surface mode (S-OW) Oyashio water system, surface mode

SeaTides Conclusion

 Converts large quantities of spatial data into timeseries format

- Allows visual check on timeseries format
- Provides opportunity to examine tidally driven features against bathymetry over large areas of ocean
- Provides opportunity to examine non-tidal mechanisms
- SeaTides + SeaDisplay allows movie-making of total, tidal, and residual data
- A minimum of one month of data is recommended, more may be run depending on the size of the dataset

Rayleigh Criterion

Constituents separated by at least a complete period over the data length can be identified.

To separate M2 and S2:

T(M2) = 12.42 hr speed=360/T=360/12.42=28.986 deg/hr T(S2) = 12.00 hr speed=360/T=360/12.00=30.000 deg/hr

360/(30-28.986) = 352.94 hrs = 14.7 days of data needed

for O1 and K1: 360/(25.82-23.93) = 7.94 days of data needed

Nyquist Frequency

To quantify a phenomenon of period T, the sample rate may not be greater than T/2. If the period is 12 hours, the sampling rate dt must be < or = 6 hours.

If you have a set sampling rate (say dt=2 hours), then only mechanisms with a period twice that or greater can be quantified:

 $T \ge 2^* dt = 4$ hours

In terms of frequency, with a sampling frequency, n, of twice a day, or 2/24 = 1/12 hours mechanisms with frequency, N, with frequencies smaller or equal to 1/24 hours can be quantified:

 $N \le 0.5n = 0.5^{2}/24 = 1/24$ hour

snr = [(major axis velocity)/(error)]^2

Confidence versus Signal to Noise Ratio (snr)

- least squares fit,
- difference between input velocity and tidally predicted velocity, squares it.
- matrix algebra minimizes the difference.
- statistical look up tables determine which are in 95% confidence interval.

- snr=[(major axis velocity)/(error)]²
- threshold is set by user

- oyashio
- depth Luu at all study. ADCP measurements at 25 m depth show amplitudes of K1 and M2 are roughly 0.35 m/s, with max speed of K1 off Cape > 1m/s. model depths not sp'd.
- Tsugaru Strait 128 m depth on average (Luu et al, 2011)
- waters of the East/Japan Sea more saline than the North Pacific waters and are cold enough to modify propreties in western North Pacific waters (Luu et all, 2011, citing others)
- TWC a throughflow from East/Japan Sea to North Pacific. TWC 1.0 Sv to 2.1 Sv
- southward residual in strait look at other timeseries. can corliolis be present here?
- t_tide harominic ana
- tidal ellipses O1, S1, S2 (ellipses over ridge)