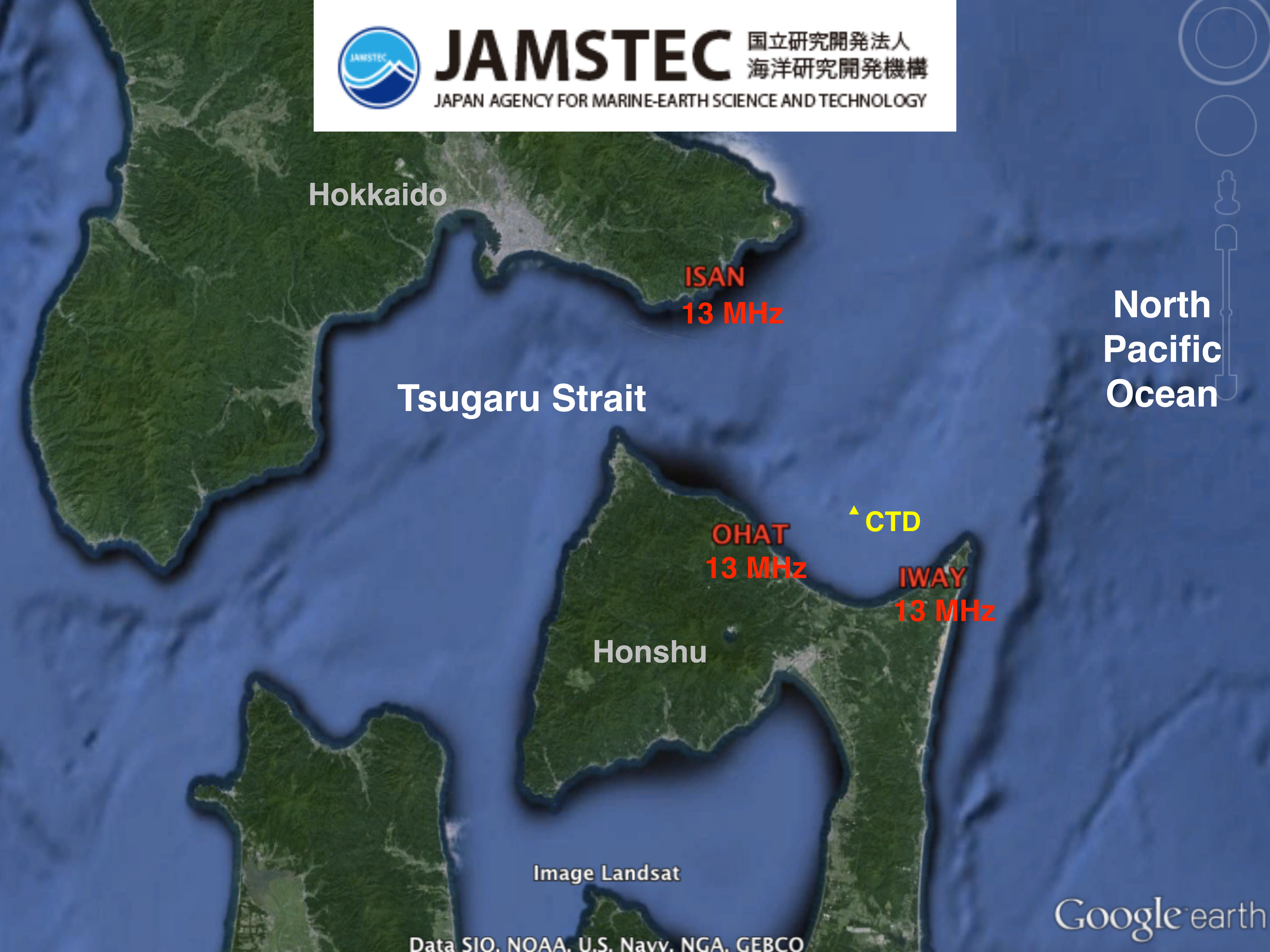
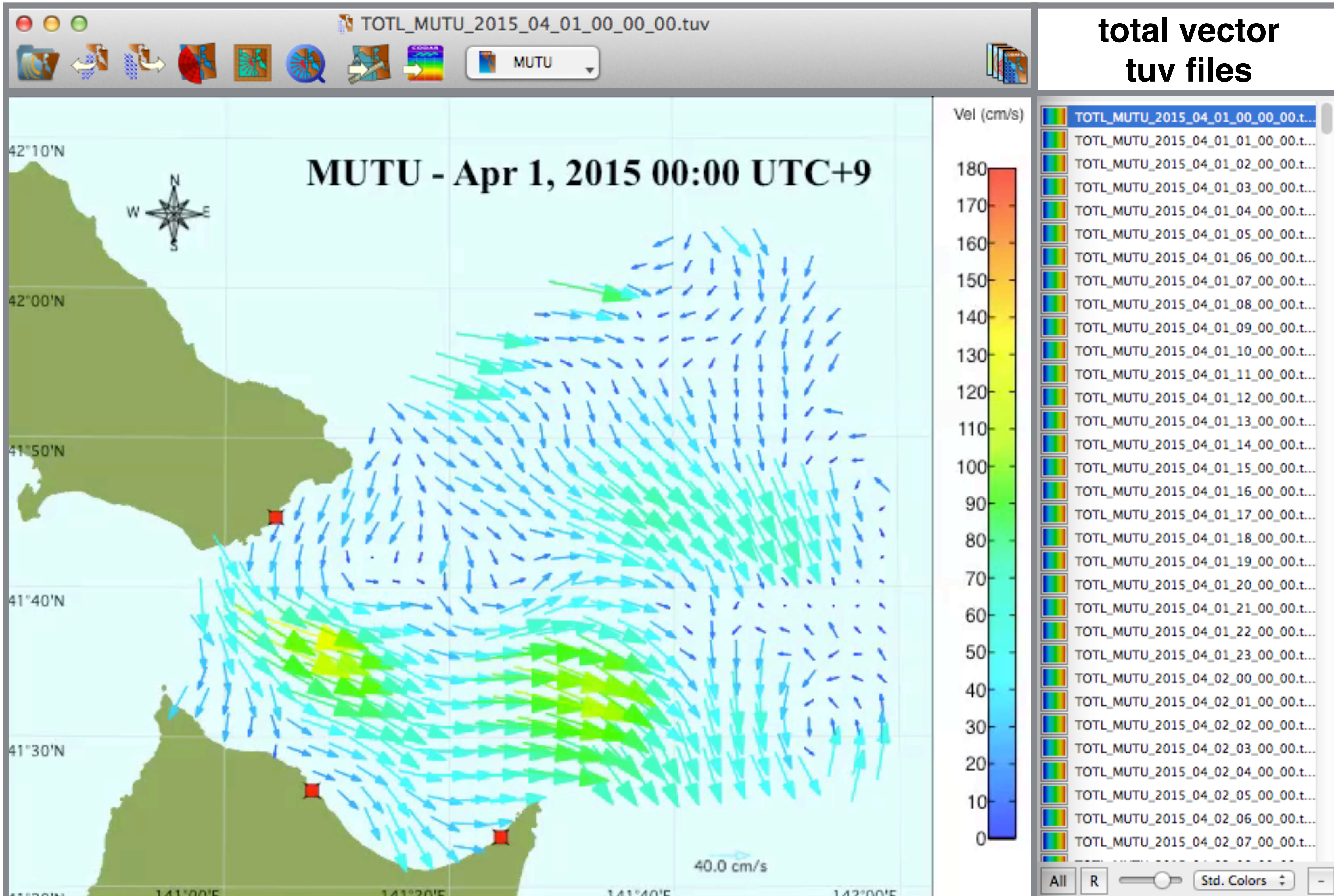

SeaTides

JAMSTEC 国立研究開発法人 海洋研究開発機構
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY





total vector
tuv files
TOTL_MUTU_2015_04_01_00_00_00.tuv
MUTU
MUTU - Apr 1, 2015 00:00 UTC+9
N
W
E
S
42°10'N
42°00'N
41°50'N
41°40'N
41°30'N
41°20'N
141°00'E
141°20'E
141°40'E
142°00'E
40.0 cm/s
Vel (cm/s)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
TOTL_MUTU_2015_04_01_00_00_00.t...
TOTL_MUTU_2015_04_01_01_00_00.t...
TOTL_MUTU_2015_04_01_02_00_00.t...
TOTL_MUTU_2015_04_01_03_00_00.t...
TOTL_MUTU_2015_04_01_04_00_00.t...
TOTL_MUTU_2015_04_01_05_00_00.t...
TOTL_MUTU_2015_04_01_06_00_00.t...
TOTL_MUTU_2015_04_01_07_00_00.t...
TOTL_MUTU_2015_04_01_08_00_00.t...
TOTL_MUTU_2015_04_01_09_00_00.t...
TOTL_MUTU_2015_04_01_10_00_00.t...
TOTL_MUTU_2015_04_01_11_00_00.t...
TOTL_MUTU_2015_04_01_12_00_00.t...
TOTL_MUTU_2015_04_01_13_00_00.t...
TOTL_MUTU_2015_04_01_14_00_00.t...
TOTL_MUTU_2015_04_01_15_00_00.t...
TOTL_MUTU_2015_04_01_16_00_00.t...
TOTL_MUTU_2015_04_01_17_00_00.t...
TOTL_MUTU_2015_04_01_18_00_00.t...
TOTL_MUTU_2015_04_01_19_00_00.t...
TOTL_MUTU_2015_04_01_20_00_00.t...
TOTL_MUTU_2015_04_01_21_00_00.t...
TOTL_MUTU_2015_04_01_22_00_00.t...
TOTL_MUTU_2015_04_01_23_00_00.t...
TOTL_MUTU_2015_04_02_00_00_00.t...
TOTL_MUTU_2015_04_02_01_00_00.t...
TOTL_MUTU_2015_04_02_02_00_00.t...
TOTL_MUTU_2015_04_02_03_00_00.t...
TOTL_MUTU_2015_04_02_04_00_00.t...
TOTL_MUTU_2015_04_02_05_00_00.t...
TOTL_MUTU_2015_04_02_06_00_00.t...
TOTL_MUTU_2015_04_02_07_00_00.t...
All
R
Std. Colors

t_tide: Publically available tidal anaysis tool

Classical tidal harmonic analysis including error estimates in MATLAB using T_TIDE☆

Rich Pawlowicz[a,*], Bob Beardsley[b], Steve Lentz[b]

[a] *Department of Earth and Ocean Sciences, University of British Columbia, 6270 University Blvd., Vancouver, BC, Canada V6T 1Z4*
[b] *Woods Hole Oceanographic Institution, Woods Hole, MA 02543 USA*

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

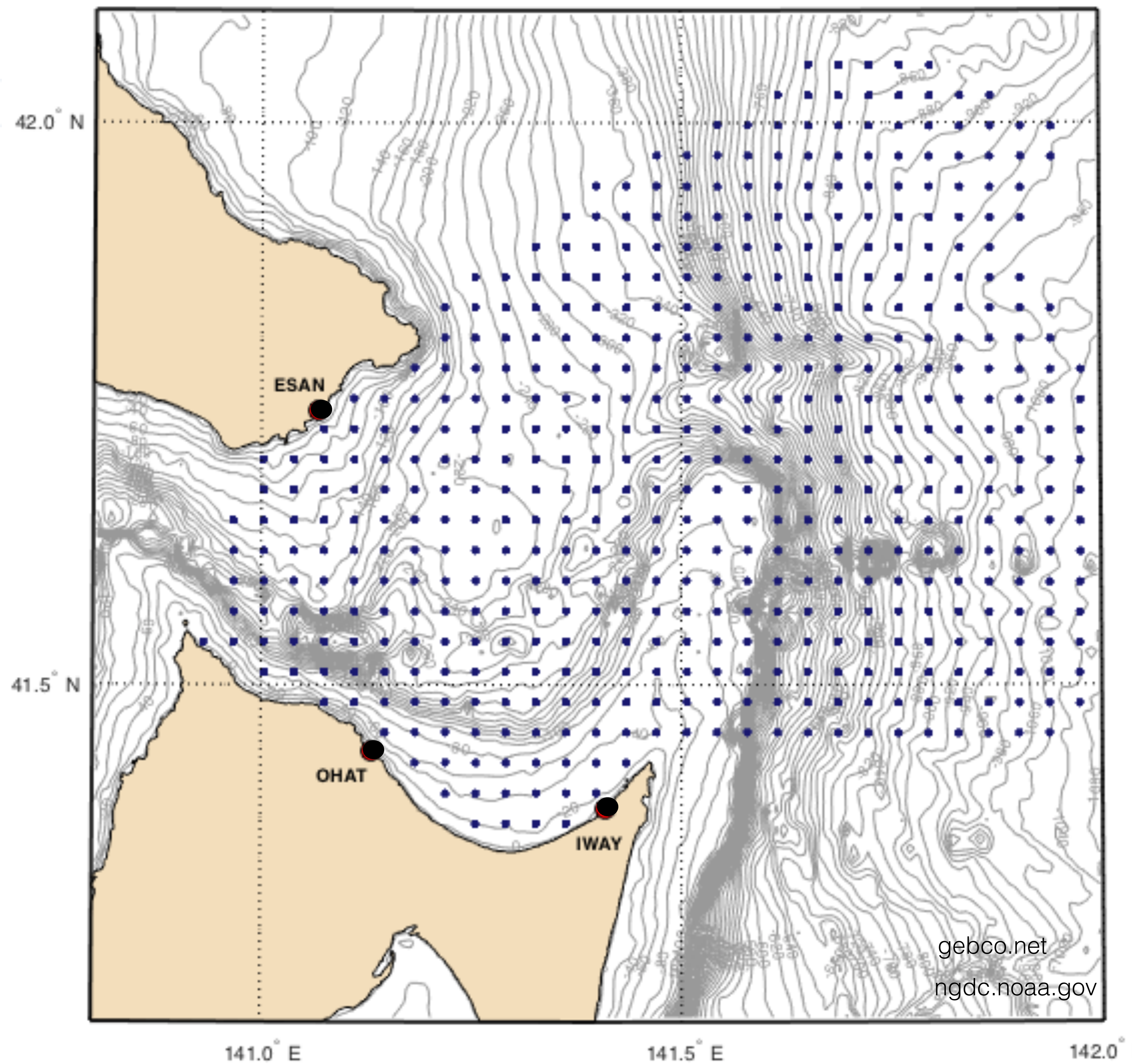
- Compiled SeaTides
- Mac
- Timeseries, tuv files

SeaTides Components

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

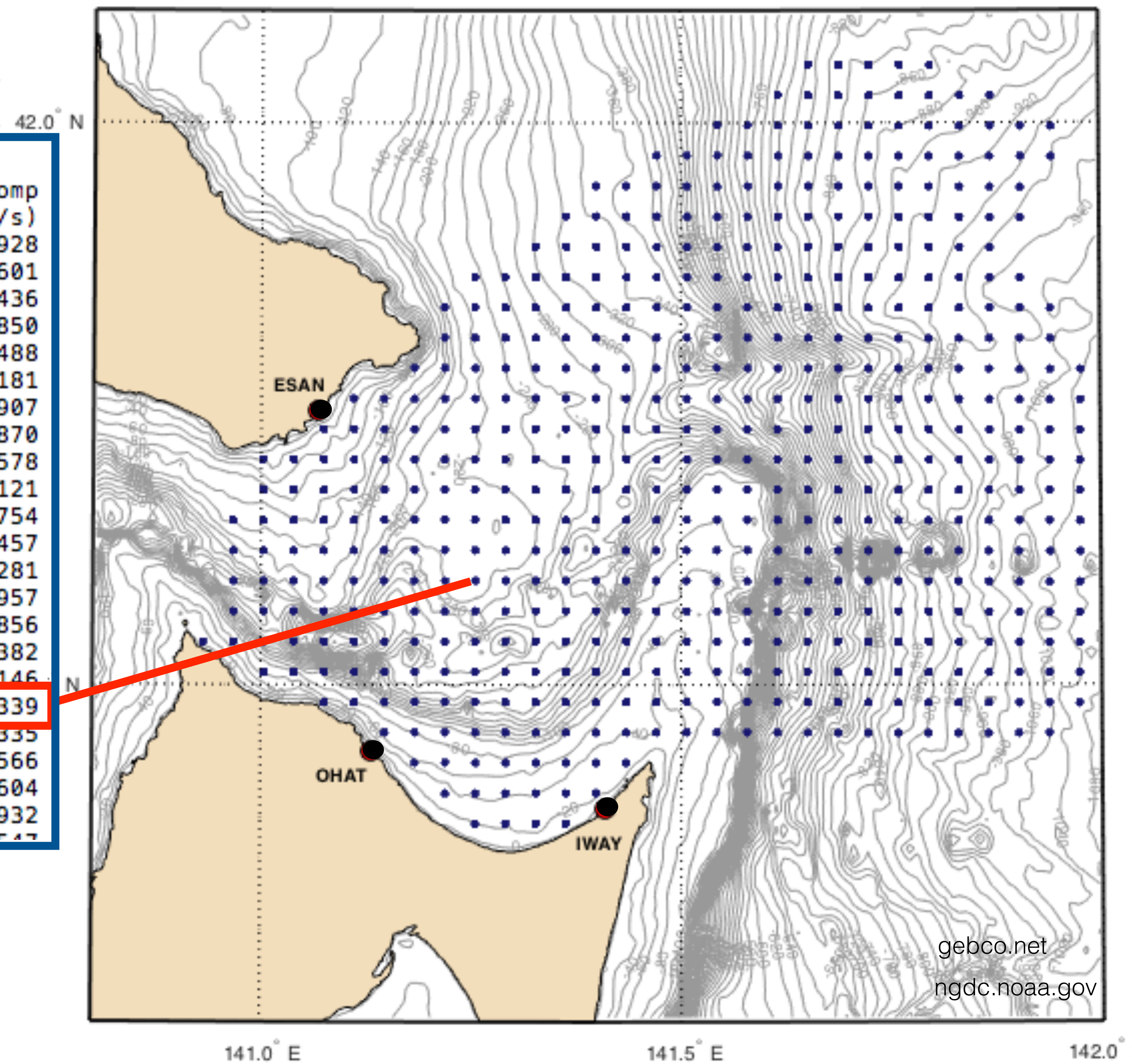
SeaTides tuv file conversion

TOTL_MUTU_2015_04_03_0730.tuv



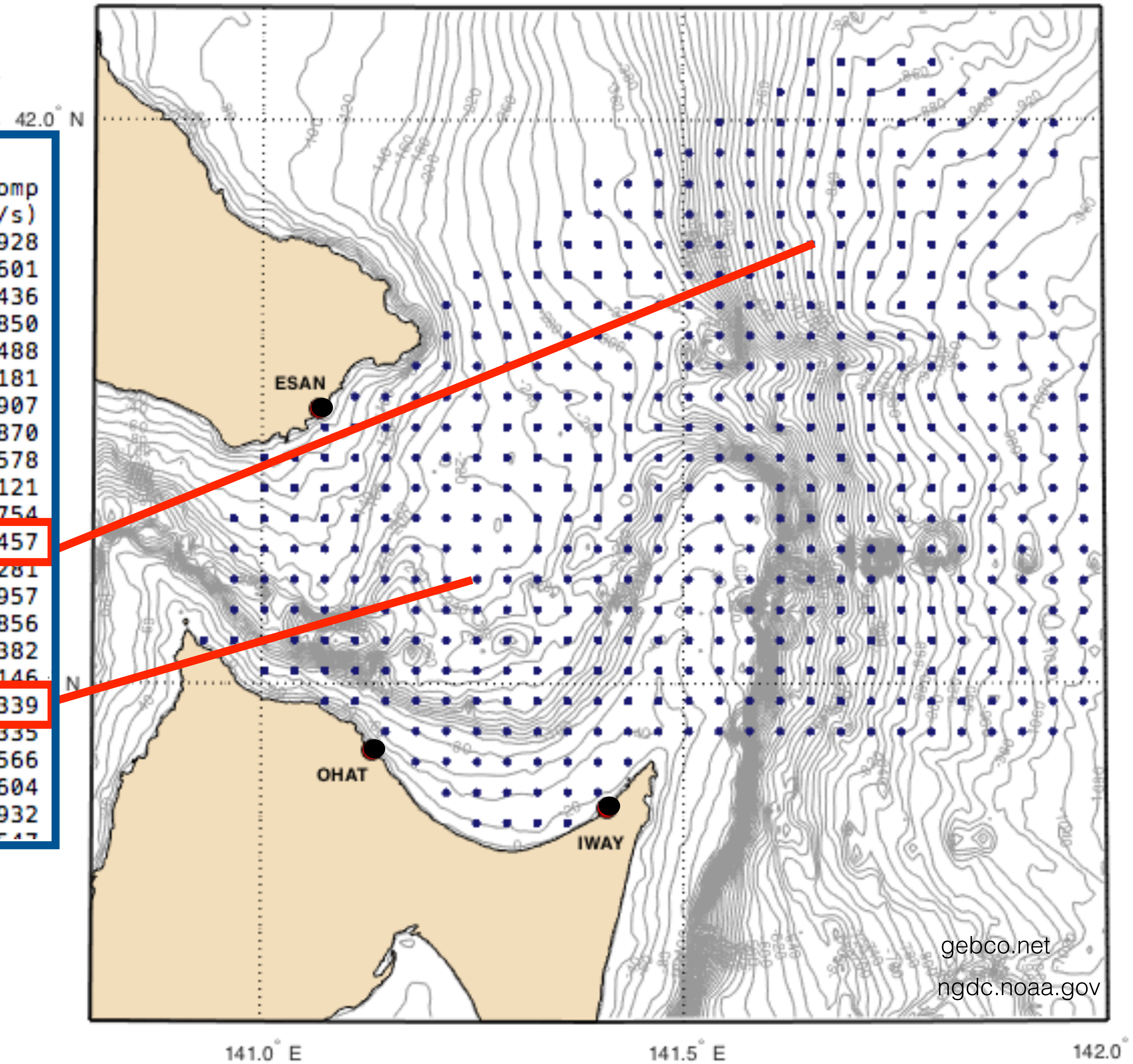
TOTL_MUTU_2015_04_03_0730.tuv

Longitude (deg)	Latitude (deg)	U comp (cm/s)	V comp (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	41.4036696	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
141.2552757	41.4306310	19.178	-19.281
141.2911671	41.4306591	23.339	-16.957
141.3270586	41.4306759	29.478	-12.856
141.3629500	41.4306816	35.972	-3.382
141.3988414	41.4306759	44.246	1.146
141.4347329	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
141.2552310	41.4576428	31.651	-15.932

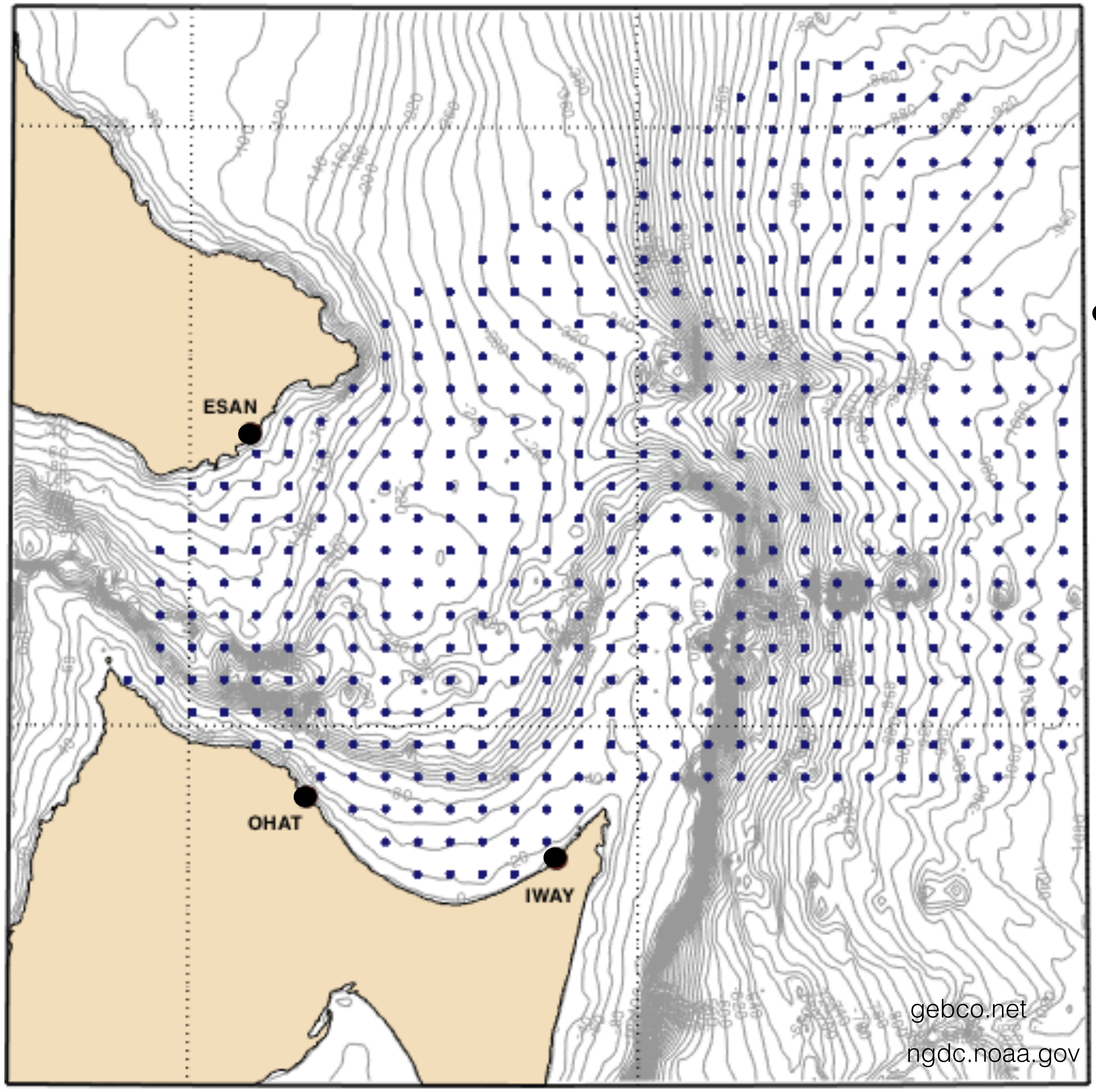


TOTL_MUTU_2015_04_03_0730.tuv

Longitude (deg)	Latitude (deg)	U comp (cm/s)	V comp (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	41.4036696	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
141.2552757	41.4306310	19.178	-19.281
141.2911671	41.4306591	23.339	-16.957
141.3270586	41.4306759	29.478	-12.856
141.3629500	41.4306816	35.972	-3.382
141.3988414	41.4306759	44.246	1.146
141.4347329	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
141.2552310	41.4576428	31.651	-15.932

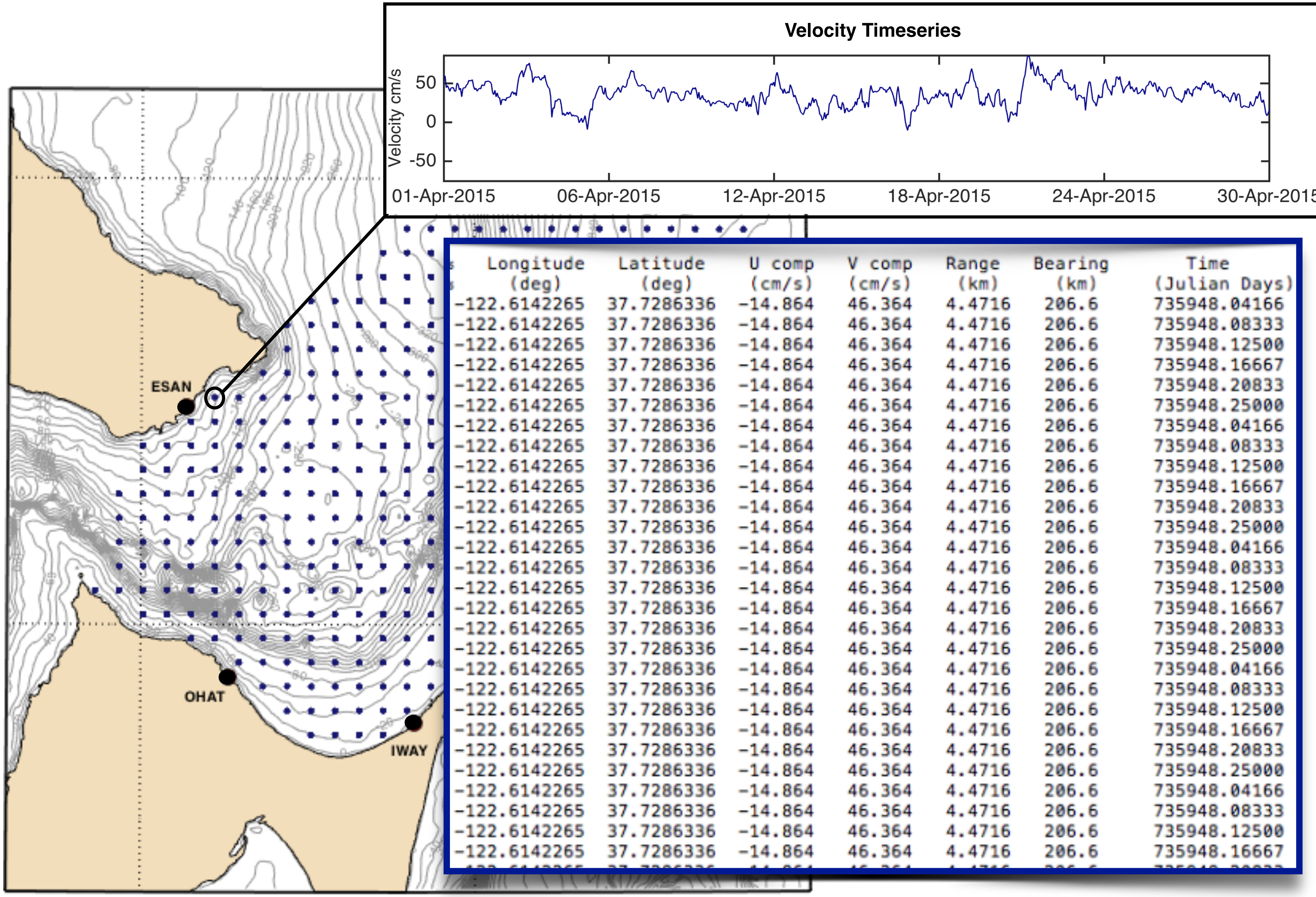


TOTL_MUTU_2015_04_01_1300.tuv
TOTL_MUTU_2015_04_01_1330.tuv
TOTL_MUTU_2015_04_01_1400.tuv
TOTL_MUTU_2015_04_01_1430.tuv
TOTL_MUTU_2015_04_01_1500.tuv
TOTL_MUTU_2015_04_01_1530.tuv
TOTL_MUTU_2015_04_01_1600.tuv
TOTL_MUTU_2015_04_01_1630.tuv
TOTL_MUTU_2015_04_01_1700.tuv
TOTL_MUTU_2015_04_01_1730.tuv
TOTL_MUTU_2015_04_01_1800.tuv
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

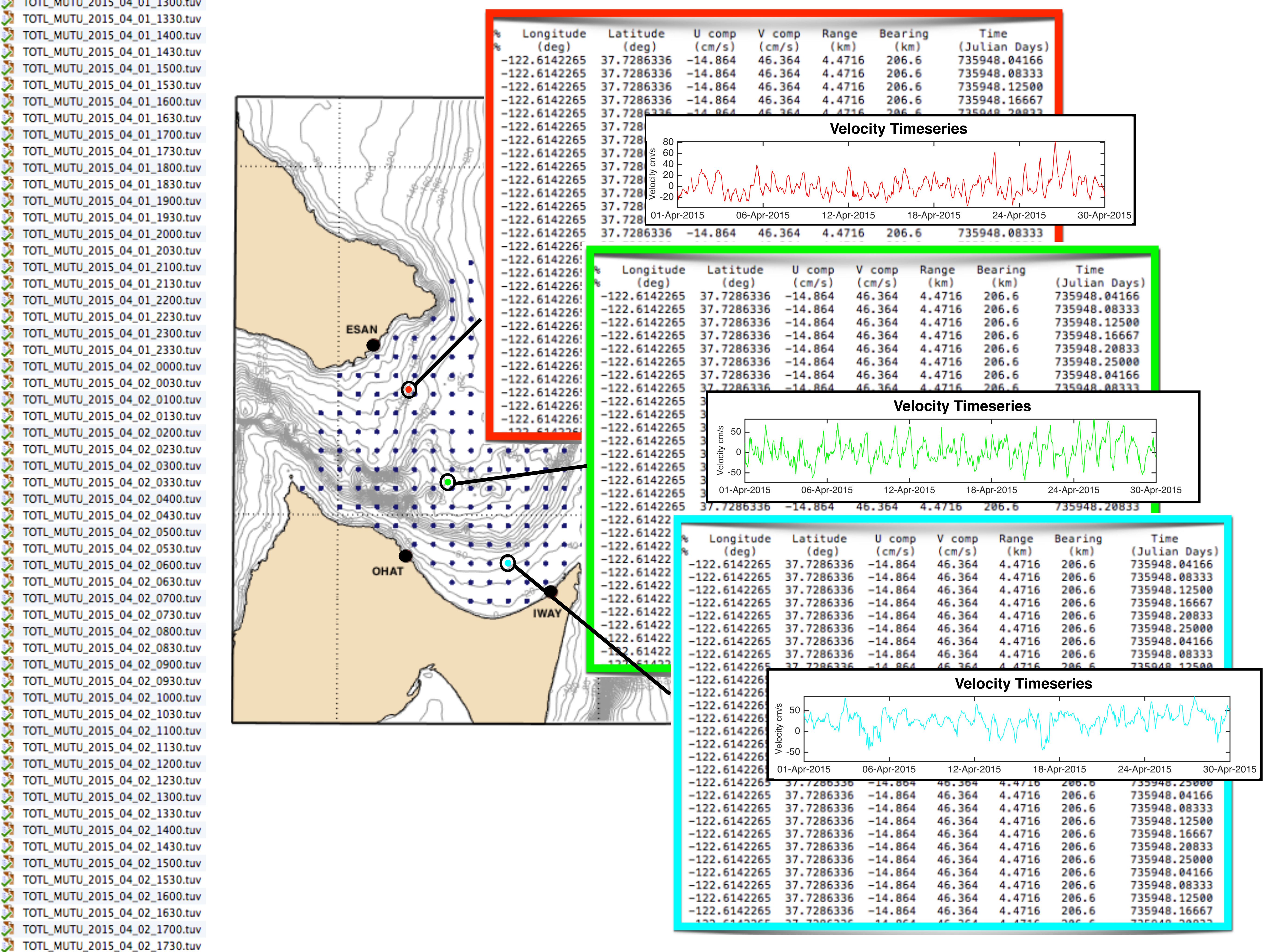


- tidal analysis,
  at least one month

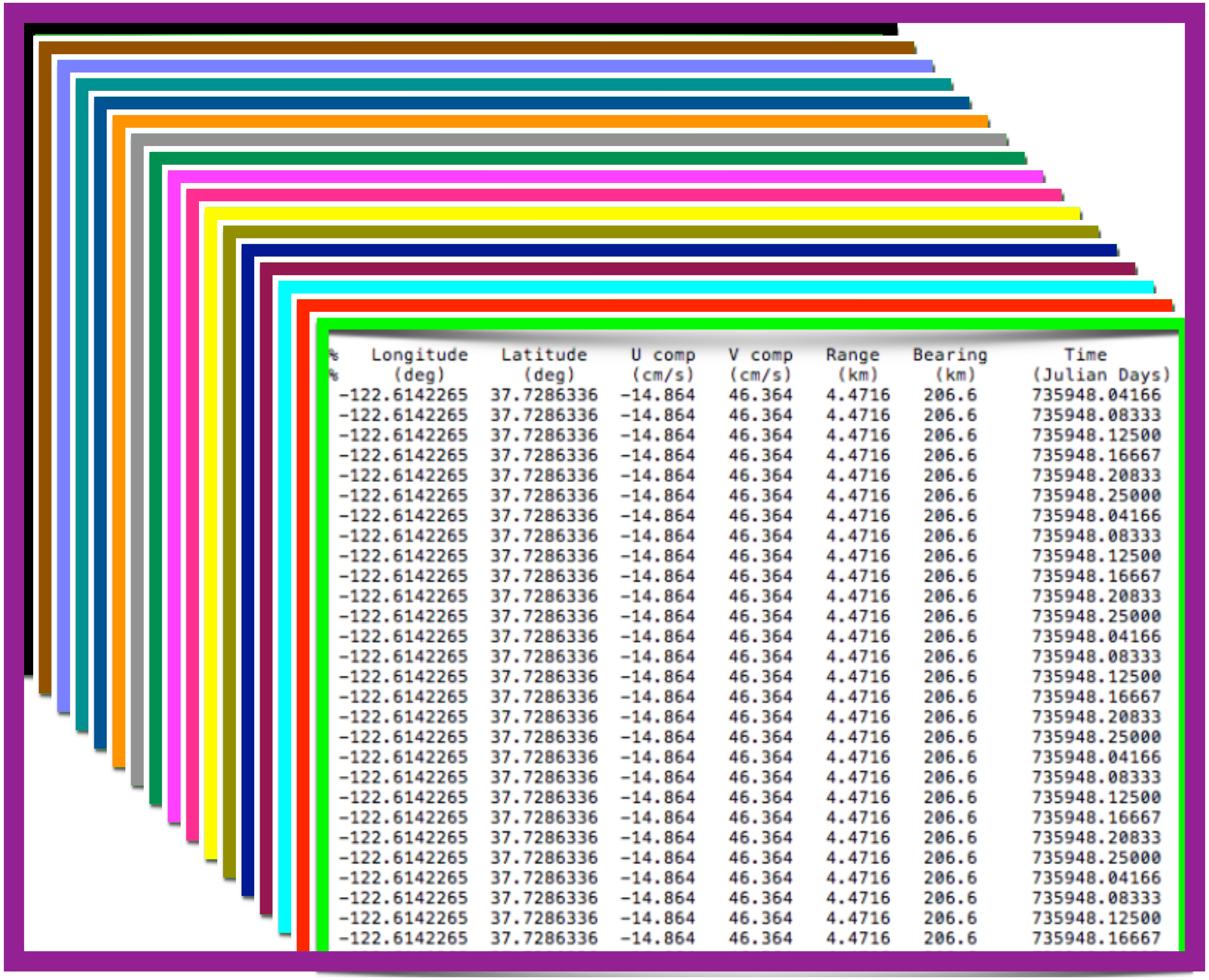
TOTL_MUTU_2015_04_01_1300.tuv
TOTL_MUTU_2015_04_01_1330.tuv
TOTL_MUTU_2015_04_01_1400.tuv
TOTL_MUTU_2015_04_01_1430.tuv
TOTL_MUTU_2015_04_01_1500.tuv
TOTL_MUTU_2015_04_01_1530.tuv
TOTL_MUTU_2015_04_01_1600.tuv
TOTL_MUTU_2015_04_01_1630.tuv
TOTL_MUTU_2015_04_01_1700.tuv
TOTL_MUTU_2015_04_01_1730.tuv
TOTL_MUTU_2015_04_01_1800.tuv
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



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


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
ESAN
OHAT
IWAY
% Longitude Latitude U comp V comp Range Bearing Time
% (deg) (deg) (cm/s) (cm/s) (km) (km) (Julian Days)
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.12500
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.16667
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
Velocity Timeseries
Velocity cm/s
80
60
40
20
0
-20
01-Apr-2015
06-Apr-2015
12-Apr-2015
18-Apr-2015
24-Apr-2015
30-Apr-2015
% Longitude Latitude U comp V comp Range Bearing Time
% (deg) (deg) (cm/s) (cm/s) (km) (km) (Julian Days)
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.12500
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.16667
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.20833
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.25000
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
Velocity Timeseries
Velocity cm/s
50
0
-50
01-Apr-2015
06-Apr-2015
12-Apr-2015
18-Apr-2015
24-Apr-2015
30-Apr-2015
% Longitude Latitude U comp V comp Range Bearing Time
% (deg) (deg) (cm/s) (cm/s) (km) (km) (Julian Days)
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.12500
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.16667
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.20833
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.25000
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.12500
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.16667
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.20833
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.25000
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.04166
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.08333
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.12500
-122.6142265 37.7286336 -14.864 46.364 4.4716 206.6 735948.16667
Velocity Timeseries
Velocity cm/s
50
0
-50
01-Apr-2015
06-Apr-2015
12-Apr-2015
18-Apr-2015
24-Apr-2015
30-Apr-2015

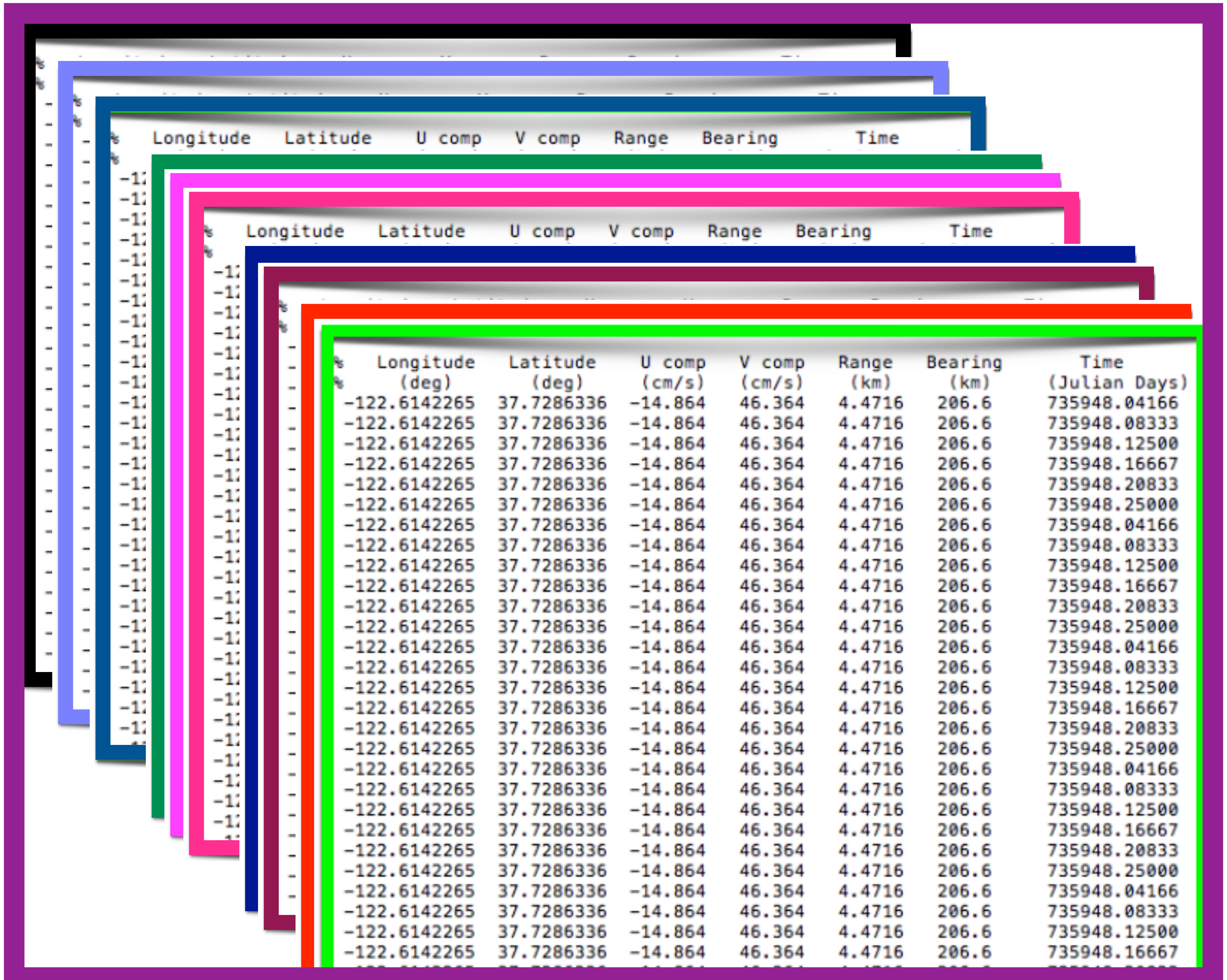
3D Timeseries Matrix



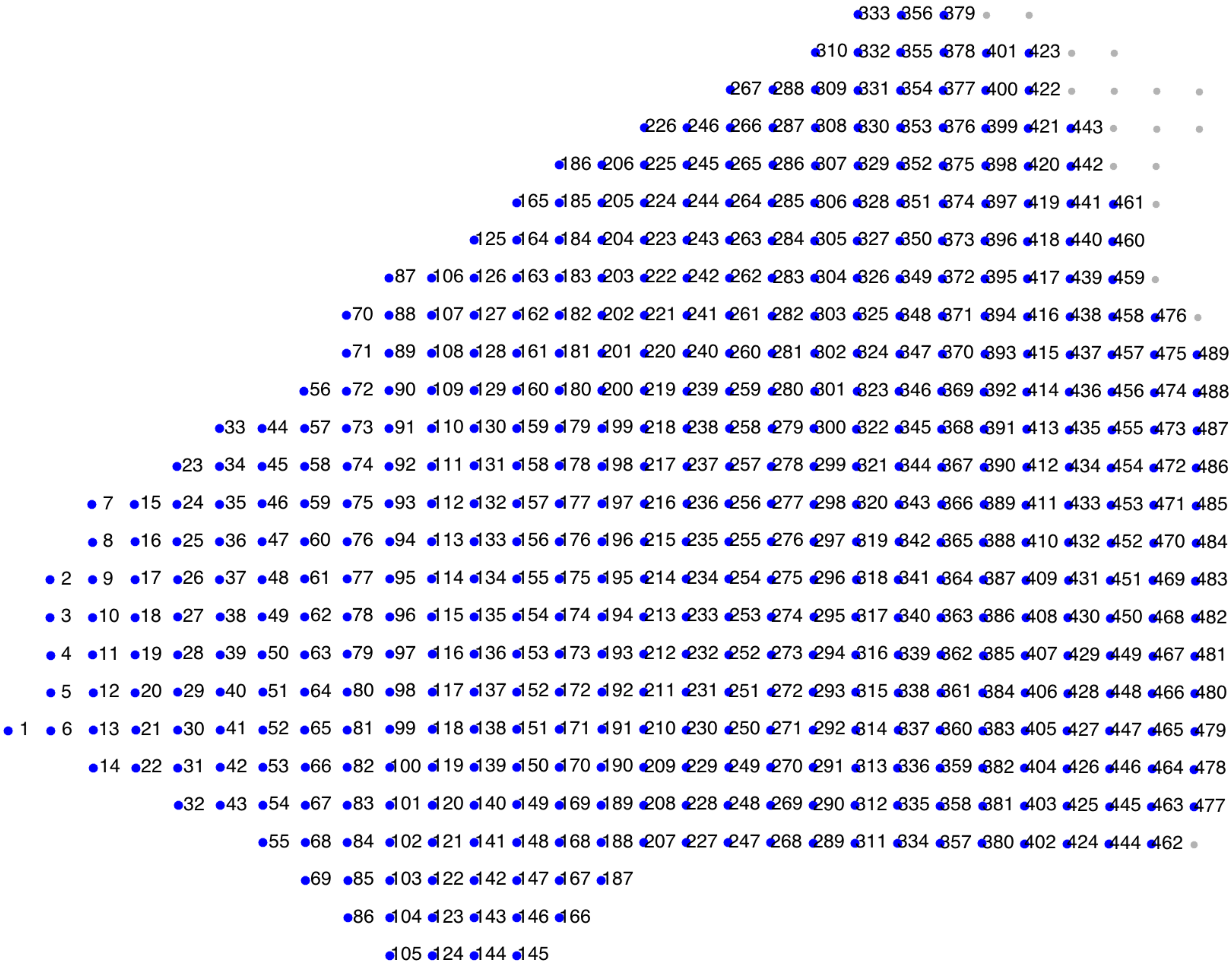
% Longitude (deg)	Latitude (deg)	U comp (cm/s)	V comp (cm/s)	Range (km)	Bearing (km)	Time (Julian Days)
-122.6142265	37.7286336	-14.864	46.364	4.4716	206.6	735948.04166
-122.6142265	37.7286336	-14.864	46.364	4.4716	206.6	735948.08333
-122.6142265	37.7286336	-14.864	46.364	4.4716	206.6	735948.12500
-122.6142265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

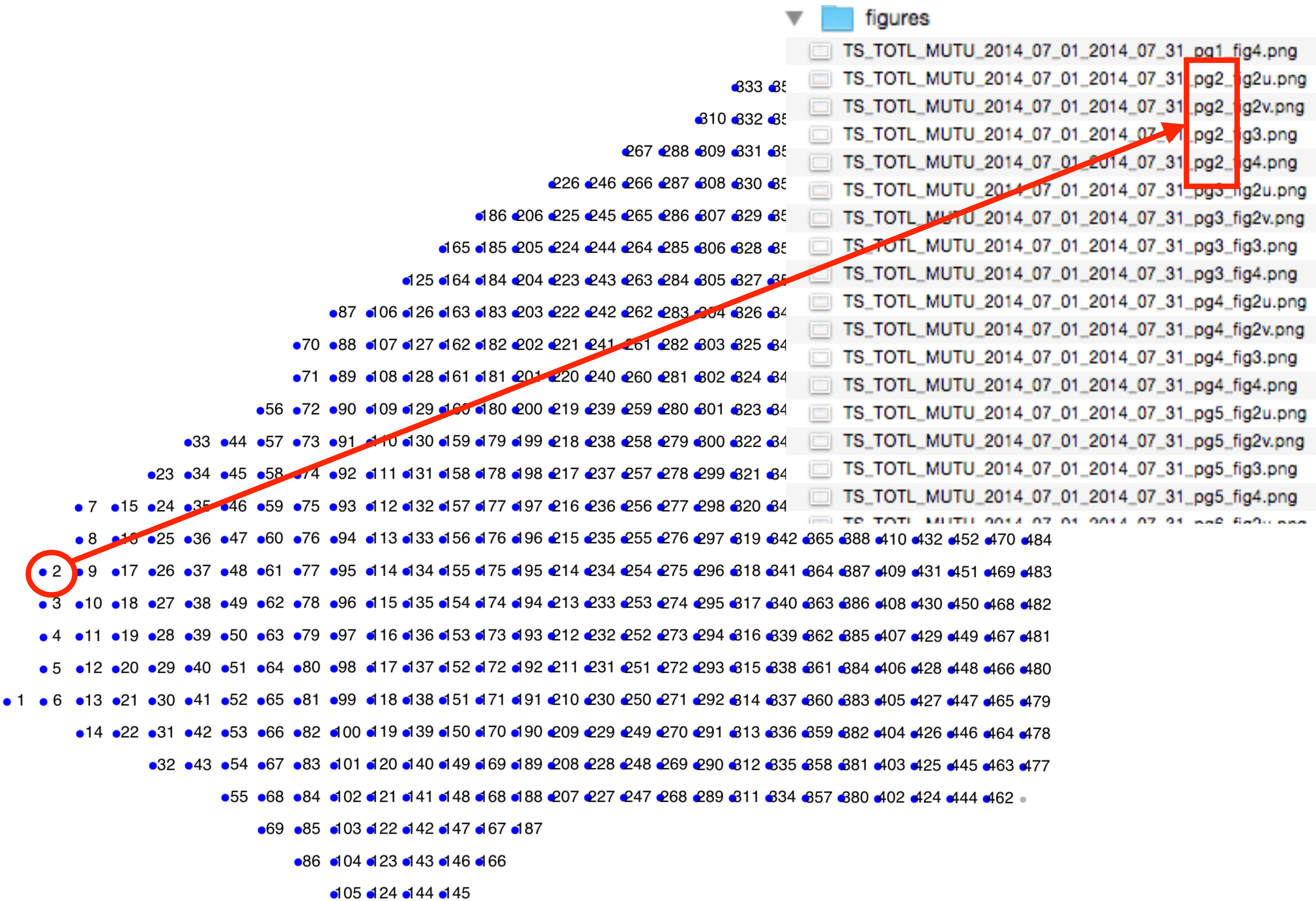
Filtered 3D Timeseries Matrix

removes pages (grid points) with < 50% coverage



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


333 356 379
310 332 355 378 401 423
267 288 309 331 354 377 400 422
226 246 266 287 308 330 353 376 399 421 443
186 206 225 245 265 286 307 329 352 375 398 420 442
165 185 205 224 244 264 285 306 328 351 374 397 419 441 461
125 164 184 204 223 243 263 284 305 327 350 373 396 418 440 460
87 106 126 163 183 203 222 242 262 283 304 326 349 372 395 417 439 459
70 88 107 127 162 182 202 221 241 261 282 303 325 348 371 394 416 438 458 476
71 89 108 128 161 181 201 220 240 260 281 302 324 347 370 393 415 437 457 475 489
56 72 90 109 129 160 180 200 219 239 259 280 301 323 346 369 392 414 436 456 474 488
33 44 57 73 91 110 130 159 179 199 218 238 258 279 300 322 345 368 391 413 435 455 473 487
23 34 45 58 74 92 111 131 158 178 198 217 237 257 278 299 321 344 367 390 412 434 454 472 486
7 15 24 35 46 59 75 93 112 132 157 177 197 216 236 256 277 298 320 343 366 389 411 433 453 471 485
8 16 25 36 47 60 76 94 113 133 156 176 196 215 235 255 276 297 319 342 365 388 410 432 452 470 484
2 9 17 26 37 48 61 77 95 114 134 155 175 195 214 234 254 275 296 318 341 364 387 409 431 451 469 483
3 10 18 27 38 49 62 78 96 115 135 154 174 194 213 233 253 274 295 317 340 363 386 408 430 450 468 482
4 11 19 28 39 50 63 79 97 116 136 153 173 193 212 232 252 273 294 316 339 362 385 407 429 449 467 481
5 12 20 29 40 51 64 80 98 117 137 152 172 192 211 231 251 272 293 315 338 361 384 406 428 448 466 480
1 6 13 21 30 41 52 65 81 99 118 138 151 171 191 210 230 250 271 292 314 337 360 383 405 427 447 465 479
14 22 31 42 53 66 82 100 119 139 150 170 190 209 229 249 270 291 313 336 359 382 404 426 446 464 478
32 43 54 67 83 101 120 140 149 169 189 208 228 248 269 290 312 335 358 381 403 425 445 463 477
55 68 84 102 121 141 148 168 188 207 227 247 268 289 311 334 357 380 402 424 444 462
69 85 103 122 142 147 167 187
86 104 123 143 146 166
105 124 144 145

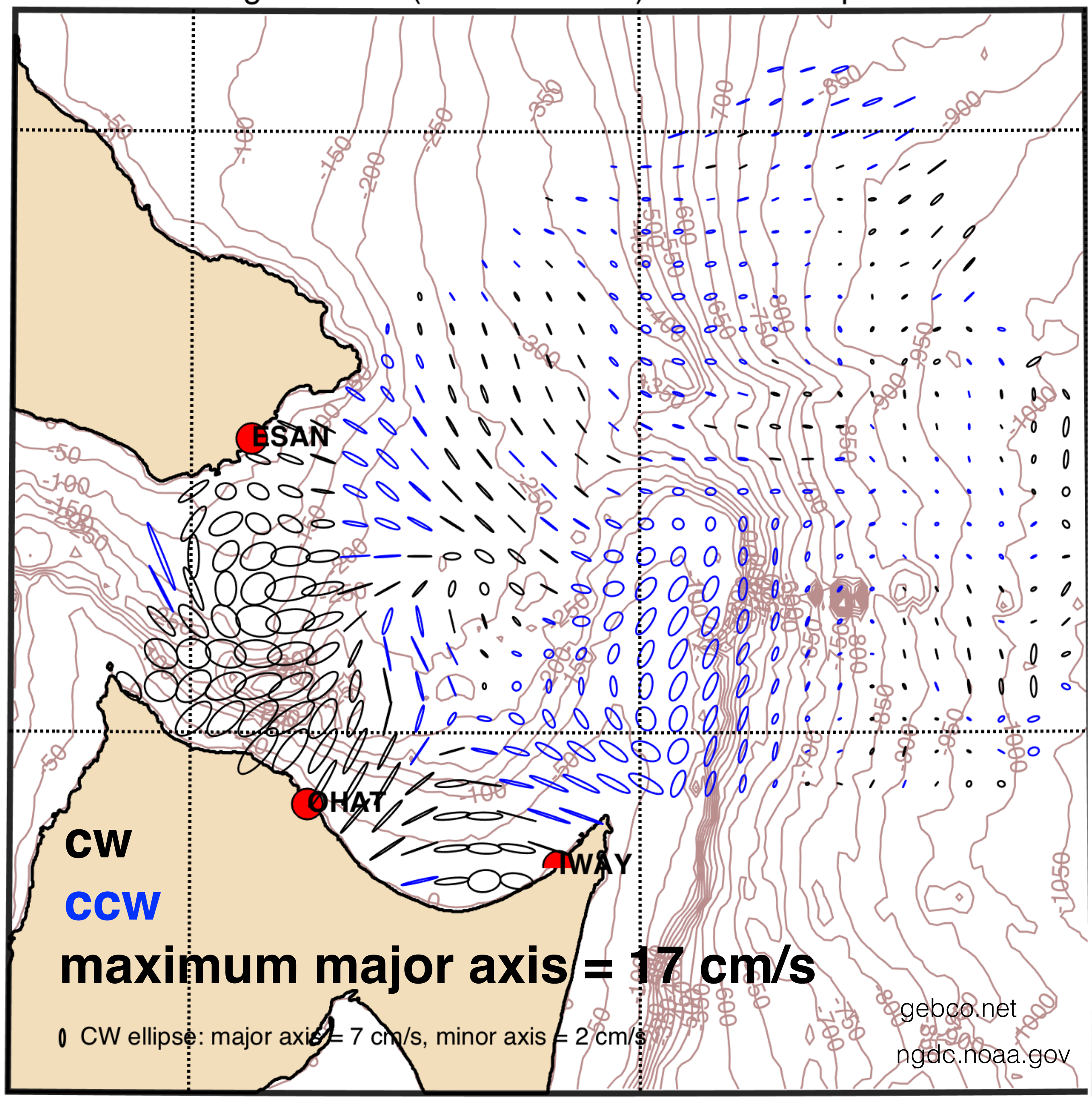

figures
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg1_fig4.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg2_fig2u.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg2_fig2v.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg2_fig3.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg2_fig4.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg3_fig2u.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg3_fig2v.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg3_fig3.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg3_fig4.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg4_fig2u.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg4_fig2v.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg4_fig3.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg4_fig4.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg5_fig2u.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg5_fig2v.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg5_fig3.png
TS_TOTL_MUTU_2014_07_01_2014_07_31_pg5_fig4.png

SeaTides Components

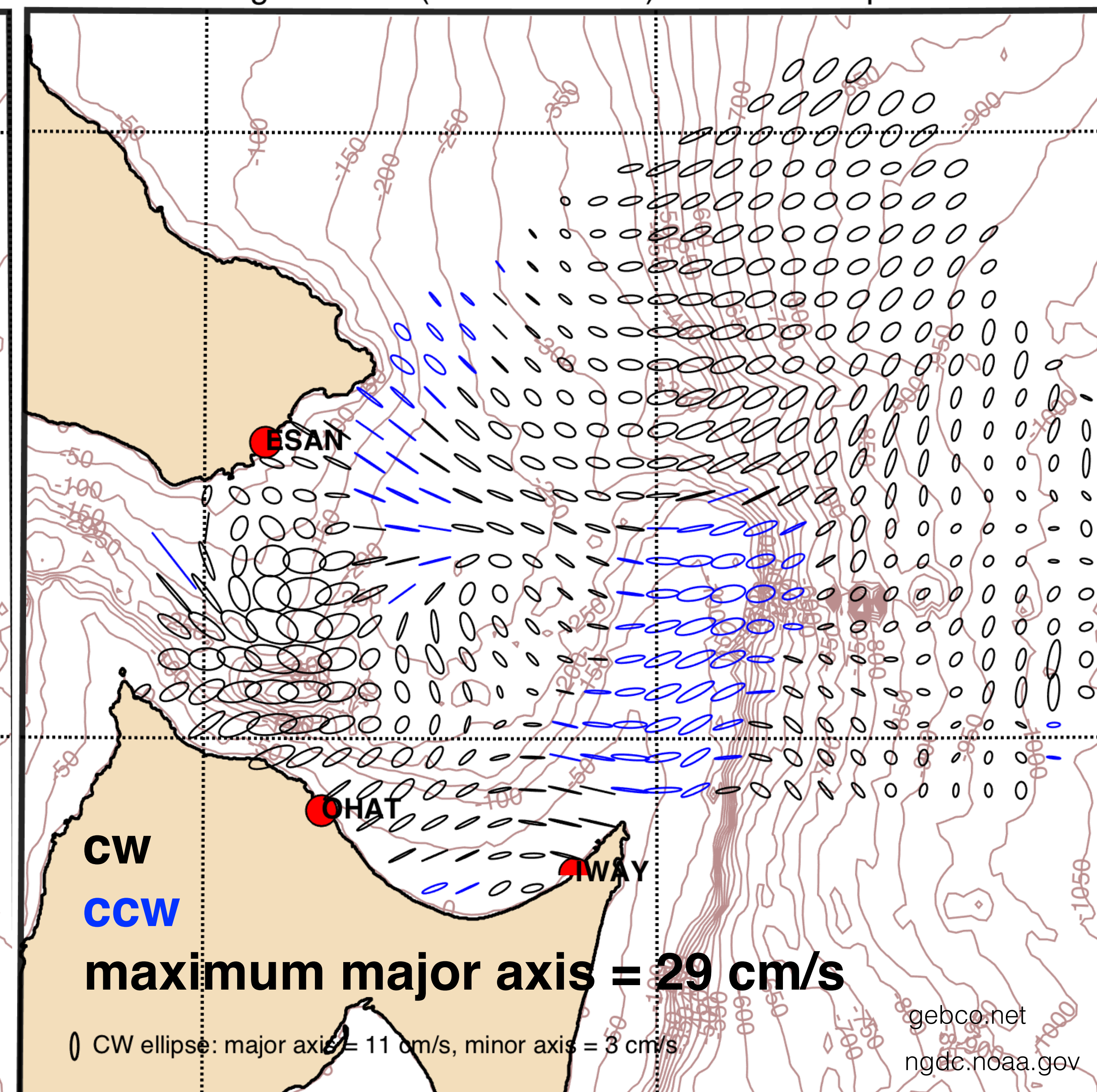
1. tuv file conversion
2. tidal ellipse
3. total, tidal, residual timeseries
4. converts tidal and residual timeseries into tuv

SeaTides Tidal Ellipse Plots

Tsugaru Strait (MUTU Station) M2 Tidal Ellipses



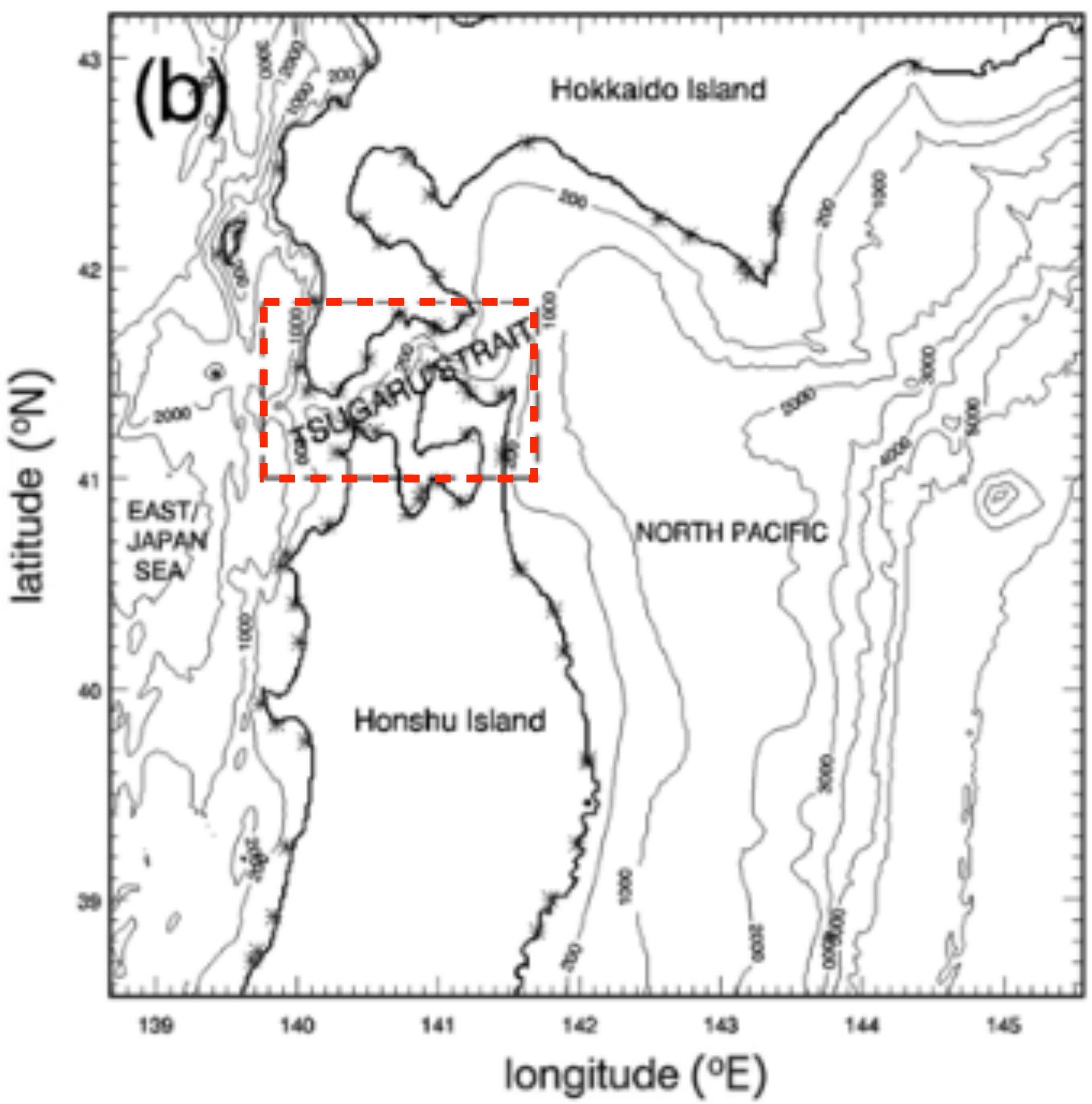
Tsugaru Strait (MUTU Station) K1 Tidal Ellipses



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

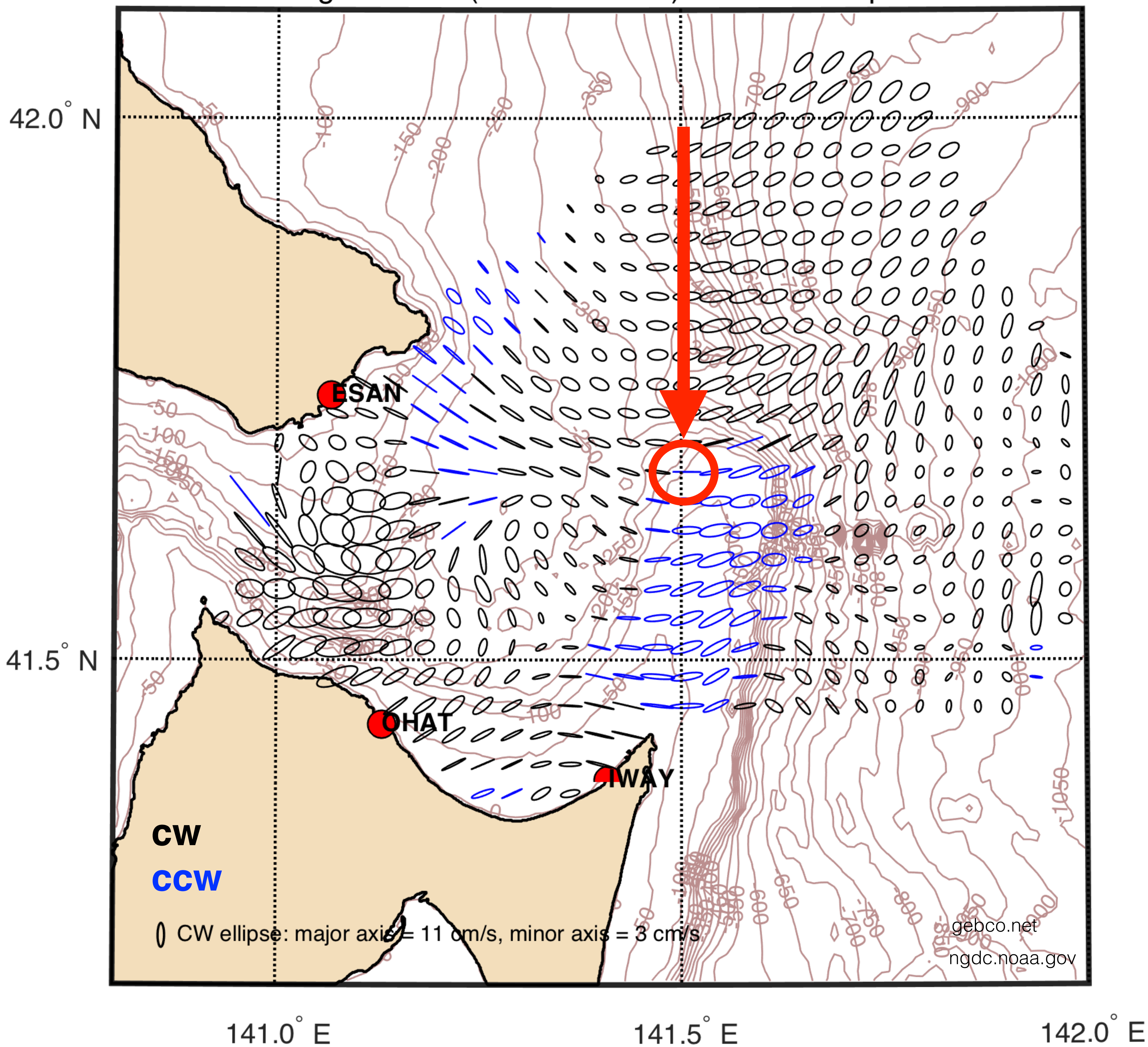
Quang-Hung Luu[1,2*], Kosuke Ito[1,3], Yoichi Ishikawa[1], and Toshiyuki Awaji[1]
[1]*Department of Geophysics, Kyoto University, Kyoto 606-8502, Japan*
[2]*Department of Mathematics, Vietnam National University, Hanoi, Vietnam*
[3]*Department of Atmospheric Sciences, Taiwan National University, Taipei 10617, Taiwan*

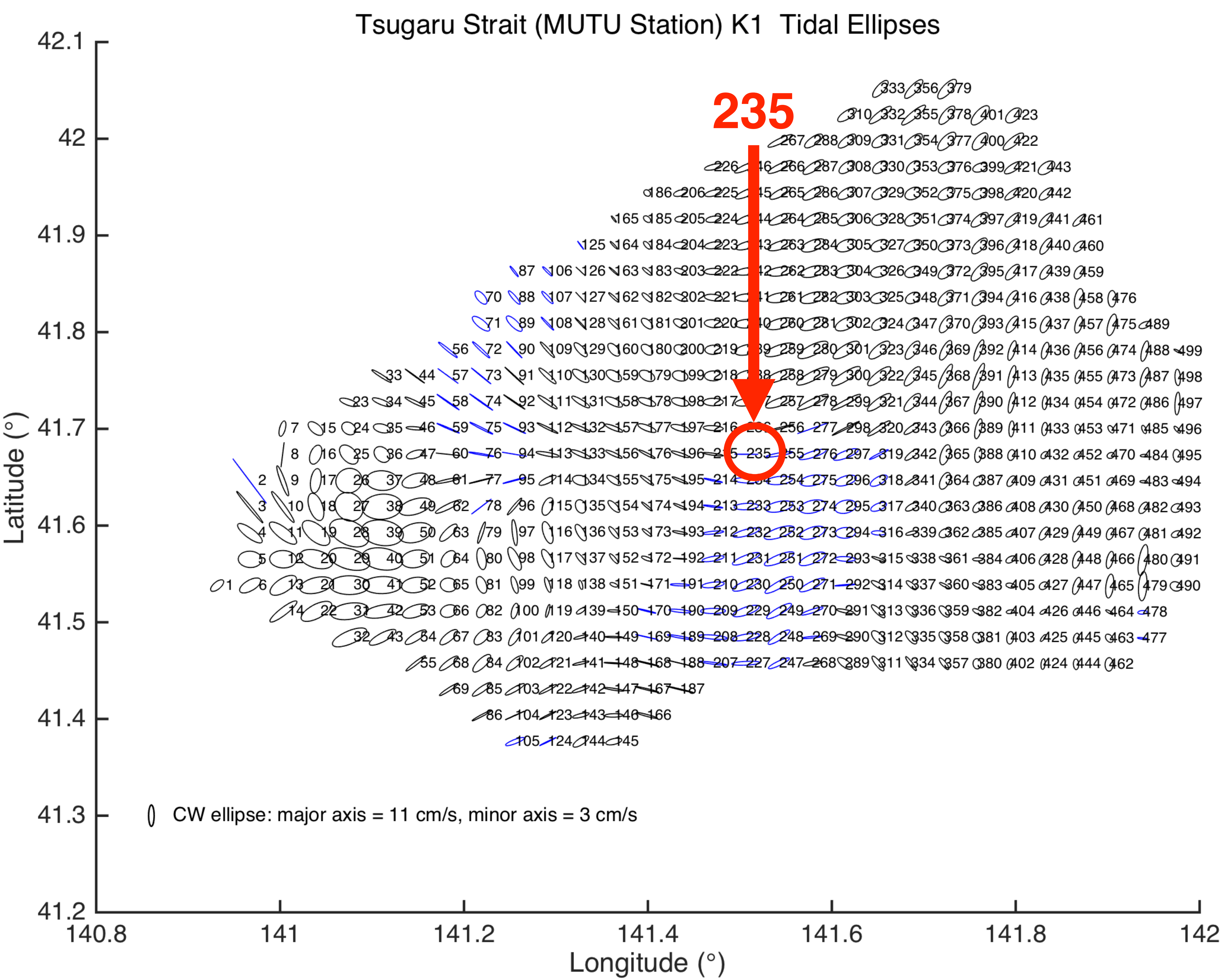
Received 19 October 2011; Revised 5 December 2011; Accepted 20 December 2011



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

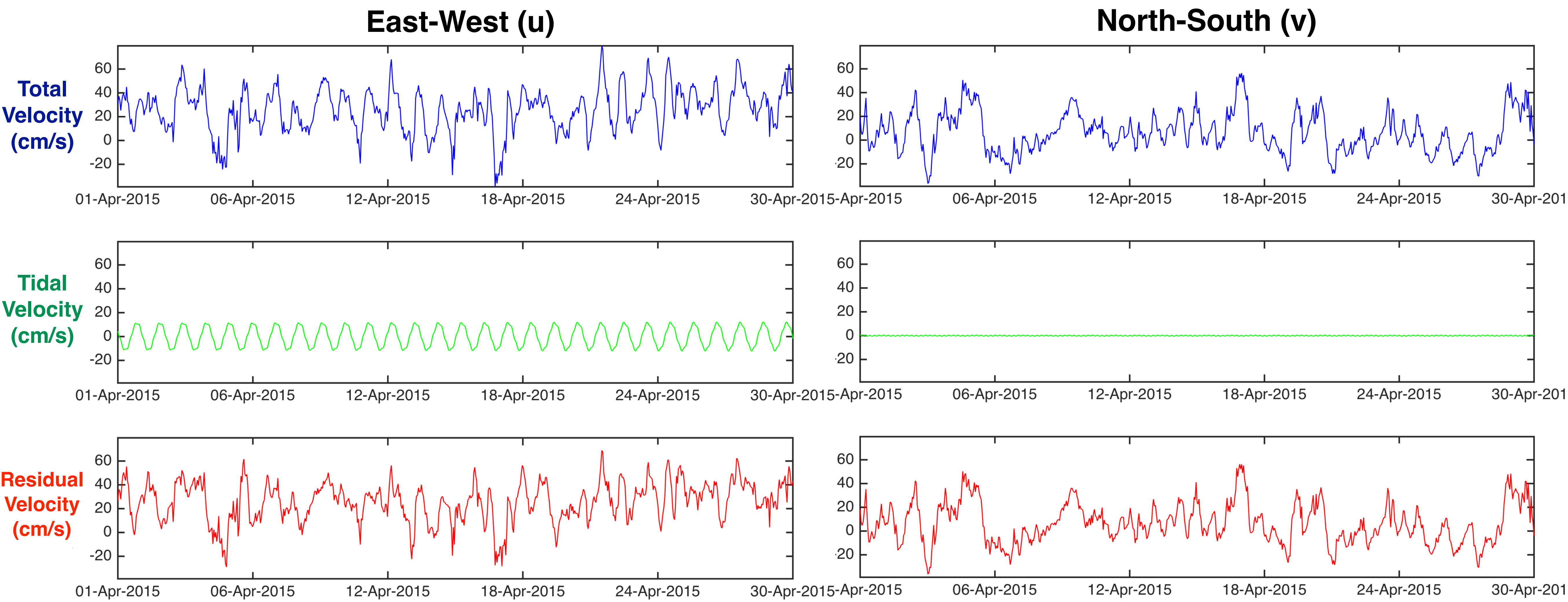
Tsugaru Strait (MUTU Station) K1 Tidal Ellipses



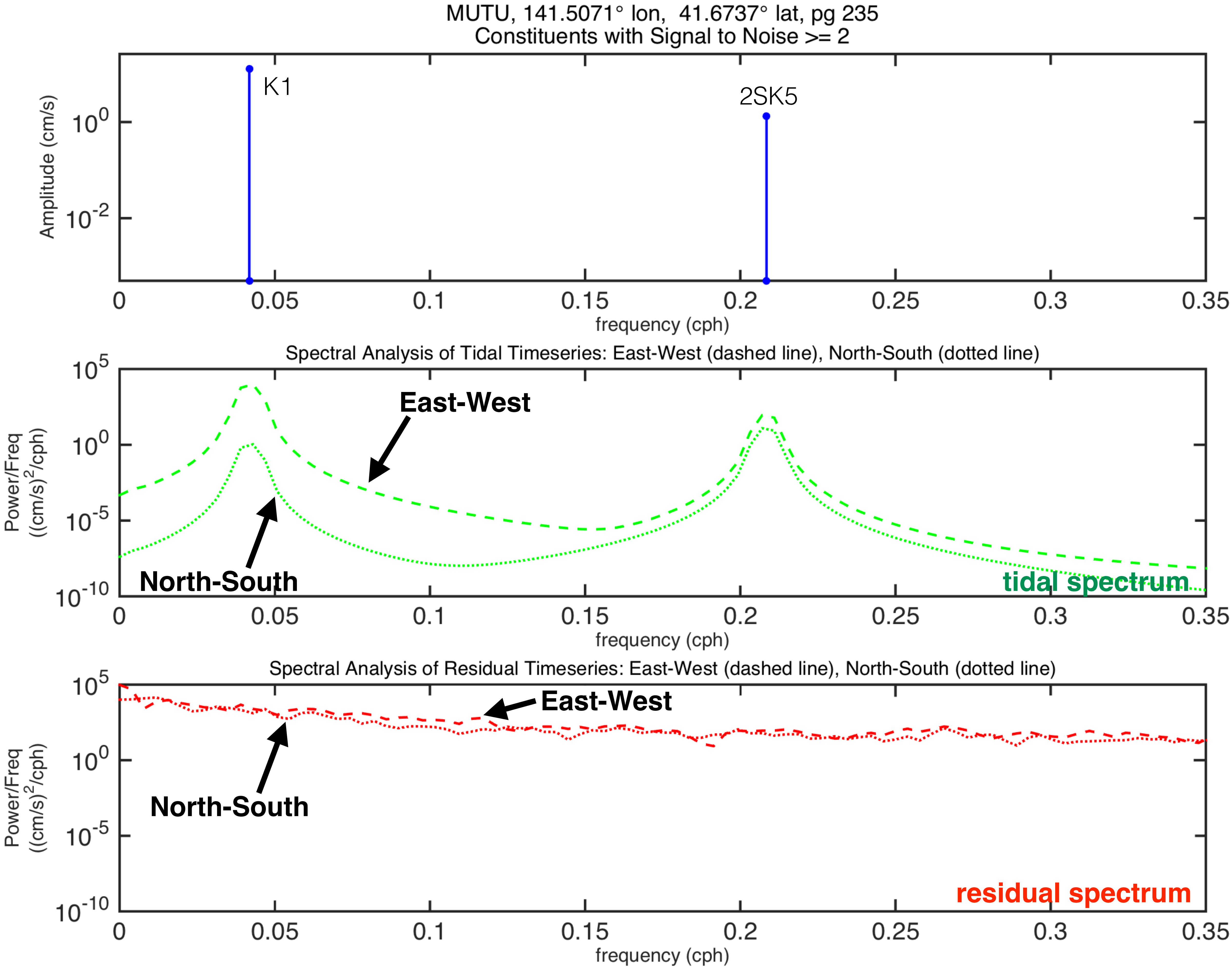


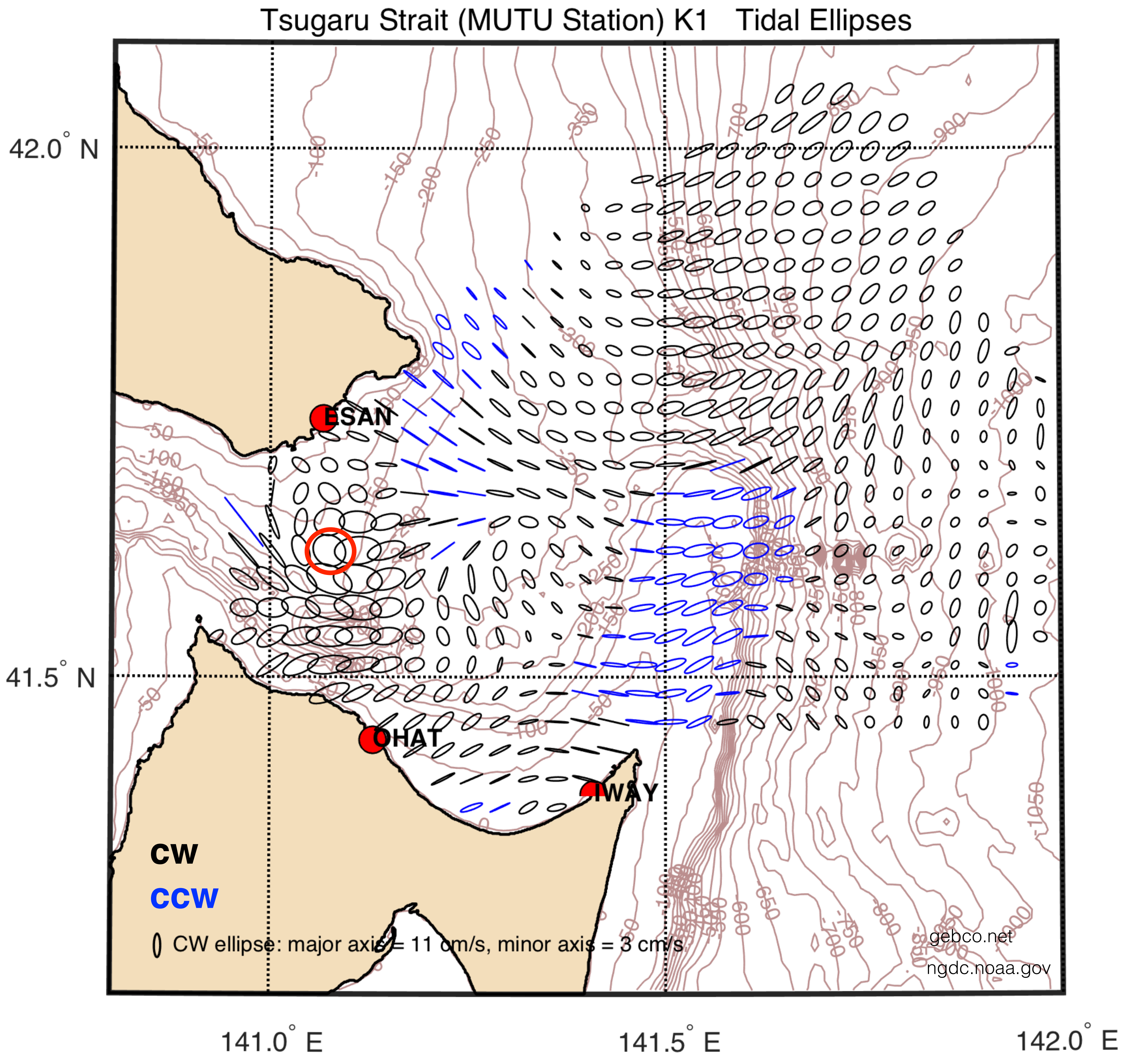
Tsugaru Strait (MUTU Station) K1 Tidal Ellipses
235
CW ellipse: major axis = 11 cm/s, minor axis = 3 cm/s
Latitude (°)
Longitude (°)
42.1
42
41.9
41.8
41.7
41.6
41.5
41.4
41.3
41.2
140.8
141
141.2
141.4
141.6
141.8
142

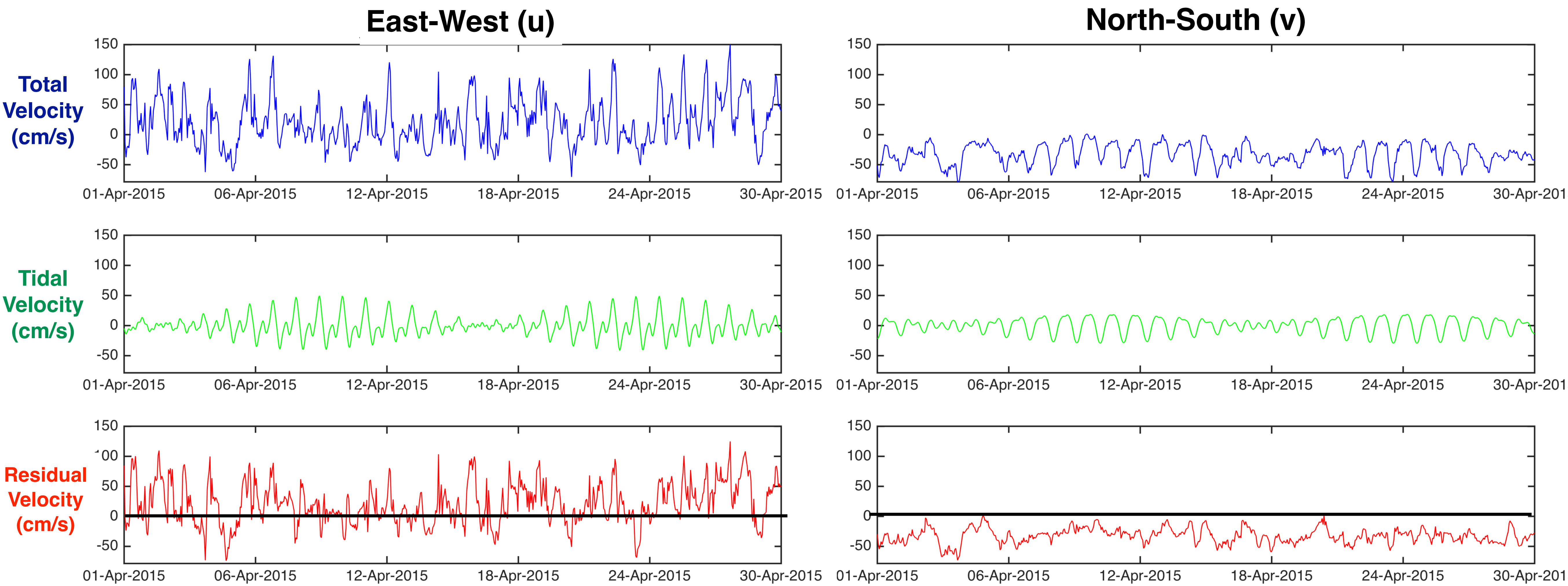
SeaTides Figure Names



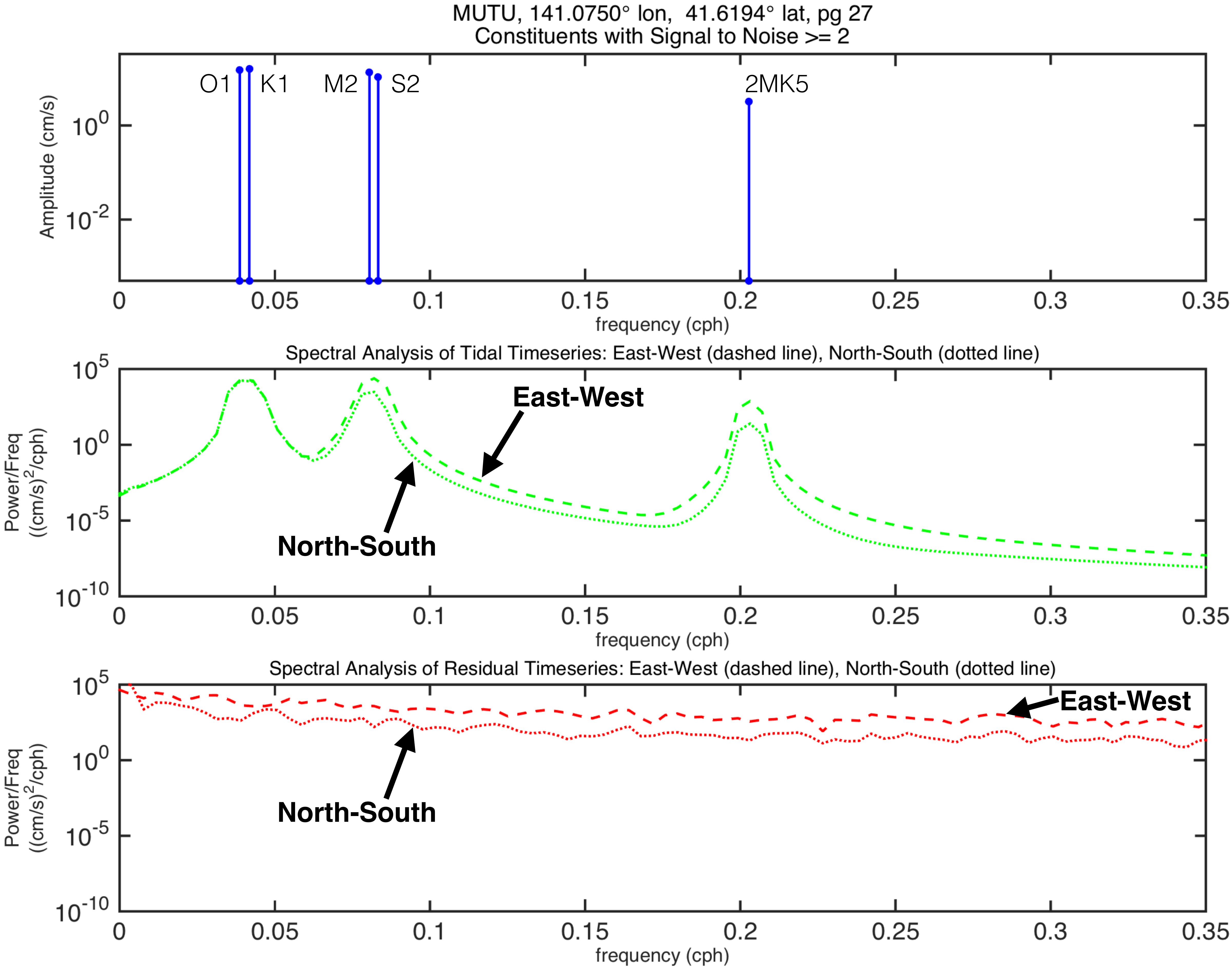
East-West (u)
North-South (v)
Total Velocity (cm/s)
Tidal Velocity (cm/s)
Residual Velocity (cm/s)
60
40
20
0
-20
01-Apr-2015
06-Apr-2015
12-Apr-2015
18-Apr-2015
24-Apr-2015
30-Apr-2015


MUTU, 141.5071° lon, 41.6737° lat, pg 235
Constituents with Signal to Noise >= 2
K1
2SK5
Amplitude (cm/s)
frequency (cph)
Spectral Analysis of Tidal Timeseries: East-West (dashed line), North-South (dotted line)
East-West
North-South
tidal spectrum
Power/Freq ((cm/s)^2/cph)
frequency (cph)
Spectral Analysis of Residual Timeseries: East-West (dashed line), North-South (dotted line)
East-West
North-South
residual spectrum
Power/Freq ((cm/s)^2/cph)
frequency (cph)


Tsugaru Strait (MUTU Station) K1 Tidal Ellipses
42.0° N
41.5° N
141.0° E
141.5° E
142.0° E
ESAN
OHAT
IWAY
CW
CCW
CW ellipse: major axis = 11 cm/s, minor axis = 3 cm/s
gebco.net
ngdc.noaa.gov



East-West (u)
North-South (v)
Total Velocity (cm/s)
Tidal Velocity (cm/s)
Residual Velocity (cm/s)
150
100
50
0
-50
01-Apr-2015
06-Apr-2015
12-Apr-2015
18-Apr-2015
24-Apr-2015
30-Apr-2015



MUTU, 141.0750° lon, 41.6194° lat, pg 27
Constituents with Signal to Noise >= 2
O1
K1
M2
S2
2MK5
Amplitude (cm/s)
frequency (cph)
Spectral Analysis of Tidal Timeseries: East-West (dashed line), North-South (dotted line)
East-West
North-South
Power/Freq ((cm/s)^2/cph)
frequency (cph)
Spectral Analysis of Residual Timeseries: East-West (dashed line), North-South (dotted line)
East-West
North-South
Power/Freq ((cm/s)^2/cph)
frequency (cph)

SeaTides Components

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

TOTL

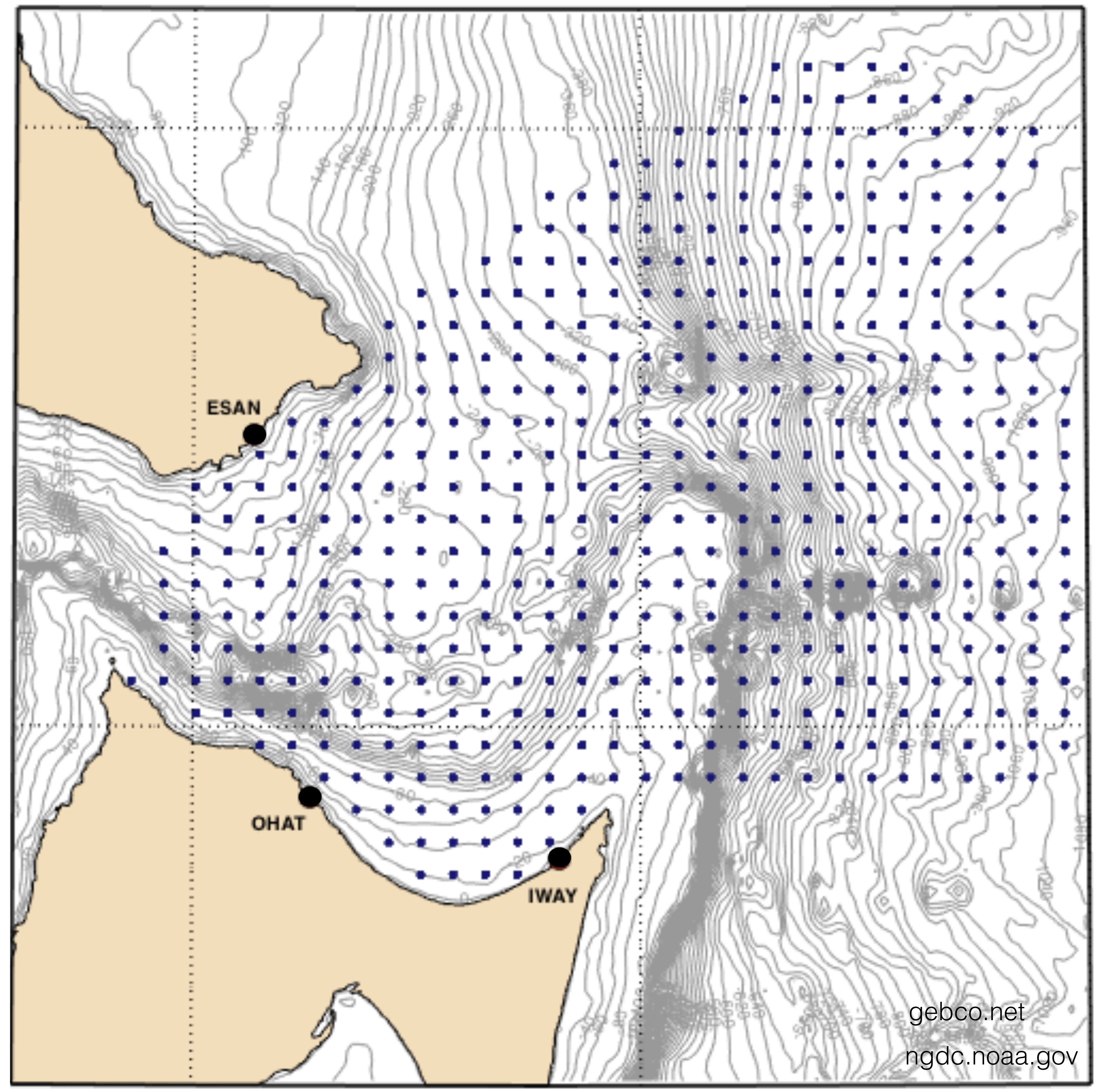
TOTL_MUTU_2015_04_01_00_00_00.tuv
TOTL_MUTU_2015_04_01_01_00_00.tuv
TOTL_MUTU_2015_04_01_02_00_00.tuv
TOTL_MUTU_2015_04_01_03_00_00.tuv
TOTL_MUTU_2015_04_01_04_00_00.tuv
TOTL_MUTU_2015_04_01_05_00_00.tuv
TOTL_MUTU_2015_04_01_06_00_00.tuv
TOTL_MUTU_2015_04_01_07_00_00.tuv

TIDL

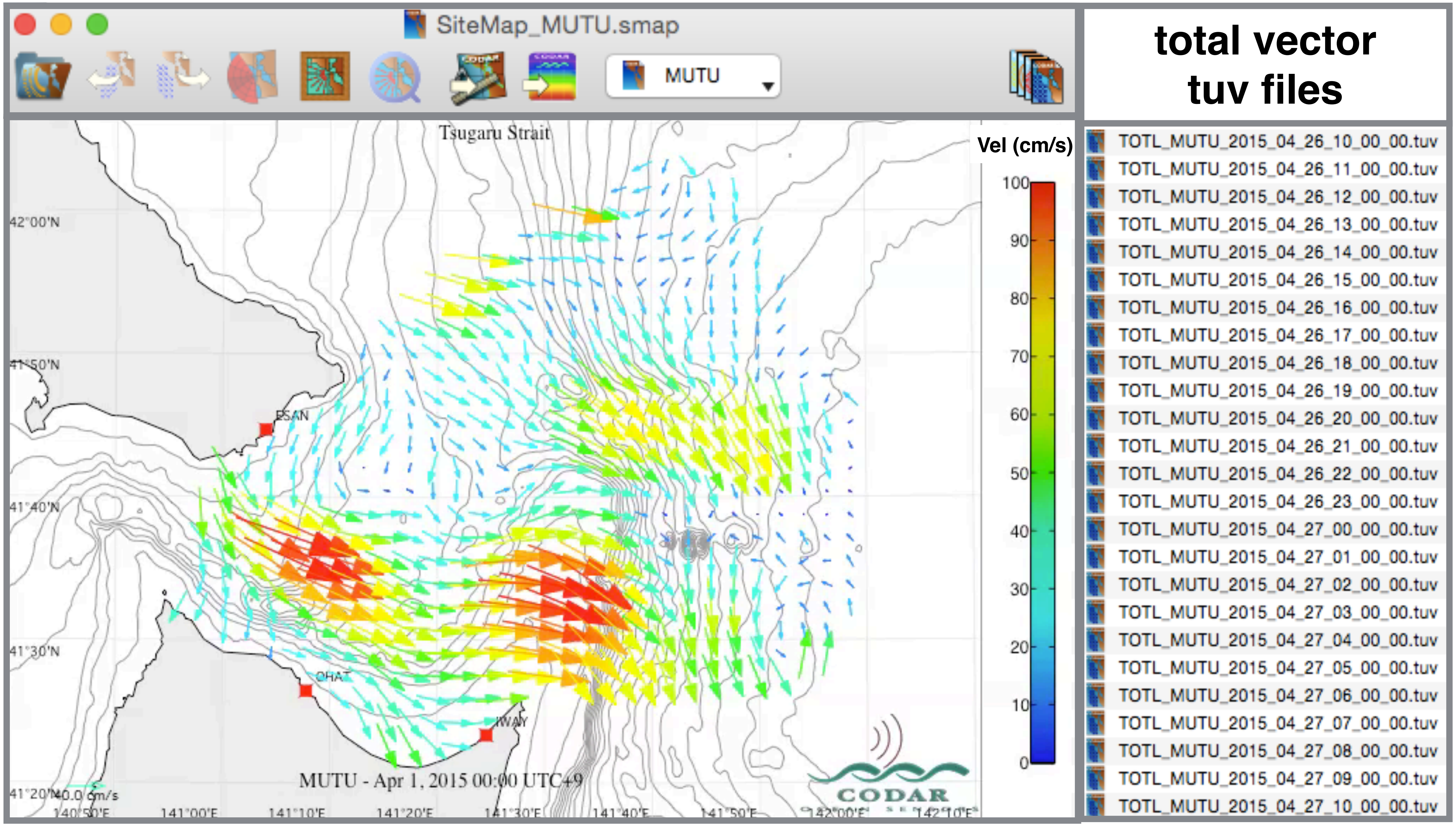
TIDL_MUTU_2015_04_01_00_00_00.tuv
TIDL_MUTU_2015_04_01_01_00_00.tuv
TIDL_MUTU_2015_04_01_02_00_00.tuv
TIDL_MUTU_2015_04_01_03_00_00.tuv
TIDL_MUTU_2015_04_01_04_00_00.tuv
TIDL_MUTU_2015_04_01_05_00_00.tuv
TIDL_MUTU_2015_04_01_06_00_00.tuv
TIDL_MUTU_2015_04_01_07_00_00.tuv

RSDL

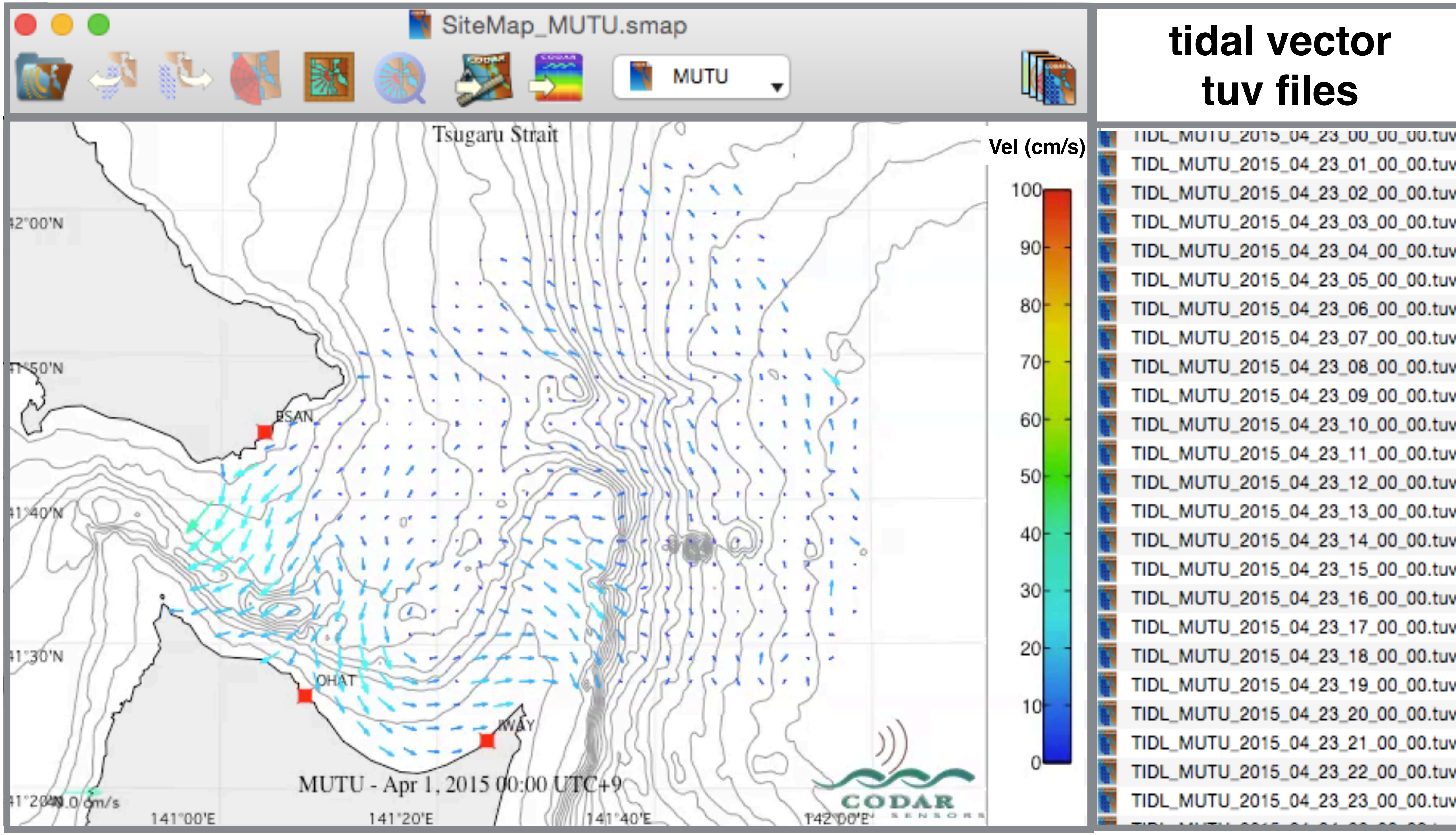
RSDL_MUTU_2015_04_01_00_00_00.tuv
RSDL_MUTU_2015_04_01_01_00_00.tuv
RSDL_MUTU_2015_04_01_02_00_00.tuv
RSDL_MUTU_2015_04_01_03_00_00.tuv
RSDL_MUTU_2015_04_01_04_00_00.tuv
RSDL_MUTU_2015_04_01_05_00_00.tuv
RSDL_MUTU_2015_04_01_06_00_00.tuv
RSDL_MUTU_2015_04_01_07_00_00.tuv



Total Signal

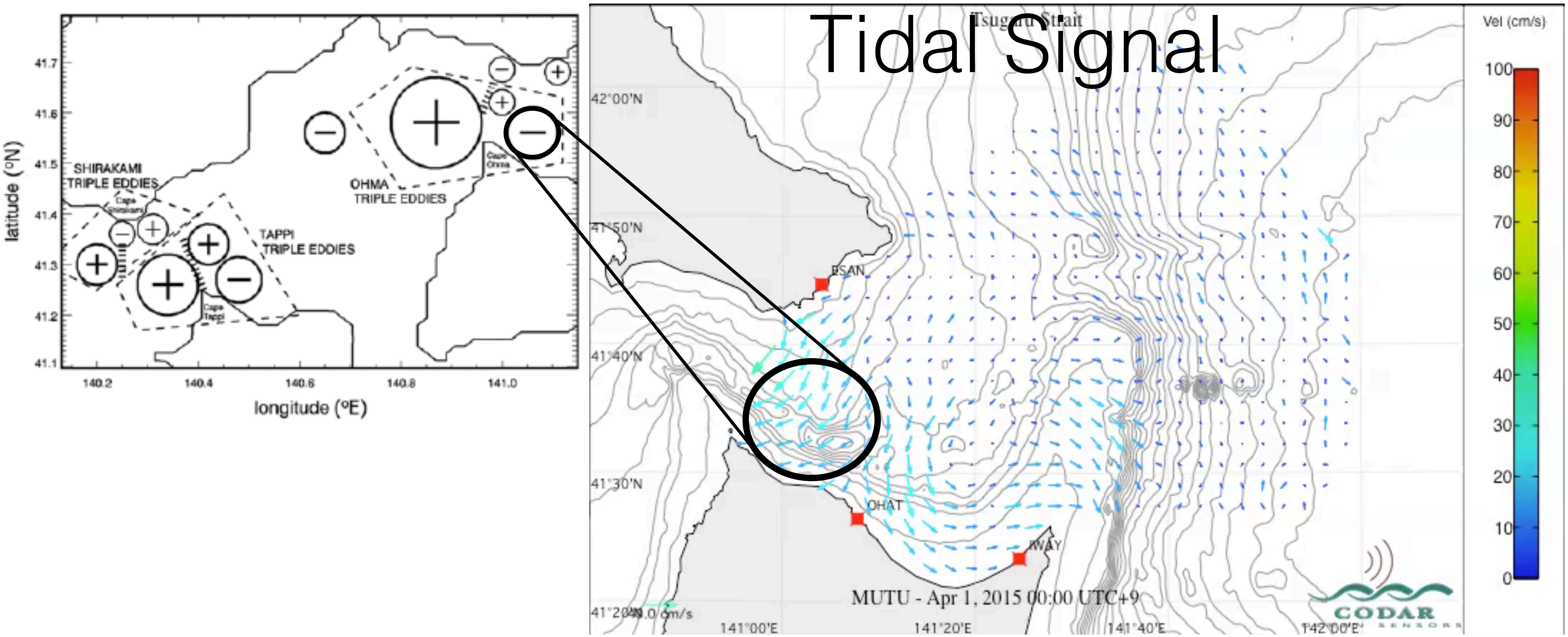


Tidal Signal

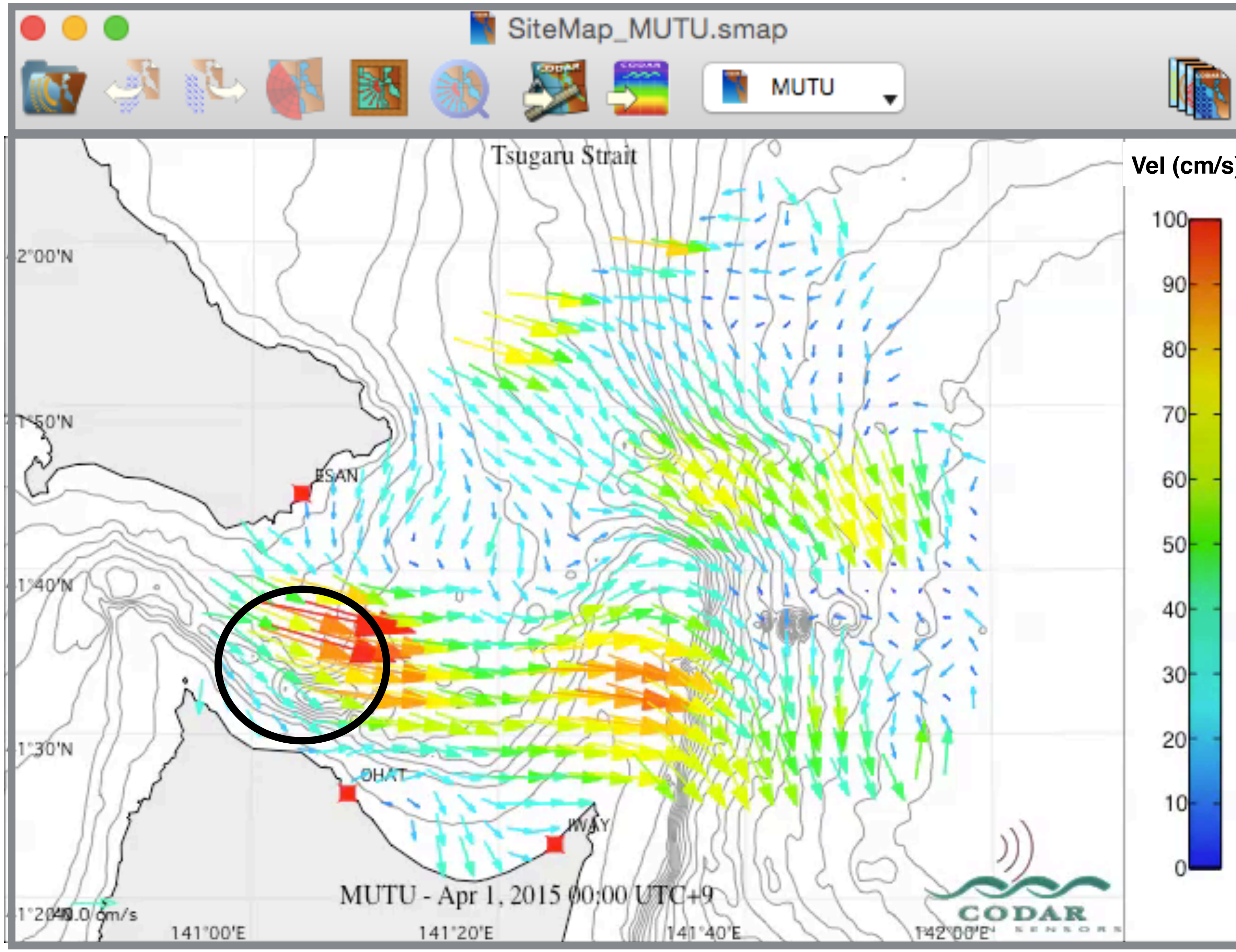


Tidal Transport through the Tsugaru Strait - Part I: Characteristics of the Major Tidal Flow and its Residual Current

Quang-Hung Luu[1,2*], Kosuke Ito[1,3], Yoichi Ishikawa[1], and Toshiyuki Awaji[1]
[1]*Department of Geophysics, Kyoto University, Kyoto 606-8502, Japan*
[2]*Department of Mathematics, Vietnam National University, Hanoi, Vietnam*
[3]*Department of Atmospheric Sciences, Taiwan National University, Taipei 10617, Taiwan*



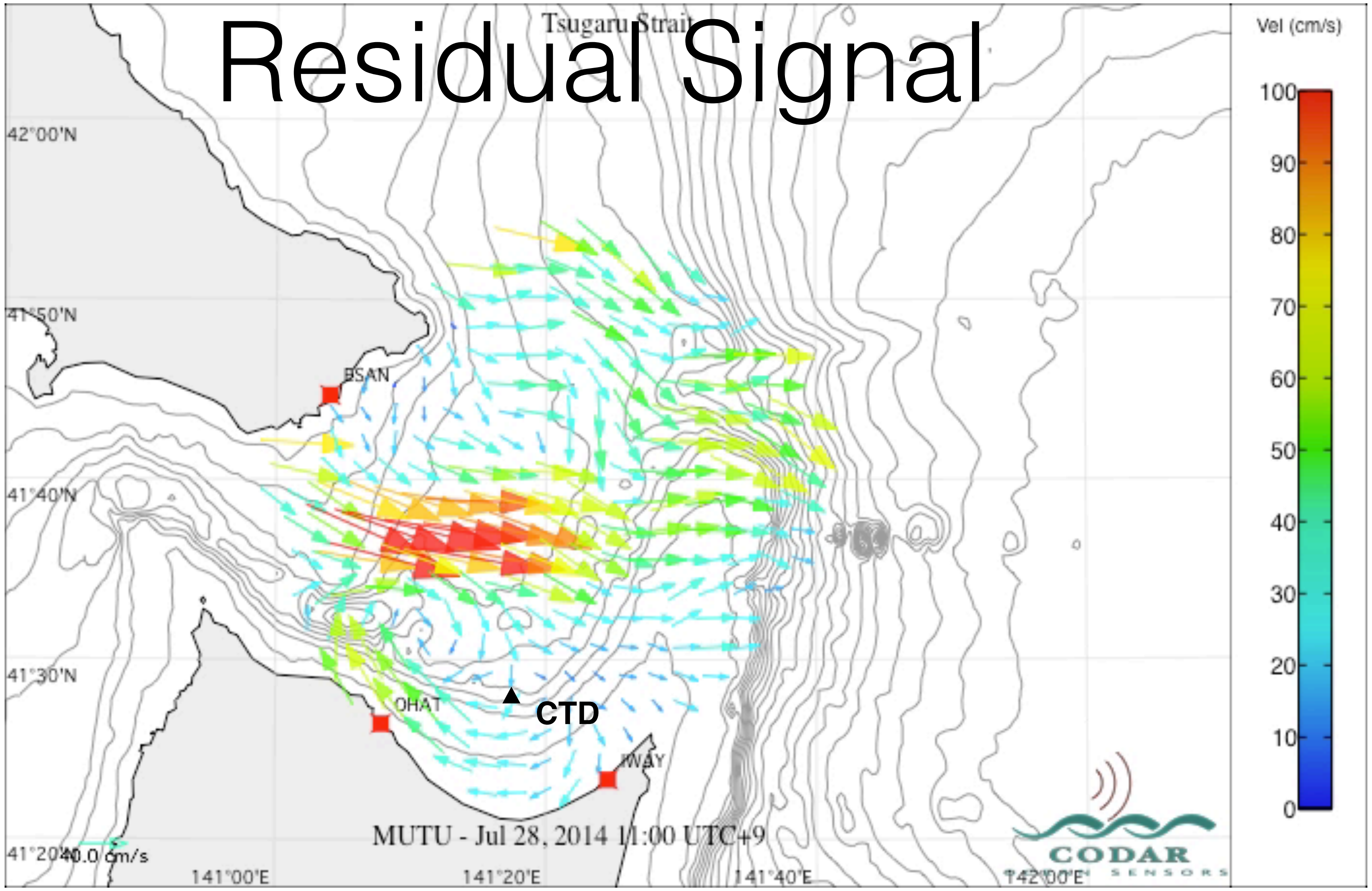
Residual Signal

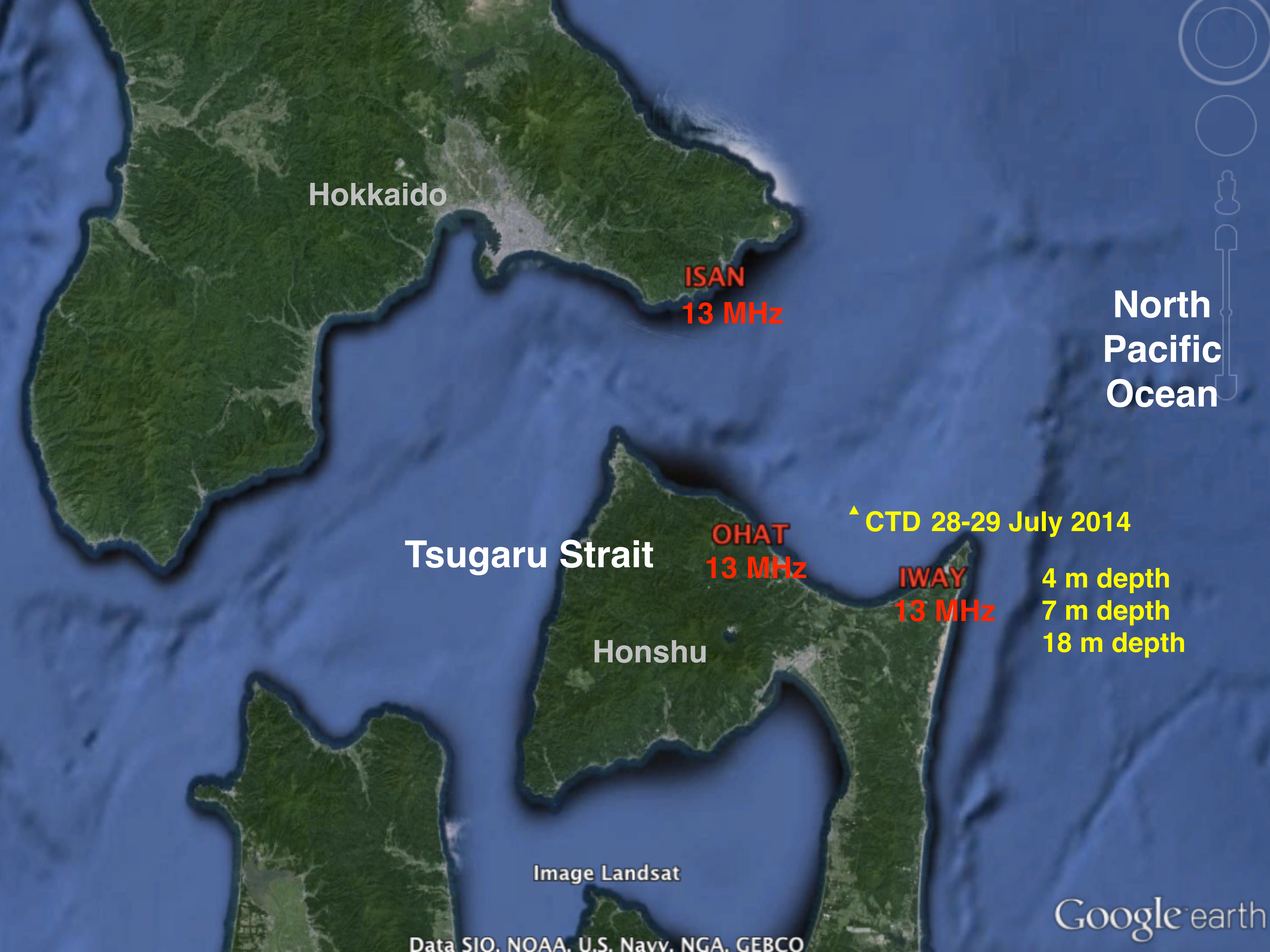


residual vector tuv files

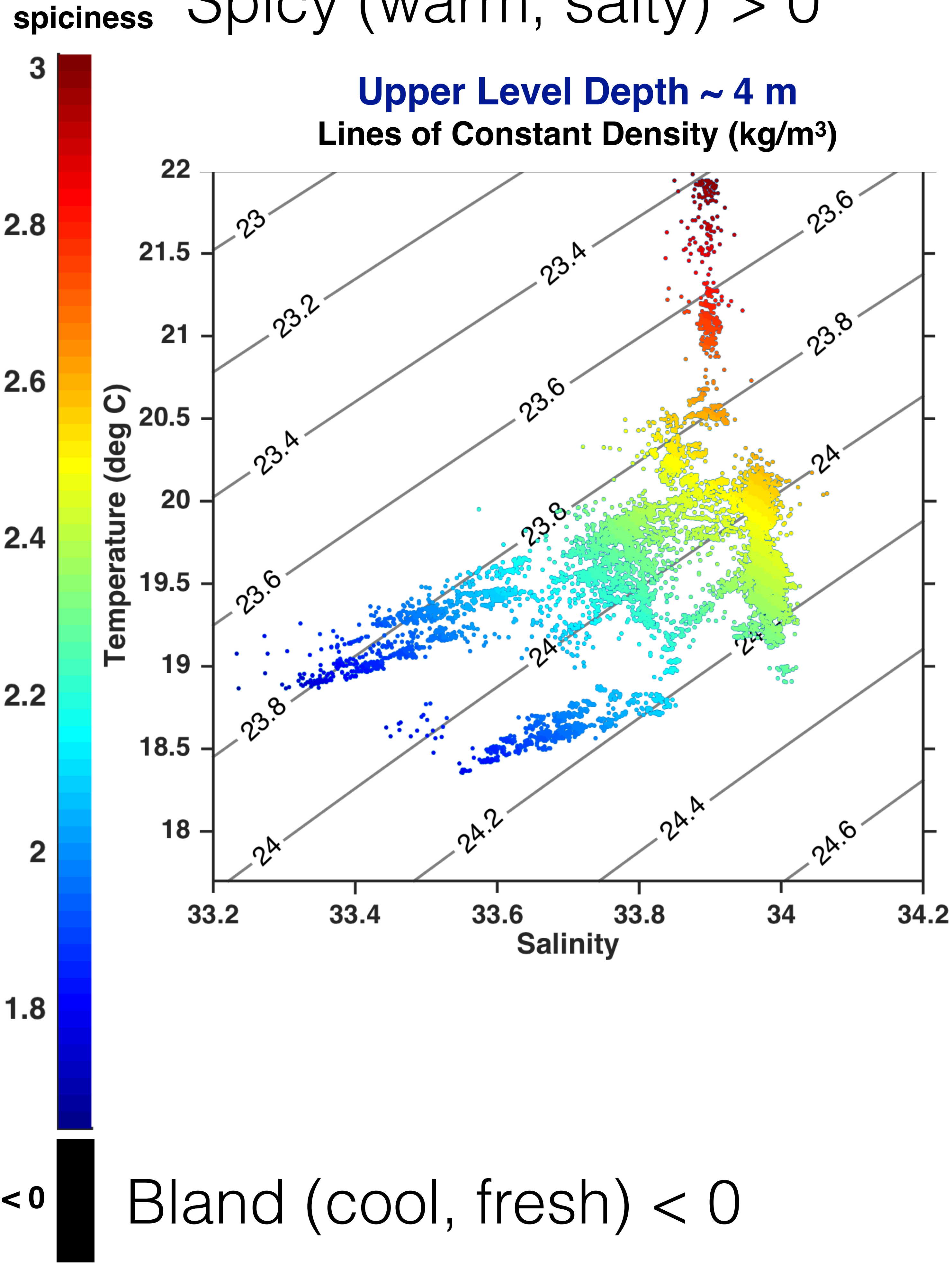
RSDL_MUTU_2015_04_01_04_00_00.tuv
RSDL_MUTU_2015_04_01_05_00_00.tuv
RSDL_MUTU_2015_04_01_06_00_00.tuv
RSDL_MUTU_2015_04_01_07_00_00.tuv
RSDL_MUTU_2015_04_01_08_00_00.tuv
RSDL_MUTU_2015_04_01_09_00_00.tuv
RSDL_MUTU_2015_04_01_10_00_00.tuv
RSDL_MUTU_2015_04_01_11_00_00.tuv
RSDL_MUTU_2015_04_01_12_00_00.tuv
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

28-29 July 2014

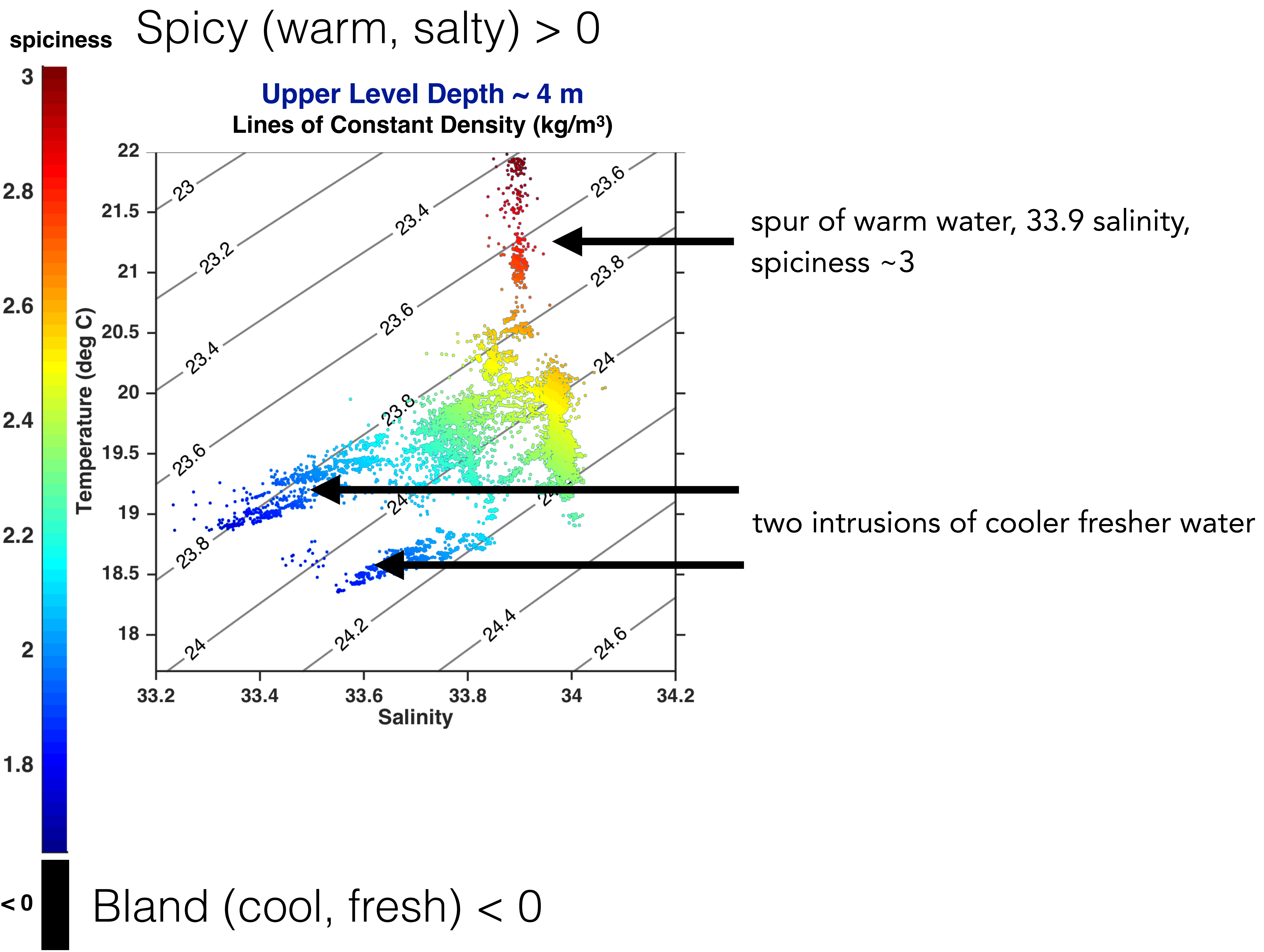



Hokkaido
ISAN
13 MHz
North
Pacific
Ocean
CTD 28-29 July 2014
Tsugaru Strait
OHAT
13 MHz
IWAY
13 MHz
4 m depth
7 m depth
18 m depth
Honshu
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth

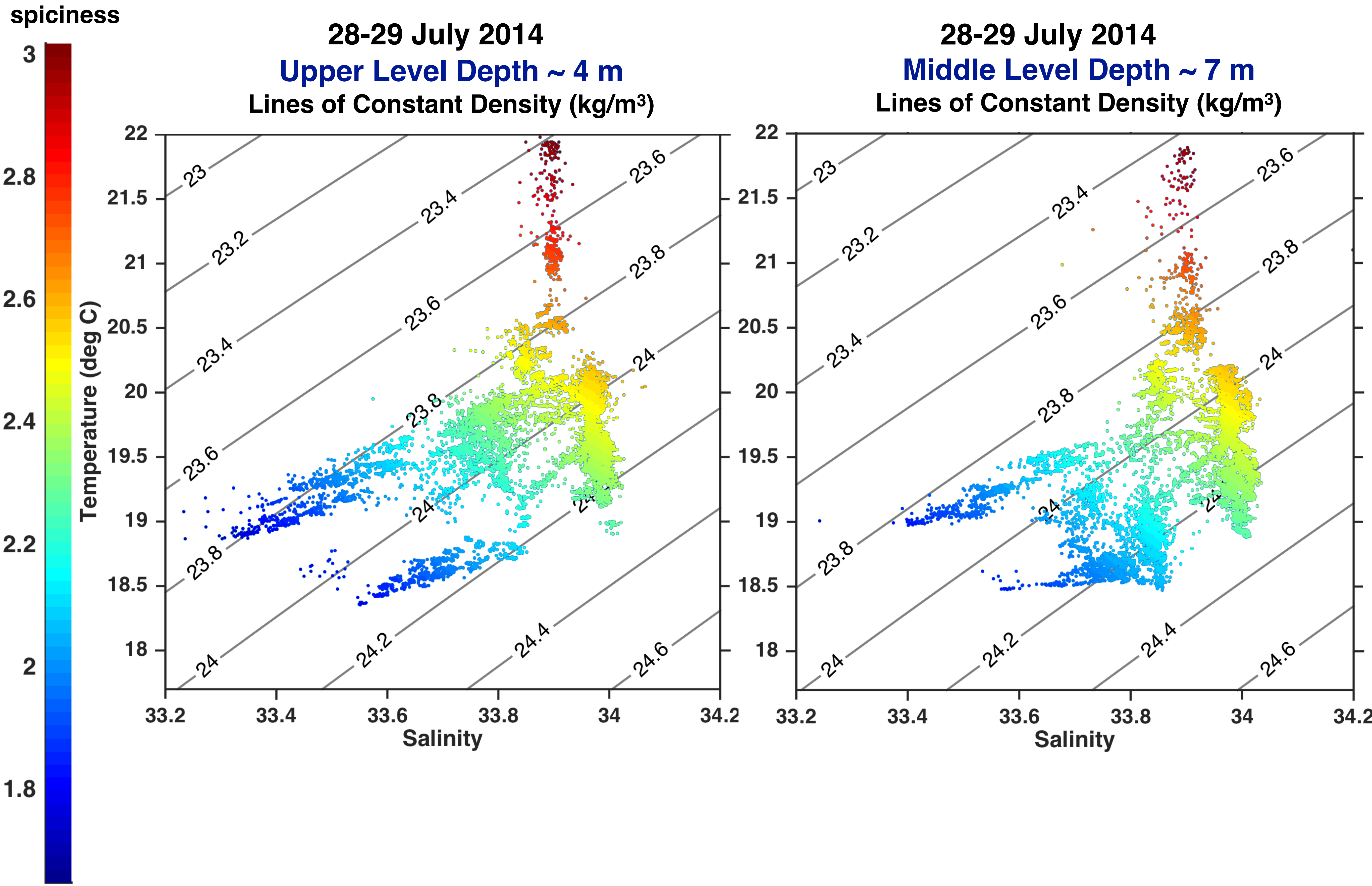
Spicy (warm, salty) > 0



Bland (cool, fresh) < 0

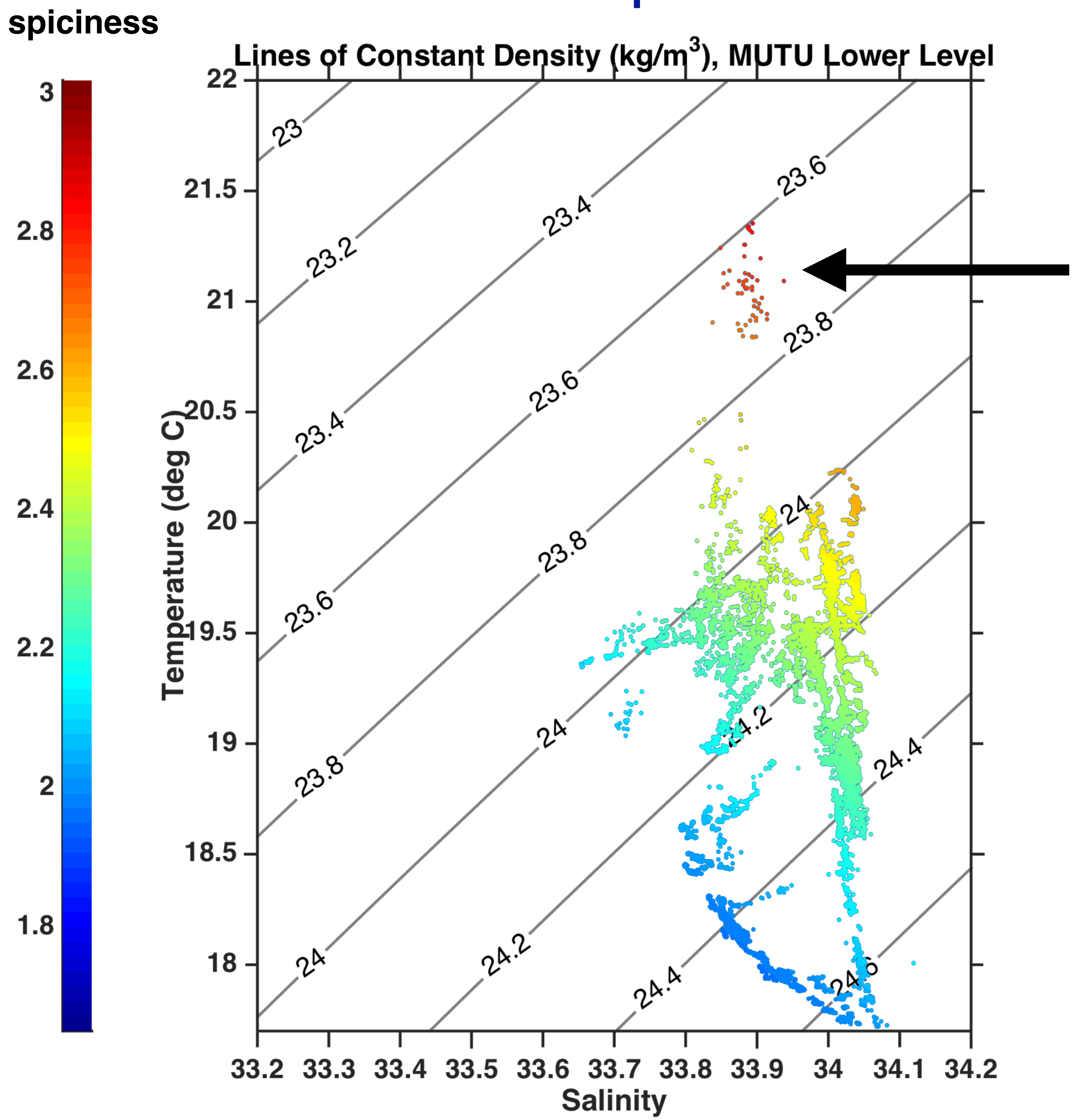


spiciness
Spicy (warm, salty) > 0
Upper Level Depth ~ 4 m
Lines of Constant Density (kg/m³)
Temperature (deg C)
Salinity
22
21.5
21
20.5
20
19.5
19
18.5
18
33.2
33.4
33.6
33.8
34
34.2
3
2.8
2.6
2.4
2.2
2
1.8
23
23.2
23.4
23.6
23.8
24
24.2
24.4
24.6
spur of warm water, 33.9 salinity, spiciness ~3
two intrusions of cooler fresher water
< 0
Bland (cool, fresh) < 0


spiciness
28-29 July 2014
Upper Level Depth ~ 4 m
Lines of Constant Density (kg/m³)
28-29 July 2014
Middle Level Depth ~ 7 m
Lines of Constant Density (kg/m³)
Temperature (deg C)
Salinity
Salinity

28-29 July 2014

Lower Level Depth ~ 18 m



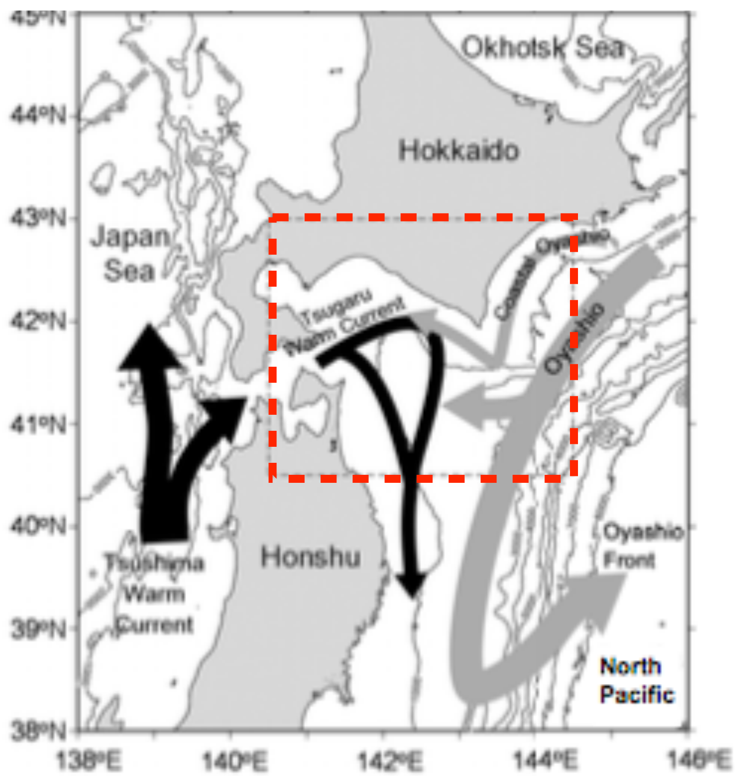
Journal of Oceanography, Vol. 63, pp. 573 to 588, 2007

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

Ana Luisa Rosa[1]*, Yutaka Isoda[1], Kazuyuki Uehara[2] and Tomokazu Aiki[1]

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

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



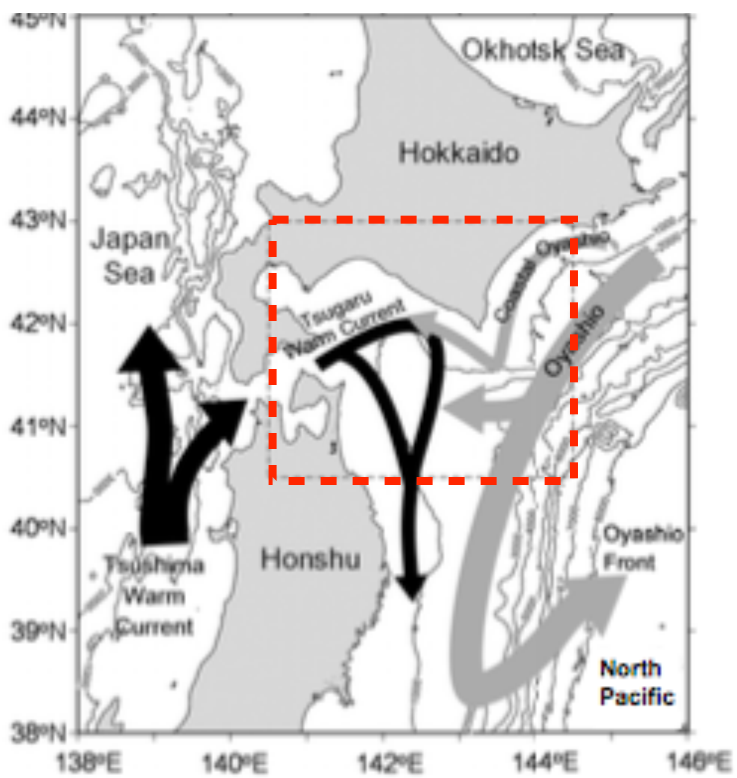
Journal of Oceanography, Vol. 63, pp. 573 to 588, 2007

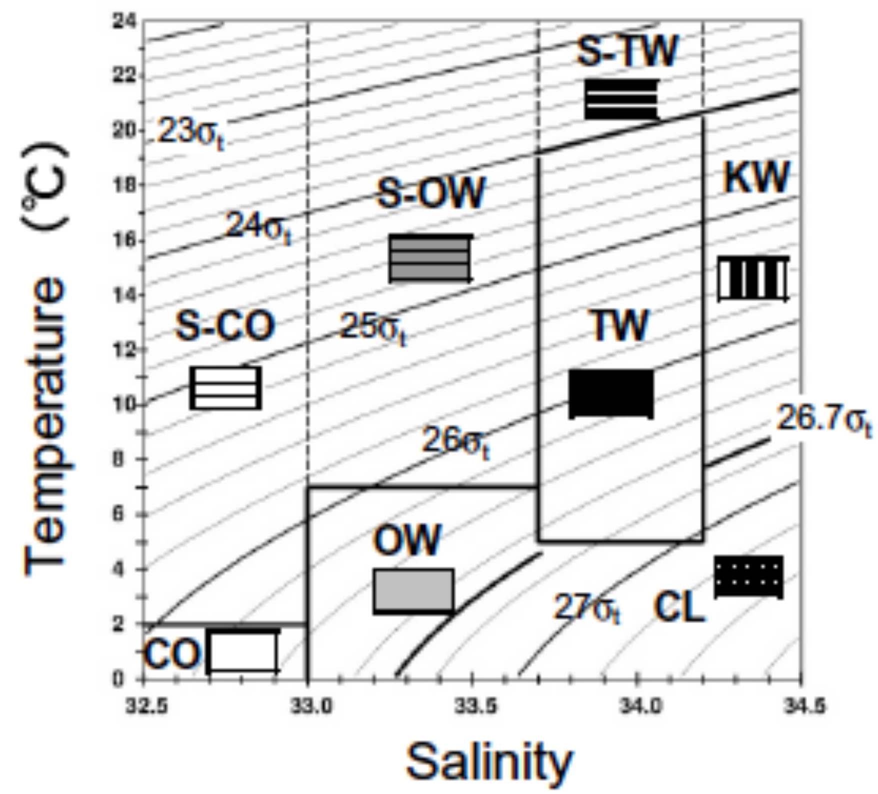
Seasonal Variations of Water System Distribution and Flow Patterns in the Southern Sea Area of Hokkaido, Japan

ANA LUISA ROSA[1]*, YUTAKA ISODA[1], KAZUYUKI UEHARA[2] and TOMOKAZU AIKI[1]

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

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



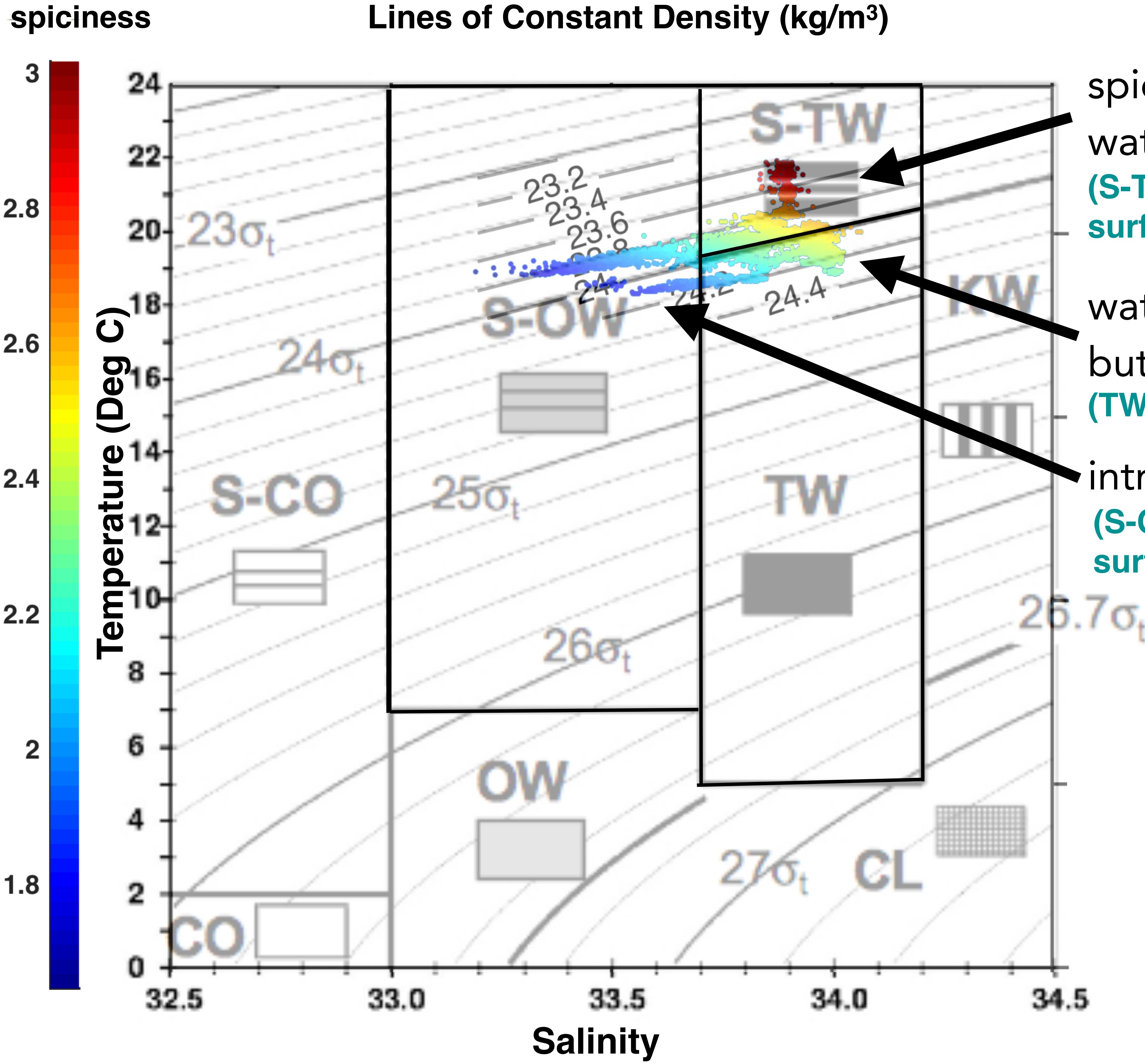


(TW) Tsugaru Warm Current
(S-TW) Tsugaru Warm Current, surface mode
(S-OW) Oyashio water system, surface mode

28-29 July 2014

Upper Level Depth ~ 4 m

Lines of Constant Density (kg/m³)



spicy, warm water spur and waters with density > 24 kg/m³

(S-TW) Tsugaru Warm Current, surface mode

waters in the same salinity band but lower temperature and density

(TW) Tsugaru Warm Current

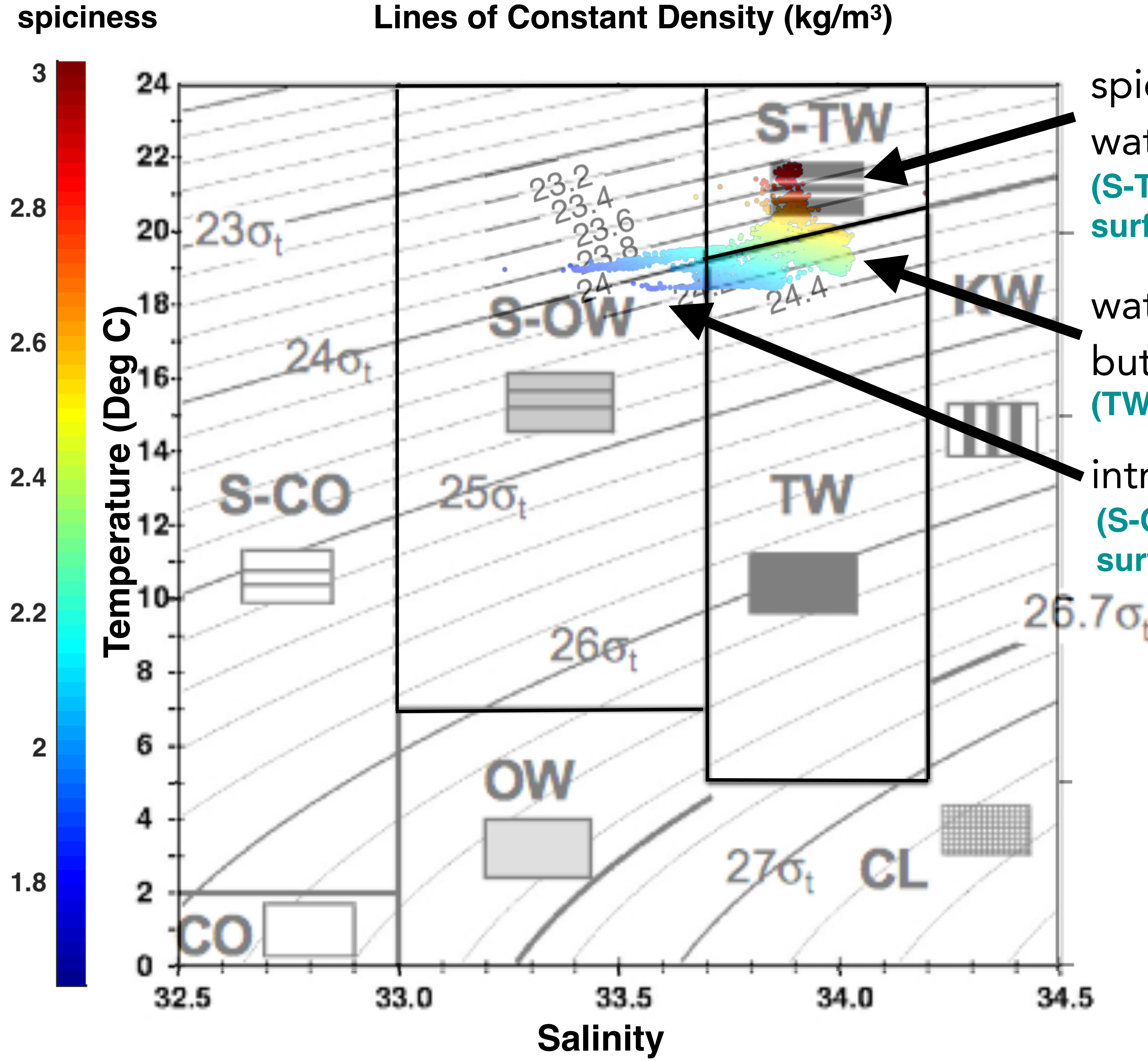
intrusions of cooler fresher water

(S-OW) Oyashio water system, surface mode

28-29 July 2014

Middle Level Depth ~ 7 m

Lines of Constant Density (kg/m³)



spicy, warm water spur and waters with density > 24 kg/m^3

(S-TW) Tsugaru Warm Current, surface mode

waters in the same salinity band but lower temperature and density

(TW) Tsugaru Warm Current

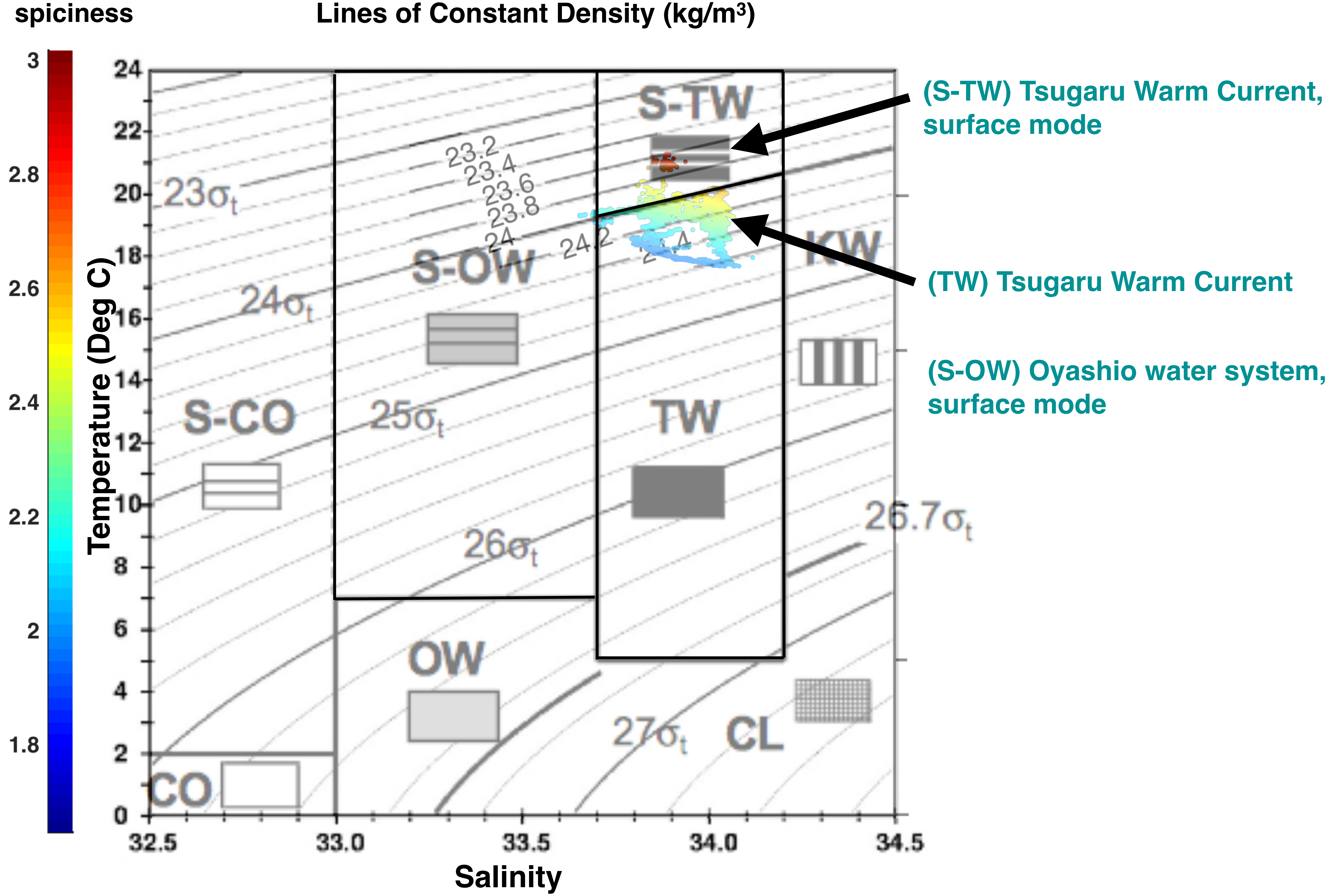
intrusions of cooler fresher water

(S-OW) Oyashio water system, surface mode

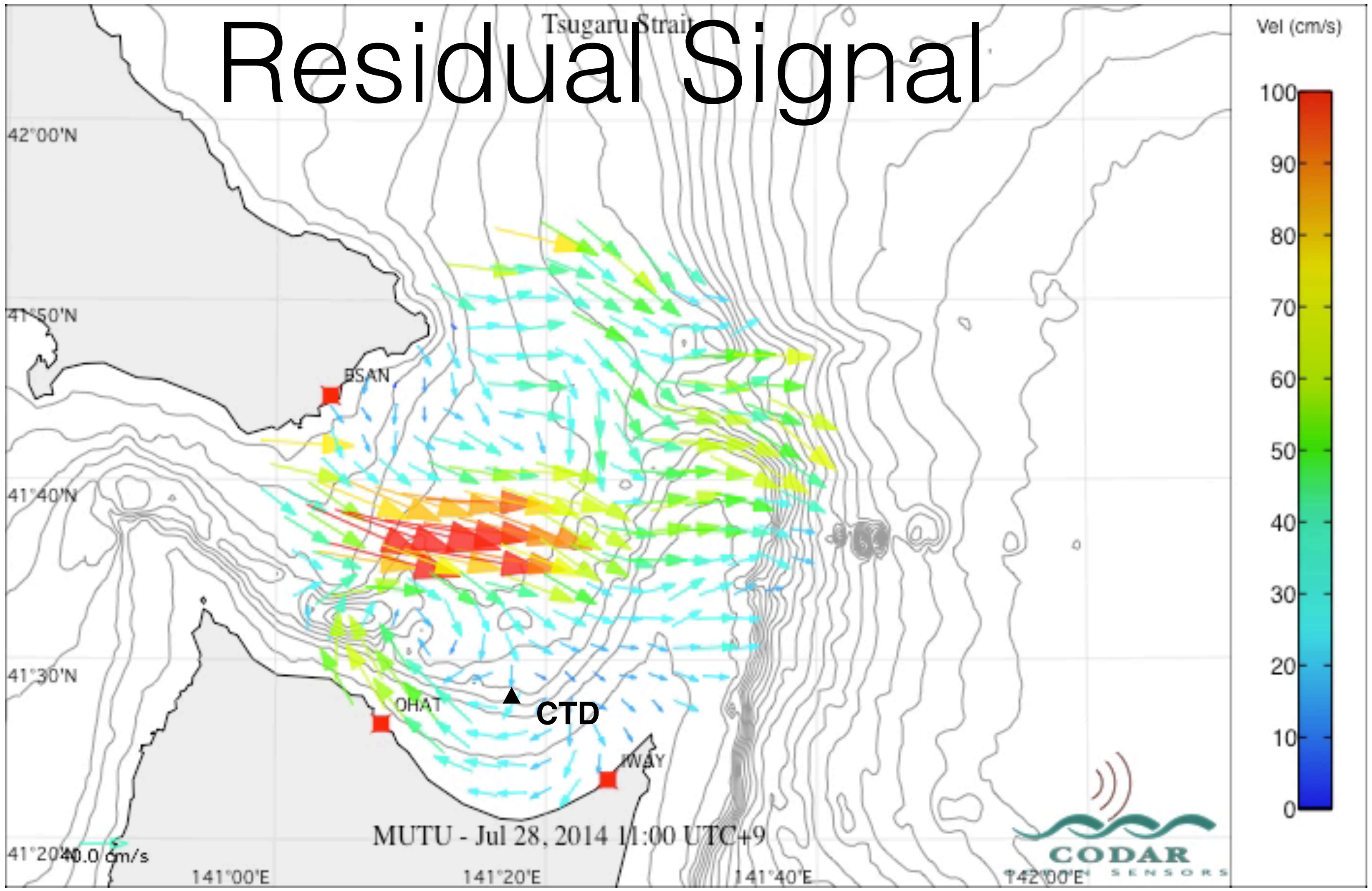
28-29 July 2014

Lower Level Depth ~ 18 m

Lines of Constant Density (kg/m³)



28-29 July 2014



(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 >= 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 <= 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=$[(\text{major axis velocity})/(\text{error})]^2$
- 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)