

**Canadian Data Report of
Hydrography and Ocean Sciences 205**

2017

**ADCP AND CTD DATA MEASURED IN THE FRASER
RIVER, MARCH AND OCTOBER 2016**

by

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ABSTRACT

X. Wang, A. van der Baaren, Y. Wu, C. Lunn, B. de Lange Boom, N. J. Dangerfield, and C. Hannah. 2017. ADCP and CTD Data Measured in The Fraser River, March and October 2016. *Can. Data. Rep. Hydrogr. Ocean Sci.* 205: vii + 346 p.

This data report presents ocean current and water property data collected in the Fraser River, British Columbia, Canada during March and October 2016.

RÉSUMÉ

X. Wang, A. van der Baaren, Y. Wu, C. Lunn, B. de Lange Boom, N. J. Dangerfield, and C. Hannah. 2017. Données ADCP et CTP mesurées dans le fleuve Fraser, en mars et octobre 2016. *Can. Data. Rep. Hydrogr. Ocean Sci.* 205: vii + 346 p.

Ce rapport de données présente les données sur les courants océaniques et les propriétés de l'eau recueillies dans le fleuve Fraser, en Colombie-Britannique, au Canada, en mars et en octobre 2016.

1 INTRODUCTION

The Fraser River was designated as a Canadian Heritage River in 1998. The river is the longest river in British Columbia, Canada, and is 1375 km long. The drainage basin of the Fraser River is 234000 km². The annual mean discharge is 3550 m³s⁻¹ ("Fraser River", 2017, *Wikipedia, The Free Encyclopedia*), but during peak freshet in May and June, the Fraser River discharges up to 10000 m³s⁻¹. (Ocean Networks Canada, 2013). Figure 1 shows the floodplain of the lower Fraser River from Hope to the Strait of Georgia.

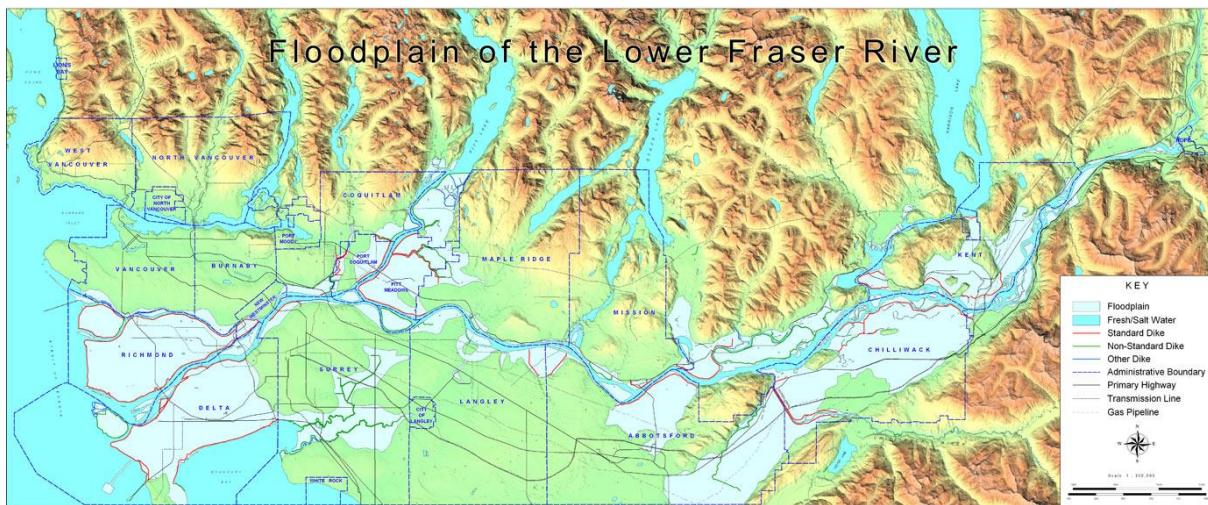


Figure 1 Map of the lower Fraser River floodplain (Fraser Basin Council, 2013)

Five species of Pacific salmon spawn in the river (Newton and Robinson, 2007). In addition, the Fraser River is the spawning location for a population of white sturgeon. The white sturgeon is the largest freshwater fish species in North America and is listed as "imperilled" by the provincial government (British Columbia Ministry of Environment, [date unknown], online). The Fraser River is also home to many other fish species, such as brook and rainbow trout, eels, and sculpin (Newton and Robinson, 2007). Proposed pipelines through the region potentially threaten species habitat and the associated fishery. With potential environmental hazards in mind, Fisheries and Oceans Canada has monitoring programs to aid current and future ocean protection measures in the region.

A vessel-mounted Acoustic Doppler Current Profiler (ADCP) collected three-dimensional water velocity data, and a Conductivity Temperature Depth (CTD) profiler measured temperature and salinity in the lower Fraser River. The data will be used to build a physical oceanographic description of mean and seasonal conditions of the Fraser River Estuary and to validate and initialize computer models of the estuary's circulation. This data report describes the ocean current velocity and water property data measured in March and October 2016 as part of an environmental monitoring project in the region.

2 INSTRUMENTATION

This section describes the instruments used in the survey of the Fraser River in 2016. Table 1 lists the sampling statistics for the October surveys. The field report for the March survey was corrupted so no statistics are available for that month.

Table 1 October ADCP and CTD sampling statistics (adapted from 2016 Field Report)

Location	Line Number	# ADCP Transects	~ Line Length (m)	# CTD casts
October 17 to 21				
Sand Heads	1	6	1000	2
Steveston Bend	2	8	600	4
Steveston	3-2	3	3000	-
Steveston	3	10	600	5
Steveston	3B	8	750	4
Steveston	3B-3	1	2200	-
Blair Point	4	10	440	6
Blair Point	4-3B	2	3000	-
Woodward's Landing	5	18	700	10
Woodward's Landing	5-4	2	4200	-
Tilbury Island	6	14	560	6
Tilbury Island	6-5	5	3500	1
Total		87		38
October 24 to 28				
Tilbury Island	6	4	560	2
Annacis Island	7	26	375	10
Alex Fraser Bridge	7a	24	450	13
Alex Fraser Bridge	7a-7	8	1600	-
New Westminster	8	26	475	13
New Westminster	8-7a	1	3600	-
New Westminster	9	20	550	11
New Westminster	9-8	8	950	-
Pattullo Bridge	10	22	560	10
Pattullo Bridge	10-9	3	2600	-
Total		142		59

2.1 CTD

A Sontek Castaway Conductivity Temperature Depth (CTD) profiler measured temperature, salinity, and speed of sound at stations next to each ADCP transect line in March and October 2016. The instrument is a handheld profiler and is designed to vertically sample up to 100 m. (Sontek, 2016) Specifications for the instrument are on the company's web page (<http://www.sontek.com/productsdetail.php?CastAway-CTD-11>).

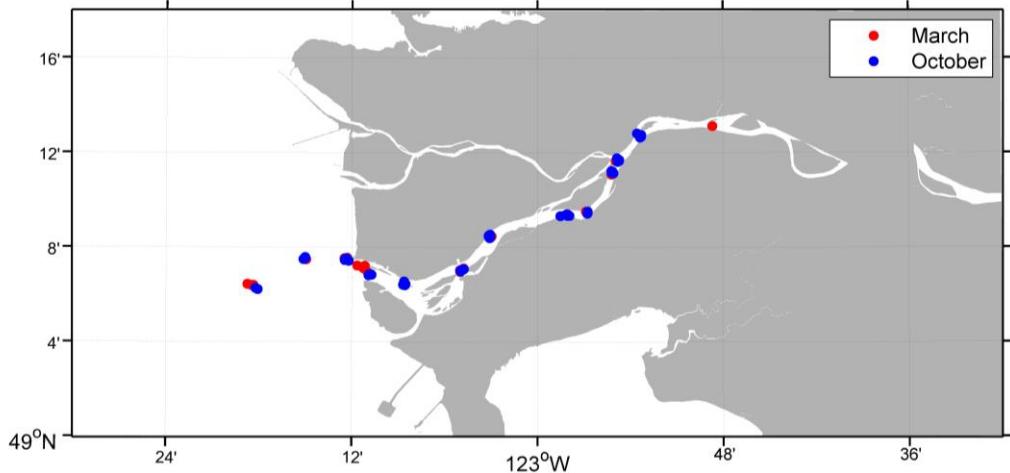


Figure 2 Map showing CTD station locations

The March data collection began on March 7 and ended on March 24. The October data collection began on October 17 and ended on October 28. Figure 2 shows the location of each CTD station while details of each cast are listed in Table 2 and Table 3. Each cast coincided with an ADCP sampling line. The CTD speed of sound data were used to correct ADCP measurements, and the temperature and salinity data will be used for numerical modelling.

Table 2 CTD station details for March

CTD March					
Cast Time (UTC)	Latitude °N	Longitude °W	Minimum Depth (m)	Maximum Depth (m)	
2016-03-07 23:09:19	49.1066	-123.3084	0.15	5.68	
2016-03-07 23:28:35	49.1073	-123.3125	0.15	6.95	
2016-03-08 01:10:13	49.1067	-123.3060	0.15	7.43	
2016-03-08 19:55:15	49.1199	-123.1860	0.15	4.05	
2016-03-08 20:00:15	49.1203	-123.1861	0.15	9.07	
2016-03-08 21:24:20	49.1248	-123.2492	0.15	10.80	
2016-03-08 22:43:42	49.1254	-123.2498	0.15	10.94	
2016-03-08 23:41:30	49.1259	-123.2049	0.15	9.22	
2016-03-09 00:52:43	49.1185	-123.1873	0.15	7.99	
2016-03-09 02:10:11	49.1204	-123.1941	0.15	15.38	
2016-03-09 17:28:36	49.1086	-123.1432	0.15	6.25	
2016-03-09 18:01:41	49.1185	-123.0796	0.15	18.60	
2016-03-09 19:50:14	49.1171	-123.0833	0.15	16.33	
2016-03-09 20:40:53	49.1169	-123.0832	0.15	16.69	
2016-03-09 21:13:29	49.1090	-123.1434	0.15	12.85	
2016-03-09 22:06:56	49.1172	-123.0833	0.15	16.36	
2016-03-10 00:13:32	49.1082	-123.1432	0.15	16.79	
2016-03-10 17:26:01	49.1421	-123.0510	0.15	17.08	
2016-03-10 19:08:20	49.1161	-123.0832	0.15	15.91	
2016-03-10 20:02:27	49.1164	-123.0832	0.15	16.00	
2016-03-10 20:20:38	49.1404	-123.0505	0.15	12.46	
2016-03-10 21:24:13	49.1407	-123.0508	0.15	12.98	
2016-03-10 21:50:57	49.1172	-123.0835	0.15	16.33	
2016-03-10 22:50:54	49.1165	-123.0834	0.15	17.69	
2016-03-10 23:02:06	49.1402	-123.0506	0.15	12.76	
2016-03-10 23:55:40	49.1409	-123.0501	0.15	13.51	
2016-03-11 00:29:32	49.1167	-123.0828	0.15	19.08	

CTD March					
Cast Time (UTC)	Latitude °N	Longitude °W	Minimum Depth (m)	Maximum Depth (m)	
2016-03-11 01:19:30	49.1166	-123.0832	0.15	19.10	
2016-03-11 01:30:14	49.1411	-123.0495	0.15	14.08	
2016-03-11 17:17:56	49.1159	-123.1831	0.15	15.96	
2016-03-11 18:16:13	49.1254	-123.2054	0.15	15.05	
2016-03-11 18:47:27	49.1140	-123.1803	0.15	14.93	
2016-03-11 19:51:02	49.1255	-123.2079	0.15	13.27	
2016-03-21 21:00:02	49.2187	-122.8115	0.15	13.86	
2016-03-22 00:25:58	49.1952	-122.9132	0.15	16.02	
2016-03-22 16:14:42	49.1586	-122.9478	0.15	13.87	
2016-03-22 16:48:59	49.1573	-122.9466	0.15	31.63	
2016-03-22 17:08:04	49.1565	-122.9680	0.15	16.29	
2016-03-22 18:31:42	49.1573	-122.9463	0.15	31.95	
2016-03-22 20:56:08	49.1577	-122.9463	0.15	23.55	
2016-03-22 21:17:51	49.1566	-122.9680	0.15	15.37	
2016-03-22 23:46:21	49.1568	-122.9680	0.15	16.14	
2016-03-23 15:36:44	49.1954	-122.9131	0.15	16.07	
2016-03-23 16:33:40	49.1852	-122.9196	0.15	16.12	
2016-03-23 18:58:08	49.1846	-122.9202	0.15	14.62	
2016-03-23 23:26:06	49.1849	-122.9203	0.15	14.16	
2016-03-24 15:41:56	49.2120	-122.8894	0.15	16.08	
2016-03-24 19:50:51	49.1942	-122.9157	0.15	14.56	

Table 3 CTD station details for October

CTD October					
Cast Time (UTC)	Latitude °N	Longitude °W	Minimum Depth (m)	Maximum Depth (m)	
2016-10-17 23:16:34			0.15	3.31	
2016-10-18 01:18:26	49.1046	-123.3036	0.15	17.76	
2016-10-18 16:24:47	49.1251	-123.2063	0.15	17.76	
2016-10-18 17:16:41	49.1263	-123.2501	0.15	17.82	
2016-10-18 17:44:26	49.1036	-123.3012	0.15	17.82	
2016-10-18 18:51:31	49.1255	-123.2063	0.15	17.82	
2016-10-18 20:15:40	49.1254	-123.2506	0.15	17.82	
2016-10-18 20:38:25	49.1238	-123.2032	0.15	17.82	
2016-10-18 21:36:05	49.1250	-123.2522	0.15	17.82	
2016-10-18 22:18:56	49.1144	-123.1793	0.15	17.82	
2016-10-18 23:12:55	49.1244	-123.2077	0.15	17.82	
2016-10-19 00:39:59	49.1258	-123.2499	0.15	20.04	
2016-10-19 16:35:33	49.1140	-123.1789	0.15	20.04	
2016-10-19 17:13:23	49.1075	-123.1420	0.15	20.04	
2016-10-19 17:43:27	49.1175	-123.0819	0.15	20.04	
2016-10-19 18:09:10	49.1164	-123.0828	0.15	20.04	
2016-10-19 19:05:26	49.1419	-123.0515	0.15	20.04	
2016-10-19 20:19:49	49.1163	-123.0829	0.15	20.04	
2016-10-19 21:52:12	49.1070	-123.1449	0.15	20.04	
2016-10-19 22:12:14	49.1137	-123.1819	0.15	20.04	
2016-10-19 22:58:25	49.1399	-123.0517	0.15	20.04	
2016-10-19 23:47:36	49.1171	-123.0822	0.15	20.04	
2016-10-20 00:24:54	49.1070	-123.1424	0.15	20.04	
2016-10-20 00:55:50	49.1173	-123.0817	0.15	20.04	
2016-10-20 16:28:59	49.1424	-123.0512	0.15	20.04	
2016-10-20 17:24:31	49.1169	-123.0831	0.15	20.04	
2016-10-20 18:55:36	49.1093	-123.1436	0.15	20.04	
2016-10-20 18:59:20	49.1071	-123.1433	0.15	20.04	
2016-10-20 19:46:33	49.1409	-123.0524	0.15	20.04	
2016-10-20 20:21:10	49.1173	-123.0822	0.15	20.04	
2016-10-20 21:56:28	49.1414	-123.0526	0.15	20.04	
2016-10-20 22:20:16	49.1174	-123.0821	0.15	20.04	

CTD October

Cast Time (UTC)	Latitude °N	Longitude °W	Minimum Depth (m)	Maximum Depth (m)
2016-10-20 23:25:37	49.1420	-123.0519	0.15	20.04
2016-10-20 23:40:51	49.1171	-123.0824	0.15	20.04
2016-10-21 00:24:29	49.1411	-123.0527	0.15	20.04
2016-10-21 00:42:03	49.1180	-123.0793	0.15	20.04
2016-10-21 16:43:44	49.1066	-123.1428	0.15	20.04
2016-10-21 17:29:03	49.1143	-123.1813	0.15	20.04
2016-10-21 17:53:33	49.1253	-123.2053	0.15	20.04
2016-10-24 18:06:15	49.1576	-122.9460	0.15	32.62
2016-10-24 19:00:26	49.1557	-122.9676	0.15	32.62
2016-10-24 19:16:59	49.1413	-123.0507	0.15	32.62
2016-10-24 19:57:04	49.1554	-122.9754	0.15	32.62
2016-10-24 20:34:36	49.1577	-122.9458	0.15	32.62
2016-10-24 21:11:58	49.1562	-122.9669	0.15	32.62
2016-10-24 21:57:50	49.1576	-122.9458	0.15	32.62
2016-10-24 22:20:51	49.1556	-122.9675	0.15	32.62
2016-10-24 23:11:38	49.1417	-123.0519	0.15	32.62
2016-10-24 23:28:48	49.1556	-122.9655	0.15	32.62
2016-10-24 23:58:39	49.1572	-122.9465	0.15	32.62
2016-10-25 00:16:59	49.1556	-122.9675	0.15	32.62
2016-10-25 00:19:04	49.1557	-122.9675	0.15	32.62
2016-10-25 16:18:20	49.1575	-122.9466	0.15	32.62
2016-10-25 16:54:03	49.1560	-122.9684	0.15	32.62
2016-10-25 17:20:07	49.1863	-122.9200	0.15	32.62
2016-10-25 18:11:29	49.1951	-122.9137	0.15	32.62
2016-10-25 18:22:32	49.1856	-122.9182	0.15	32.62
2016-10-25 18:59:39	49.1574	-122.9464	0.15	32.62
2016-10-25 19:29:17	49.1866	-122.9200	0.15	32.62
2016-10-25 20:16:15	49.1943	-122.9122	0.15	32.62
2016-10-25 20:42:45	49.1869	-122.9194	0.15	32.62
2016-10-25 20:52:28	49.1575	-122.9460	0.15	33.28
2016-10-25 21:19:55	49.1870	-122.9200	0.15	33.28
2016-10-25 22:12:37	49.1945	-122.9127	0.15	33.28
2016-10-25 22:15:02	49.1961	-122.9144	0.15	33.28
2016-10-25 22:21:42	49.1871	-122.9202	0.15	33.28
2016-10-25 22:49:45	49.1575	-122.9462	0.15	33.28
2016-10-26 00:17:35	49.1867	-122.9199	0.15	33.28
2016-10-26 16:21:38	49.1858	-122.9201	0.15	33.28
2016-10-26 17:00:46	49.2120	-122.8894	0.15	33.28
2016-10-26 17:44:06	49.1940	-122.9128	0.15	33.28
2016-10-26 18:22:28	49.1868	-122.9196	0.15	33.28
2016-10-26 18:33:21	49.2136	-122.8928	0.15	33.28
2016-10-26 18:37:08	49.2121	-122.8897	0.15	33.28
2016-10-26 19:22:48	49.1937	-122.9136	0.15	33.28
2016-10-26 19:46:13	49.2122	-122.8880	0.15	33.28
2016-10-26 20:35:23	49.1945	-122.9136	0.15	33.28
2016-10-26 21:15:34	49.2117	-122.8890	0.15	33.28
2016-10-26 22:01:11	49.2121	-122.8885	0.15	33.28
2016-10-26 22:11:04	49.1949	-122.9120	0.15	33.28
2016-10-26 22:41:15	49.2113	-122.8884	0.15	33.28
2016-10-26 23:36:33	49.1870	-122.9195	0.15	33.28
2016-10-27 00:09:40	49.1942	-122.9122	0.15	33.28
2016-10-27 16:34:50	49.1572	-122.9463	0.15	33.28
2016-10-27 17:04:06	49.1564	-122.9679	0.15	33.28
2016-10-27 17:32:33	49.1575	-122.9459	0.15	33.28
2016-10-27 18:26:23	49.1868	-122.9193	0.15	33.28
2016-10-27 18:35:37	49.1586	-122.9459	0.15	33.28
2016-10-27 19:05:59	49.1565	-122.9691	0.15	33.28
2016-10-27 19:44:16	49.2108	-122.8895	0.15	33.28

CTD October					
Cast Time (UTC)	Latitude °N	Longitude °W	Minimum Depth (m)	Maximum Depth (m)	
2016-10-27 20:41:36	49.1559	-122.9670	0.15	33.28	
2016-10-27 21:55:58	49.1576	-122.9461	0.15	33.28	
2016-10-27 22:44:06	49.1863	-122.9198	0.15	33.28	
2016-10-28 15:54:56	49.2114	-122.8898	0.15	33.28	
2016-10-28 16:21:59	49.1951	-122.9126	0.15	33.28	
2016-10-28 17:03:01	49.1862	-122.9202	0.15	33.28	
2016-10-28 17:11:56	49.2125	-122.8880	0.15	33.28	
2016-10-28 17:59:44	49.1948	-122.9124	0.15	33.28	

2.2 FRASER RIVER VESSEL-MOUNTED ADCP

An ADCP was mounted on a pole and towed in a small boat to measure water currents. The vessel-mounted ADCP configuration was the Sontek River Surveyor M9 (<http://www.sontek.com/productsdetail.php?RiverSurveyor-S5-and-M9-14>) with Serial Number M905082. Specifications for the instrument are on the company web page.

Sampling occurred in 2016 from March 7 to March 11, March 22 to March 24, October 17 to October 21, and October 24 to October 28. October survey lines were the same as those sampled in March (Figure 3 to Figure 6). Data were sampled from Sand Heads to Tilbury Island during the first sampling period and from Annacis Island to New Westminster during the second sampling period.

The ADCP lines were sampled in pairs, running forwards and backwards as “A” and “B” lines. The A lines were always sampled in the same direction and B lines were always sampled in the same direction. Forward lines were always left bank to right bank. Data were plotted as “along channel” and “cross channel” transects. Sampling was done only during daylight hours.

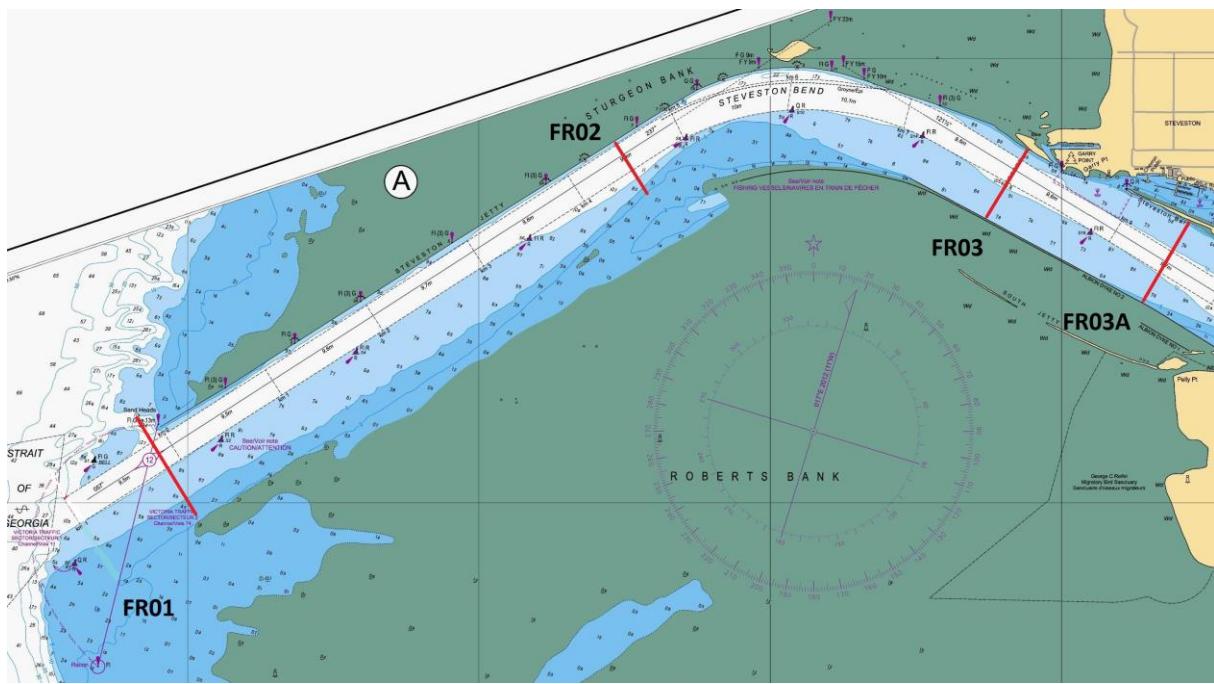


Figure 3 ADCP survey lines: Sand Heads to Steveston (FR01, FR02, FR03, and FR03A)

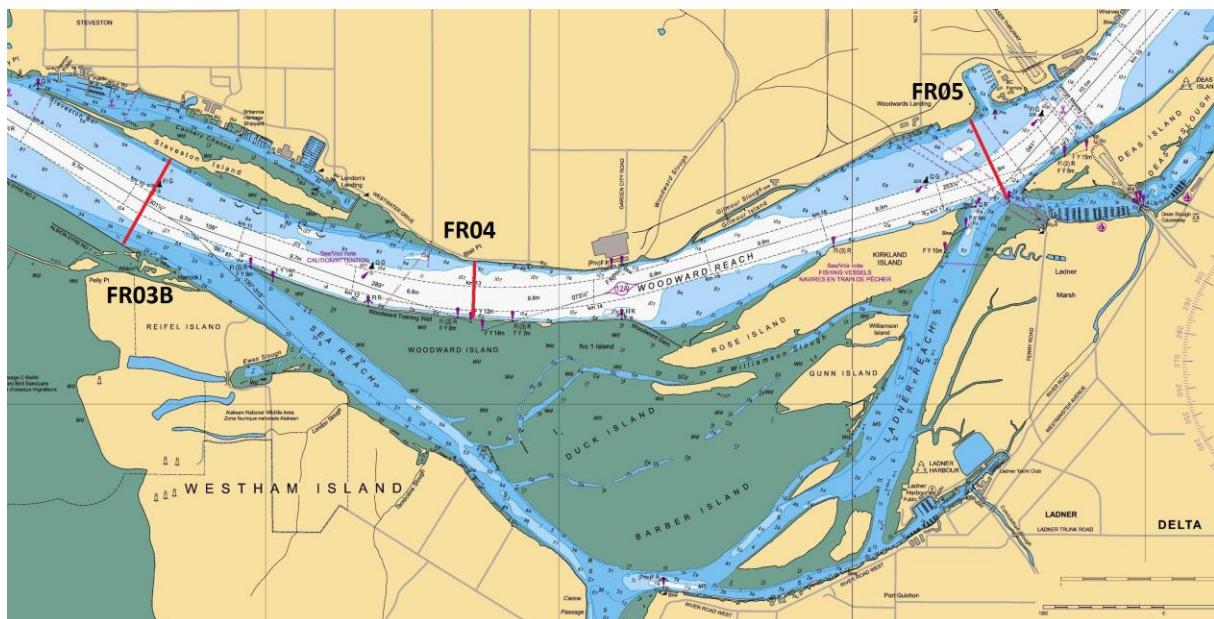


Figure 4 ADCP survey lines: Steveston to Deas Island (FR03B, FR04, and FR05)

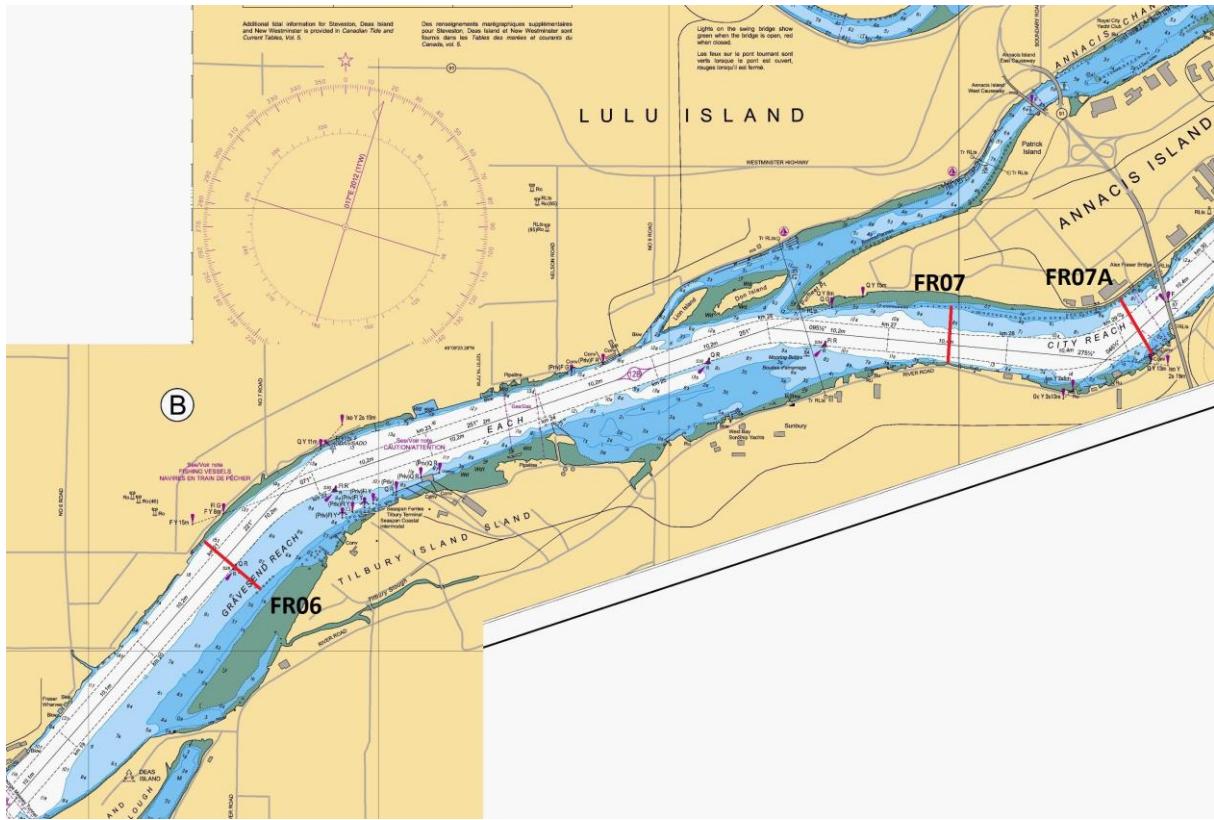


Figure 5 ADCP survey lines: Fraser River, Tilbury Island to Annacis Island (FR06, FR07, and FR07A)

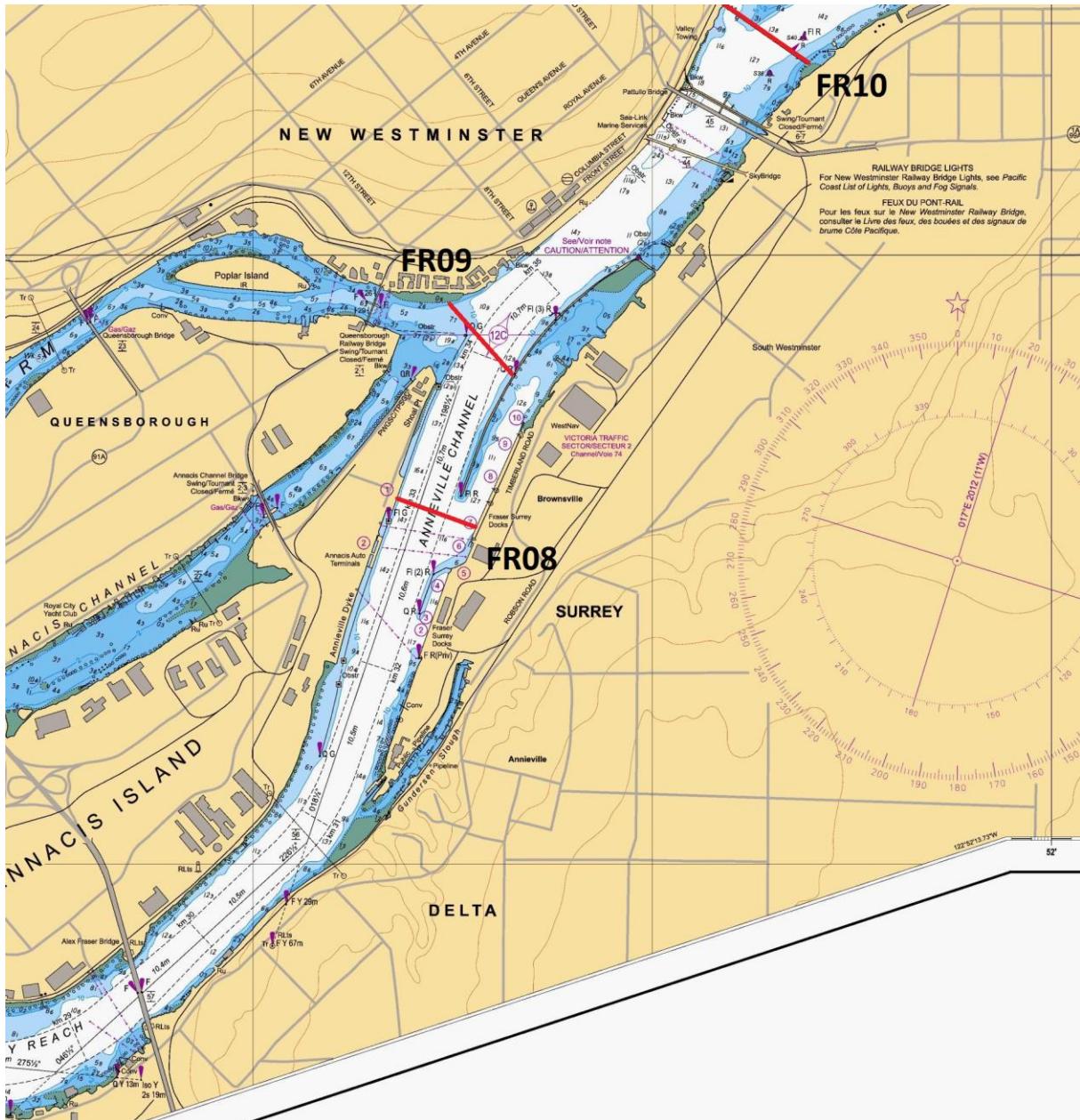


Figure 6 ADCP survey lines: Annacis Island to New Westminster (FR08, FR09, and FR10)

3 DESCRIPTION OF DATA AND DATA PROCESSING

Initial raw data processing occurred at the Institute of Ocean Sciences, and C. Lunn, of the Canadian Hydrographic Service, transferred the data to the Bedford Institute of Oceanography. C. Lunn performed the post-processing and quality control of the data, and X. Wang plotted the data for this report using Matlab®.

3.1 CTD DATA

CTD vertical and horizontal profiles for March and October 2016 are in Appendix 1. The horizontal profile lines are for three vertically averaged depths: surface (0 to ~10 m), mid-depth (10 to ~15 m), and bottom (15 to ~33 m).

3.2 VESSEL-MOUNTED ADCP DATA

Data were stored on a laptop with RiverSurveyor Live software installed for ADCP data pre-processing.

Figures of the vessel-mounted ADCP data are in Appendix 2. Vertical sections and quiver plots were drawn. The transects and their geographic names are listed in Table 4.

The means and standard deviations were calculated for East (u) and North (v) directions and averaged into 5-m bins horizontally and 1-m bins vertically.

Table 4 Transect line name and location for March and October vessel-mounted ADCP surveys (metadata are in Appendix 2)

Line	Location
FR01	Sandheads
FR02	Steveston Bend
FR03	Steveston
FR03-02	Steveston
FR03a	Steveston
FR03a-03	Steveston
FR03b	Steveston
FR04	Blair Point
FR05	Woodward's Landing
FR05-04	Woodward's Landing
FR06	Tilbury Island
FR06-05	Tilbury Island
FR07	Annacis Island
FR07a	Alex Fraser Bridge
FR07a-07	Alex Fraser Bridge
FR07a_deephole	Alex Fraser Bridge
FR07b	Alex Fraser Bridge
FR08	New Westminster
FR09	New Westminster
FR09-08	New Westminster
FR10	Pattullo Bridge
FR10-09	Pattullo Bridge

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5 ACKNOWLEDGEMENTS

The authors gratefully acknowledge the data collection team from the Institute of Ocean Sciences. The team included the following staff from the Canadian Hydrographic Service: Craig Lessels, Denny Sinnott, Ralph Loschiavo, and Serge Paquet.

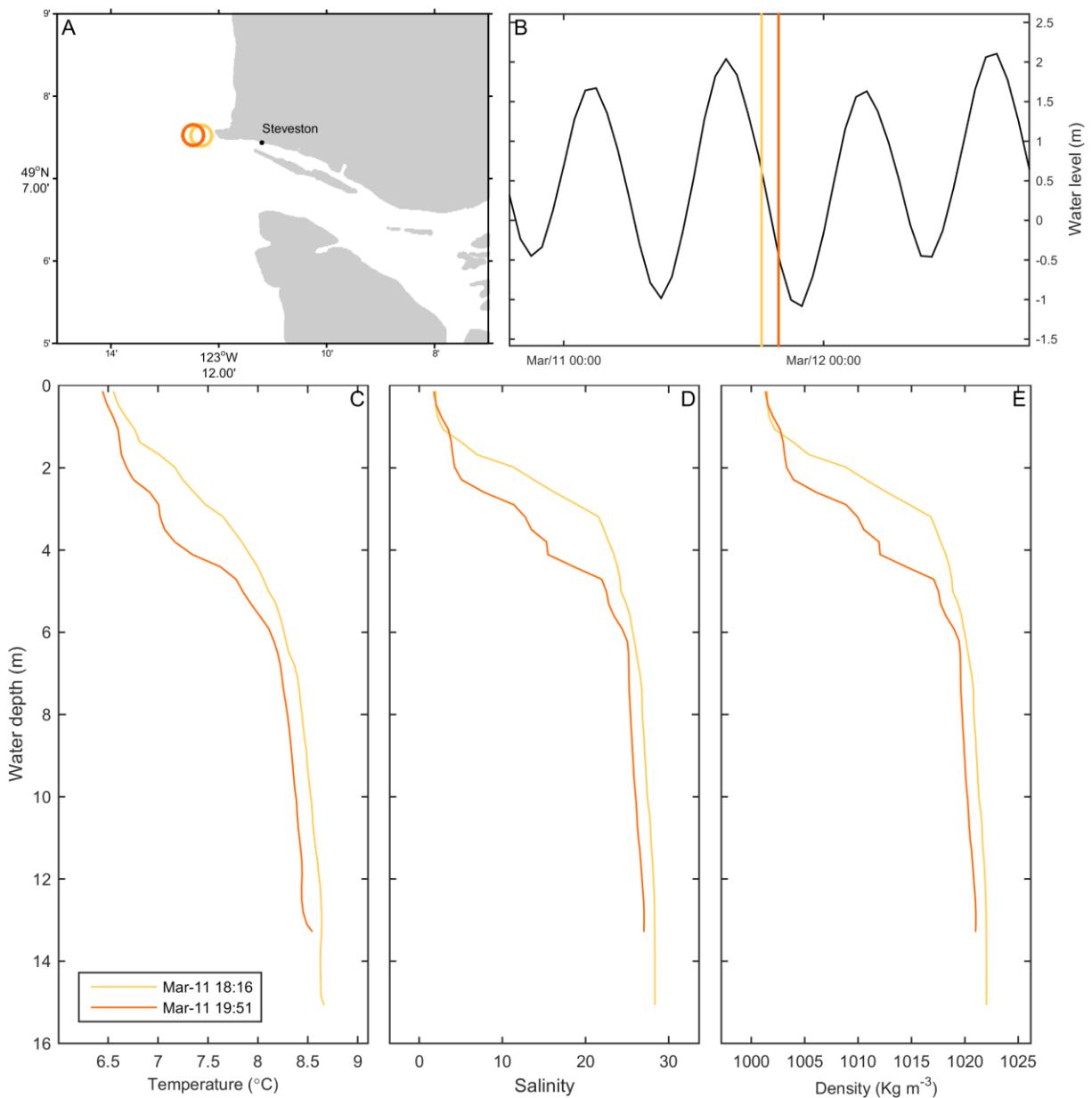
6 APPENDIX 1: CTD DATA PROFILES

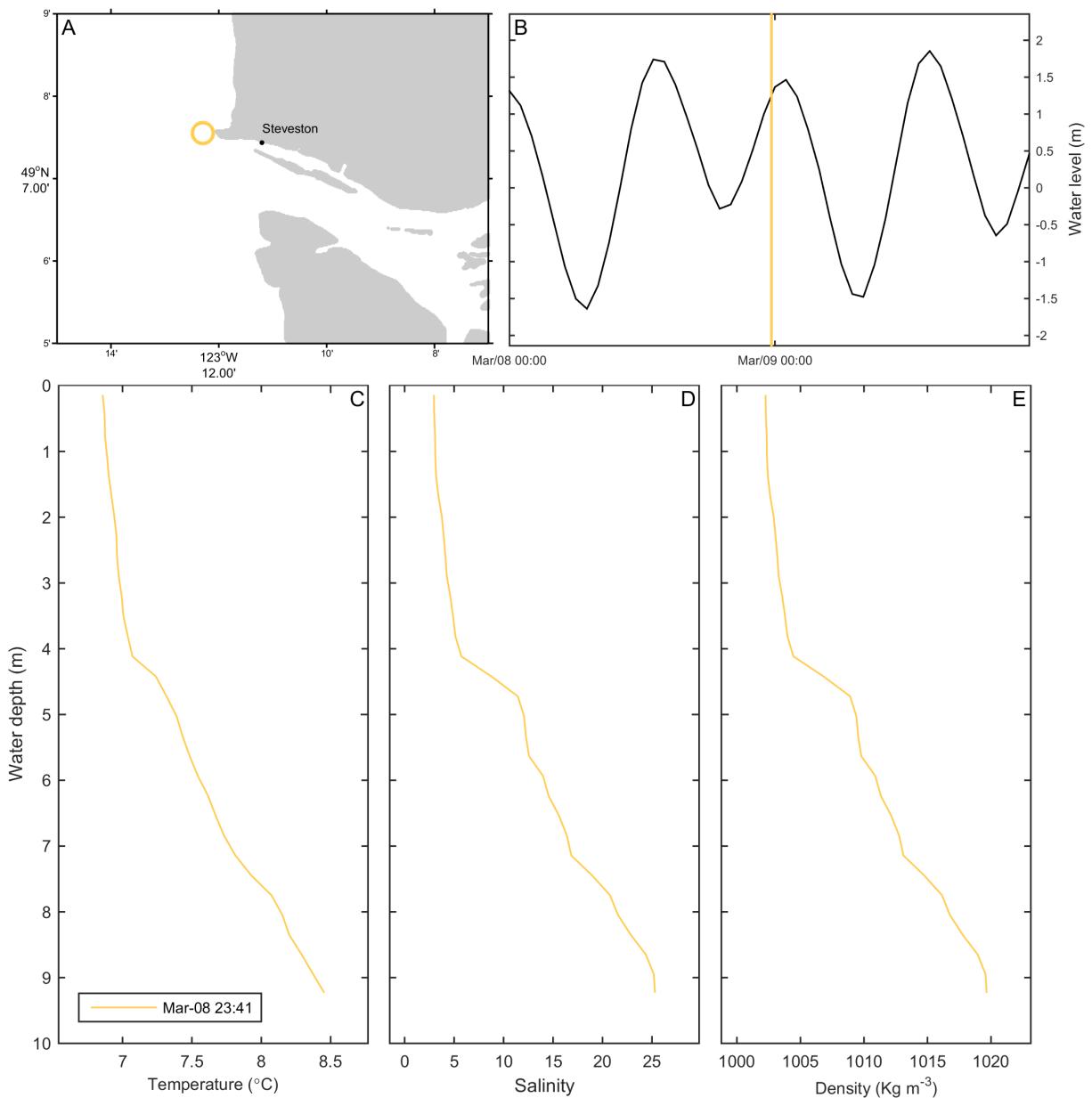
This appendix contains the vertical profiles of the CTD data measured in March and October and the horizontal profile lines for the averaged surface (0 to ~10m), mid-depth (10 to ~15m), and bottom (15 to ~33m) data.

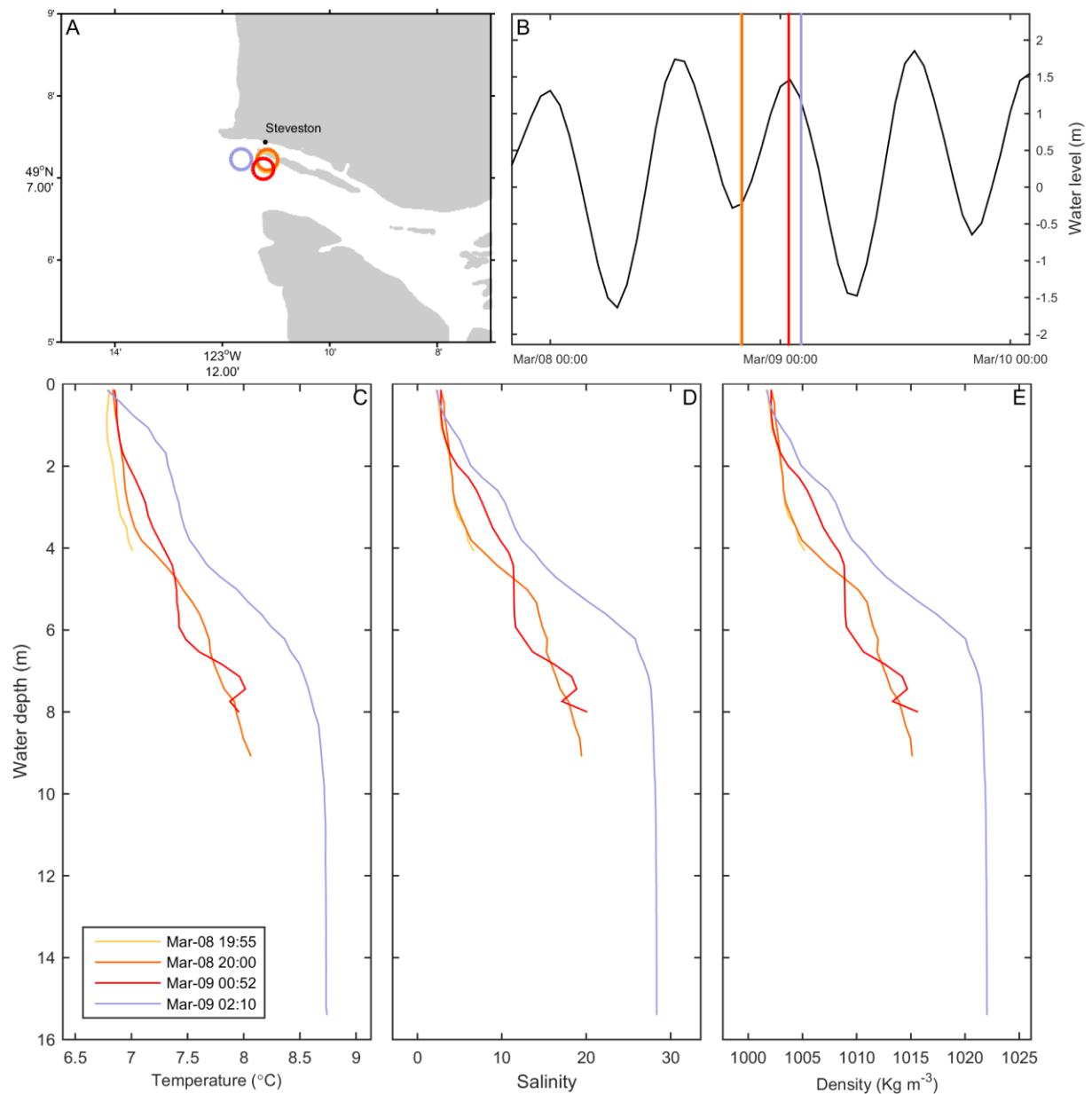
6.1 MARCH

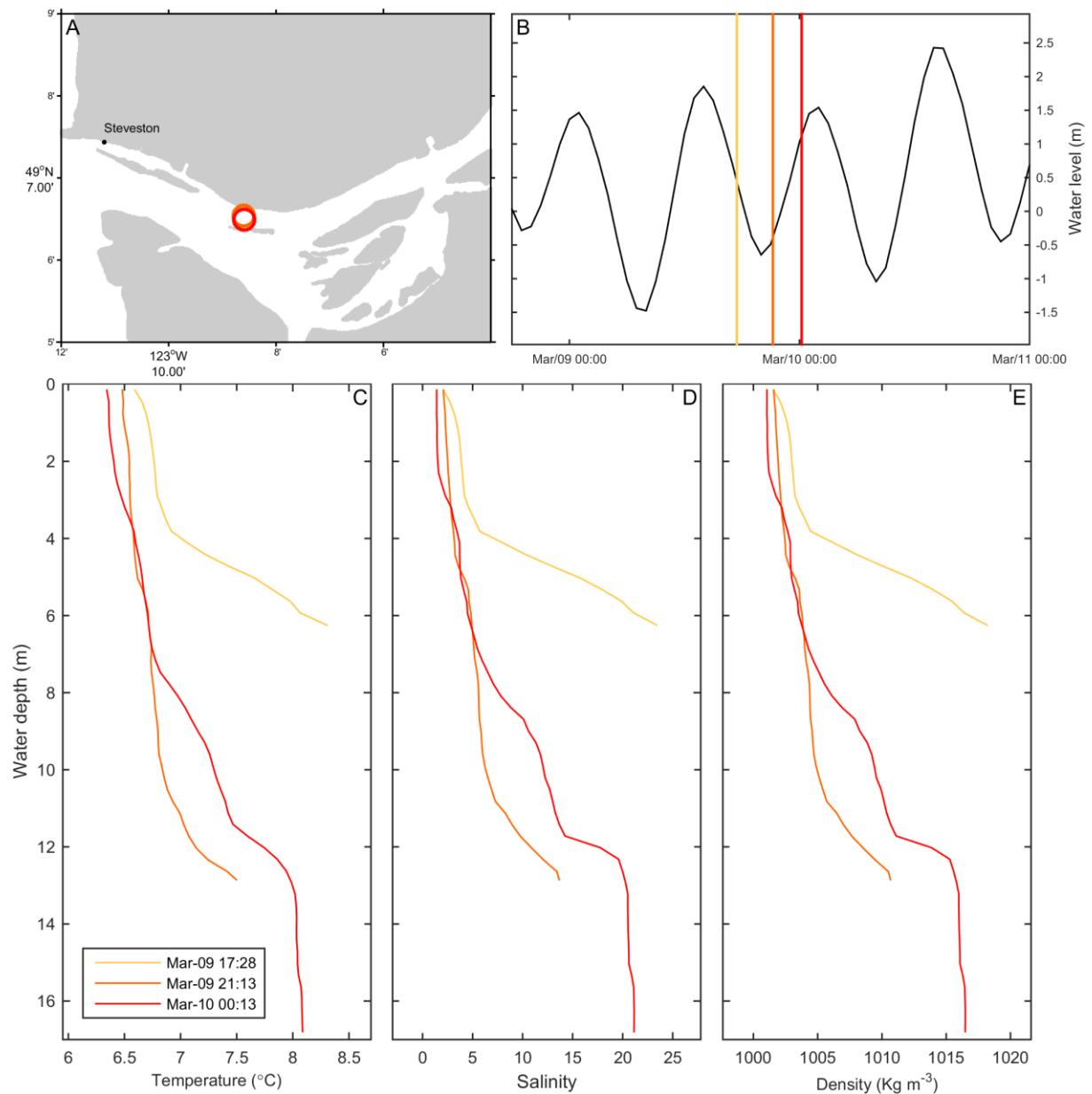
6.1.1 Vertical profiles

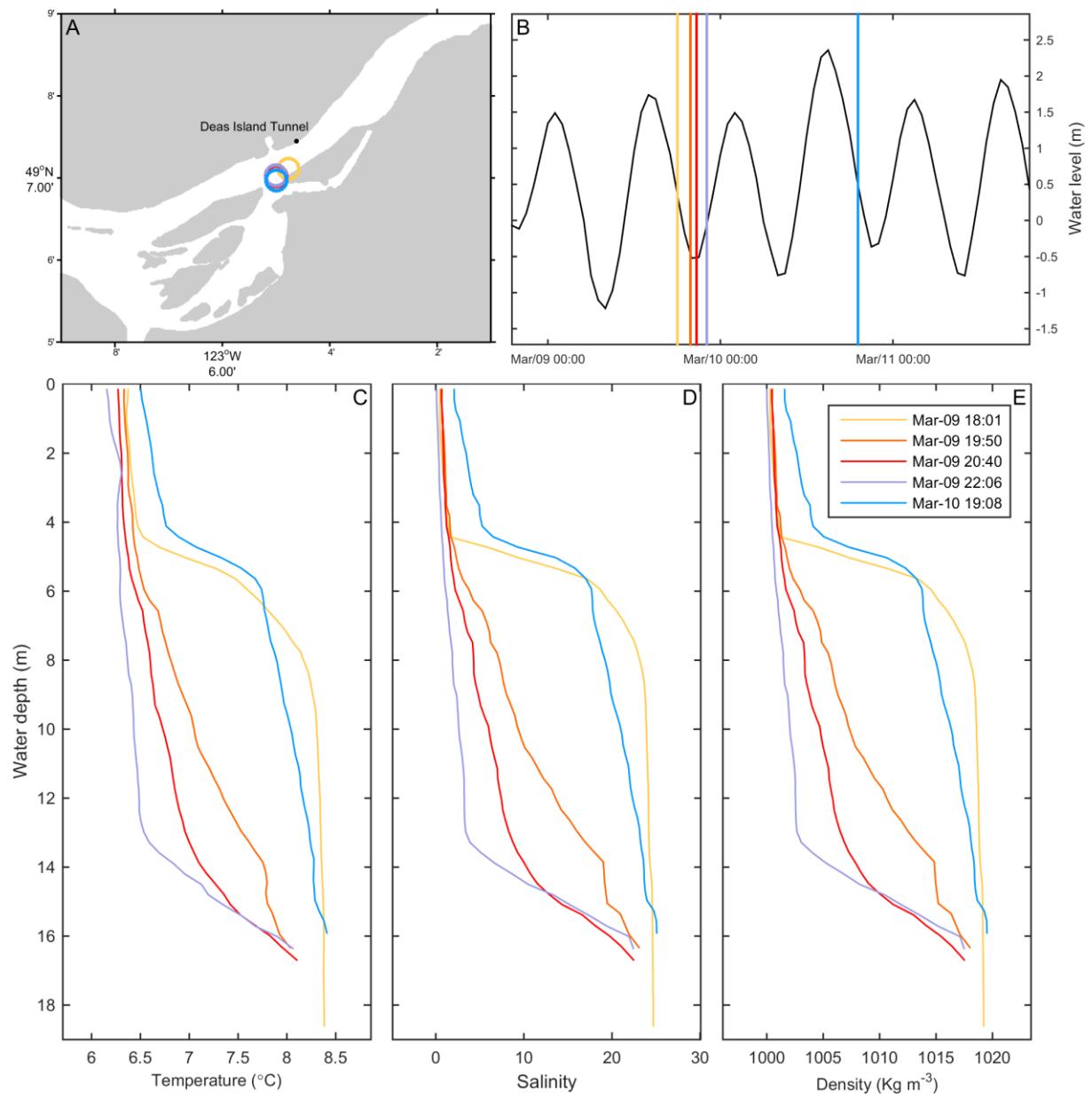
The following figures are vertical profiles of the March CTD data: temperature, salinity, and density. The figures also show the time during the tidal cycle when the profiles were measured and the locations of the casts.

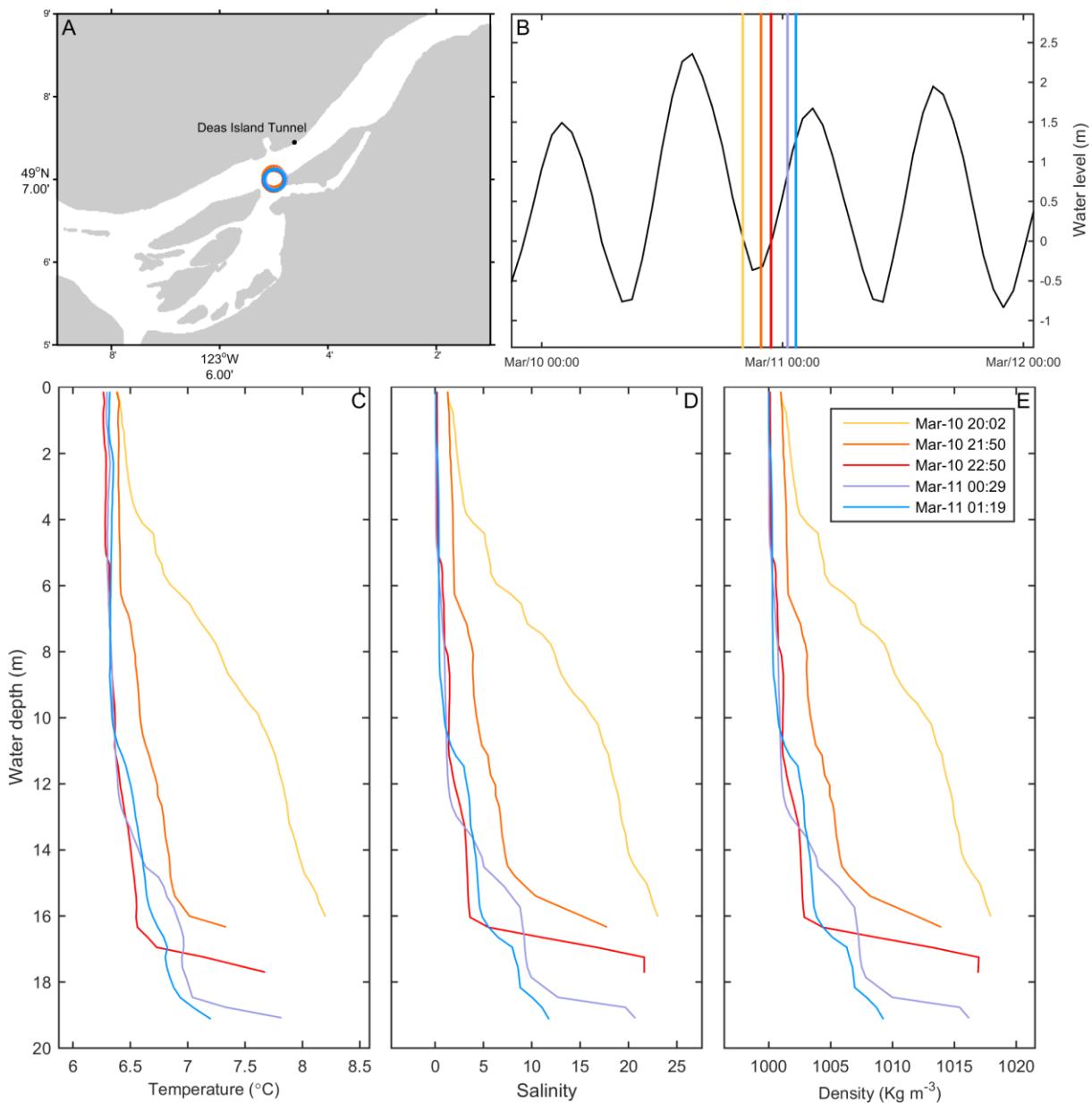


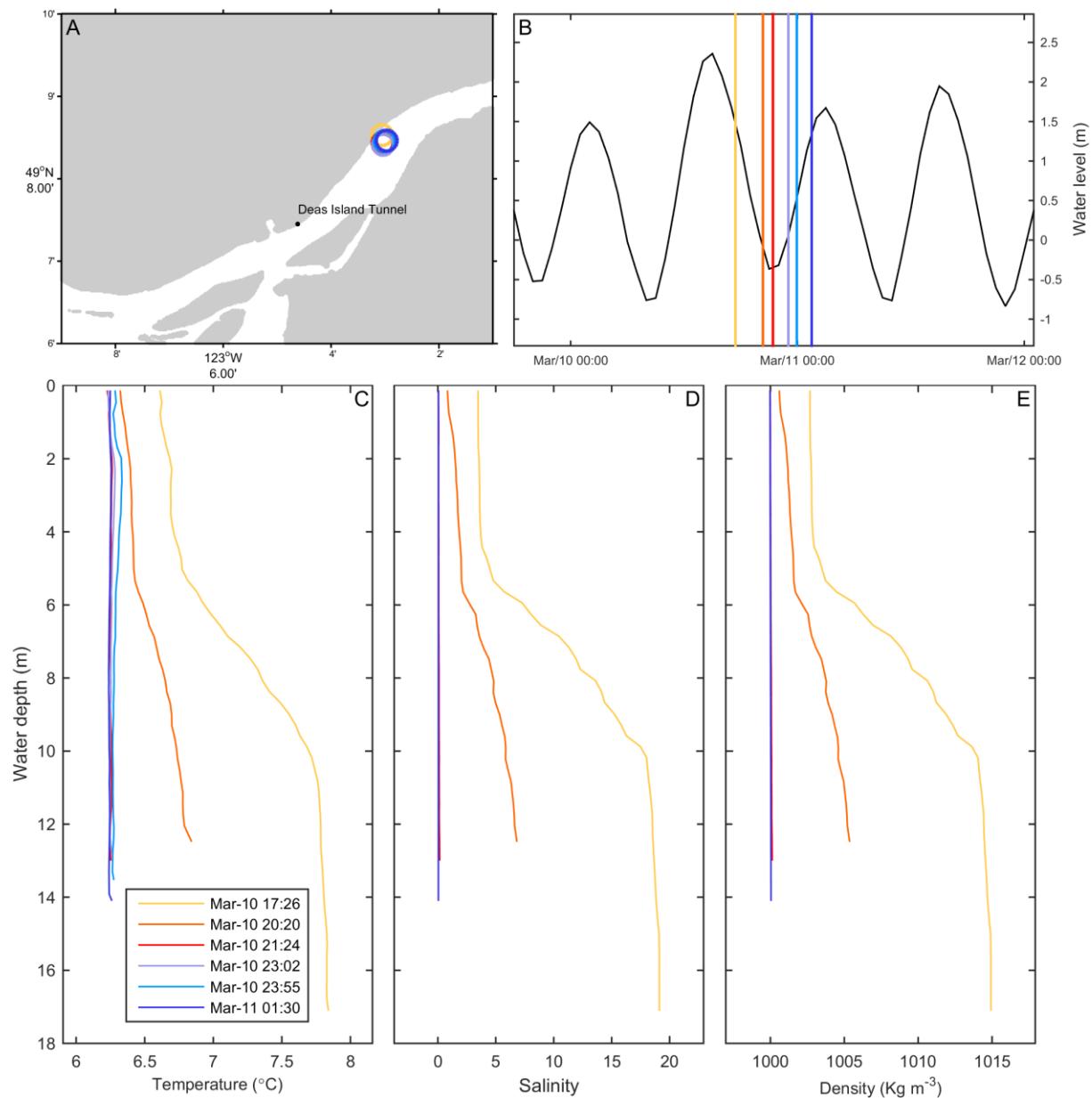


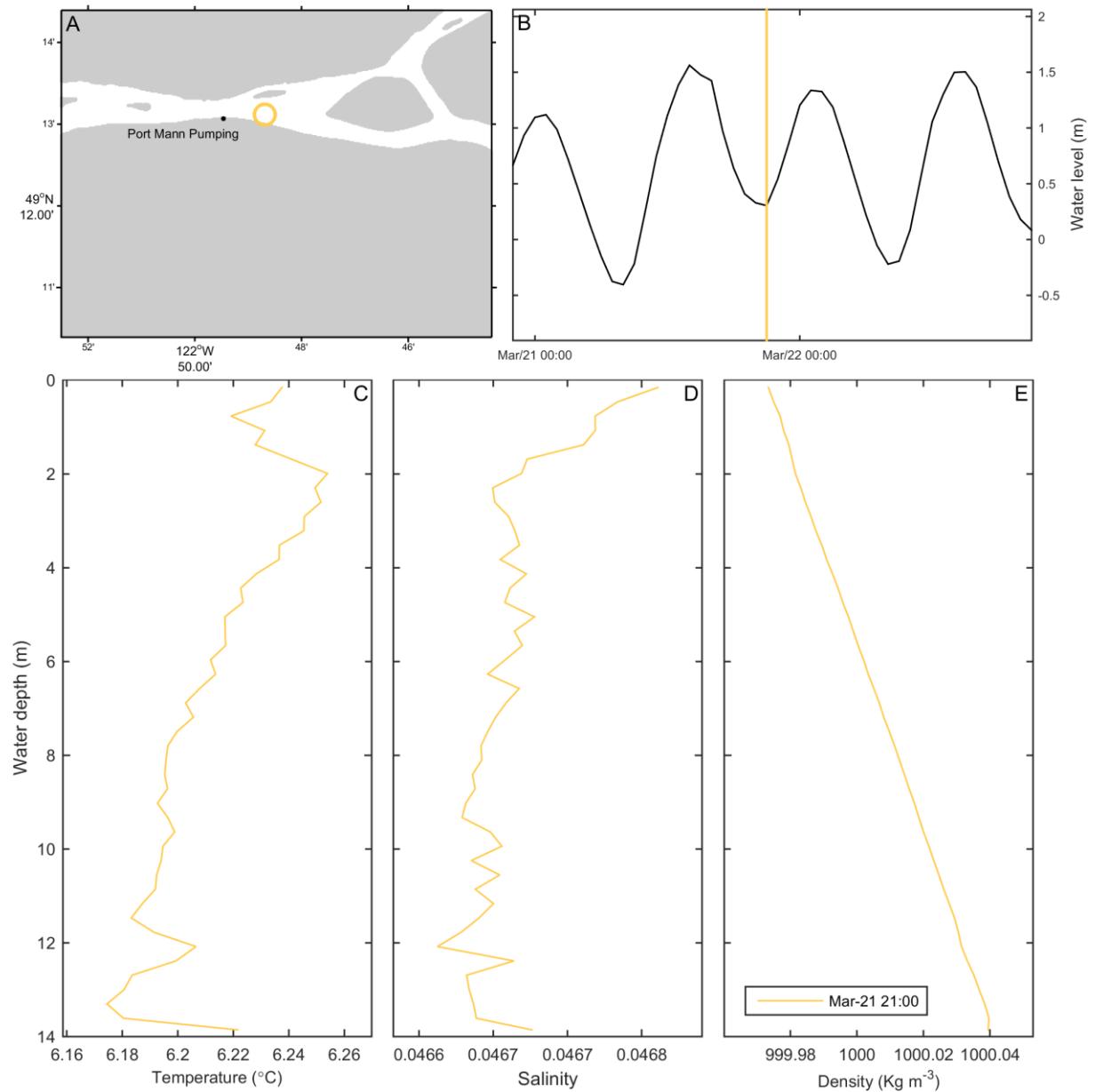


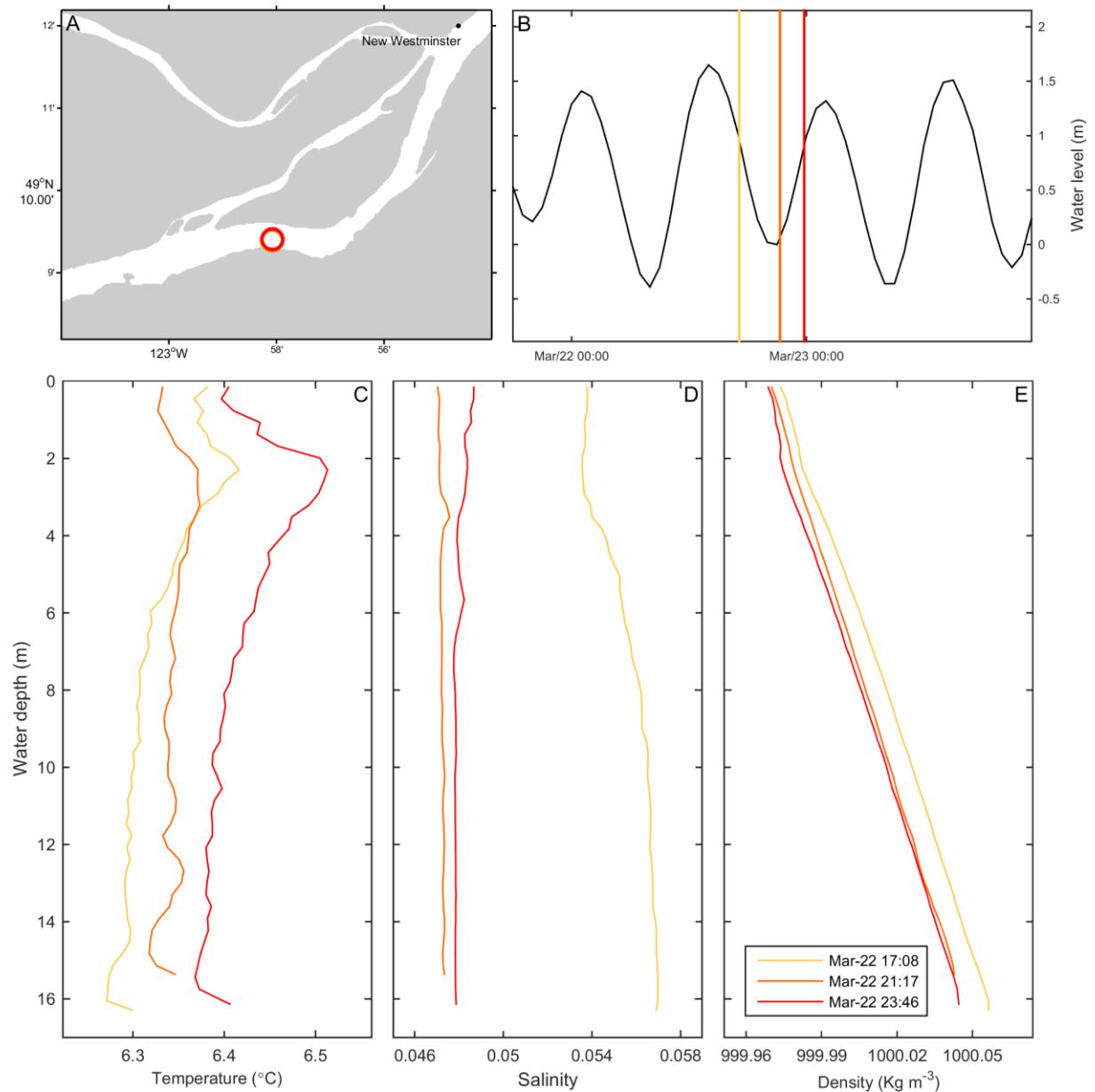


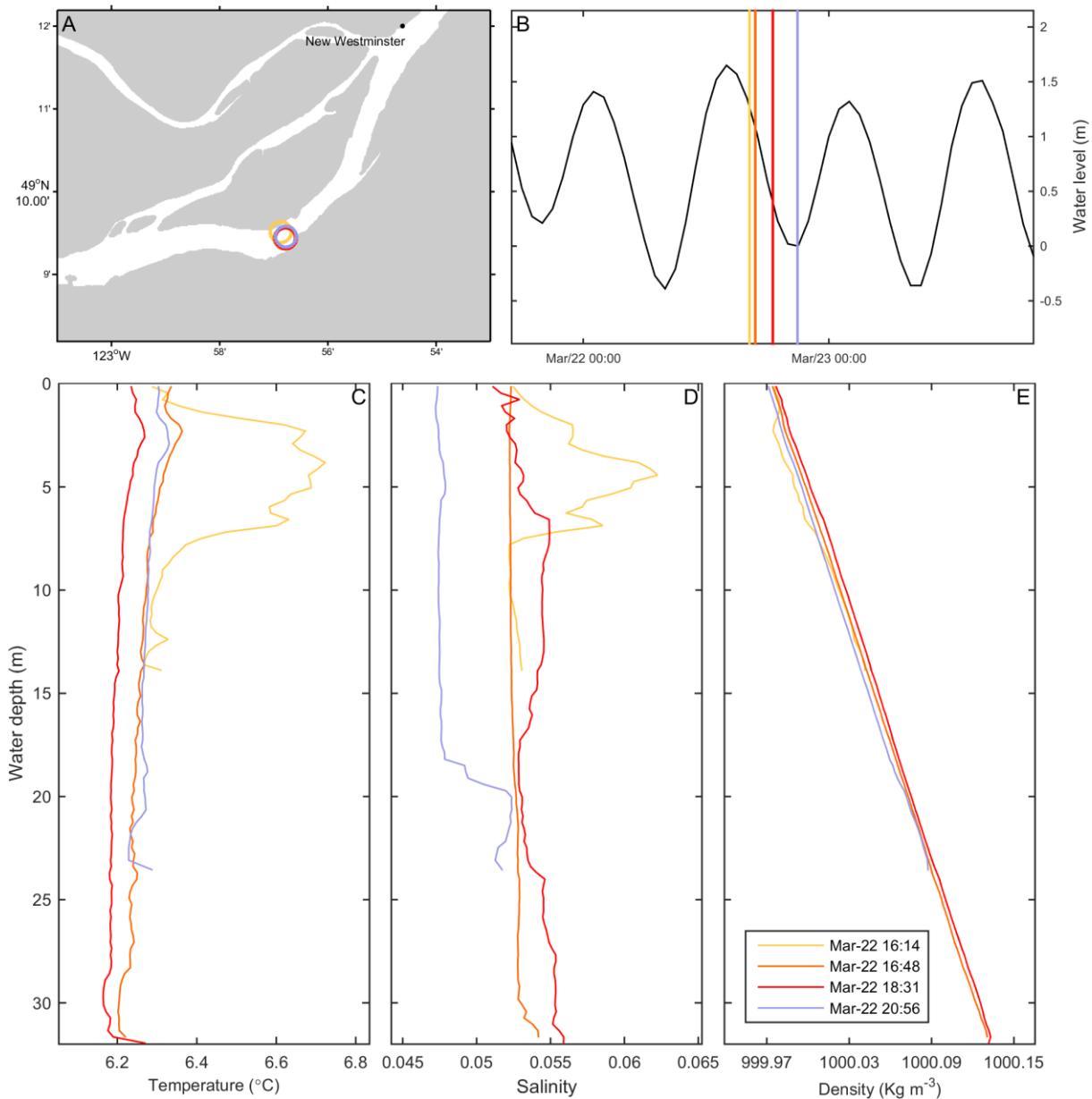


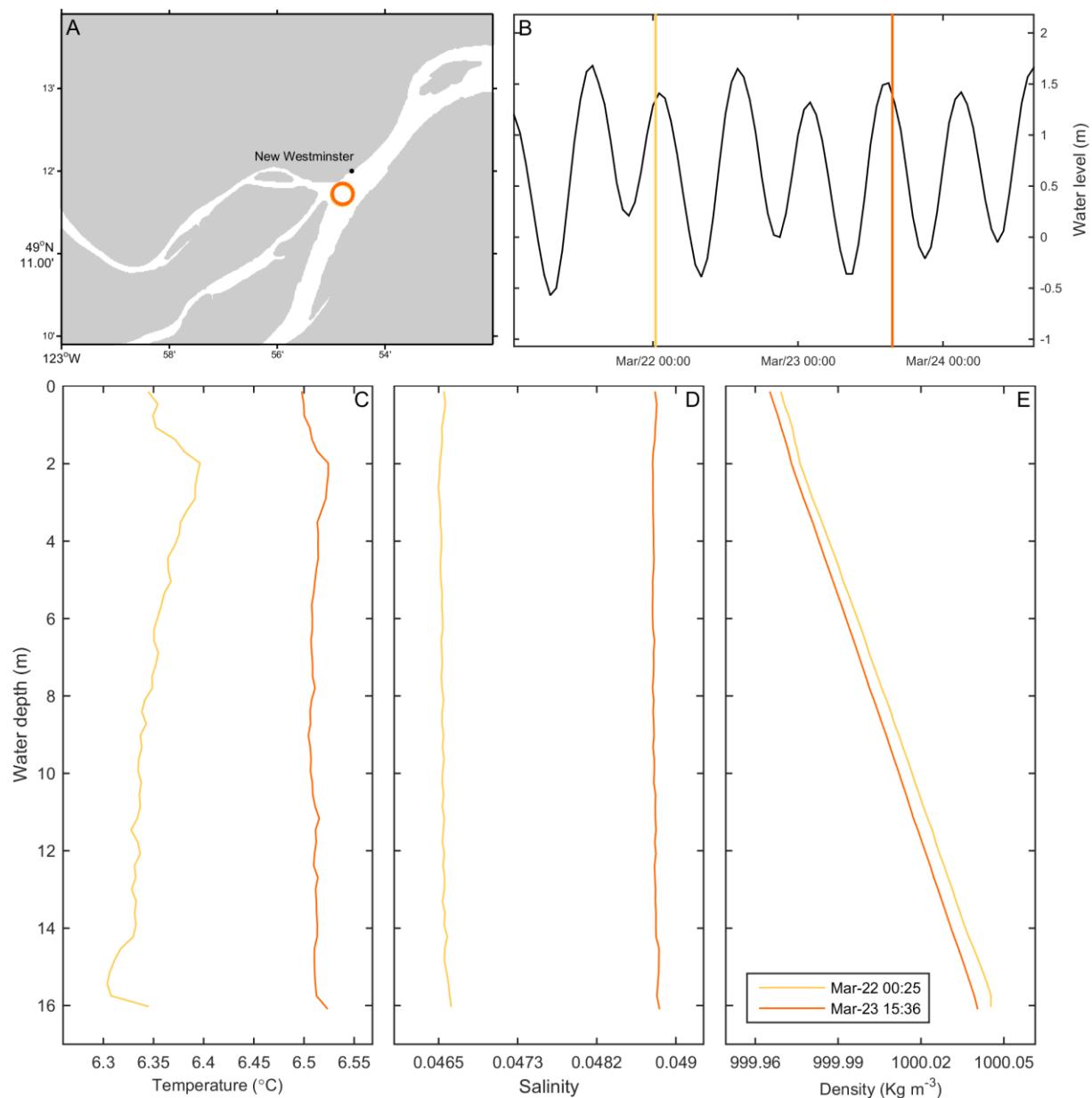


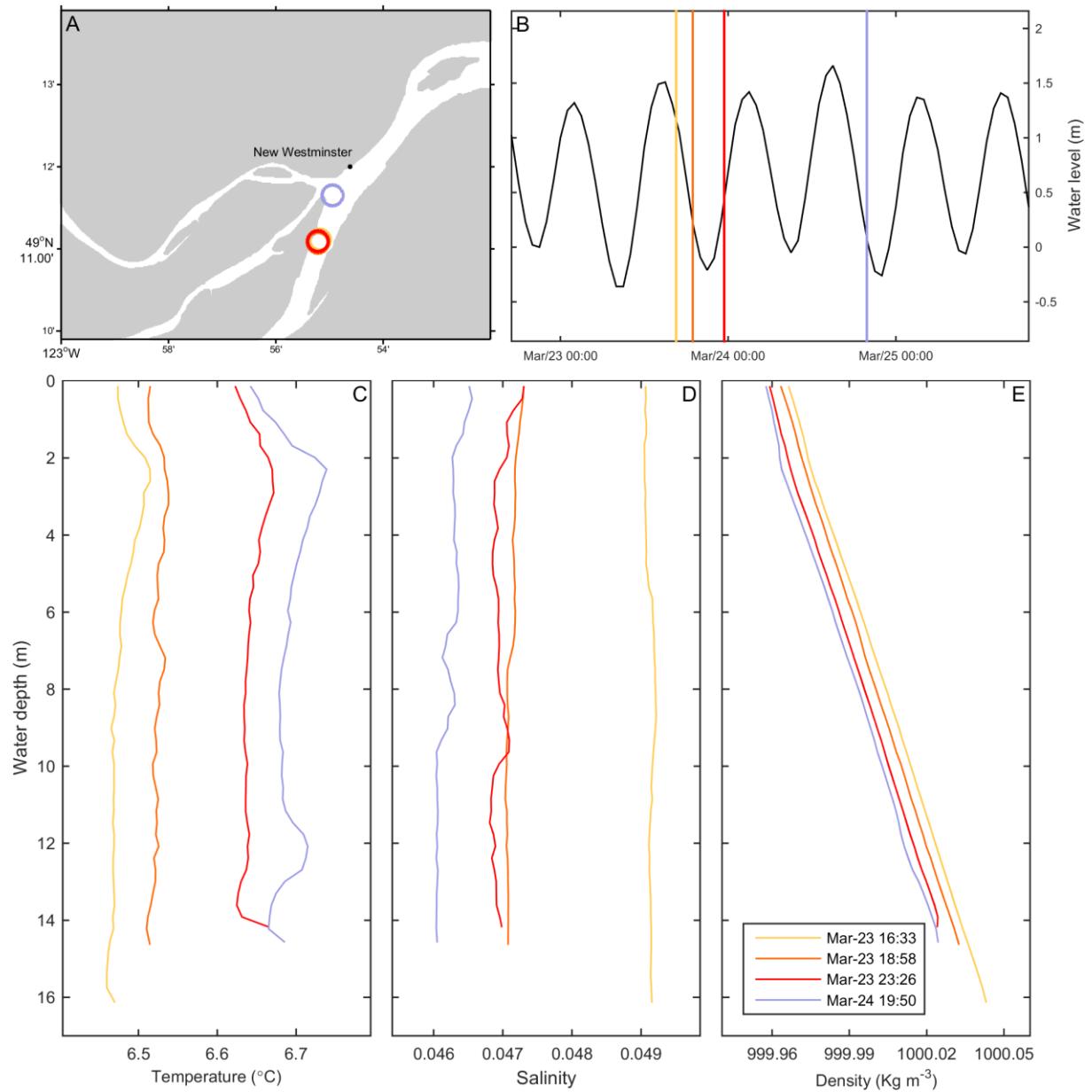


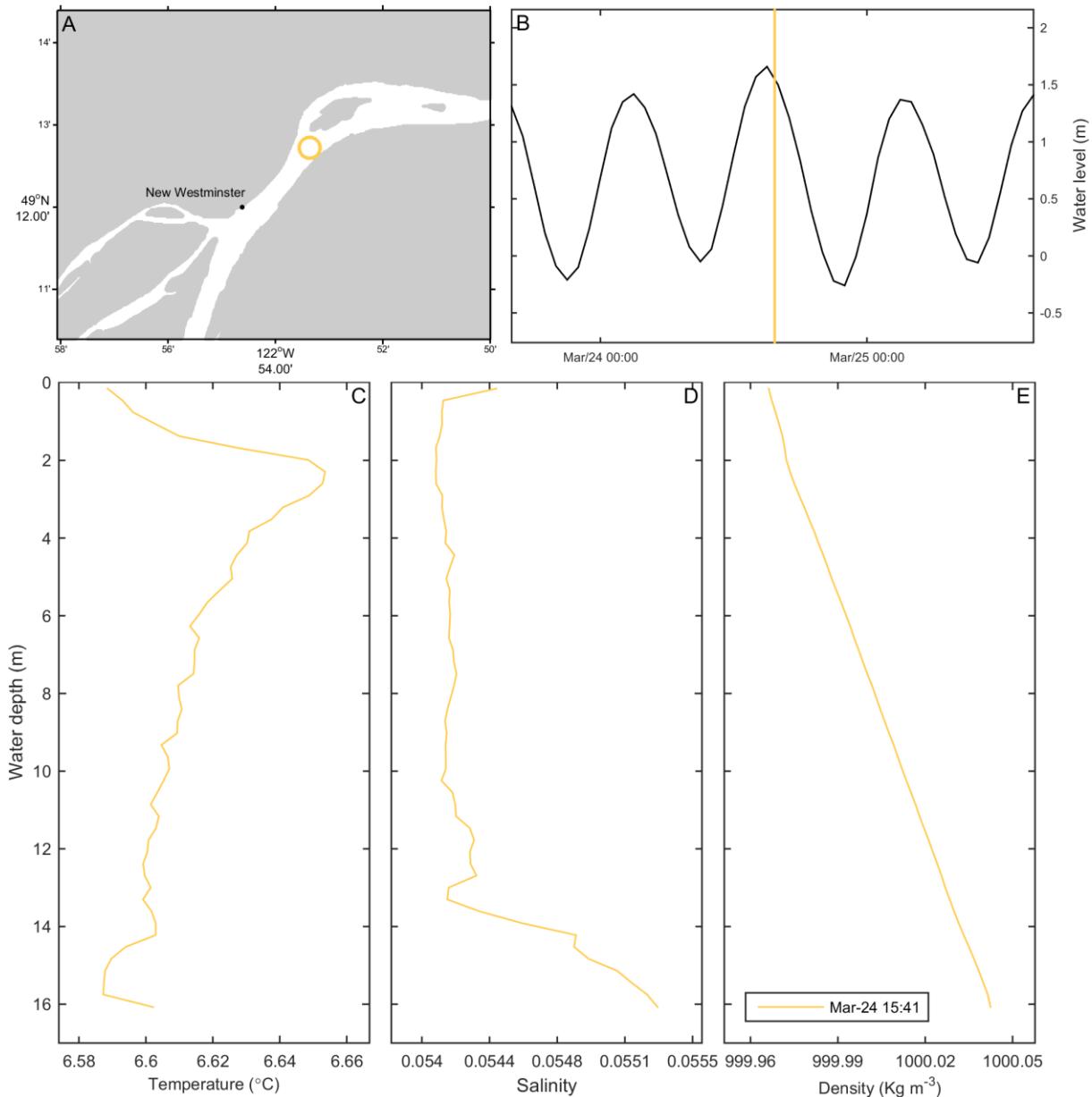








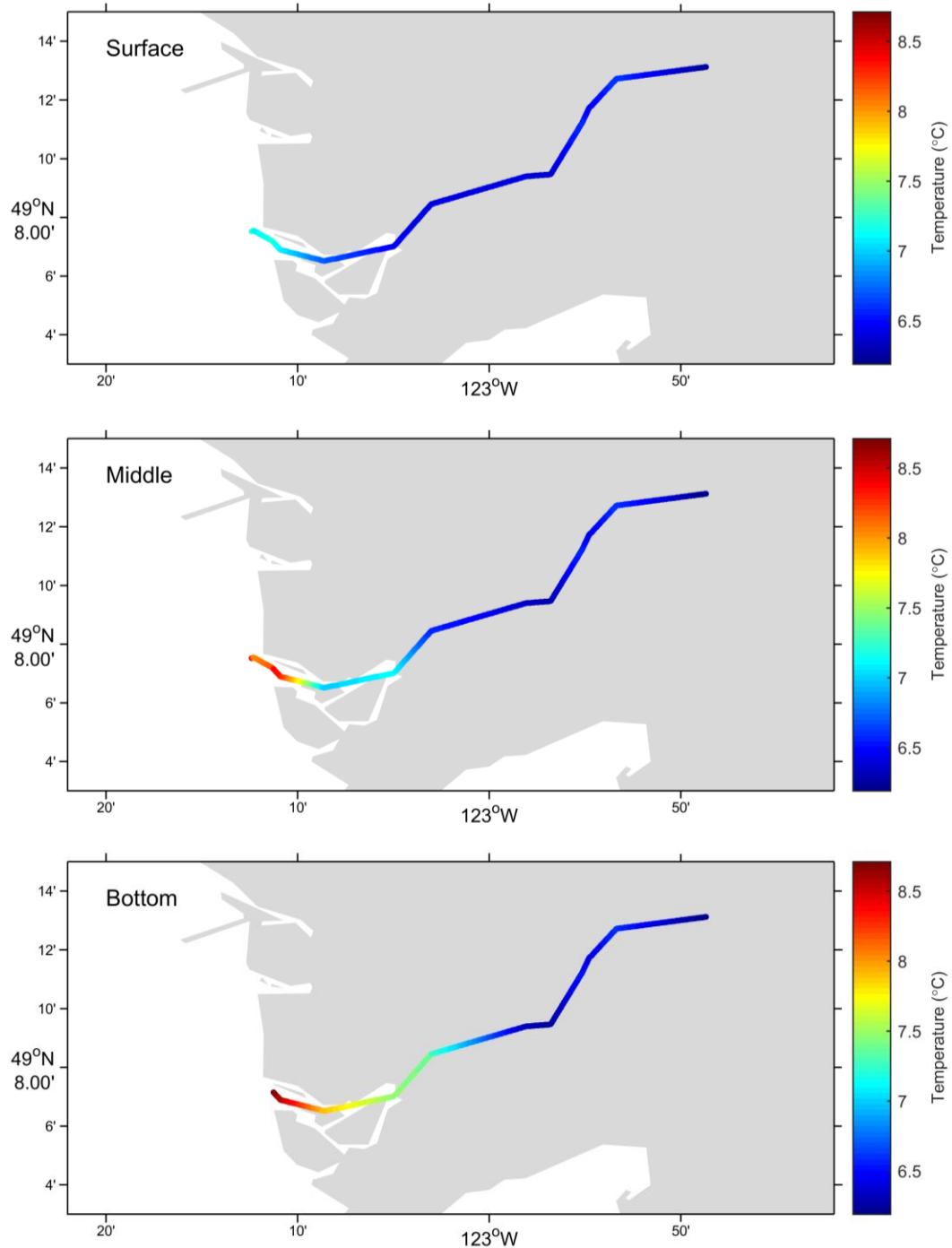




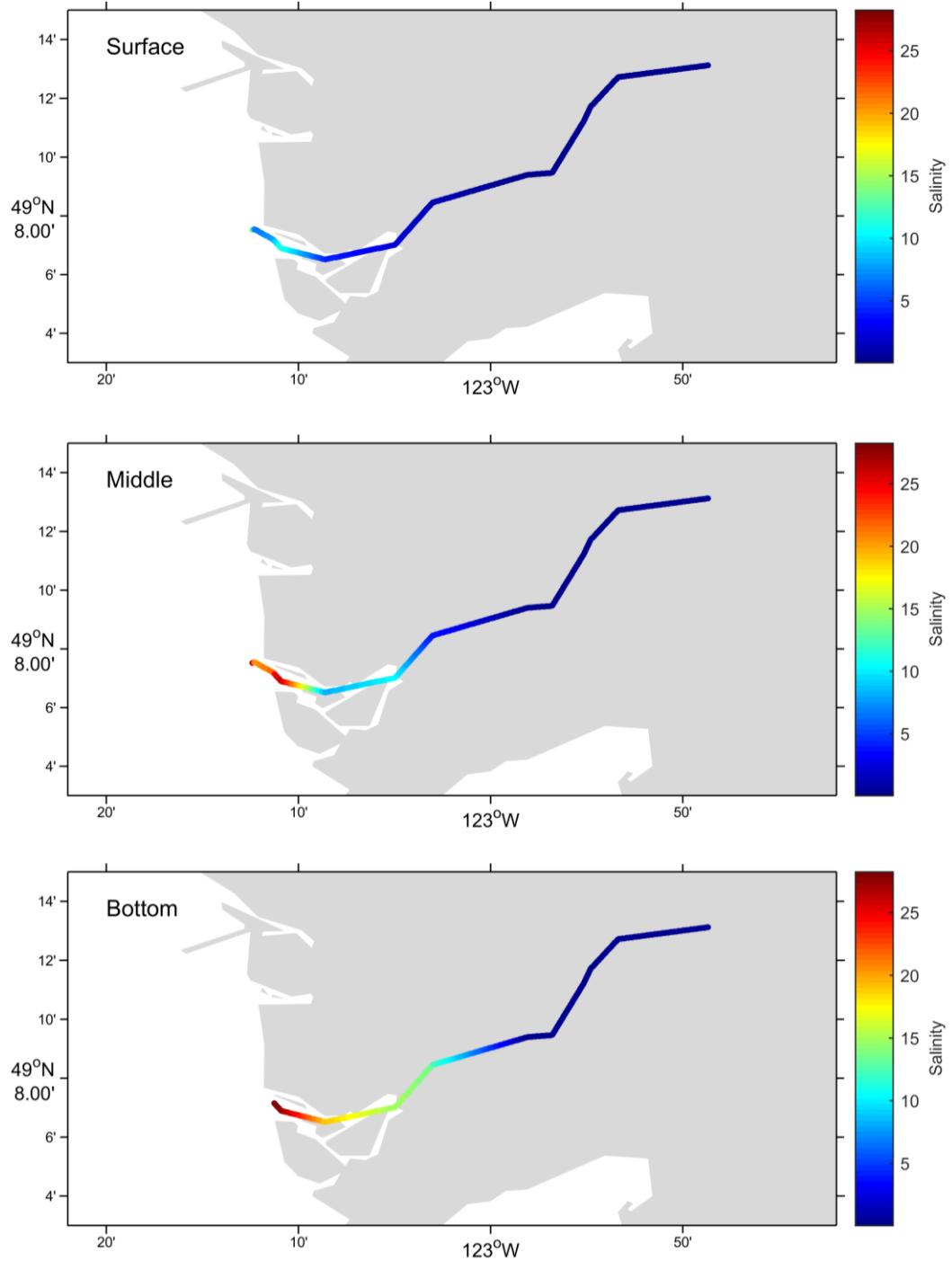
6.1.2 Horizontal profiles

The following figures are horizontal profiles of the March CTD data: temperature, salinity, and density at surface, mid-depth, and at the bottom.

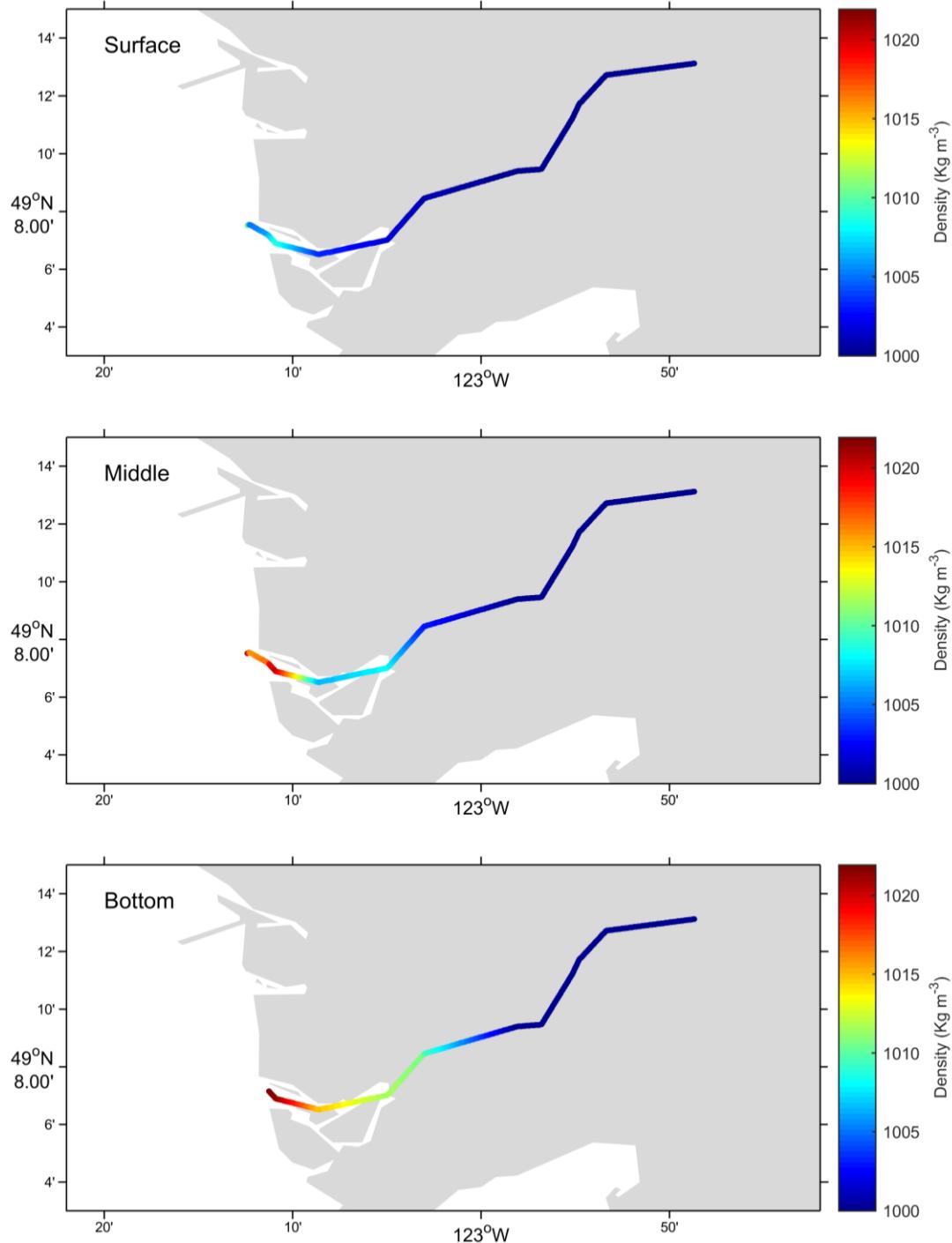
6.1.2.1 Temperature



6.1.2.2 Salinity



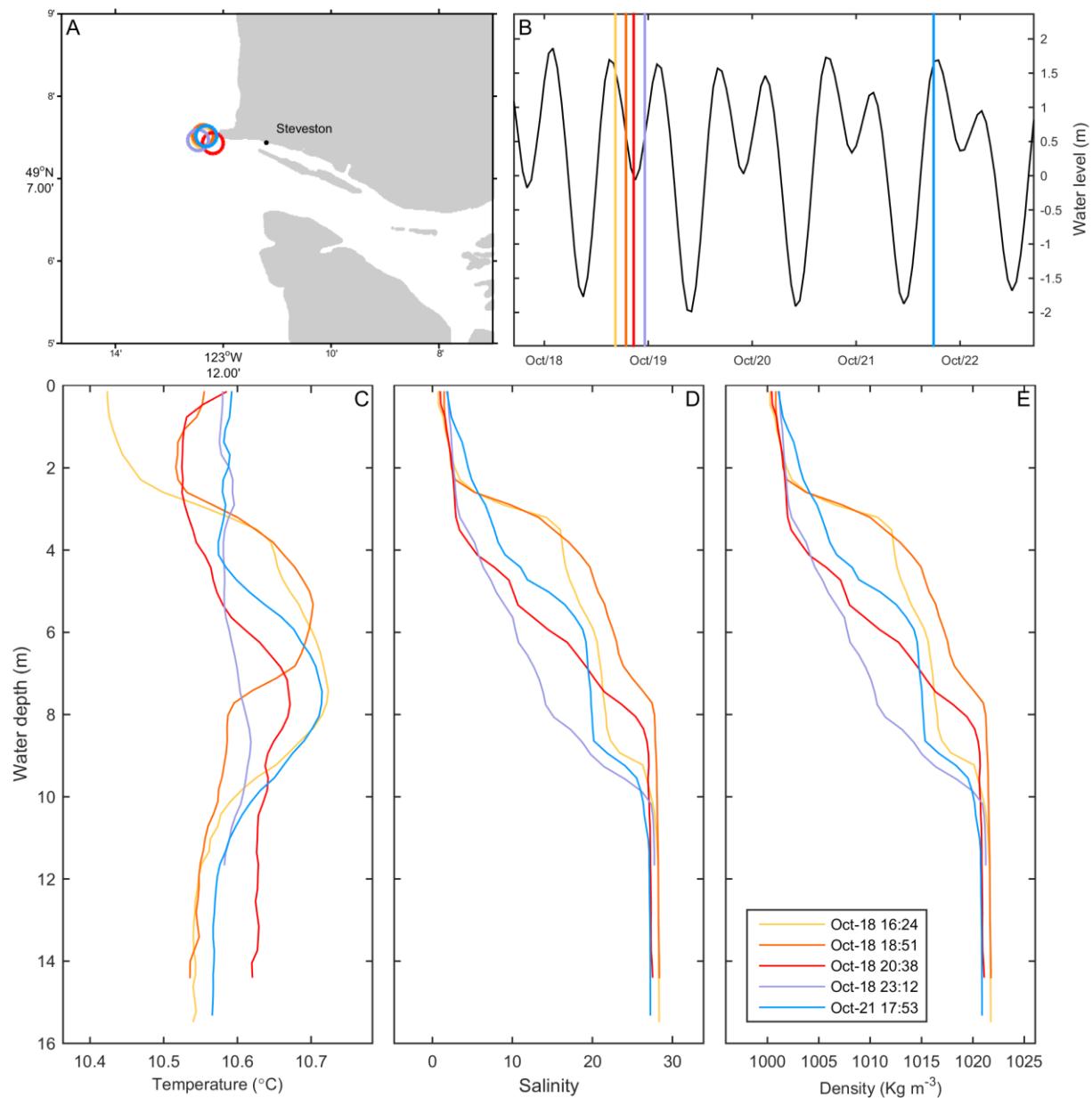
6.1.2.3 Density

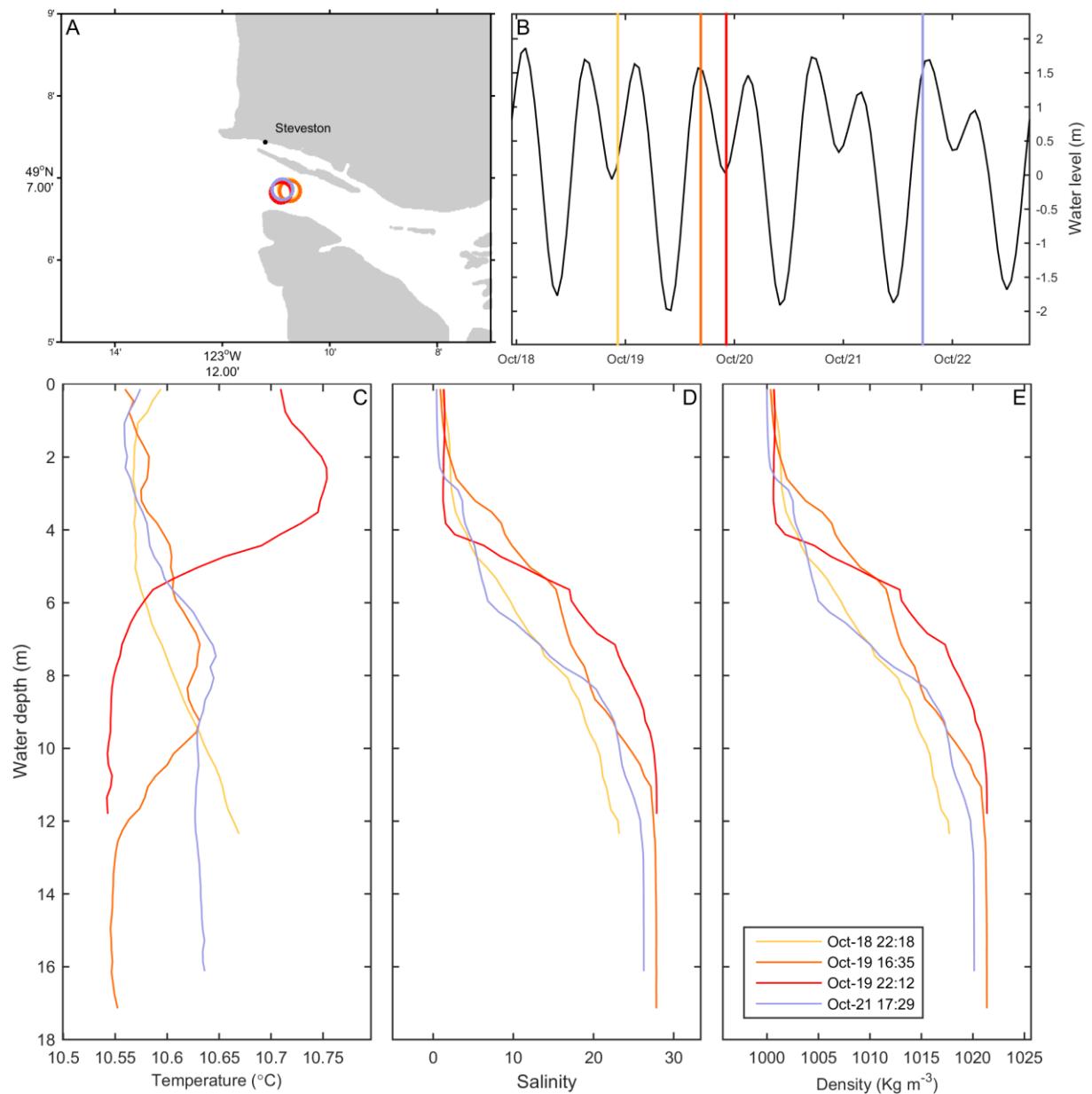


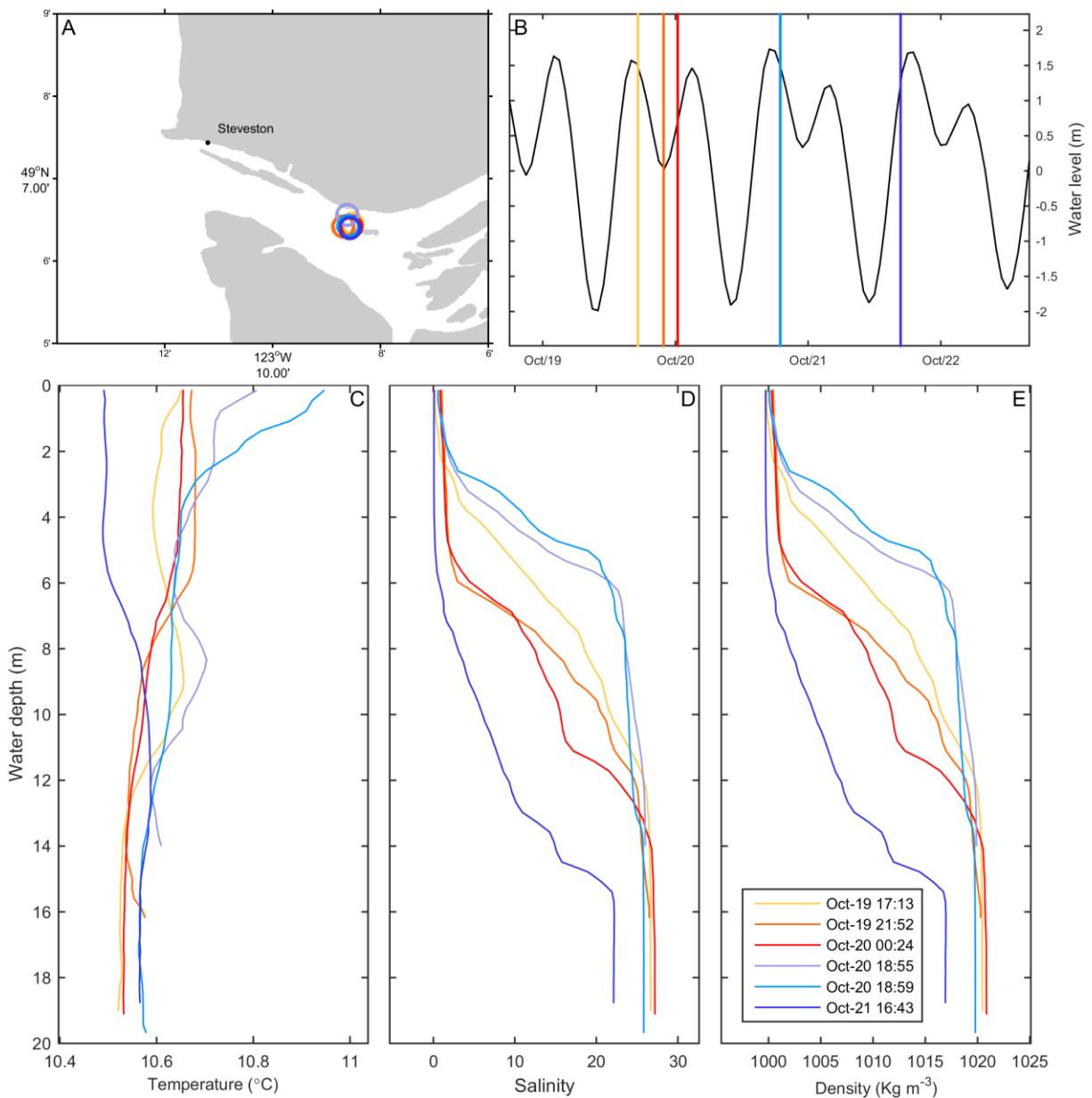
6.2 OCTOBER

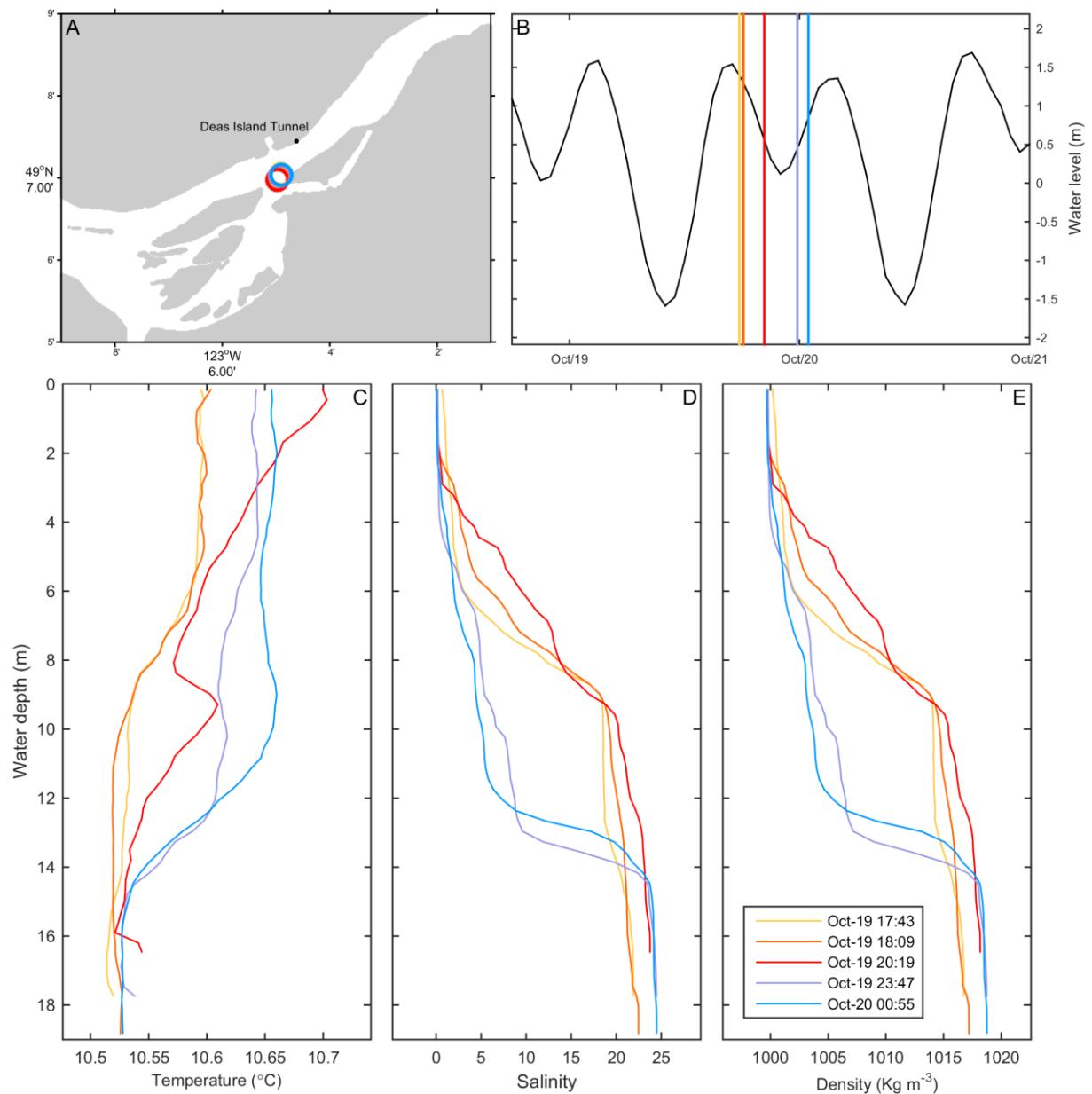
6.2.1 Vertical profiles

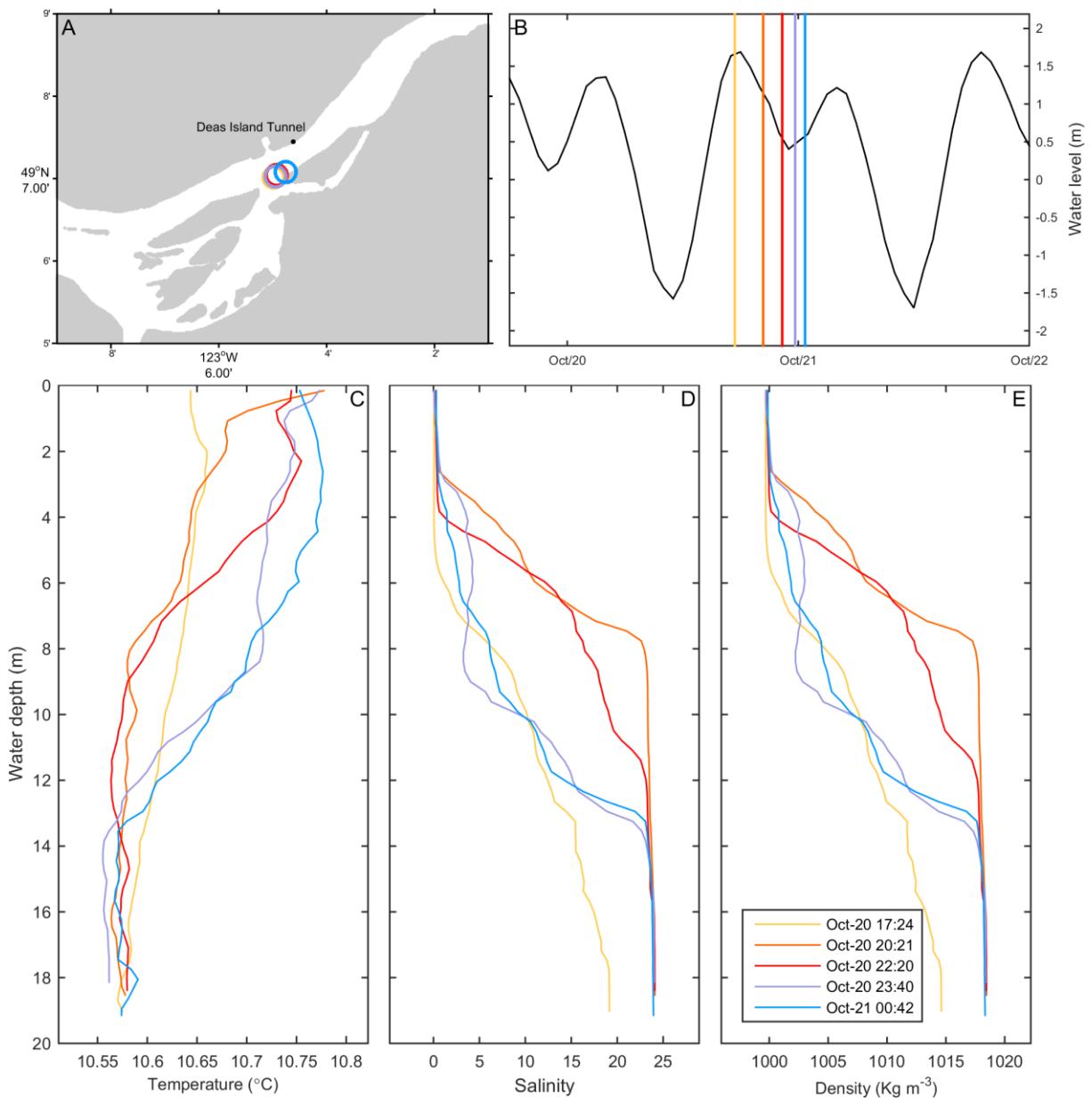
The following figures show vertical profiles of the October CTD data: temperature, salinity, and density. The figures also show the time during the tidal cycle when the profiles were measured.

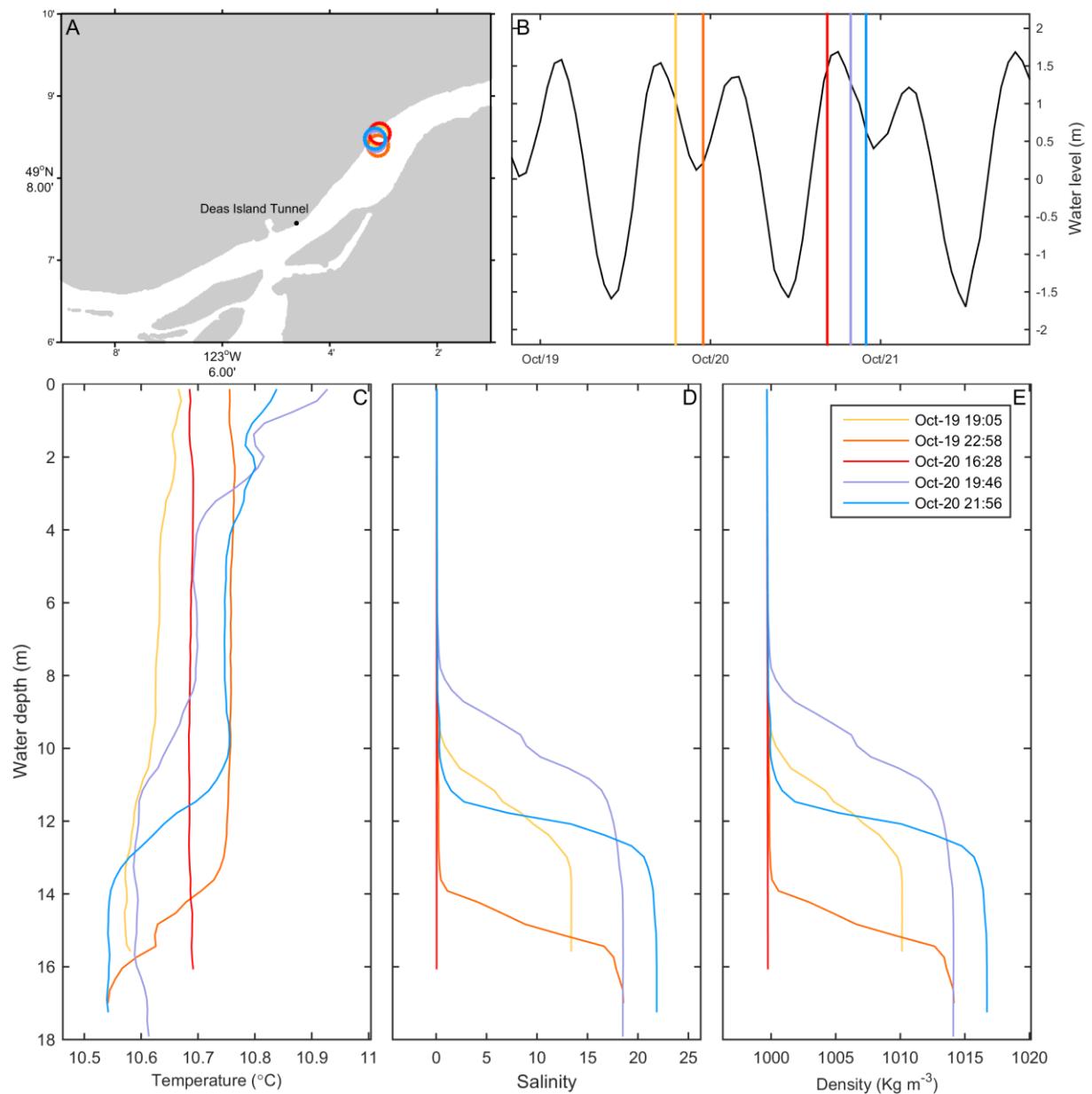


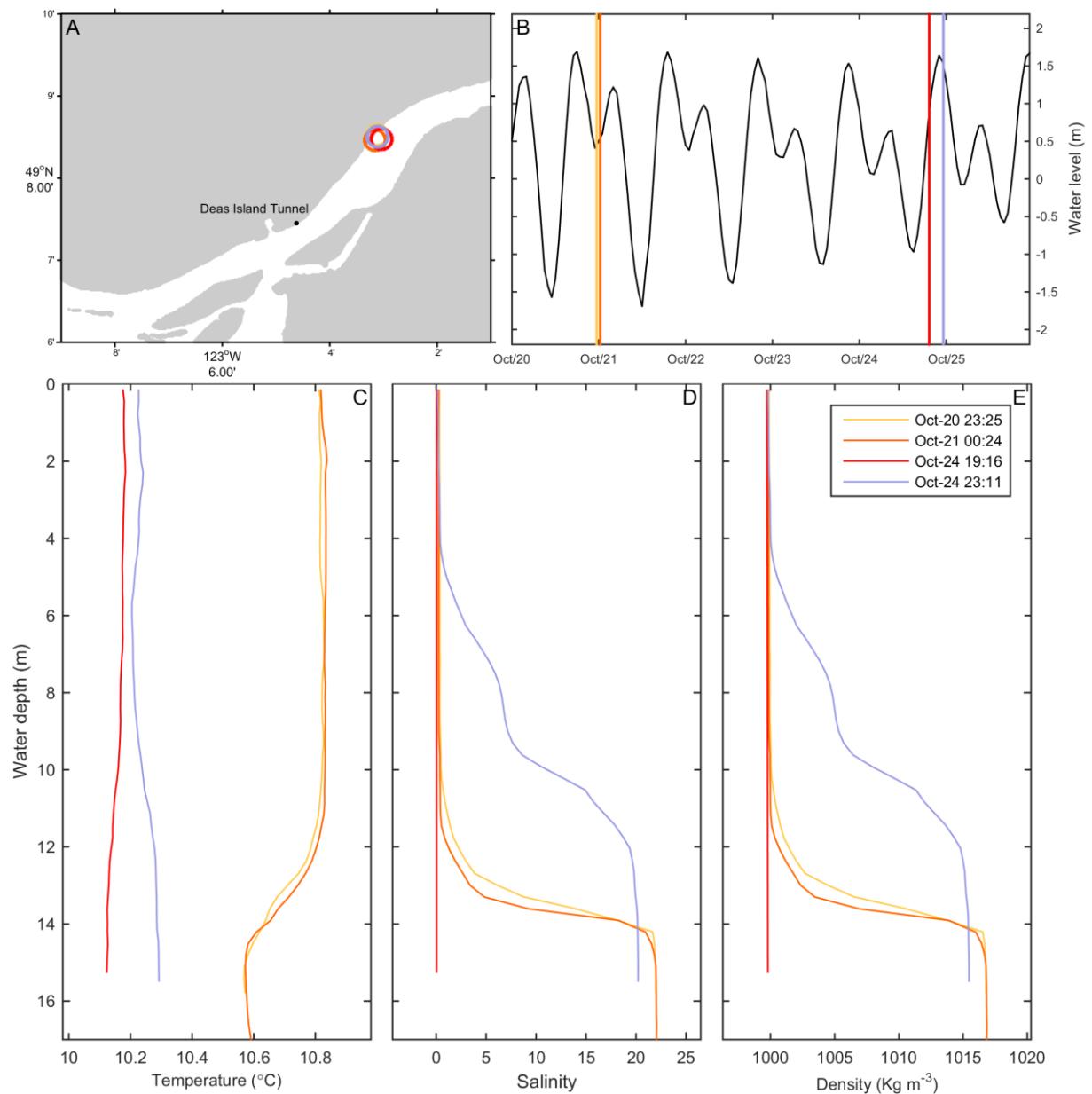


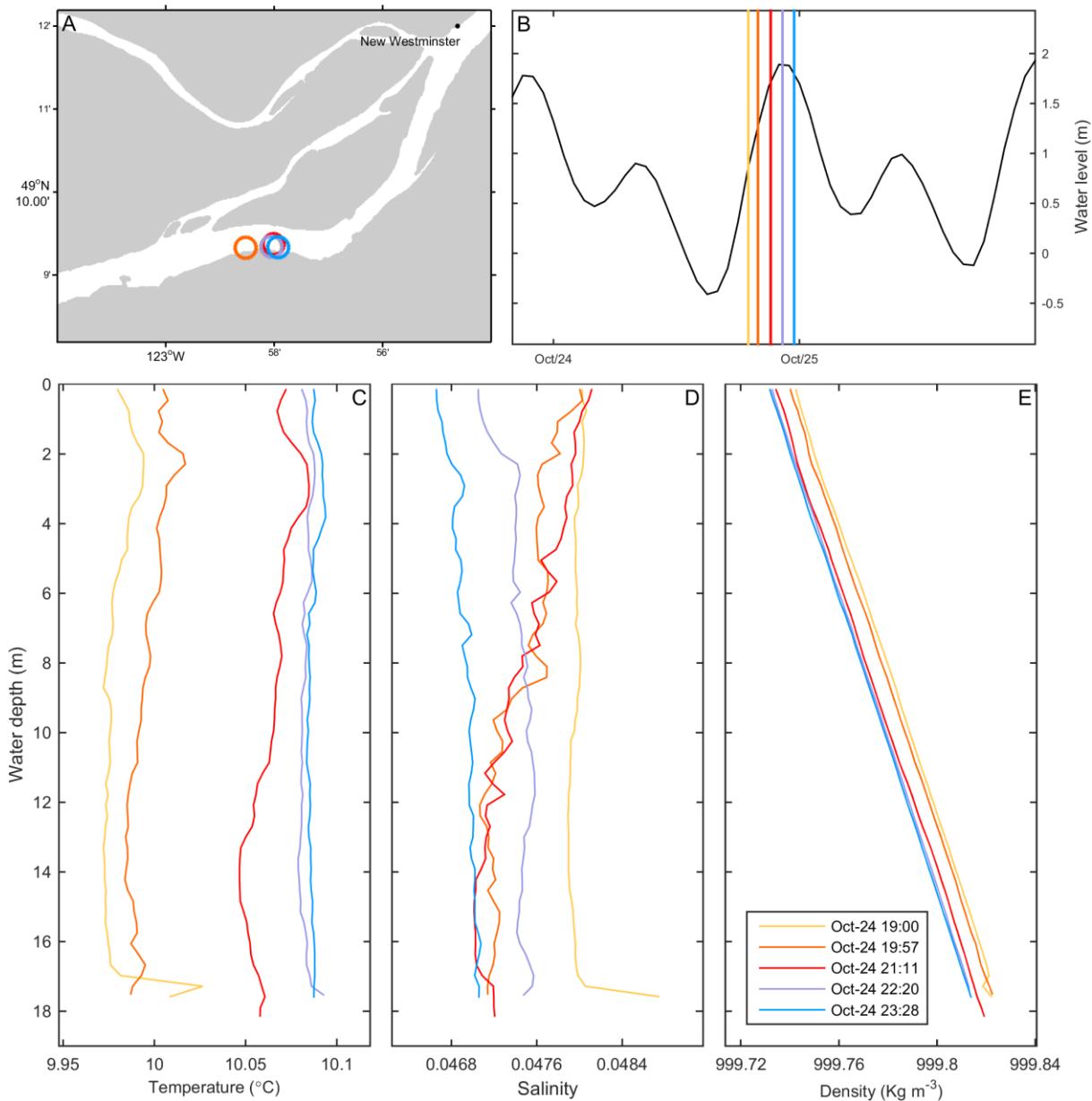


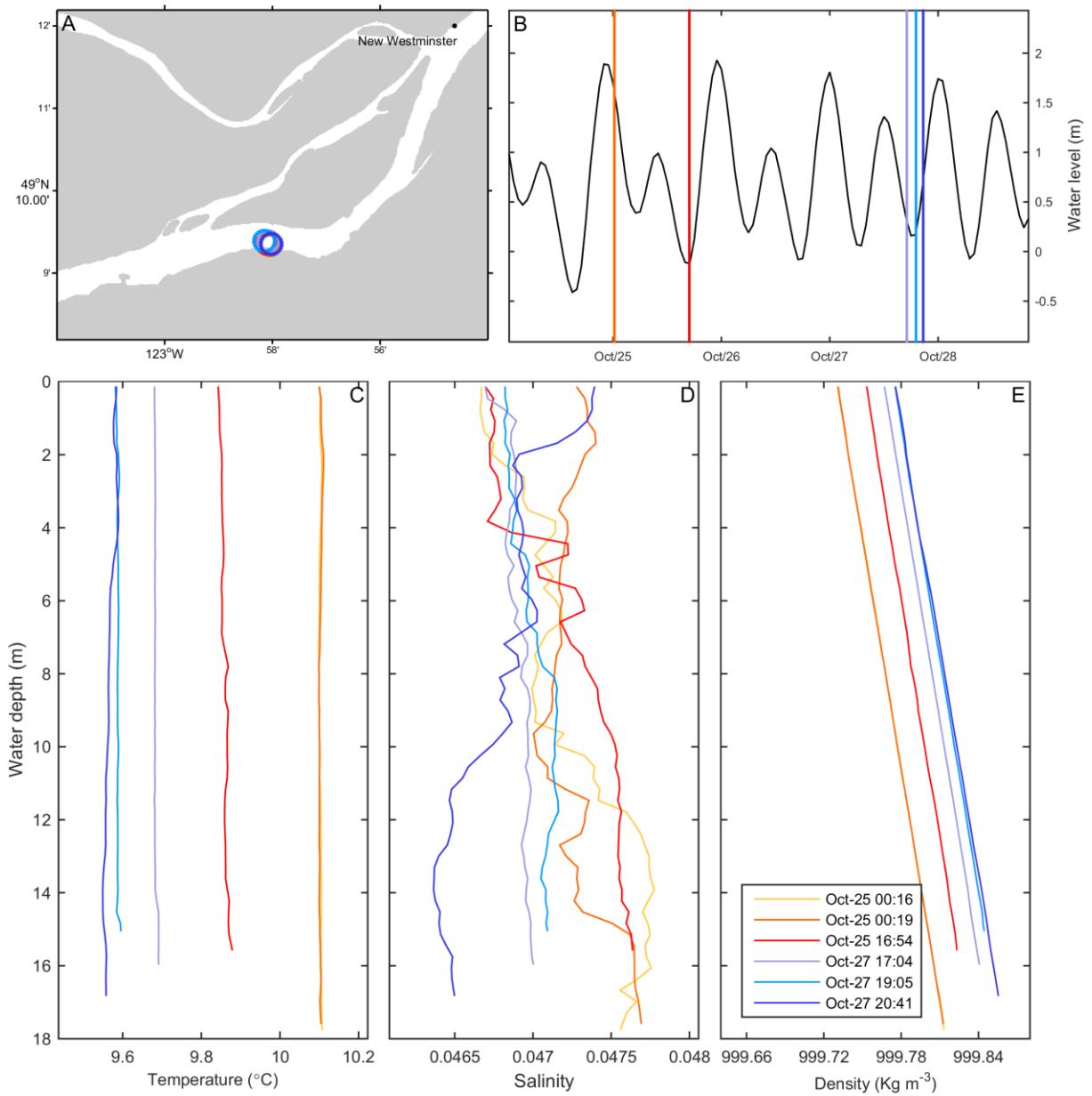


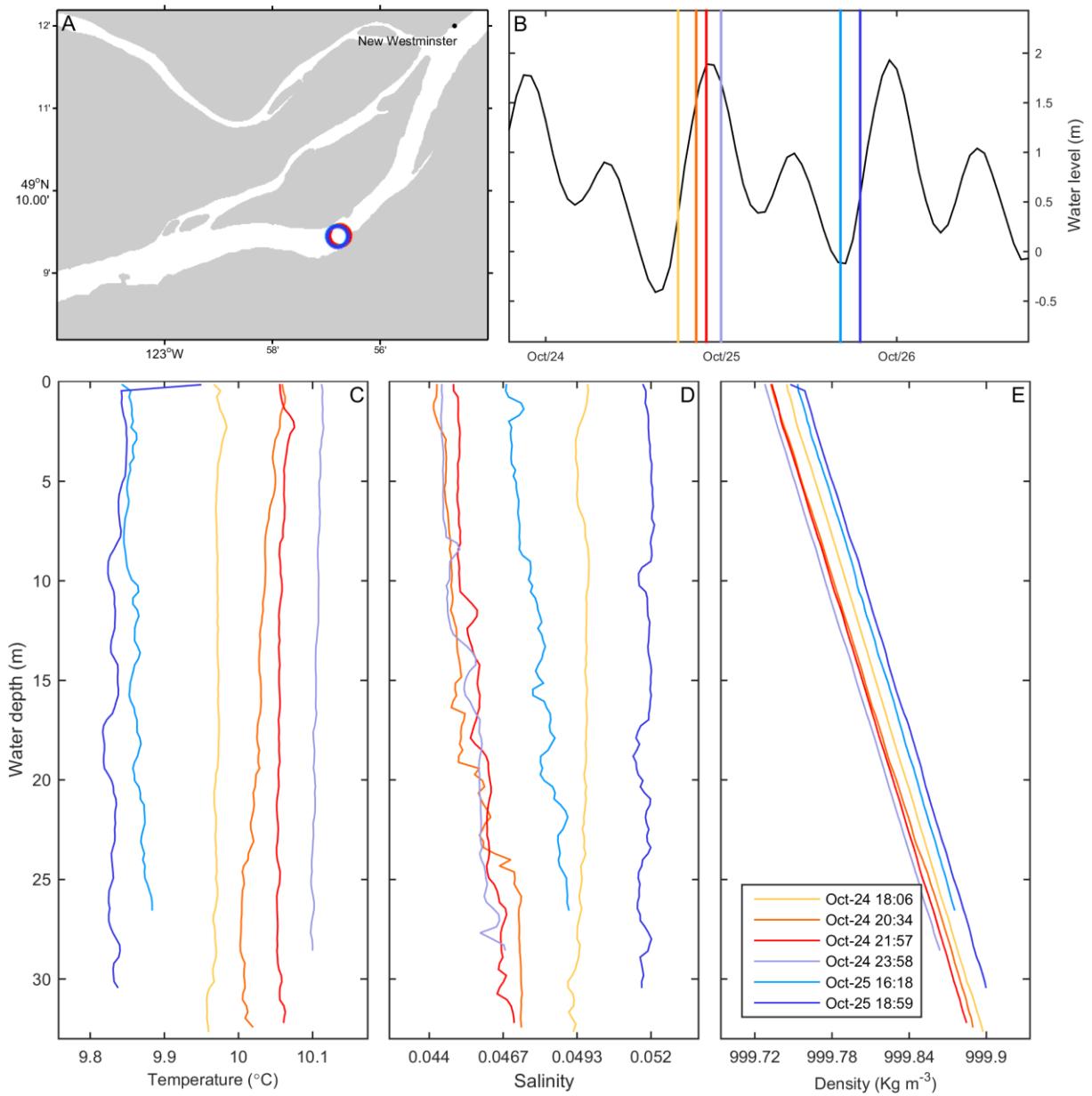


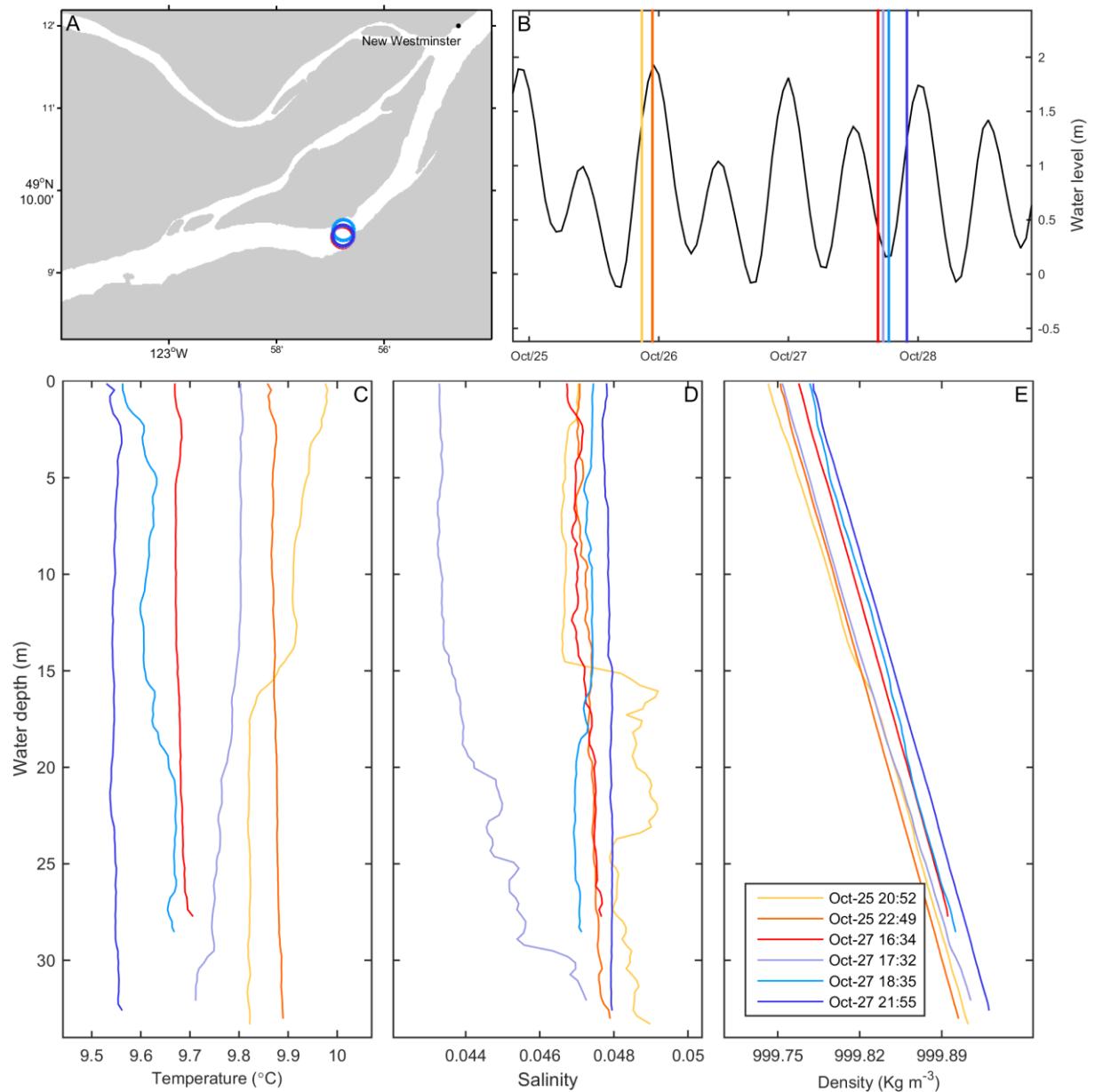


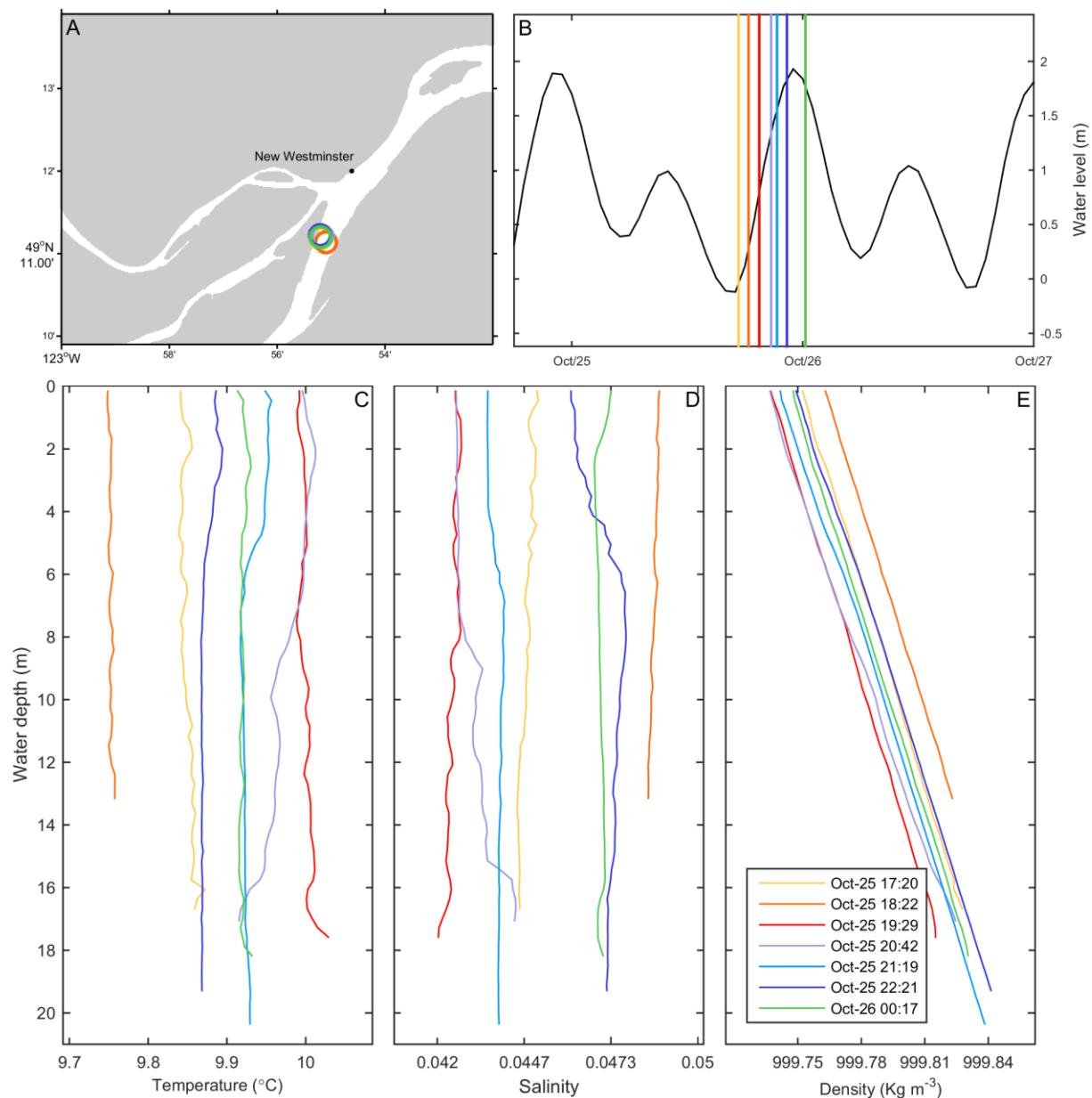


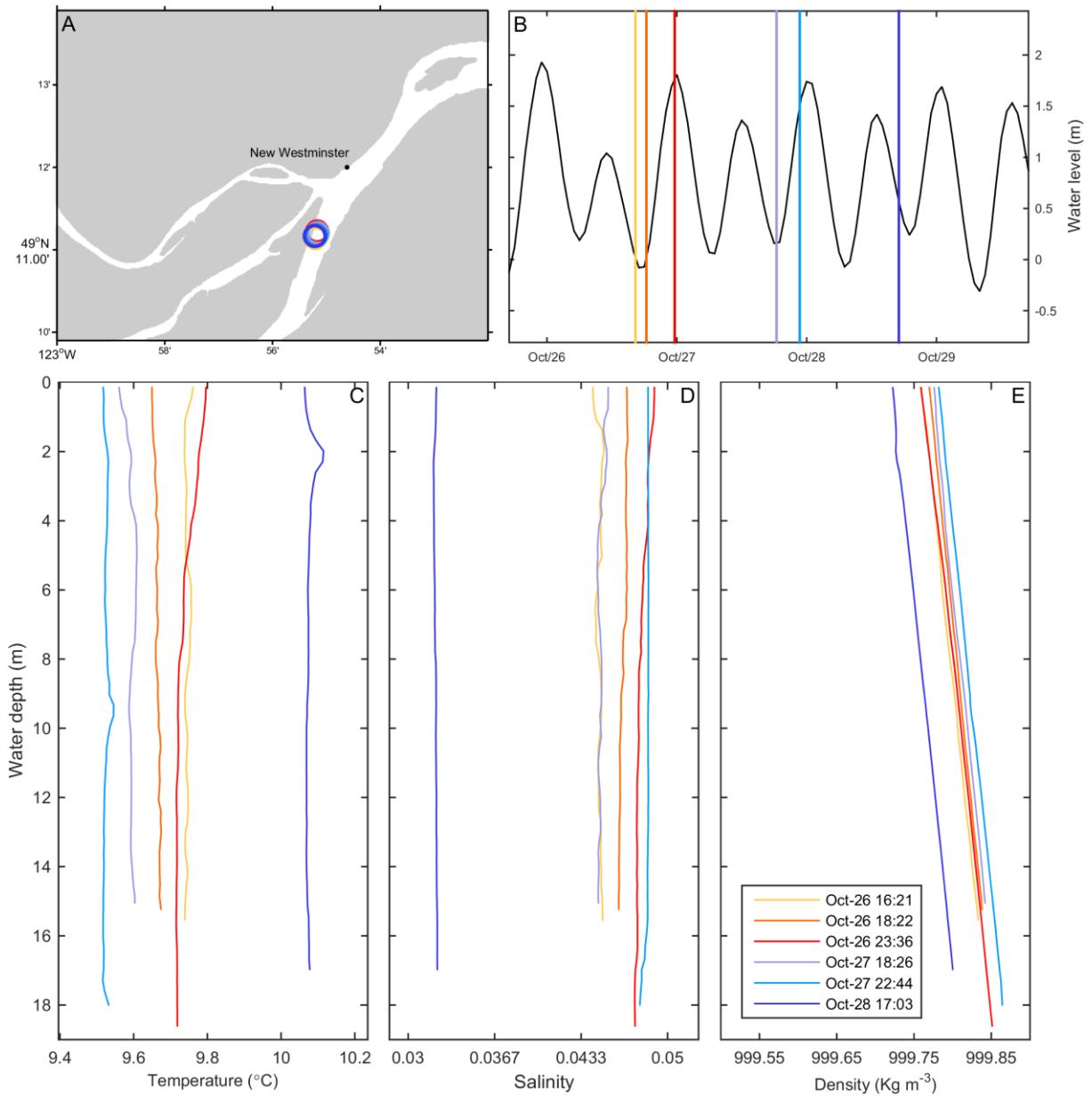


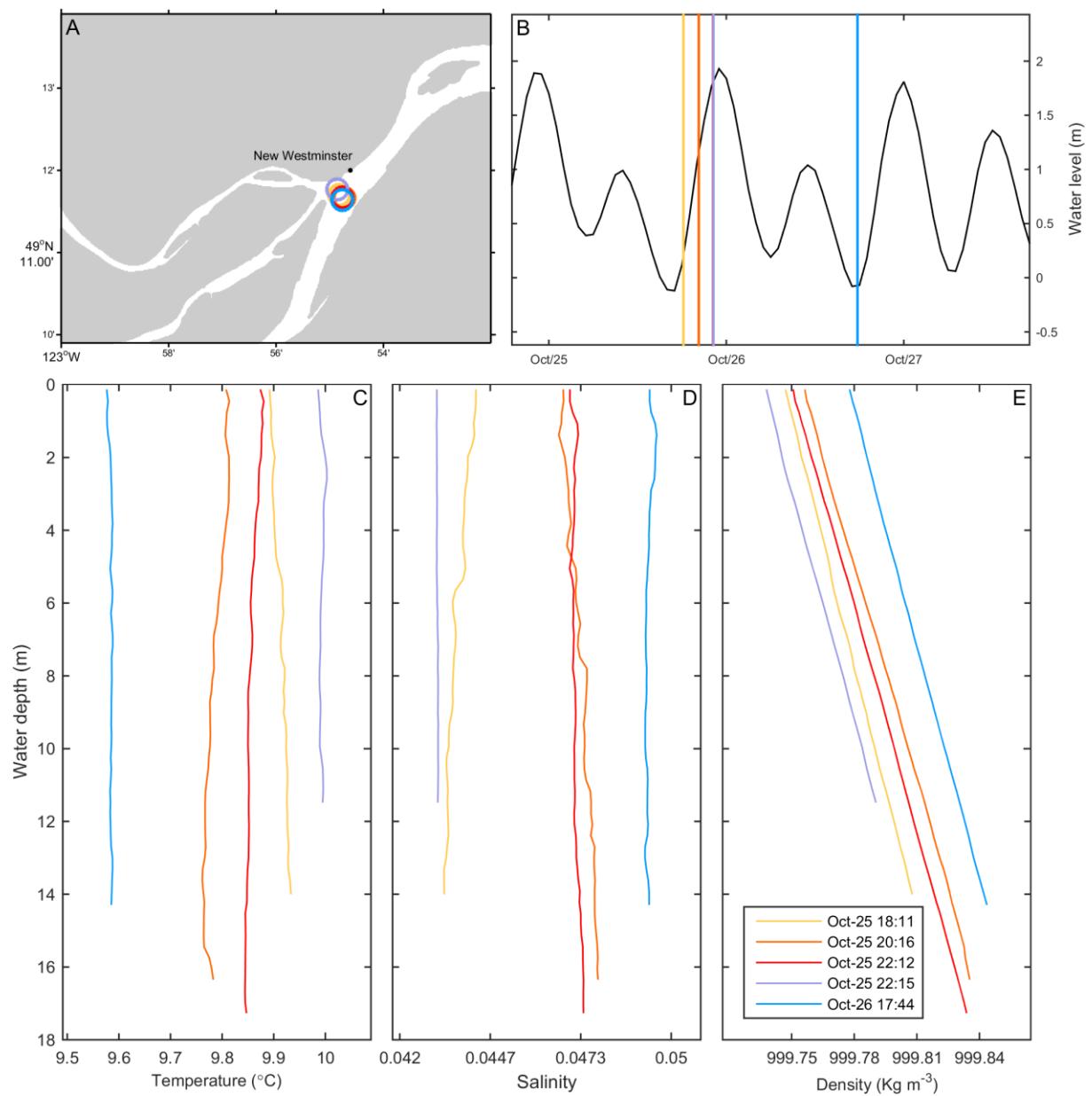


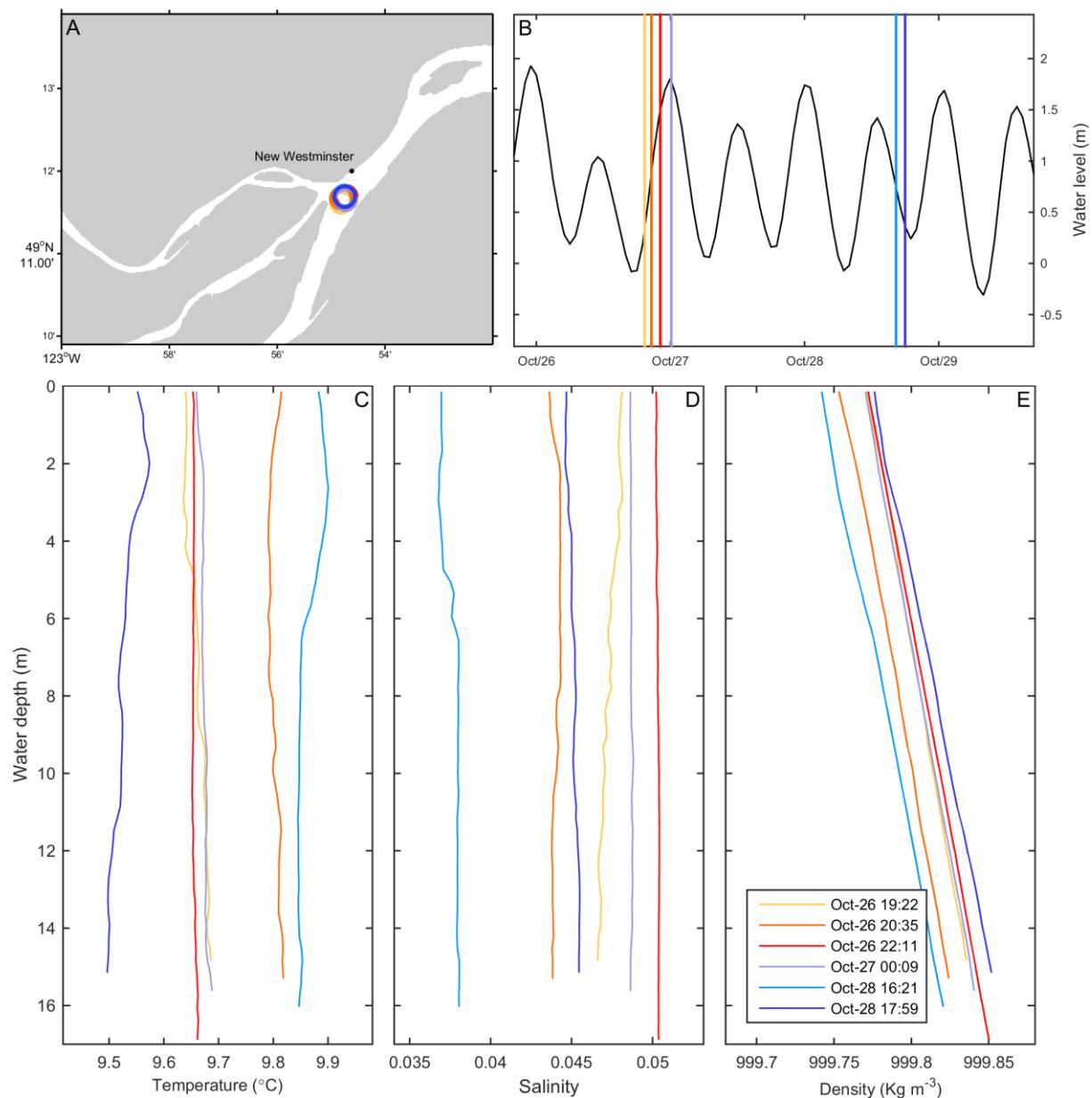


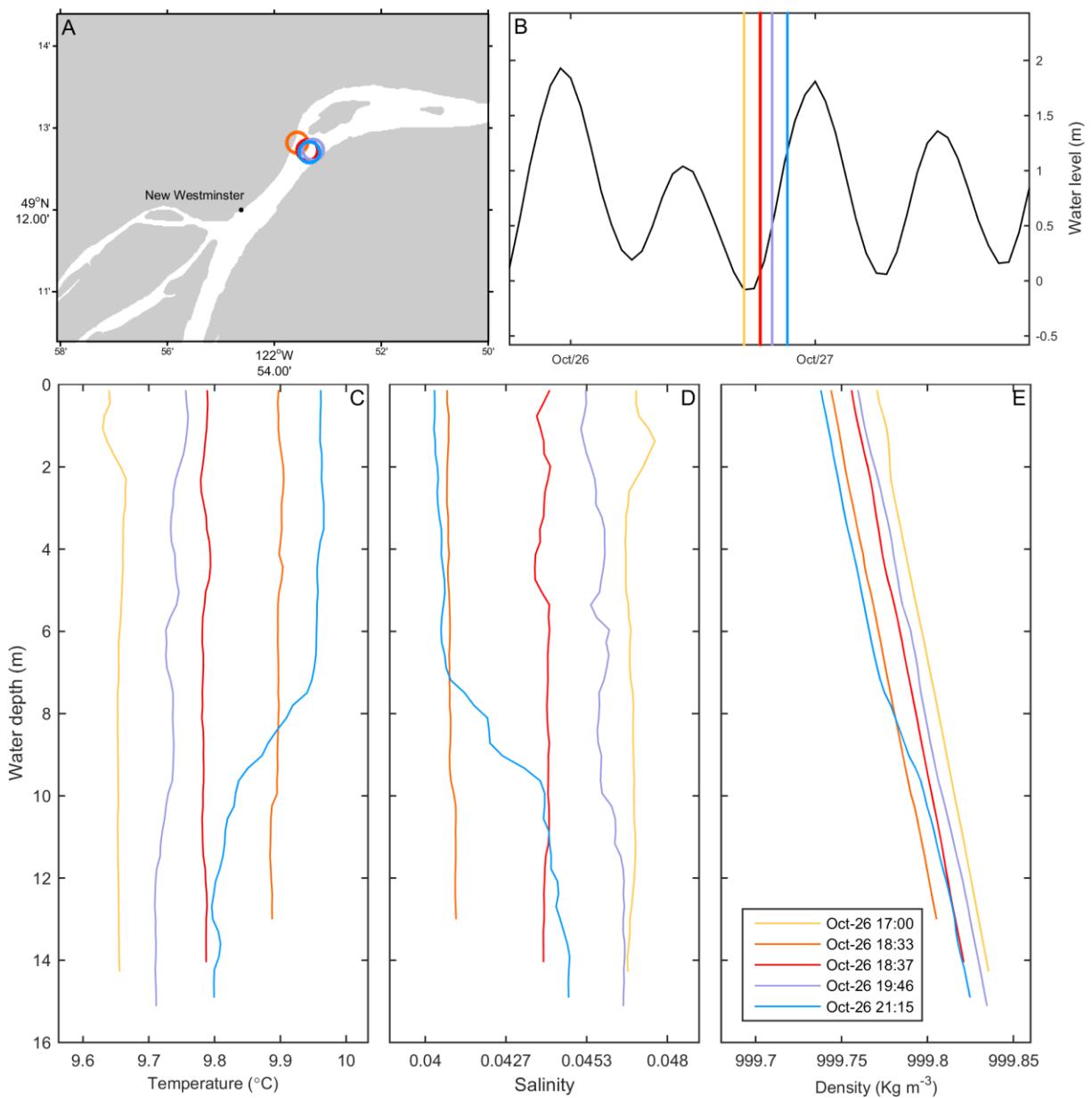


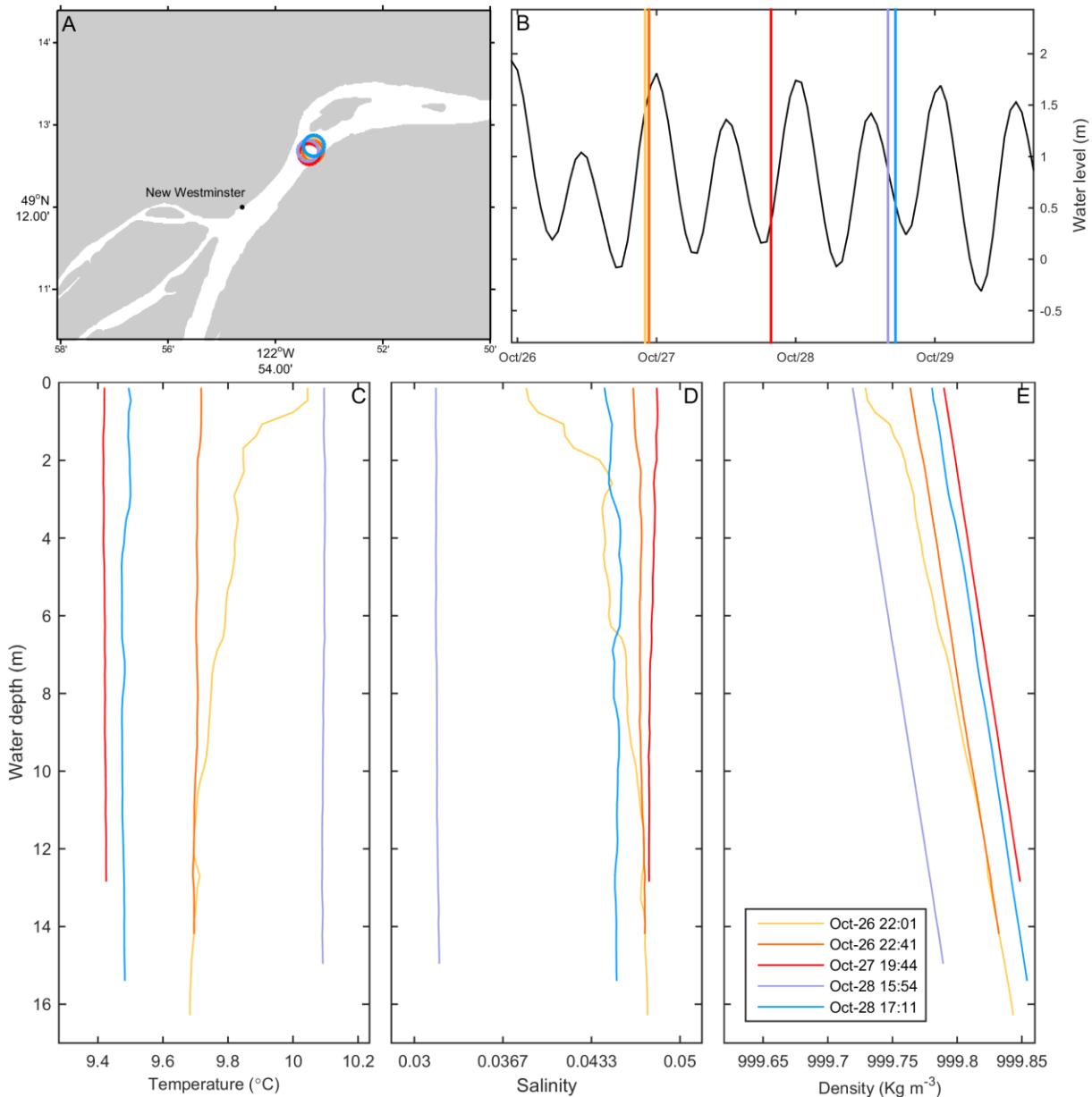








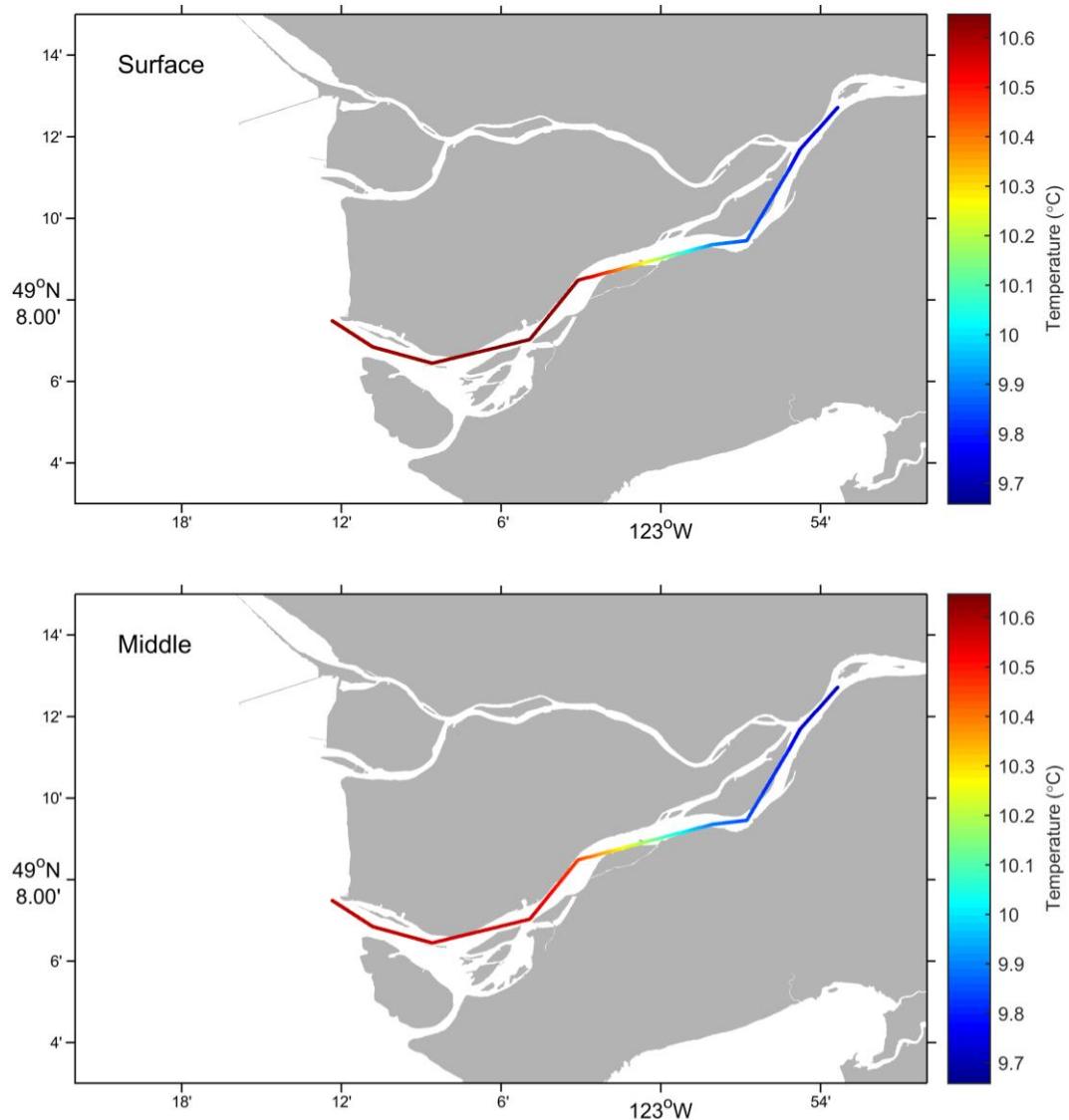


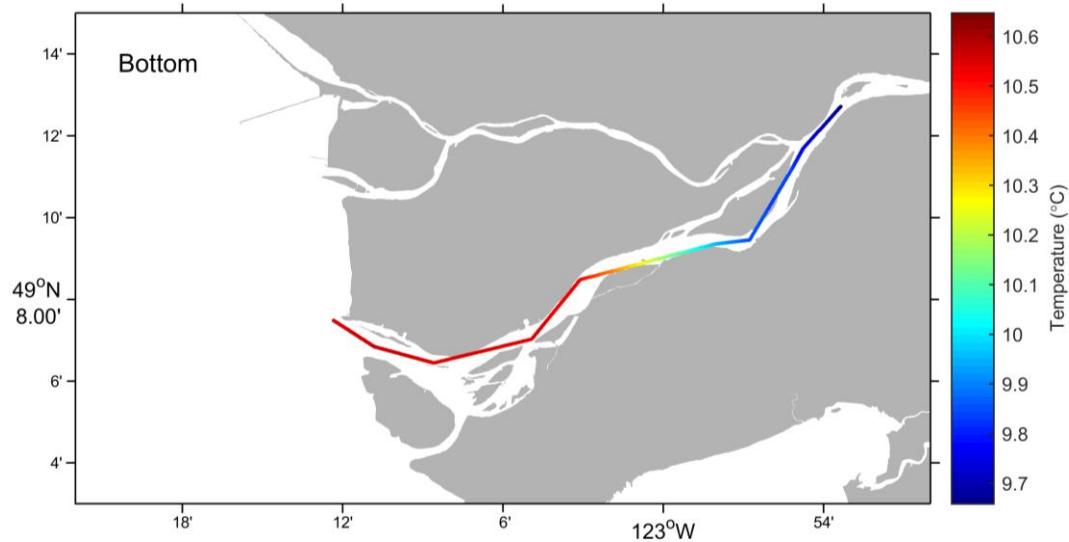


6.2.2 Horizontal profiles

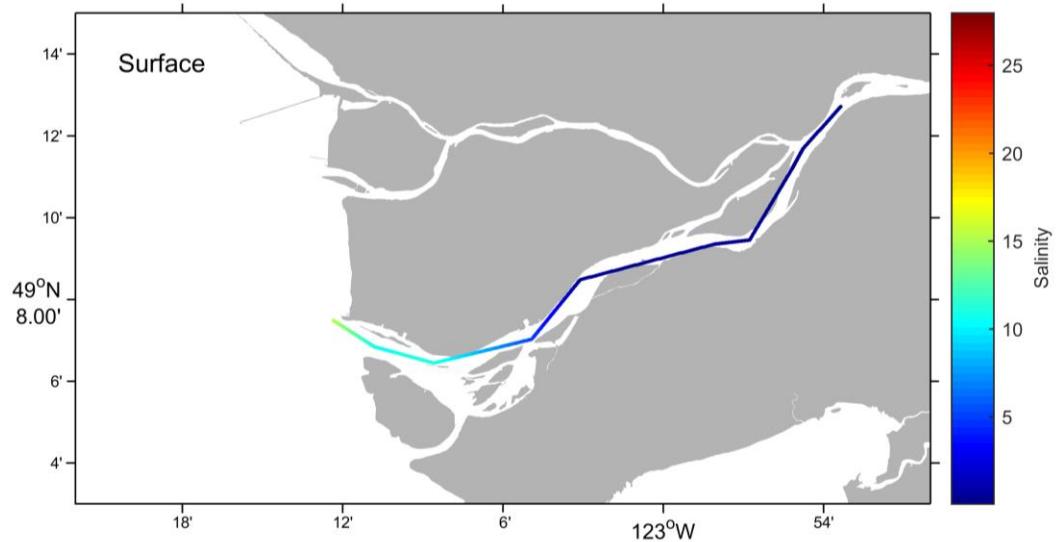
The following figures are horizontal profiles of the October CTD data: temperature, salinity, and density at surface, mid-depth, and at the bottom.

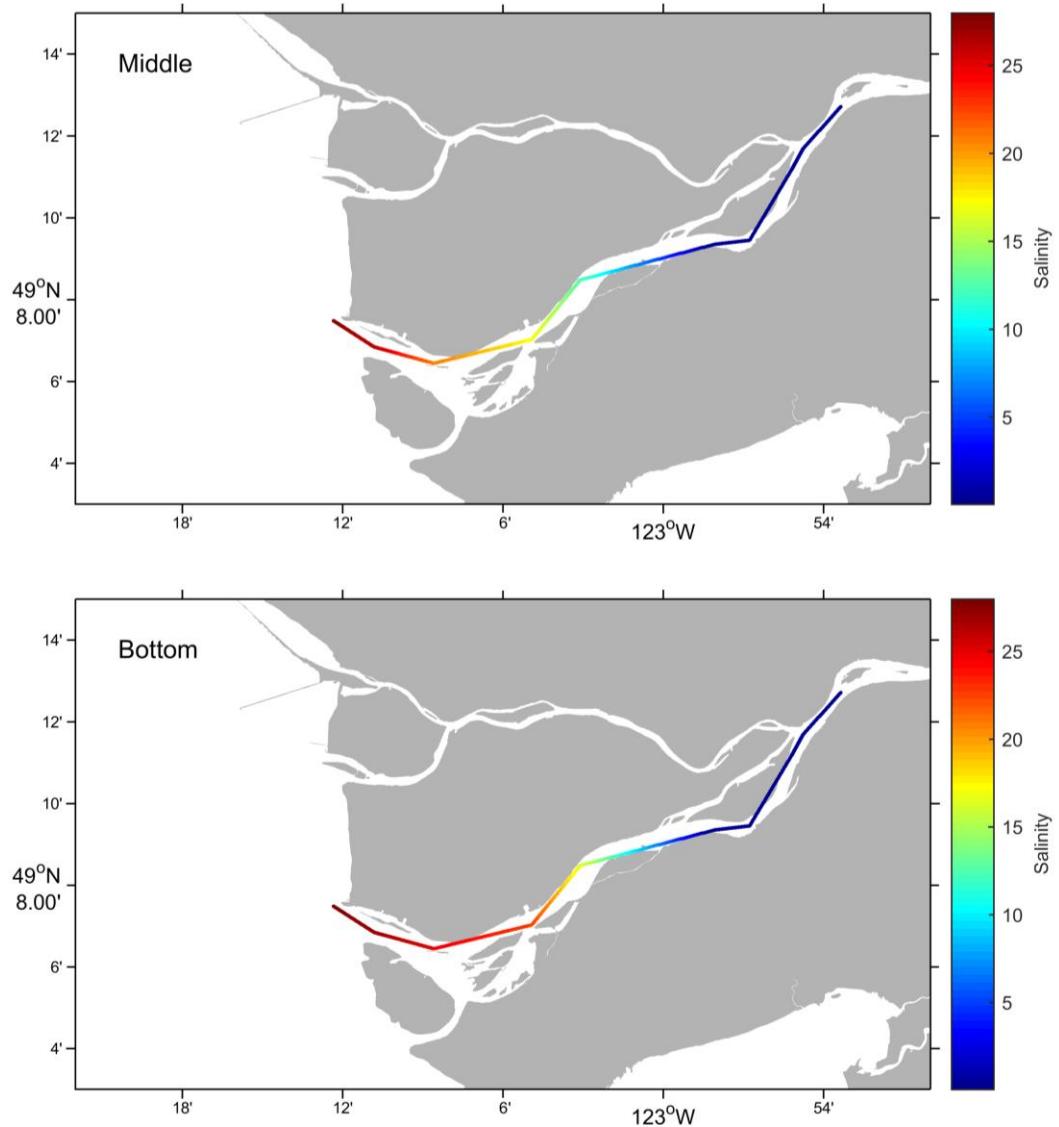
6.2.2.1 Temperature



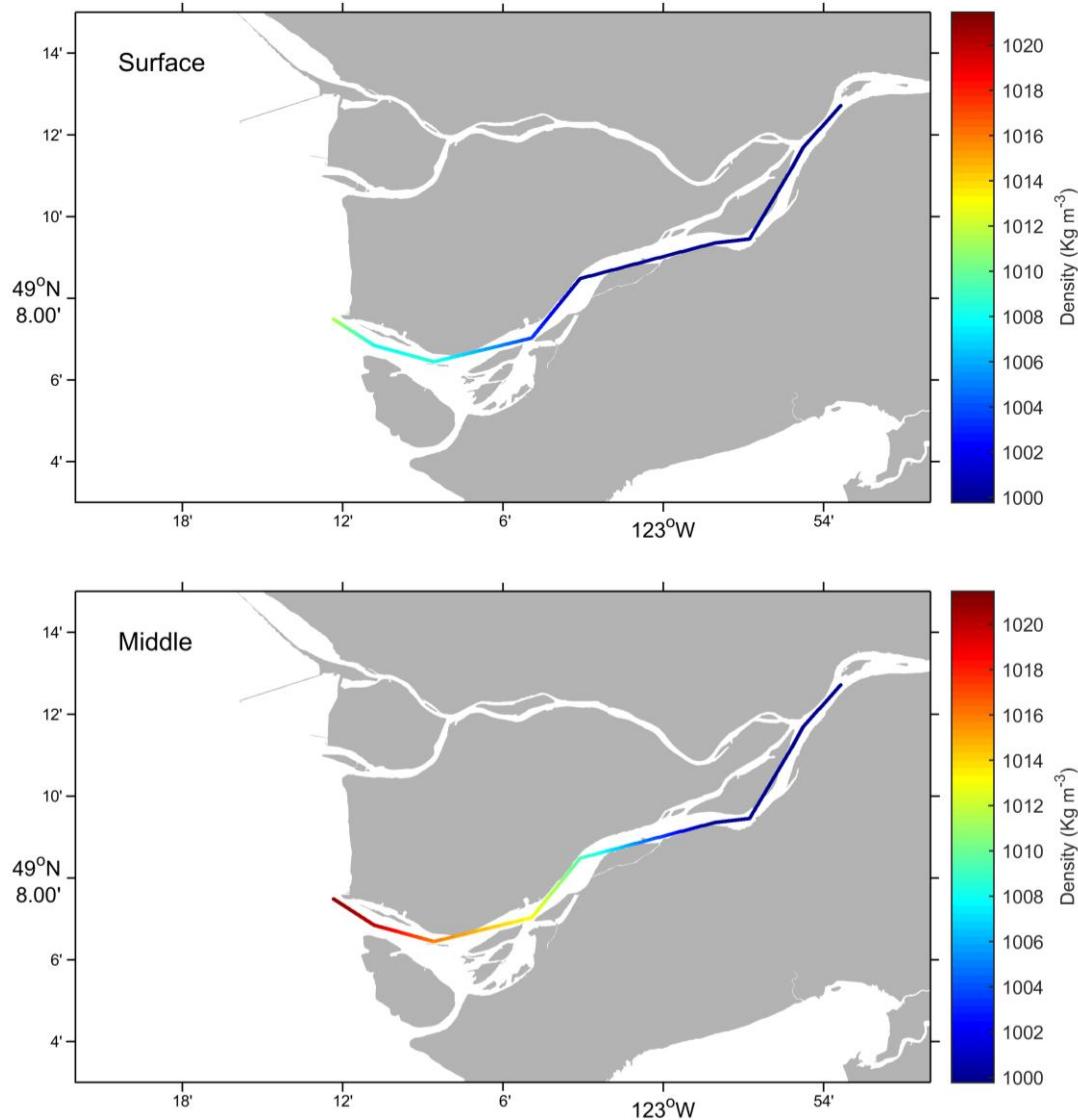


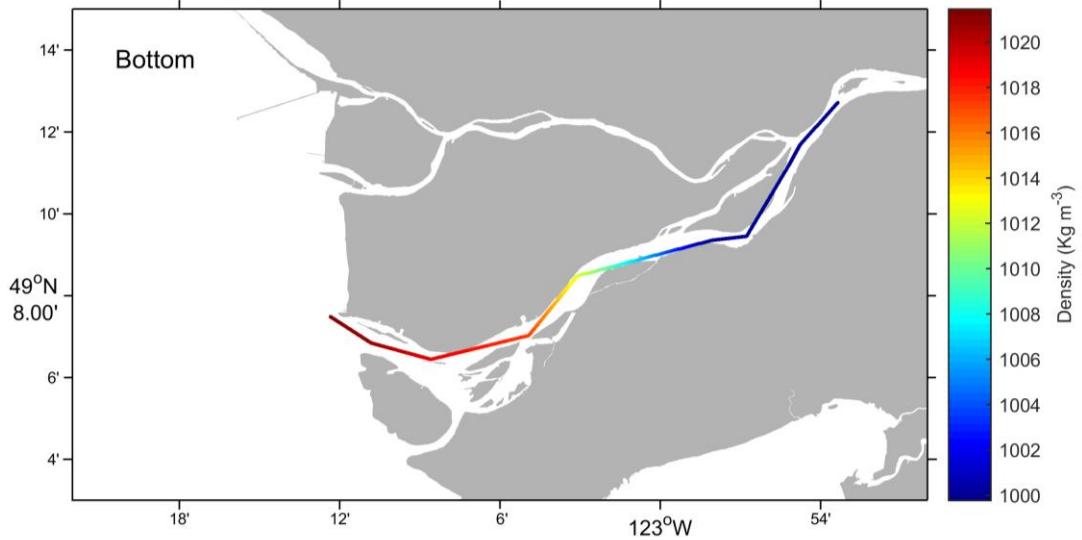
6.2.2.2 Salinity





6.2.2.3 Density





7 APPENDIX 2: VESSEL-MOUNTED ADCP DATA PROFILES

The metadata for the vessel-mounted ADCP lines sampled in March and October are listed in tables in this Appendix. We also present vertical sections and quiver plots of the velocities.

7.1 MARCH

The following table lists the metadata for the vessel-mounted ADCP lines measured in March 2016.

Table 5 March 2016 vessel-mounted ADCP metadata

Line #	ADCP March					
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR01	2016/03/07 23:47:53	2016/03/07 23:56:20	49.0989	-123.2994	1.47	23.91
	2016/03/08 00:09:46	2016/03/08 00:20:53	49.0991	-123.2995	1.47	25.95
	2016/03/08 00:28:05	2016/03/08 00:35:38	49.0991	-123.2995	1.47	25.95
	2016/03/08 00:50:15	2016/03/08 01:01:03	49.0991	-123.2997	1.47	25.95
FR02	2016/03/08 21:31:55	2016/03/08 21:36:20	49.1231	-123.2479	1.47	15.75
	2016/03/08 21:41:34	2016/03/08 21:46:01	49.1231	-123.2478	1.47	15.75
	2016/03/08 21:50:59	2016/03/08 21:55:51	49.1232	-123.2479	1.47	16.77
	2016/03/08 22:00:54	2016/03/08 22:13:54	49.1230	-123.2481	1.47	16.77

Line #	ADCP March					
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR02	2016/03/08 22:21:18	2016/03/08 22:25:44	49.1231	-123.2479	1.47	16.77
FR03	2016/03/08 20:34:47	2016/03/08 20:41:27	49.1215	-123.2081	1.47	11.67
	2016/03/08 23:47:28	2016/03/08 23:52:25	49.1217	-123.2083	1.47	12.69
	2016/03/09 00:04:42	2016/03/09 00:10:11	49.1216	-123.2084	1.47	12.69
	2016/03/11 18:25:23	2016/03/11 18:31:18	49.1220	-123.2085	1.47	11.67
	2016/03/11 19:56:55	2016/03/11 20:03:21	49.1219	-123.2085	1.47	10.65
FR03-02	2016/03/08 20:54:42	2016/03/08 20:54:42	49.1260	-123.2047	1.47	21.87
FR03a	2016/03/08 20:11:31	2016/03/08 20:20:19	49.1150	-123.1899	1.47	10.65
	2016/03/09 00:36:58	2016/03/09 00:43:51	49.1152	-123.1903	1.47	11.67
	2016/03/09 01:00:54	2016/03/09 01:06:43	49.1151	-123.1904	1.47	11.67
	2016/03/09 01:13:17	2016/03/09 01:19:23	49.1152	-123.1904	1.47	12.69
	2016/03/11 17:49:47	2016/03/11 17:56:53	49.1154	-123.1902	1.47	11.67
	2016/03/11 19:25:37	2016/03/11 19:34:24	49.1157	-123.1901	1.47	10.65
FR03a-03	2016/03/09 01:31:22	2016/03/09 01:31:22	49.1109	-123.1704	1.47	14.73
	2016/03/09 01:50:52	2016/03/09 01:50:52	49.1108	-123.1707	1.47	14.73
	2016/03/11 18:07:44	2016/03/11 18:07:44	49.1184	-123.1882	1.47	11.67
	2016/03/11 19:42:02	2016/03/11 19:42:02	49.1162	-123.1903	1.47	9.63
FR03b	2016/03/11 17:33:08	2016/03/11 17:39:39	49.1128	-123.1832	1.47	12.69
	2016/03/11 19:05:42	2016/03/11 19:11:41	49.1134	-123.1837	1.47	11.67
FR03b-03a	2016/03/11 19:20:20	2016/03/11 19:20:20	49.1137	-123.1816	1.47	10.65
FR04	2016/03/09 17:34:42	2016/03/09 17:39:08	49.1068	-123.1429	1.47	14.73
	2016/03/09 19:03:47	2016/03/09 19:09:29	49.1069	-123.1430	1.47	13.71
	2016/03/09 19:13:50	2016/03/09 19:18:53	49.1069	-123.1430	1.47	13.71
	2016/03/09 19:22:54	2016/03/09 19:28:09	49.1070	-123.1428	1.47	13.71
	2016/03/09 21:17:40	2016/03/09 21:31:57	49.1069	-123.1429	1.47	13.71
	2016/03/09 21:36:14	2016/03/09 21:40:43	49.1068	-123.1428	1.47	13.71
	2016/03/09 21:45:55	2016/03/09 21:50:21	49.1068	-123.1429	1.47	13.71
	2016/03/10 00:22:54	2016/03/10 00:27:16	49.1068	-123.1427	1.47	14.73
	2016/03/10 00:32:03	2016/03/10 00:36:19	49.1068	-123.1421	1.47	15.75

Line #	ADCP March					
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR04	2016/03/10 00:40:18	2016/03/10 00:44:25	49.1069	-123.1427	1.47	14.73
	2016/03/10 00:47:57	2016/03/10 00:51:38	49.1068	-123.1430	1.47	14.73
FR05	2016/03/09 18:10:50	2016/03/09 18:17:06	49.1155	-123.0825	1.47	13.71
	2016/03/09 18:22:59	2016/03/09 18:30:16	49.1157	-123.0821	1.47	13.71
	2016/03/09 19:54:29	2016/03/09 20:01:45	49.1156	-123.0822	1.47	13.71
	2016/03/09 20:08:22	2016/03/09 20:16:27	49.1154	-123.0822	1.47	13.71
	2016/03/09 20:23:28	2016/03/09 20:31:24	49.1154	-123.0823	1.47	13.71
	2016/03/09 22:13:59	2016/03/09 22:20:10	49.1155	-123.0823	1.47	13.71
	2016/03/09 22:26:43	2016/03/09 22:32:44	49.1155	-123.0824	1.47	14.73
	2016/03/09 22:55:12	2016/03/09 23:01:17	49.1153	-123.0822	1.47	14.73
	2016/03/09 23:09:55	2016/03/09 23:09:55	49.1153	-123.0822	1.47	14.73
	2016/03/09 23:23:03	2016/03/09 23:30:10	49.1154	-123.0823	1.47	14.73
	2016/03/10 18:55:22	2016/03/10 19:12:12	49.1156	-123.0823	1.47	14.73
	2016/03/10 19:18:54	2016/03/10 19:28:22	49.1155	-123.0825	1.47	13.71
	2016/03/10 19:36:11	2016/03/10 19:44:40	49.1154	-123.0824	1.47	13.71
	2016/03/10 21:55:03	2016/03/10 22:05:46	49.1154	-123.0824	1.47	13.71
	2016/03/10 22:12:34	2016/03/10 22:19:09	49.1154	-123.0824	1.47	13.71
	2016/03/10 22:25:34	2016/03/10 22:32:24	49.1154	-123.0824	1.47	13.71
	2016/03/11 00:33:12	2016/03/11 00:41:44	49.1155	-123.0824	1.47	14.73
	2016/03/11 00:48:45	2016/03/11 00:54:46	49.1155	-123.0823	1.47	14.73
	2016/03/11 01:01:17	2016/03/11 01:06:54	49.1155	-123.0824	1.47	15.75
FR05-04	2016/03/09 18:40:19	2016/03/09 18:40:19	49.1168	-123.0835	1.47	13.71
	2016/03/09 20:45:53	2016/03/09 20:45:53	49.1168	-123.0835	1.47	12.69
	2016/03/09 23:39:21	2016/03/09 23:39:21	49.1177	-123.0830	1.47	13.71
FR06	2016/03/10 17:37:54	2016/03/10 17:44:13	49.1382	-123.0476	1.47	13.71
	2016/03/10 18:03:16	2016/03/10 18:08:32	49.1381	-123.0476	1.47	13.71
	2016/03/10 18:13:44	2016/03/10 18:19:00	49.1380	-123.0477	1.47	13.71
	2016/03/10 20:36:38	2016/03/10 20:44:15	49.1382	-123.0475	1.47	13.71
	2016/03/10 20:49:48	2016/03/10 20:55:29	49.1382	-123.0474	1.47	13.71

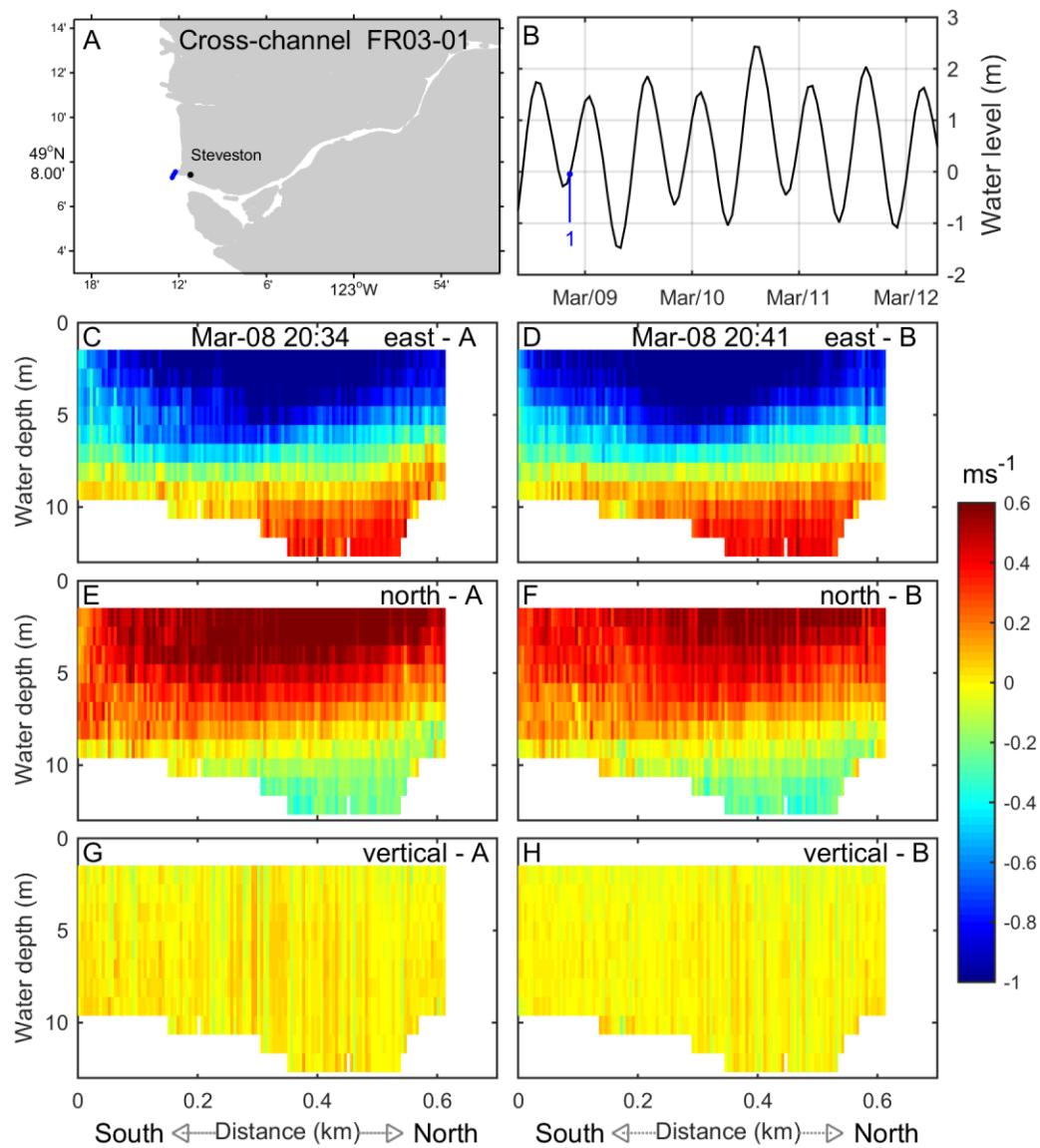
Line #	ADCP March					
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR06	2016/03/10 21:01:44	2016/03/10 21:07:11	49.1382	-123.0474	1.47	12.69
	2016/03/10 23:15:59	2016/03/10 23:20:56	49.1384	-123.0474	1.47	13.71
	2016/03/10 23:25:58	2016/03/10 23:30:32	49.1384	-123.0474	1.47	13.71
	2016/03/10 23:35:27	2016/03/10 23:40:15	49.1384	-123.0474	1.47	13.71
	2016/03/11 01:37:17	2016/03/11 01:41:57	49.1383	-123.0476	1.47	14.73
	2016/03/11 01:49:01	2016/03/11 01:55:45	49.1385	-123.0474	1.47	14.73
FR06-05	2016/03/10 18:25:30	2016/03/10 18:25:30	49.1402	-123.0526	1.47	12.69
	2016/03/10 21:30:11	2016/03/10 21:30:11	49.1409	-123.0503	1.47	12.69
	2016/03/11 00:01:41	2016/03/11 00:01:41	49.1409	-123.0507	1.47	16.77
FR07	2016/03/22 17:13:59	2016/03/22 17:19:39	49.1551	-122.9681	1.47	14.73
	2016/03/22 21:22:35	2016/03/22 21:26:48	49.1552	-122.9682	1.47	13.71
	2016/03/22 23:53:17	2016/03/22 23:58:09	49.1552	-122.9679	1.47	15.75
FR07a	2016/03/22 16:35:33	2016/03/22 16:41:31	49.1560	-122.9447	1.47	27.99
	2016/03/22 18:47:59	2016/03/22 18:53:49	49.1561	-122.9446	1.47	27.99
	2016/03/22 18:59:29	2016/03/22 19:05:10	49.1560	-122.9446	1.47	27.99
	2016/03/22 20:00:35	2016/03/22 20:06:27	49.1561	-122.9447	1.47	27.99
	2016/03/22 20:43:25	2016/03/22 20:49:03	49.1561	-122.9448	1.47	27.99
	2016/03/22 21:47:25	2016/03/22 21:53:05	49.1560	-122.9448	1.47	27.99
	2016/03/22 21:58:50	2016/03/22 22:03:58	49.1560	-122.9447	1.47	27.99
	2016/03/22 22:33:57	2016/03/22 22:39:42	49.1561	-122.9448	1.47	27.99
	2016/03/22 23:17:04	2016/03/22 23:23:22	49.1560	-122.9448	1.47	27.99
FR07a-07	2016/03/22 16:54:53	2016/03/22 16:54:53	49.1578	-122.9459	1.47	19.83
	2016/03/22 21:04:37	2016/03/22 21:04:37	49.1581	-122.9453	1.47	21.87
	2016/03/22 23:31:23	2016/03/22 23:31:23	49.1584	-122.9456	1.47	14.73
FR07a _deephole	2016/03/22 20:20:56	2016/03/22 20:20:56	49.1617	-122.9396	1.47	23.91
	2016/03/22 22:16:48	2016/03/22 22:16:48	49.1623	-122.9388	1.47	21.87
FR07b	2016/03/22 22:51:24	2016/03/22 22:58:02	49.1574	-122.9432	1.47	12.69
FR08	2016/03/23 16:21:07	2016/03/23 16:27:05	49.1845	-122.9153	1.47	15.75
	2016/03/23 17:29:33	2016/03/23 17:36:17	49.1844	-122.9155	1.47	15.75

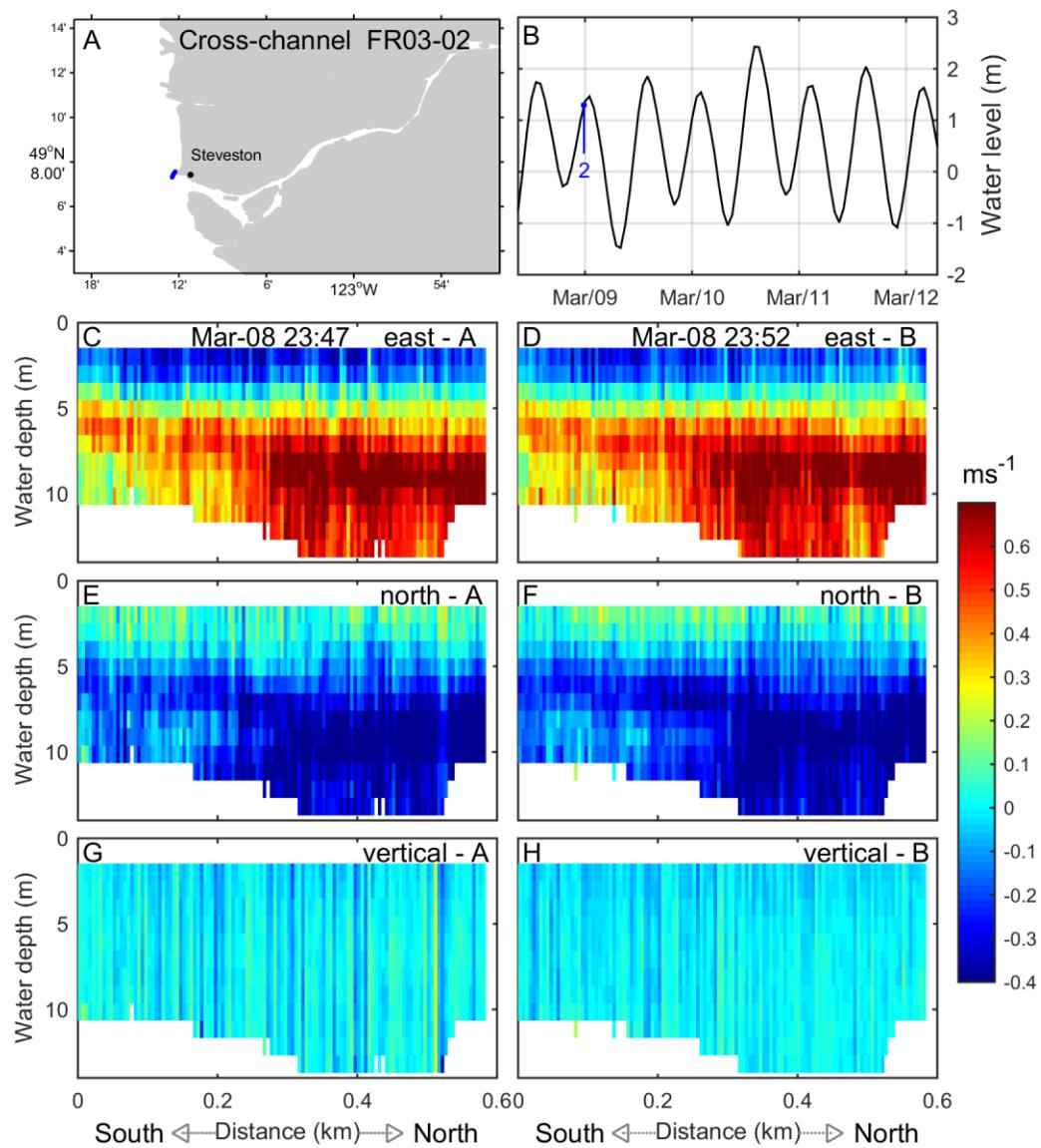
Line #	ADCP March					
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR08	2016/03/23 18:44:54	2016/03/23 18:49:51	49.1845	-122.9155	1.47	14.73
	2016/03/23 20:37:19	2016/03/23 20:42:27	49.1844	-122.9154	1.47	14.73
	2016/03/23 21:56:58	2016/03/23 22:02:27	49.1844	-122.9155	1.47	14.73
	2016/03/23 23:10:50	2016/03/23 23:16:34	49.1843	-122.9156	1.47	14.73
FR09	2016/03/22 00:07:04	2016/03/22 00:13:03	49.1936	-122.9117	1.47	14.73
	2016/03/23 15:52:21	2016/03/23 15:58:11	49.1936	-122.9117	1.47	14.73
	2016/03/23 16:51:43	2016/03/23 16:57:41	49.1936	-122.9117	1.47	13.71
	2016/03/23 17:03:15	2016/03/23 17:08:48	49.1936	-122.9117	1.47	13.71
	2016/03/23 17:56:10	2016/03/23 18:01:48	49.1936	-122.9117	1.47	13.71
	2016/03/23 18:07:30	2016/03/23 18:13:05	49.1936	-122.9117	1.47	13.71
	2016/03/23 18:18:27	2016/03/23 18:23:46	49.1936	-122.9118	1.47	13.71
	2016/03/23 20:08:57	2016/03/23 20:14:28	49.1936	-122.9117	1.47	12.69
	2016/03/23 21:08:16	2016/03/23 21:14:11	49.1936	-122.9117	1.47	12.69
	2016/03/23 21:19:37	2016/03/23 21:25:24	49.1937	-122.9117	1.47	12.69
	2016/03/23 21:31:16	2016/03/23 21:36:56	49.1937	-122.9117	1.47	12.69
	2016/03/23 22:26:23	2016/03/23 22:31:27	49.1936	-122.9118	1.47	12.69
	2016/03/23 22:36:43	2016/03/23 22:41:56	49.1936	-122.9117	1.47	12.69
	2016/03/23 22:47:08	2016/03/23 22:52:04	49.1936	-122.9117	1.47	12.69
FR09-08	2016/03/23 23:44:08	2016/03/23 23:49:42	49.1936	-122.9117	1.47	13.71
	2016/03/23 23:55:14	2016/03/24 00:00:38	49.1936	-122.9117	1.47	13.71
	2016/03/23 16:06:16	2016/03/23 16:06:16	49.1949	-122.9132	1.47	15.75
	2016/03/23 16:38:55	2016/03/23 16:38:55	49.1952	-122.9133	1.47	14.73
	2016/03/23 17:17:04	2016/03/23 17:17:04	49.1950	-122.9134	1.47	15.75
	2016/03/23 17:42:45	2016/03/23 17:42:45	49.1951	-122.9136	1.47	14.73
	2016/03/23 18:34:08	2016/03/23 18:34:08	49.1950	-122.9139	1.47	14.73
	2016/03/23 20:27:00	2016/03/23 20:27:00	49.1954	-122.9139	1.47	15.75
FR10	2016/03/23 21:46:25	2016/03/23 21:46:25	49.1952	-122.9136	1.47	14.73
	2016/03/23 22:59:34	2016/03/23 22:59:34	49.1949	-122.9136	1.47	15.75
	2016/03/24 16:05:23	2016/03/24 16:11:19	49.2098	-122.8877	1.47	15.75

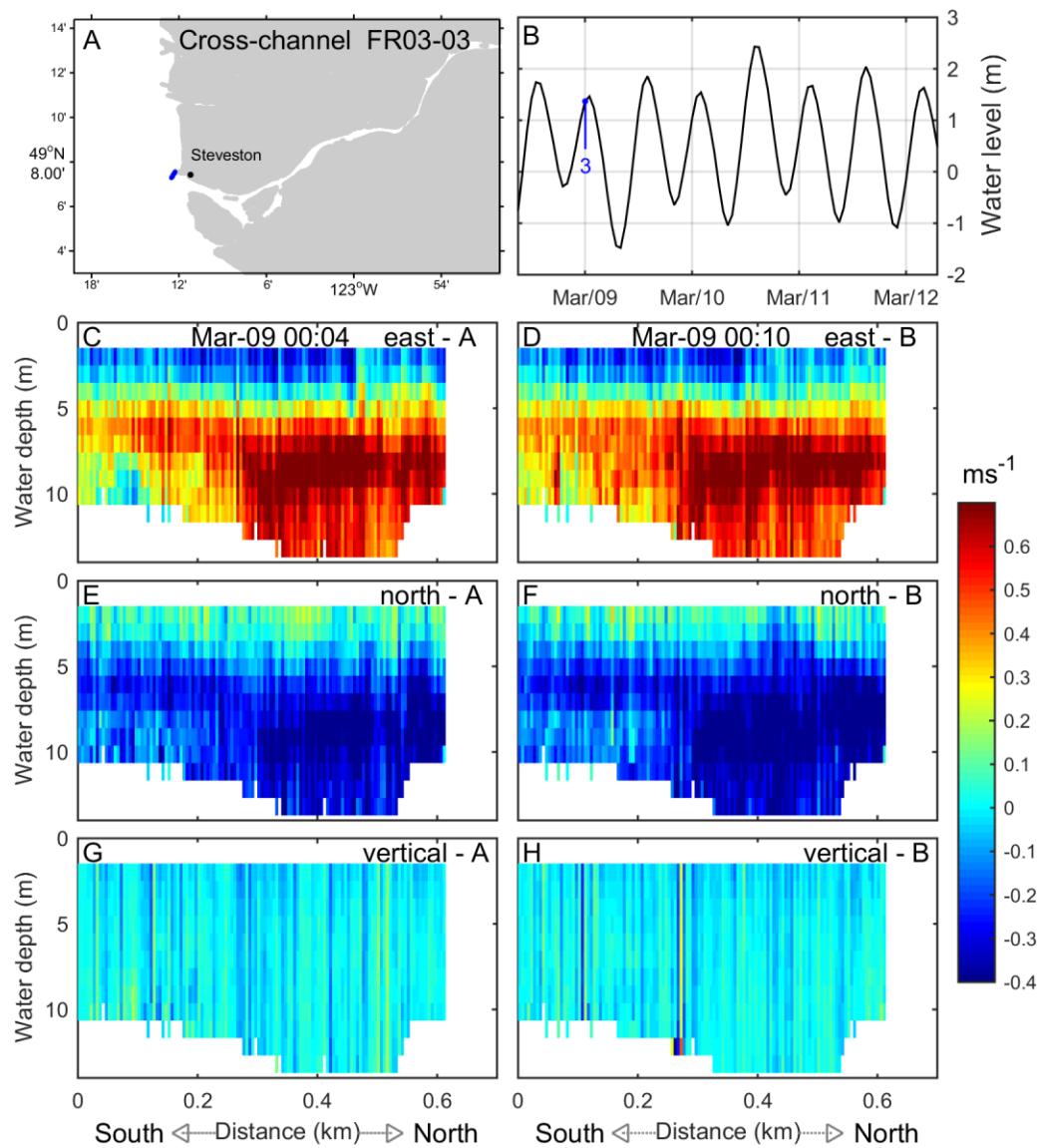
Line #	ADCP March					
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude ($^{\circ}$ N)	Start Longitude ($^{\circ}$ W)	Minimum Depth (m)	Maximum Depth (m)
FR10	2016/03/24 16:17:07	2016/03/24 16:22:42	49.2099	-122.8877	1.47	15.75
	2016/03/24 16:28:21	2016/03/24 16:34:09	49.2099	-122.8877	1.47	15.75
	2016/03/24 16:40:05	2016/03/24 16:45:28	49.2099	-122.8877	1.47	15.75
	2016/03/24 16:50:54	2016/03/24 16:56:17	49.2099	-122.8877	1.47	15.75
	2016/03/24 17:01:30	2016/03/24 17:07:13	49.2099	-122.8877	1.47	15.75
	2016/03/24 17:12:49	2016/03/24 17:18:34	49.2099	-122.8877	1.47	15.75
	2016/03/24 17:23:52	2016/03/24 17:29:44	49.2099	-122.8877	1.47	15.75
	2016/03/24 17:35:49	2016/03/24 17:41:47	49.2099	-122.8878	1.47	15.75
	2016/03/24 17:48:08	2016/03/24 17:53:47	49.2099	-122.8877	1.47	14.73
	2016/03/24 17:59:28	2016/03/24 18:05:08	49.2099	-122.8877	1.47	15.75
	2016/03/24 18:10:42	2016/03/24 18:16:39	49.2099	-122.8877	1.47	14.73
	2016/03/24 18:22:37	2016/03/24 18:28:08	49.2098	-122.8878	1.47	14.73
	2016/03/24 18:33:48	2016/03/24 18:39:39	49.2099	-122.8877	1.47	15.75
	2016/03/24 18:45:28	2016/03/24 18:51:16	49.2099	-122.8878	1.47	14.73
	2016/03/24 18:56:46	2016/03/24 19:02:15	49.2099	-122.8877	1.47	14.73
	2016/03/24 19:08:02	2016/03/24 19:13:32	49.2099	-122.8878	1.47	14.73
	2016/03/24 19:19:10	2016/03/24 19:24:52	49.2099	-122.8878	1.47	14.73
FR10-09	2016/03/24 19:32:18	2016/03/24 19:32:18	49.2128	-122.8914	1.47	18.81

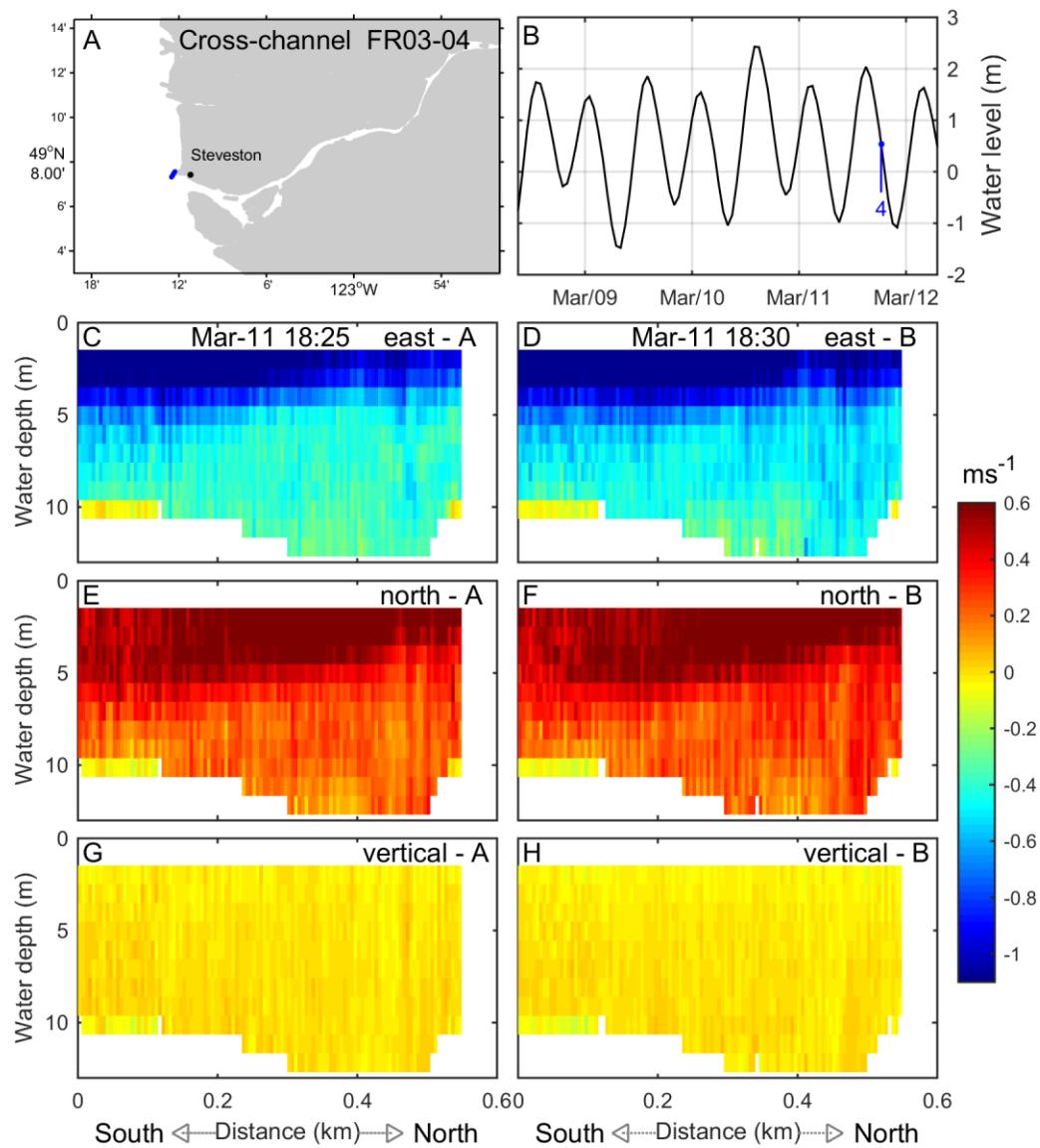
7.1.1 March Velocity Data for A and B Lines: Vertical Sections

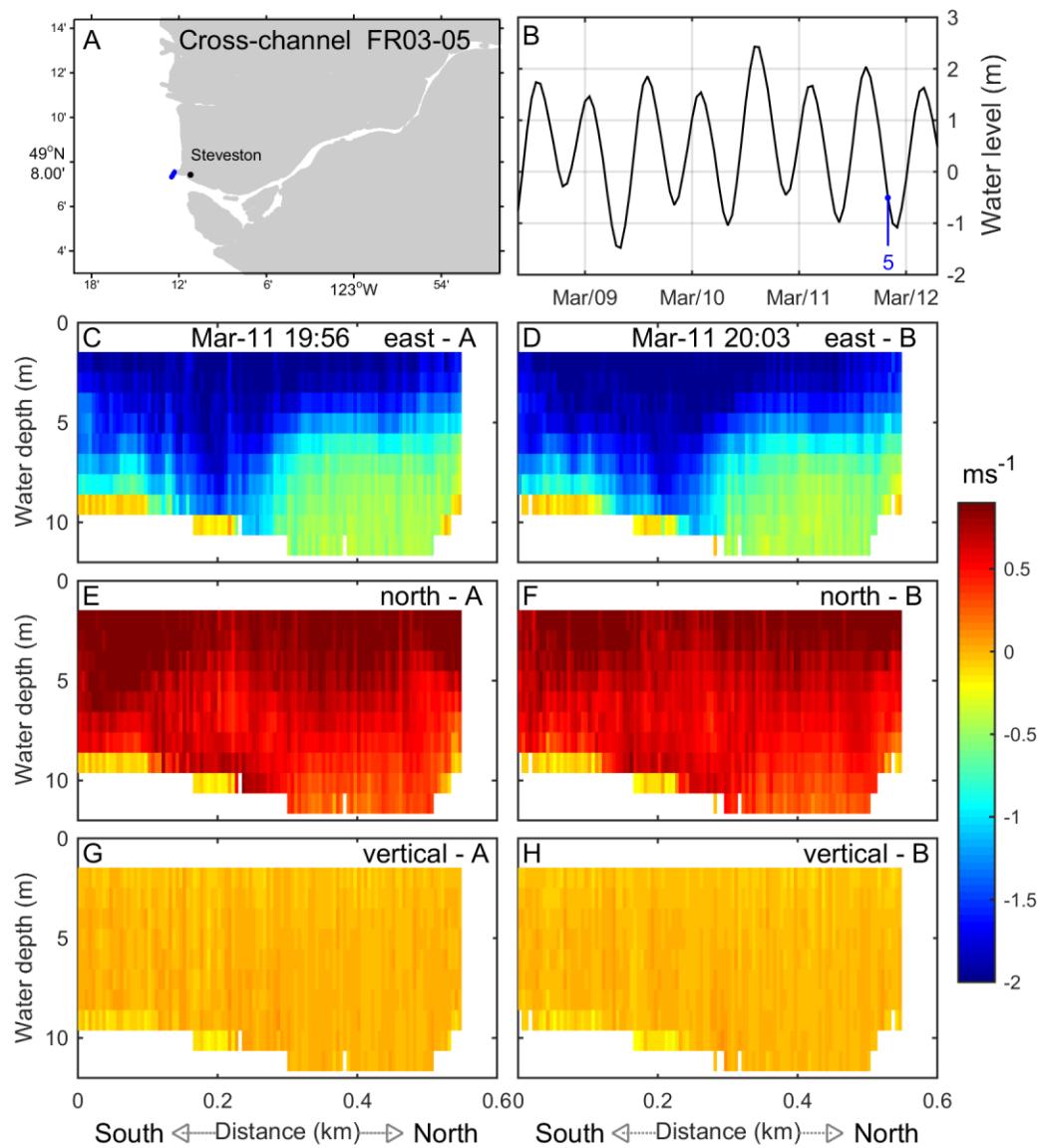
The following figures show March vertical sections of the east and north (u and v) horizontal velocity components and the vertical component for the A (left column) and B (right column) lines. The top row of each figure shows the position of the transect (A) and the time during the tidal cycle that the transect was sampled (B). The second row presents the east components (C and D), the third row presents the north components (E and F), and the bottom row presents the vertical components (G and H). The units are in ms^{-1} .

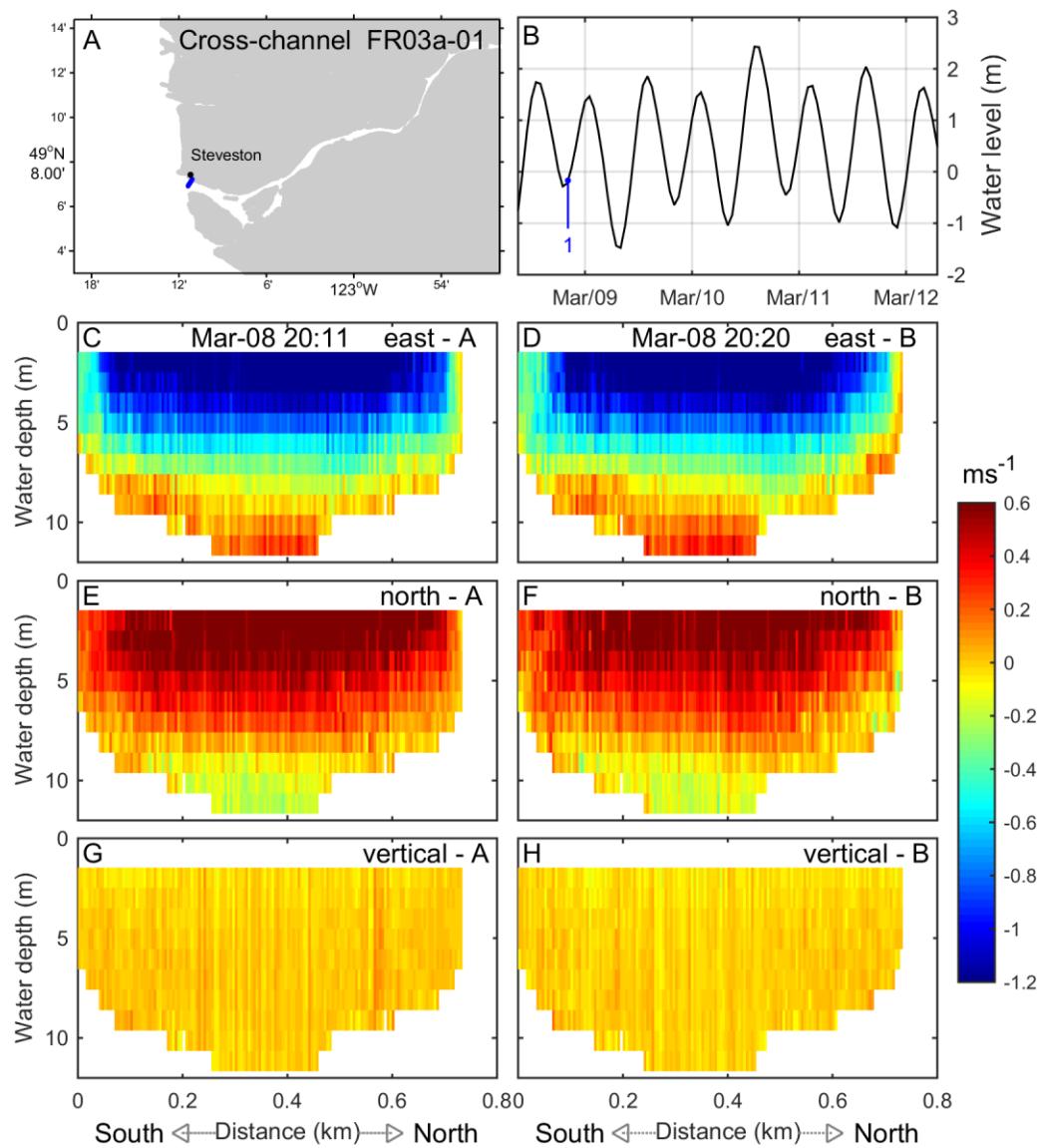


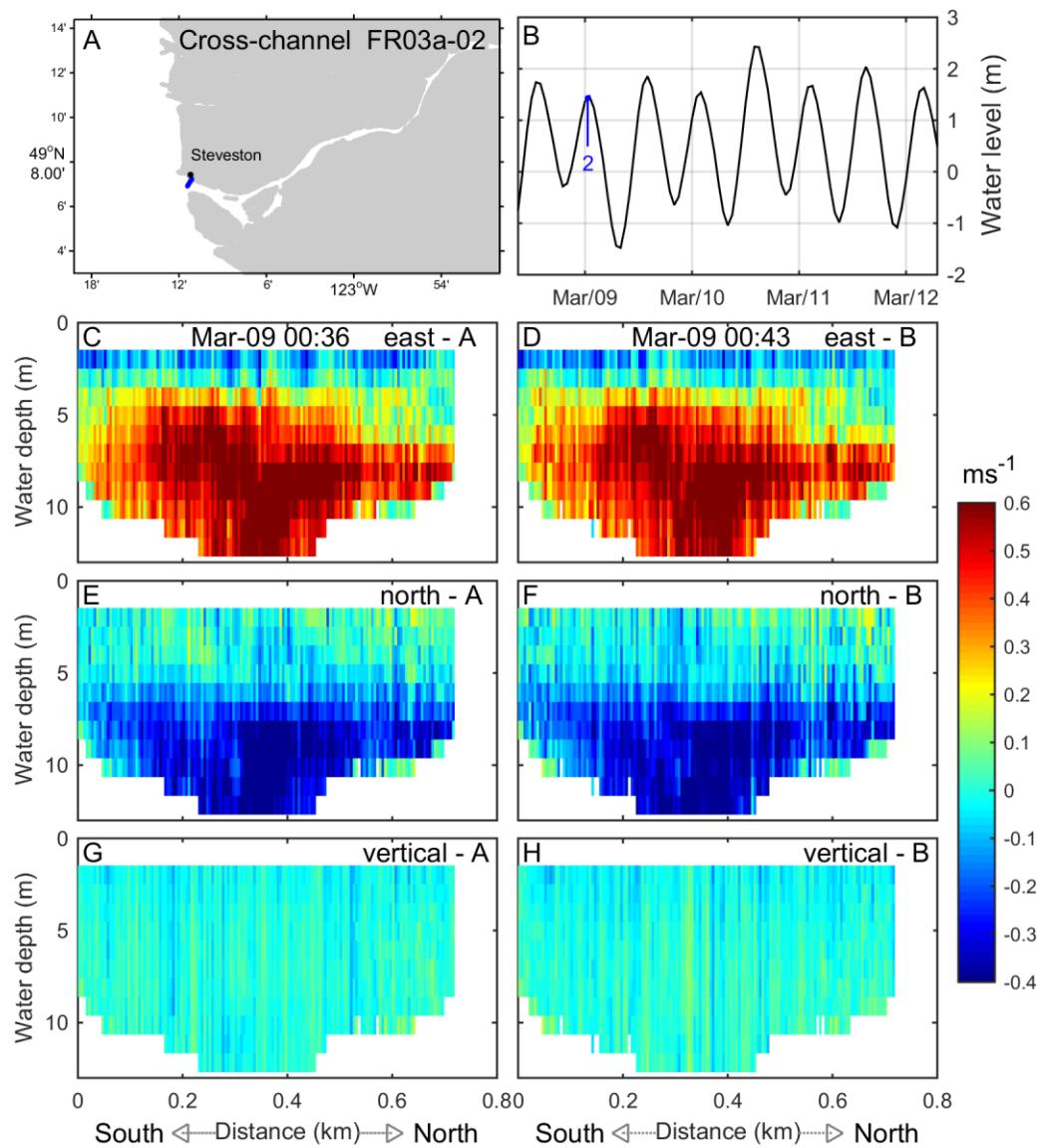


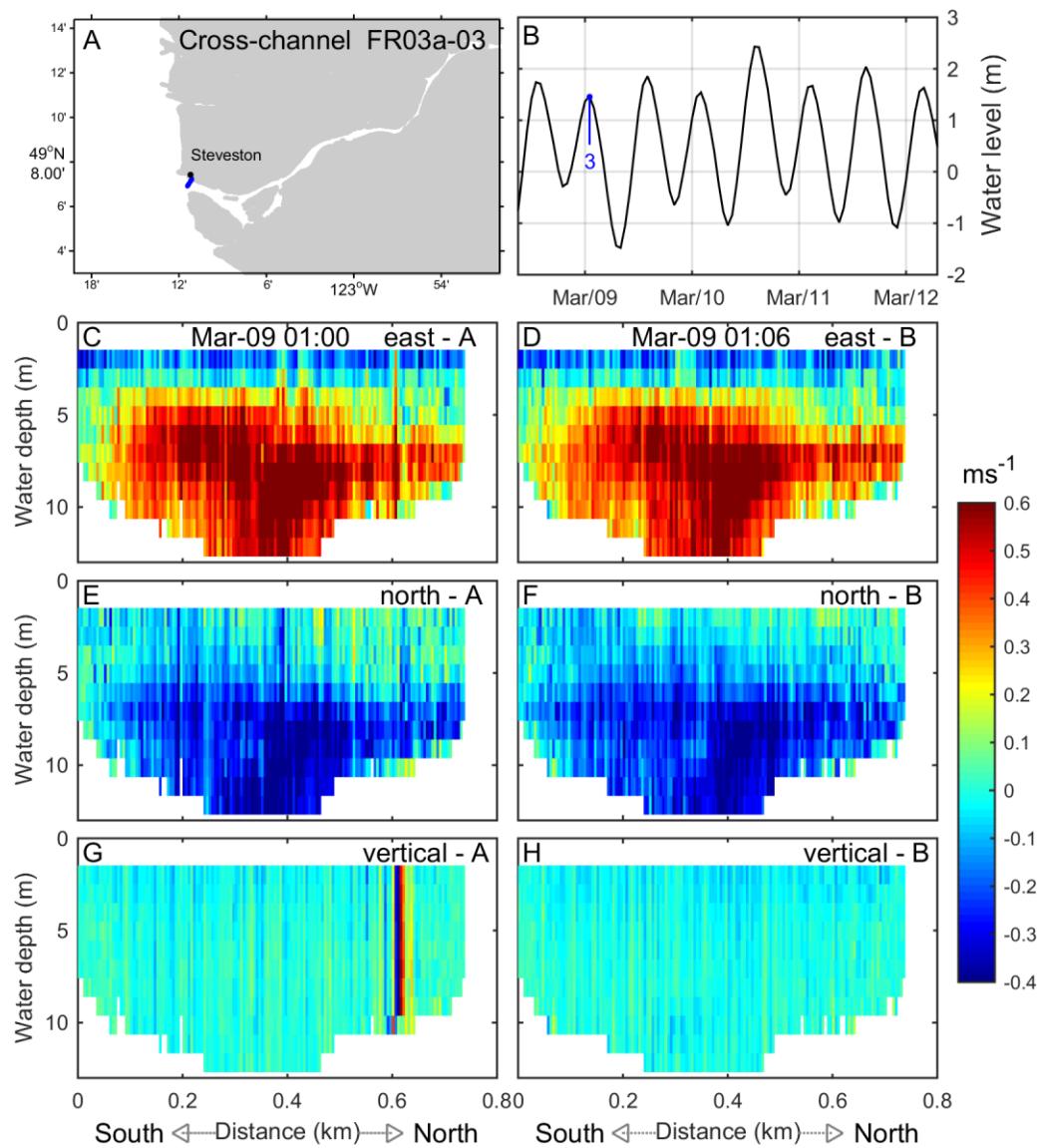


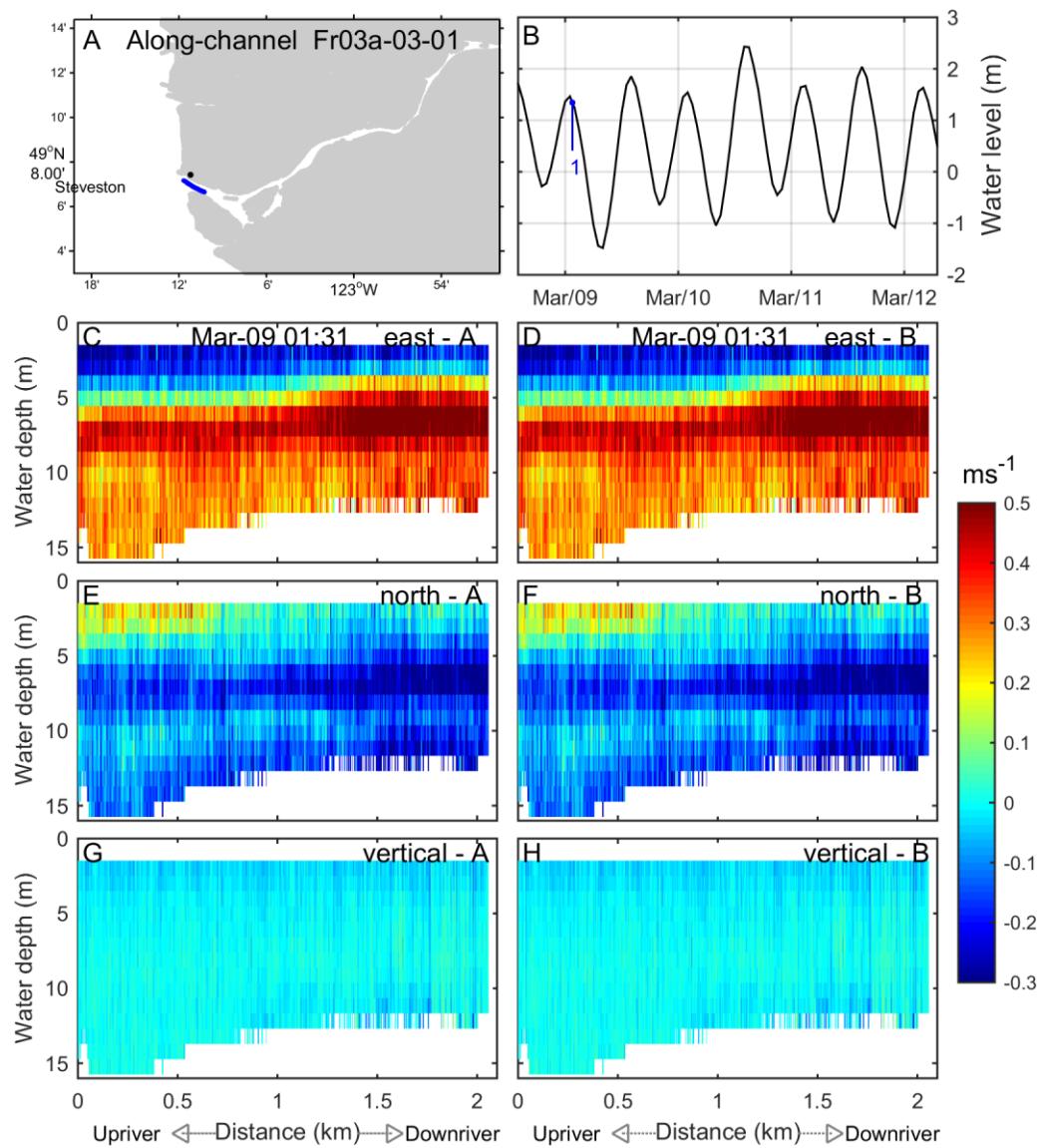


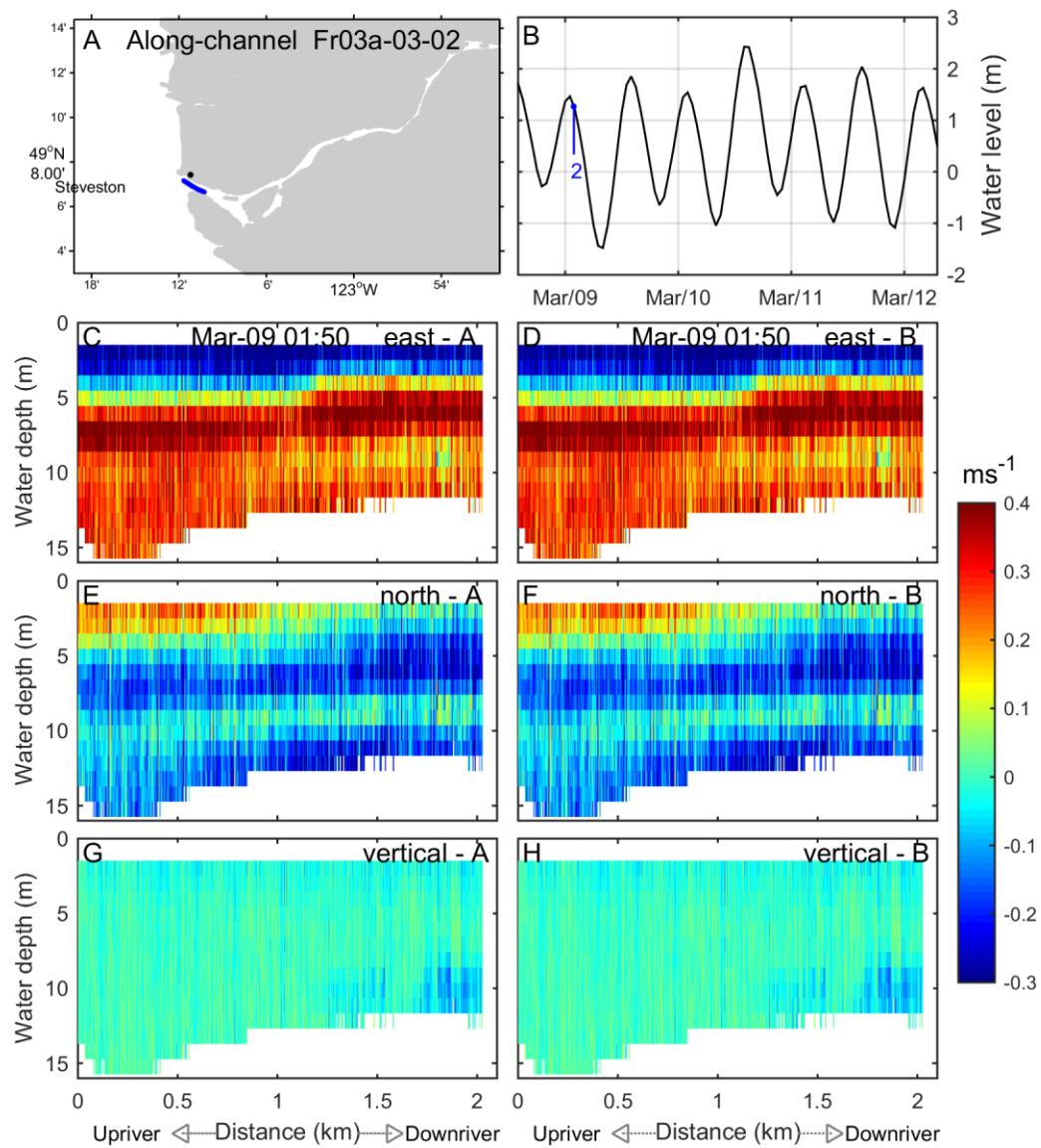


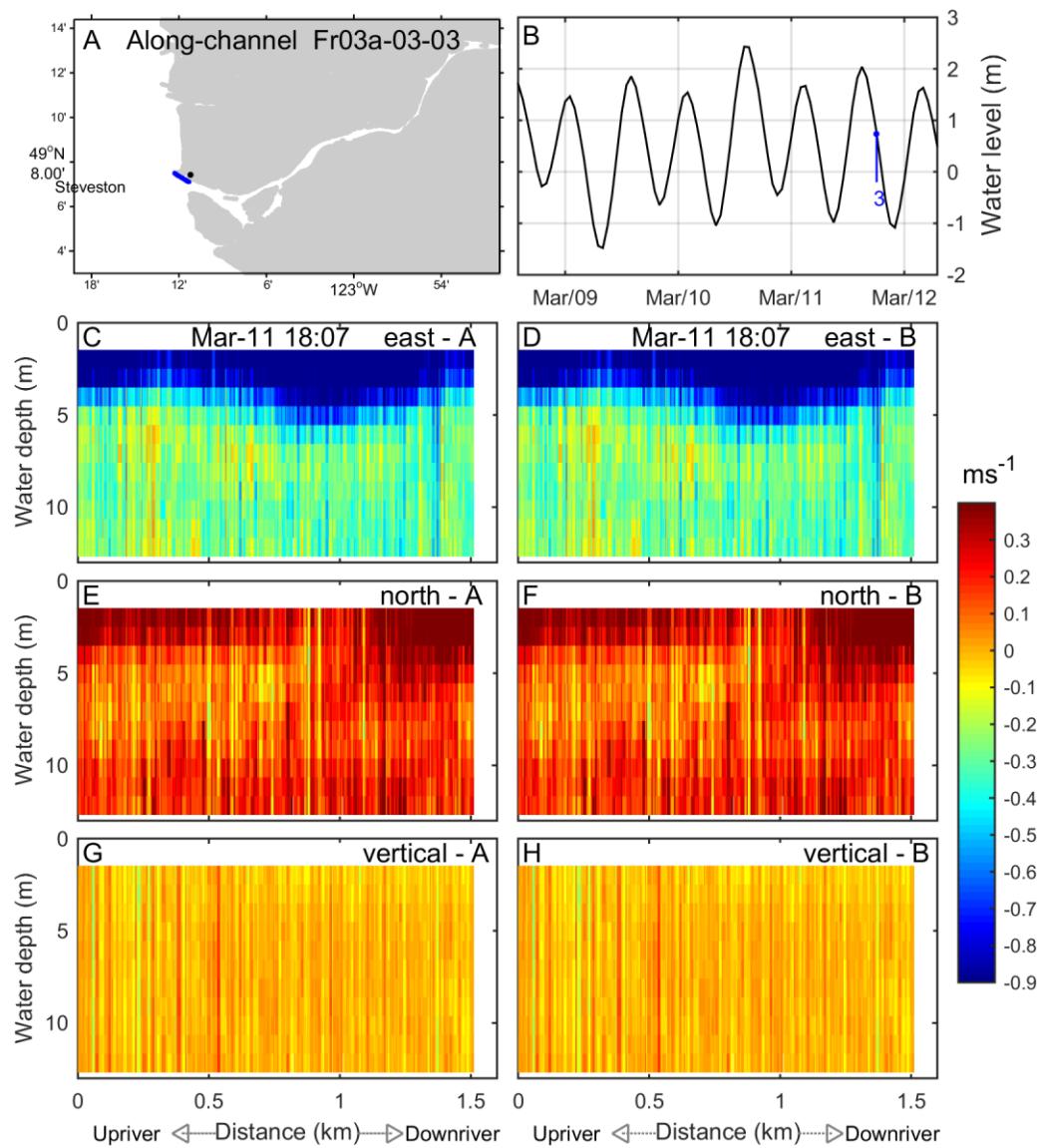


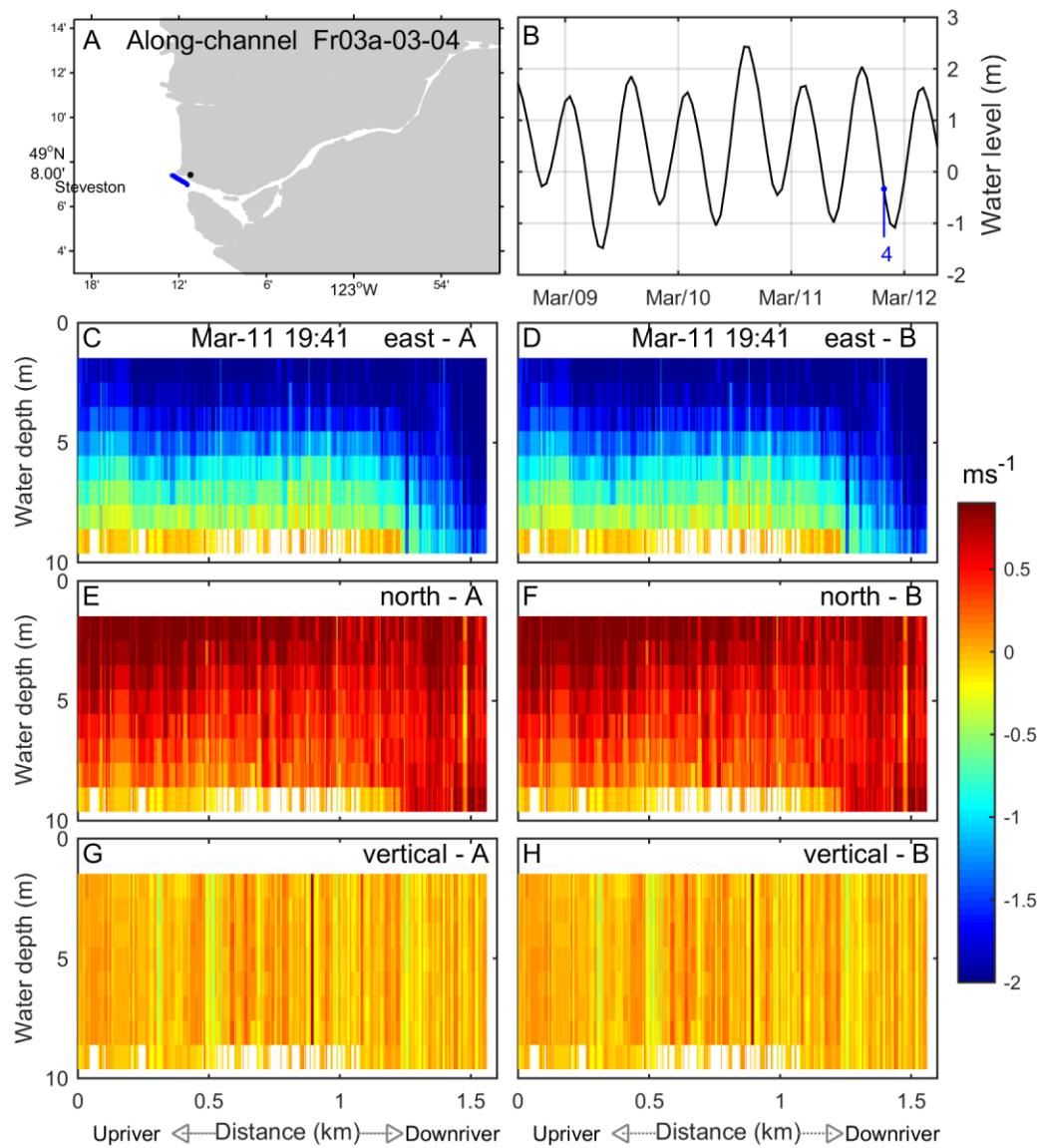


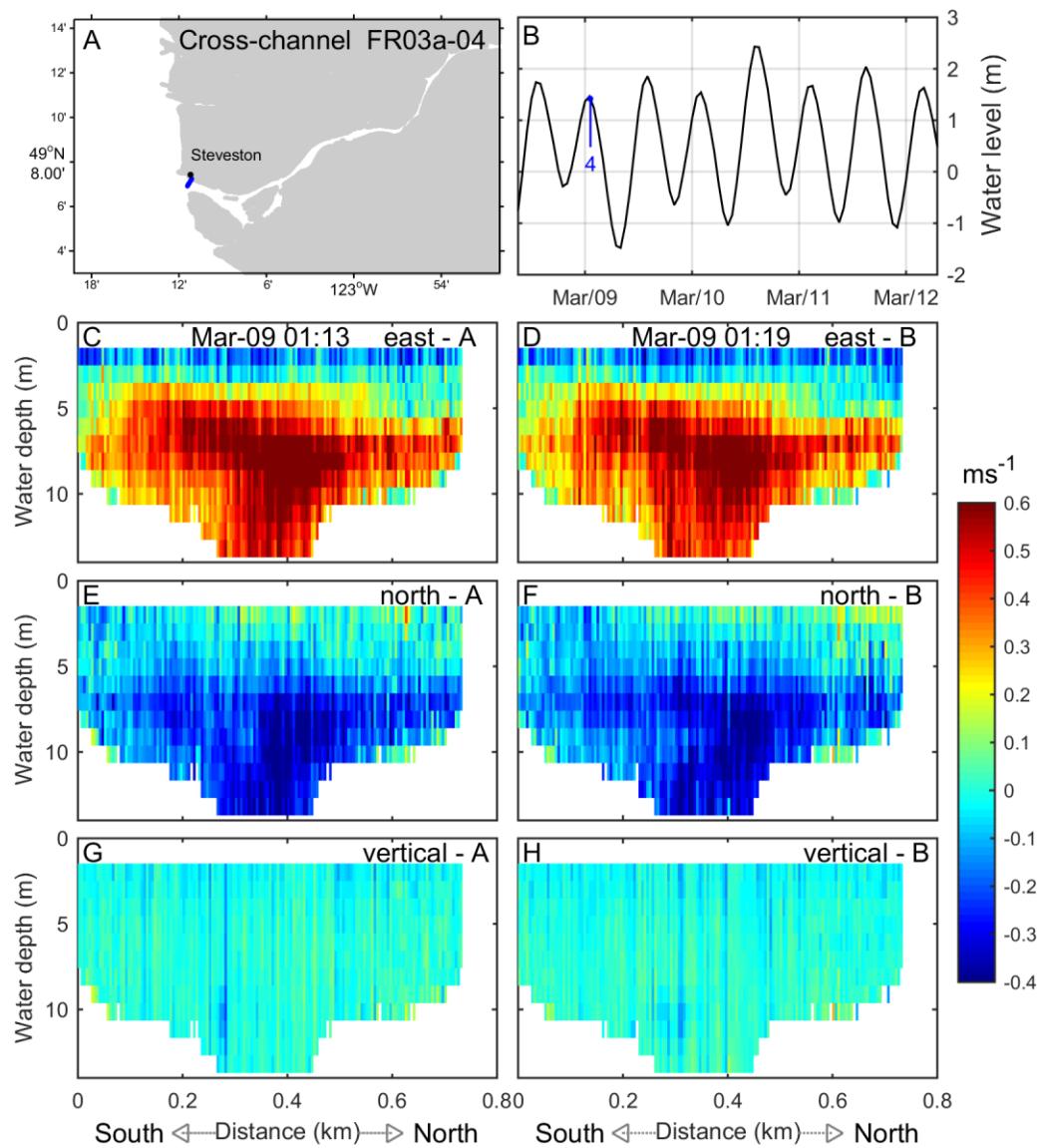


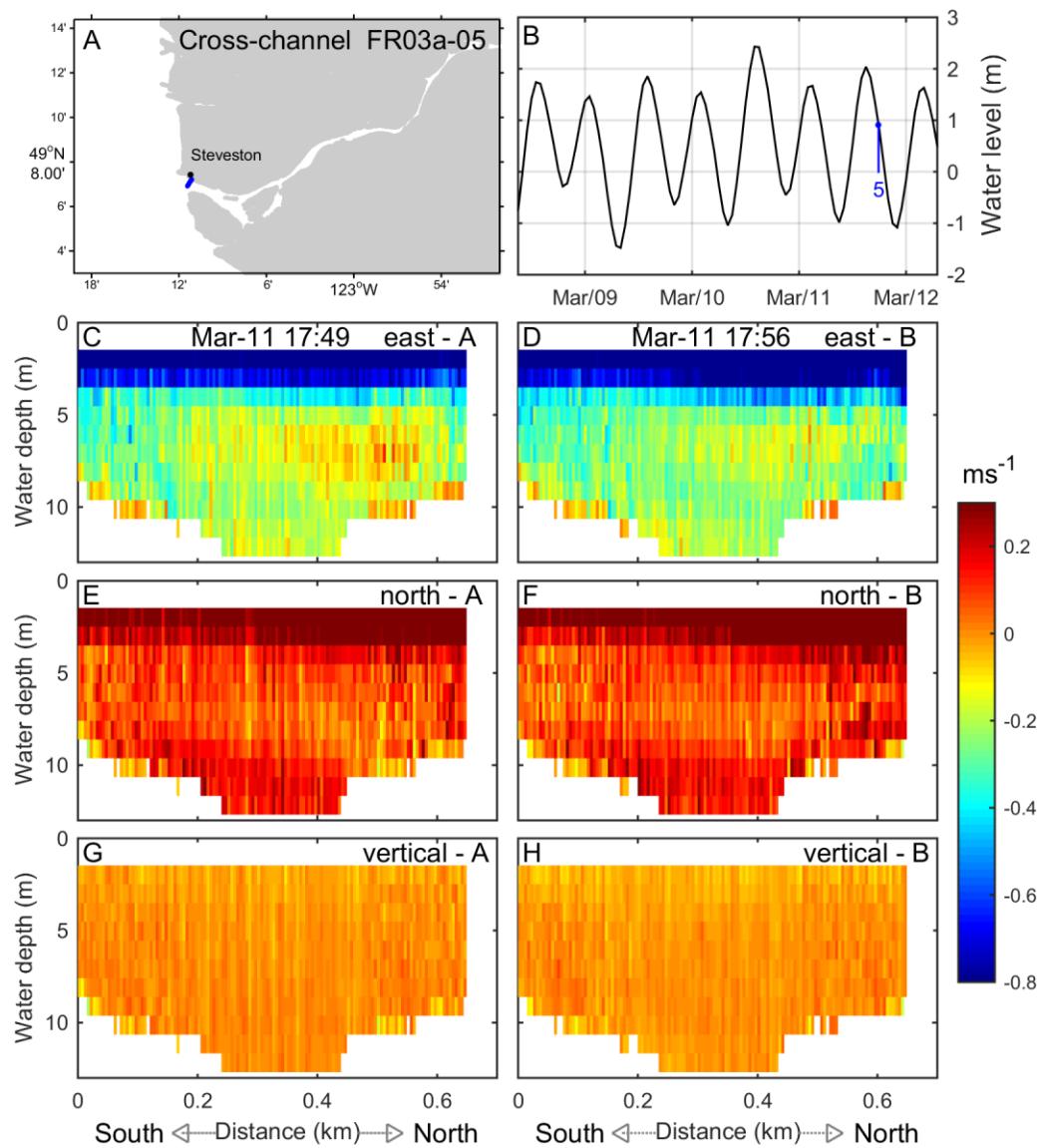


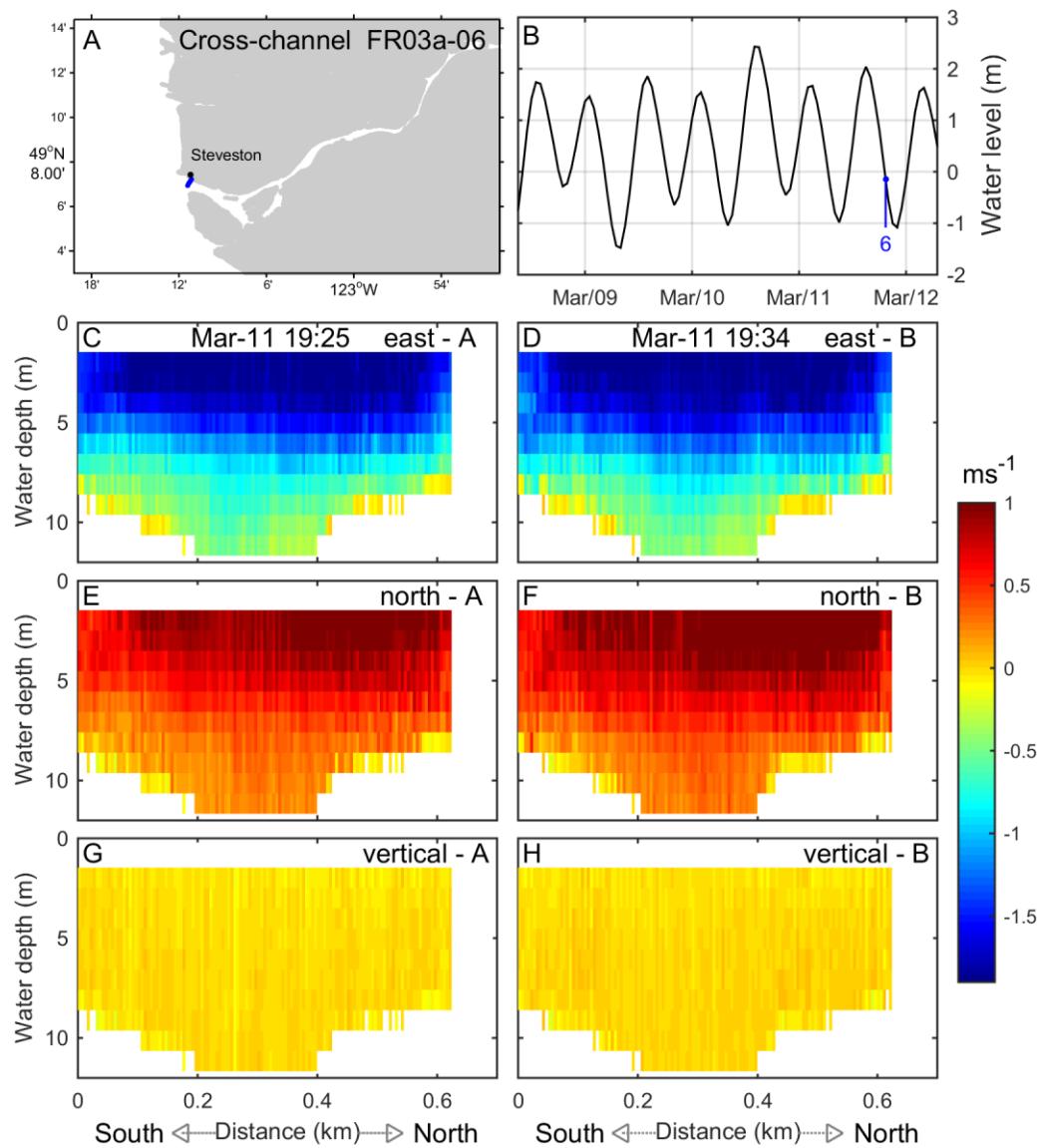


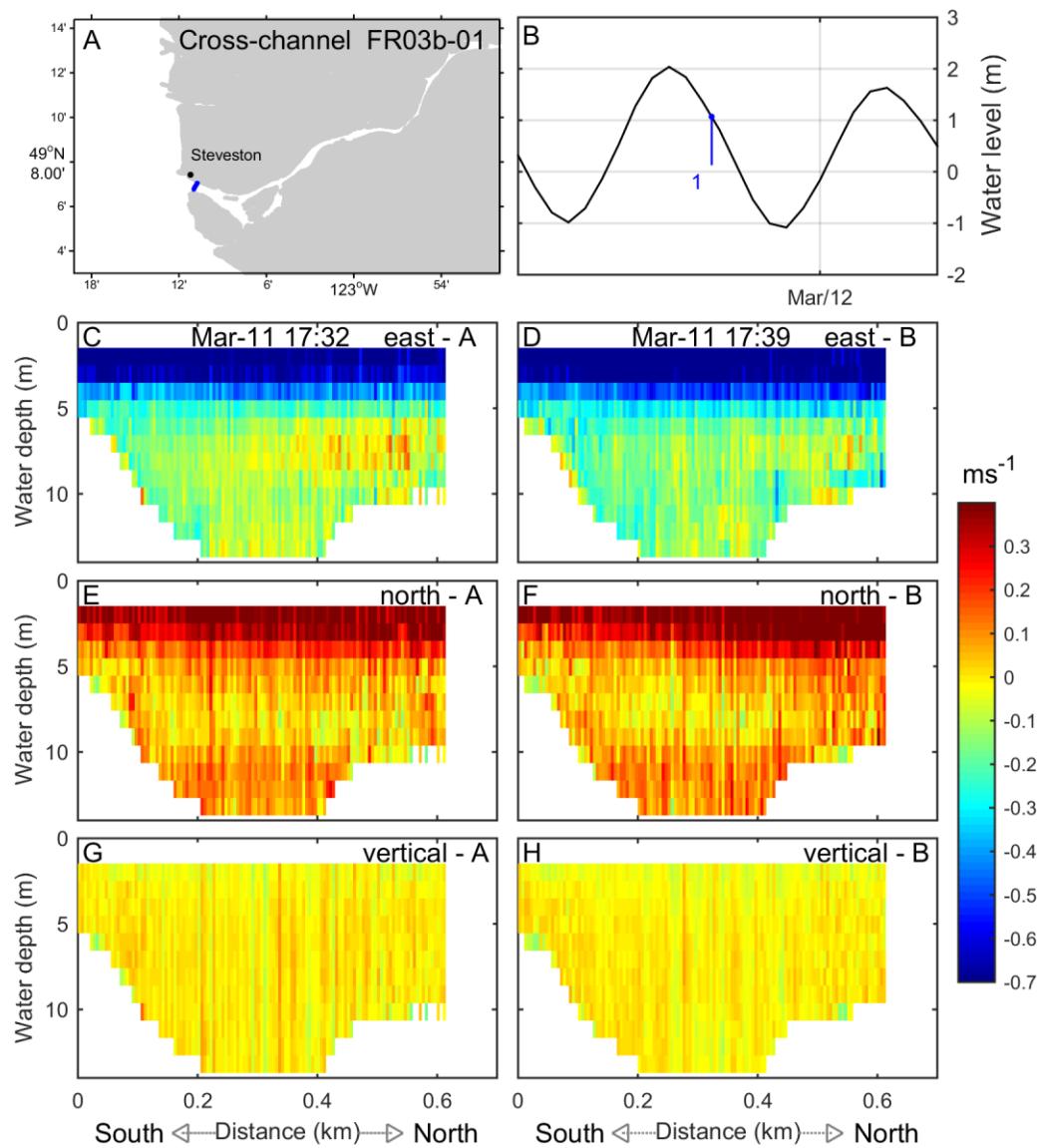


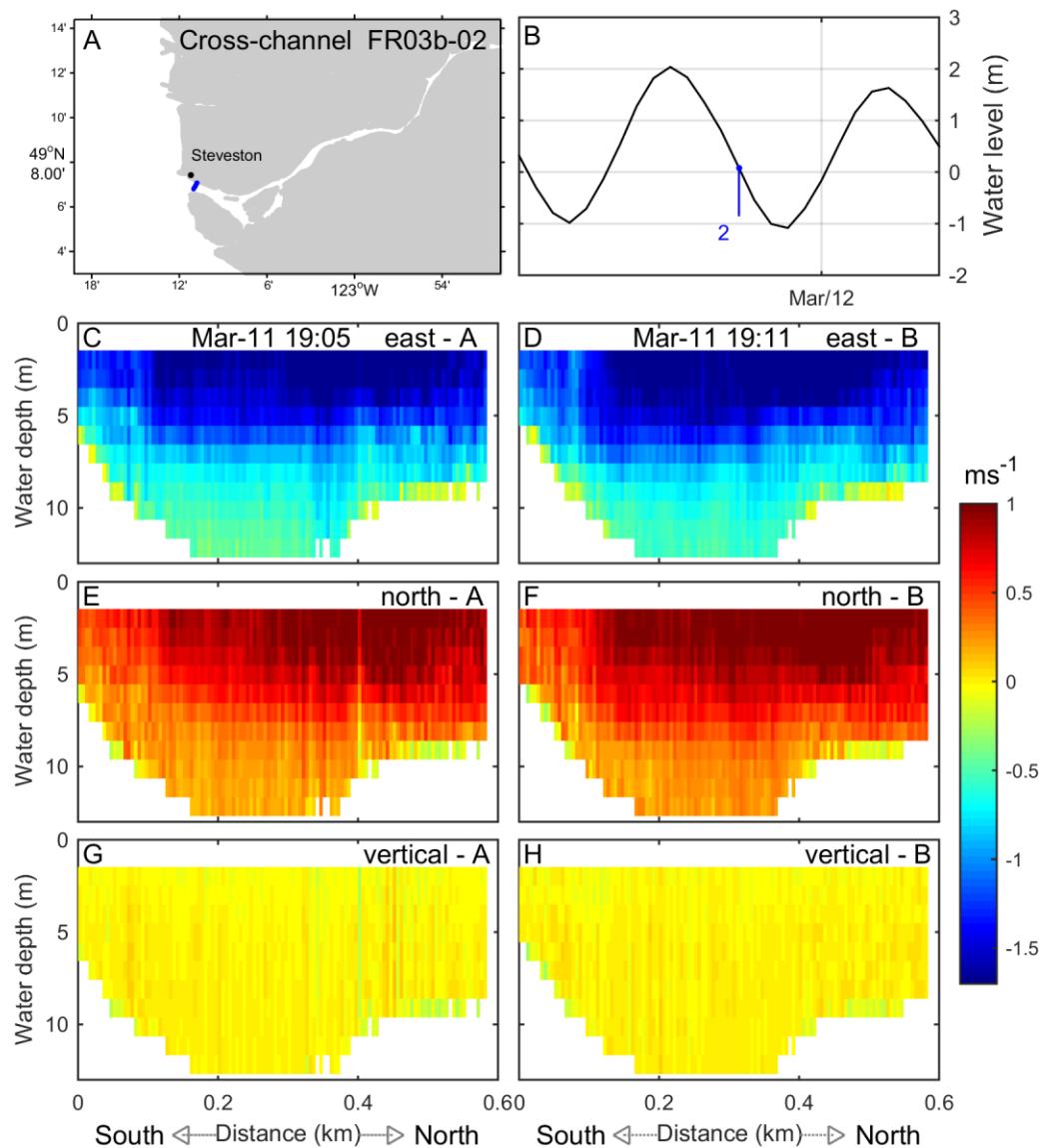


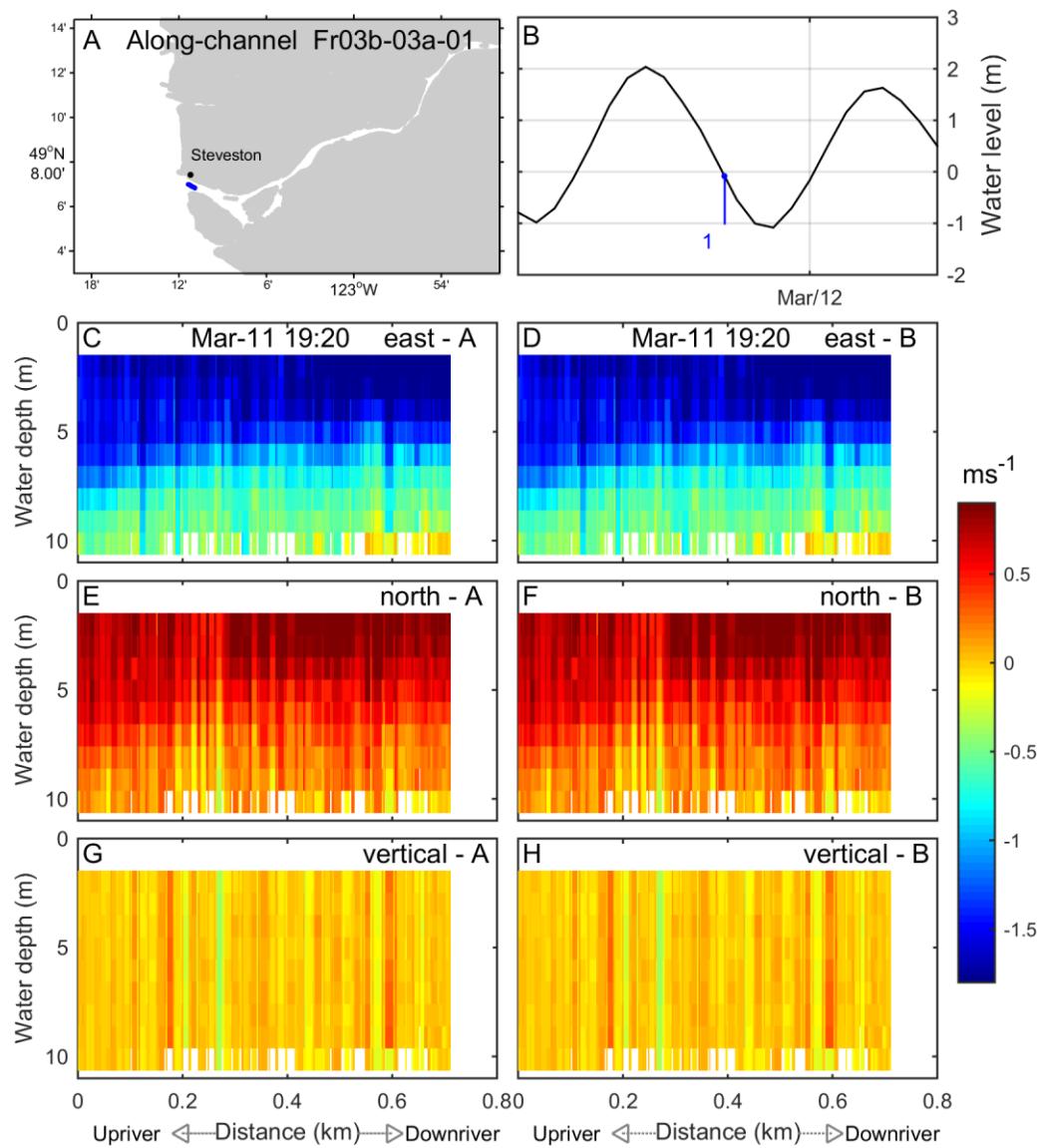


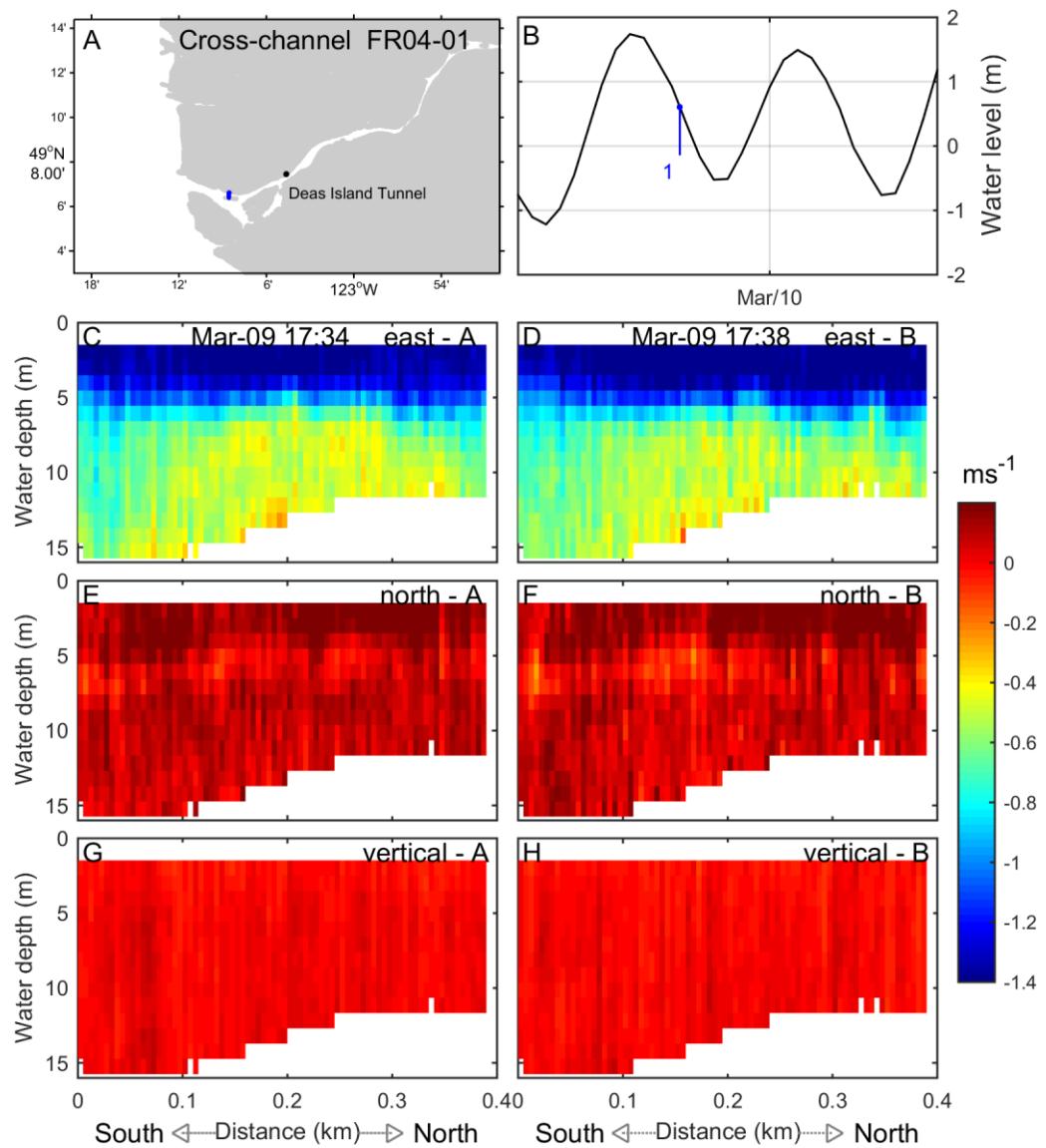


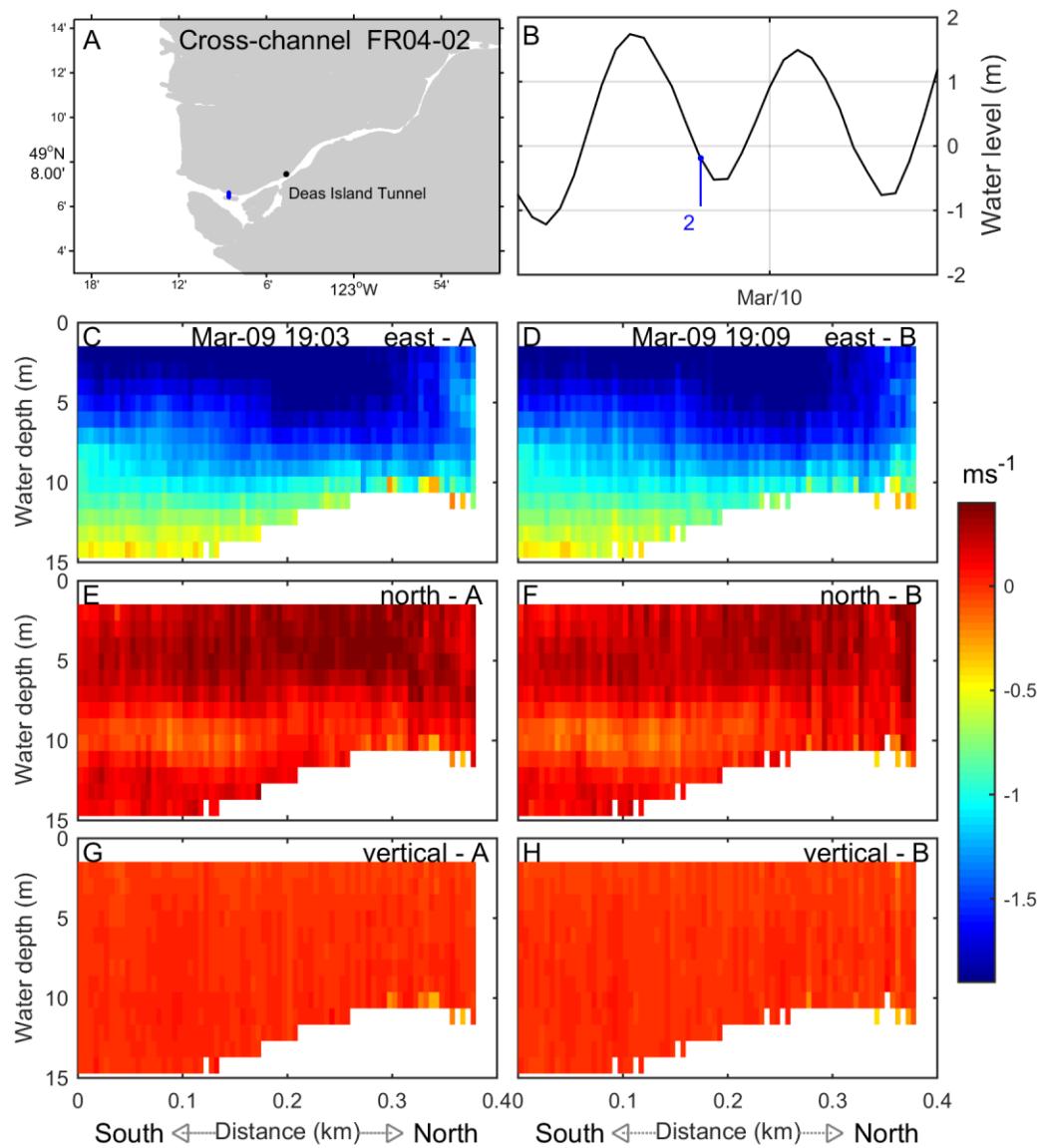


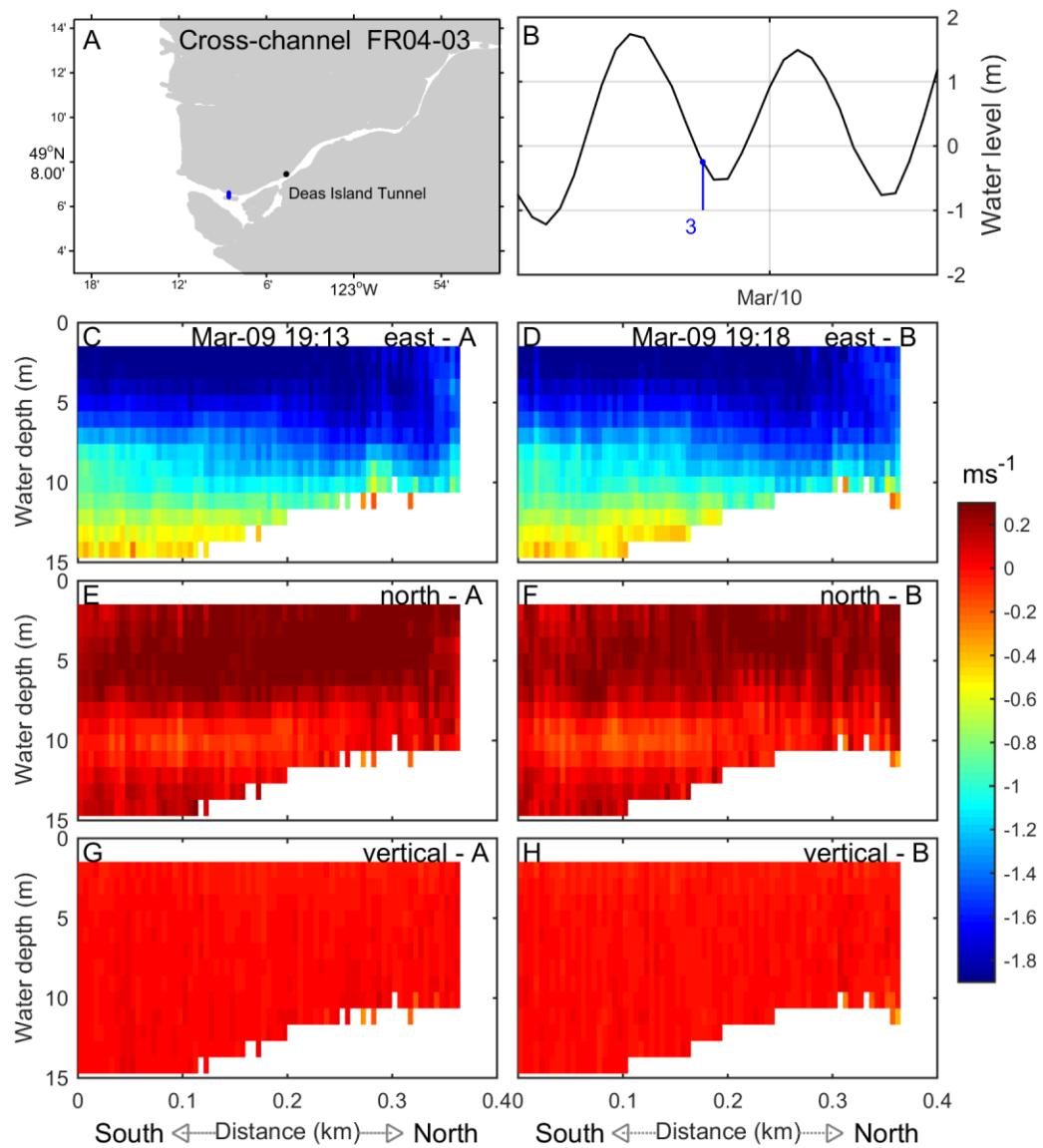


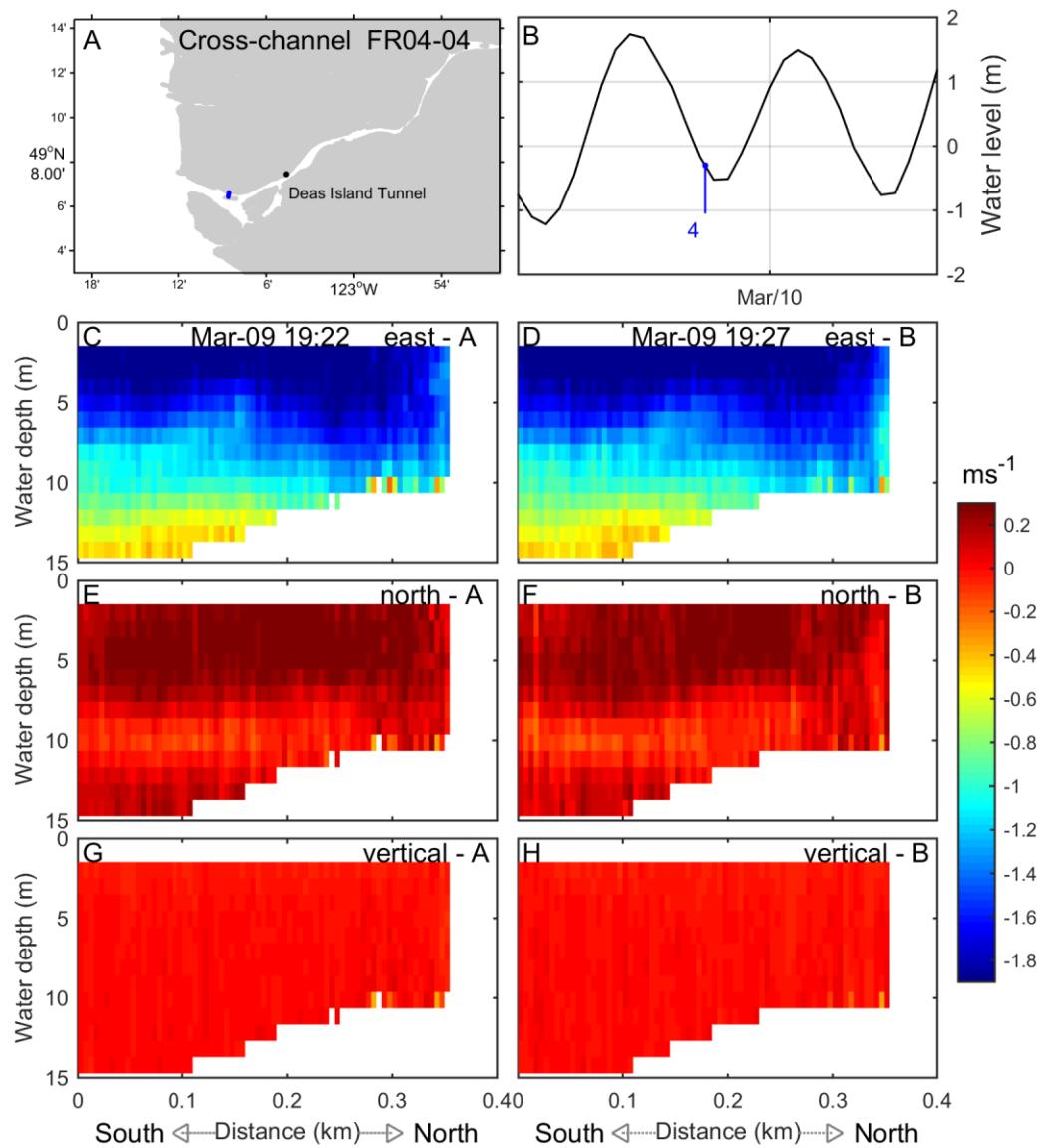


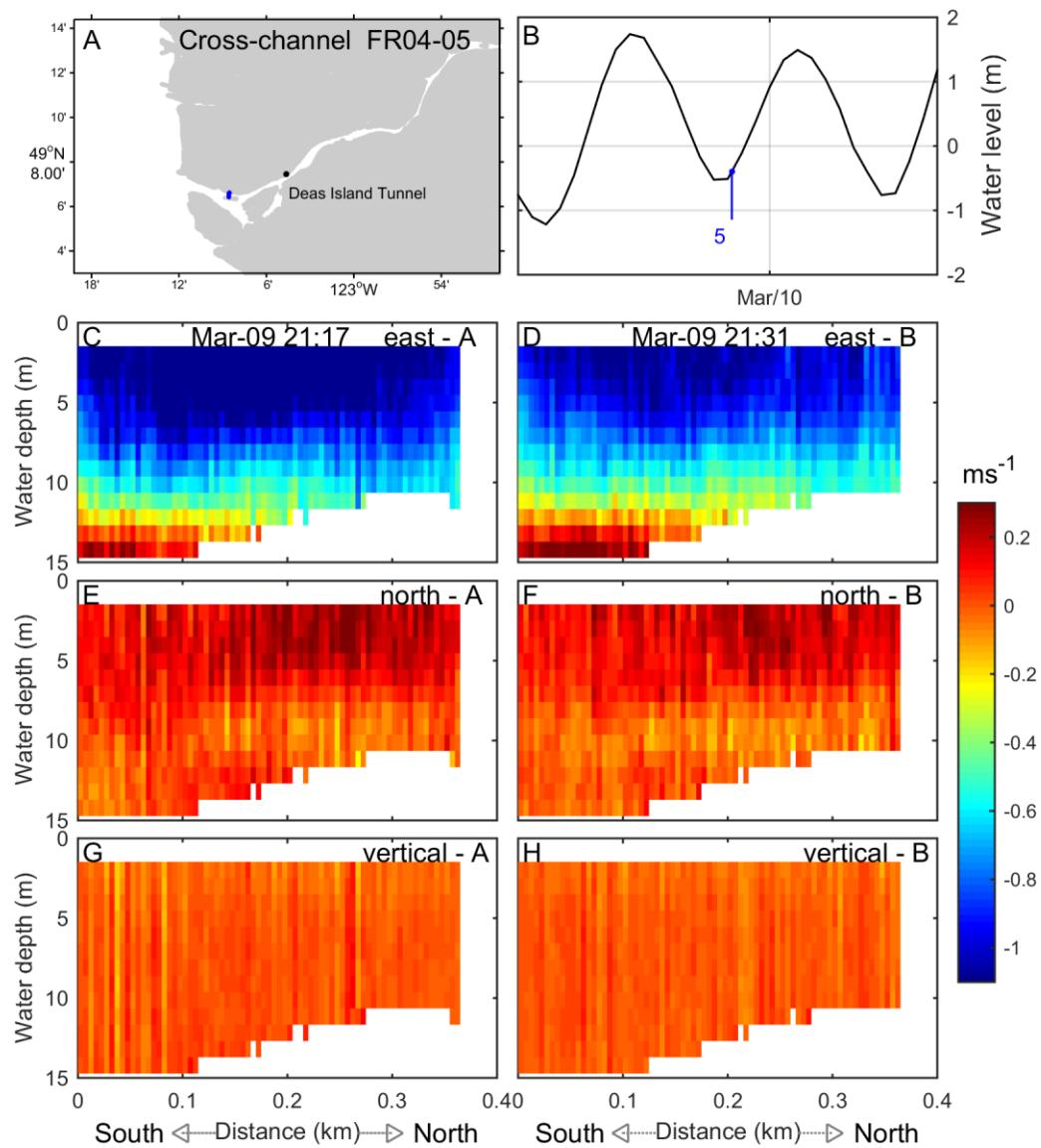


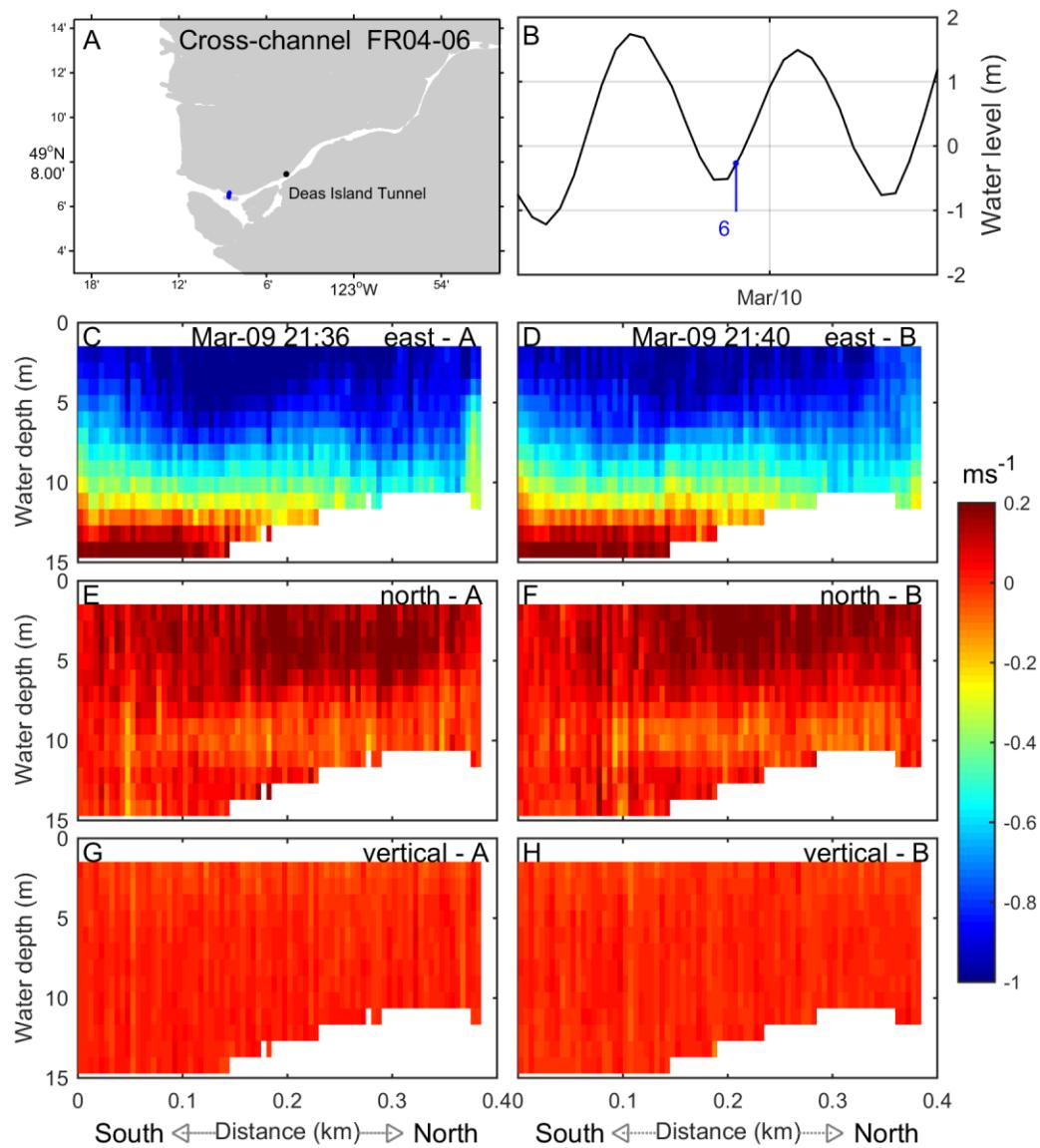


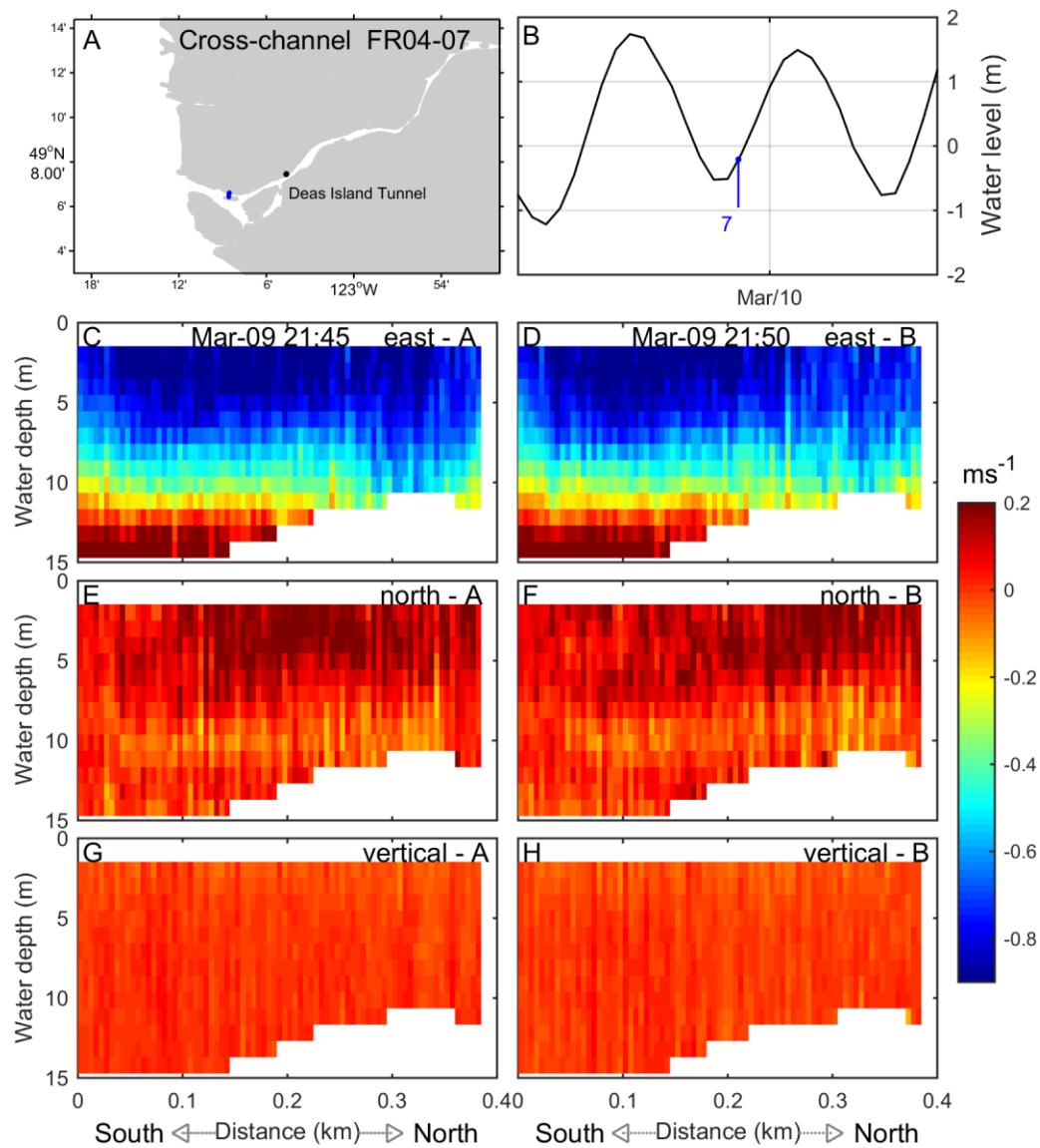


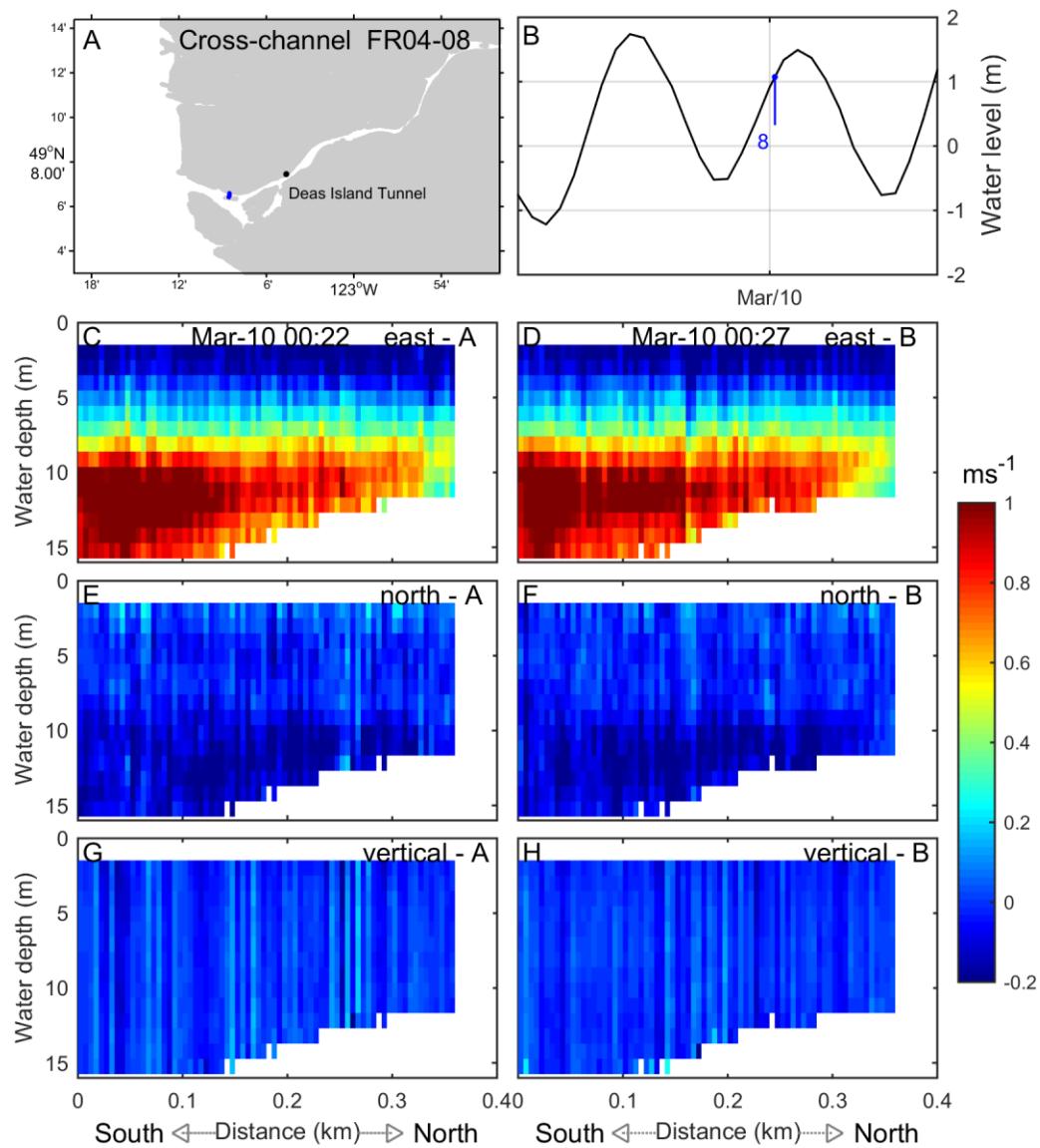


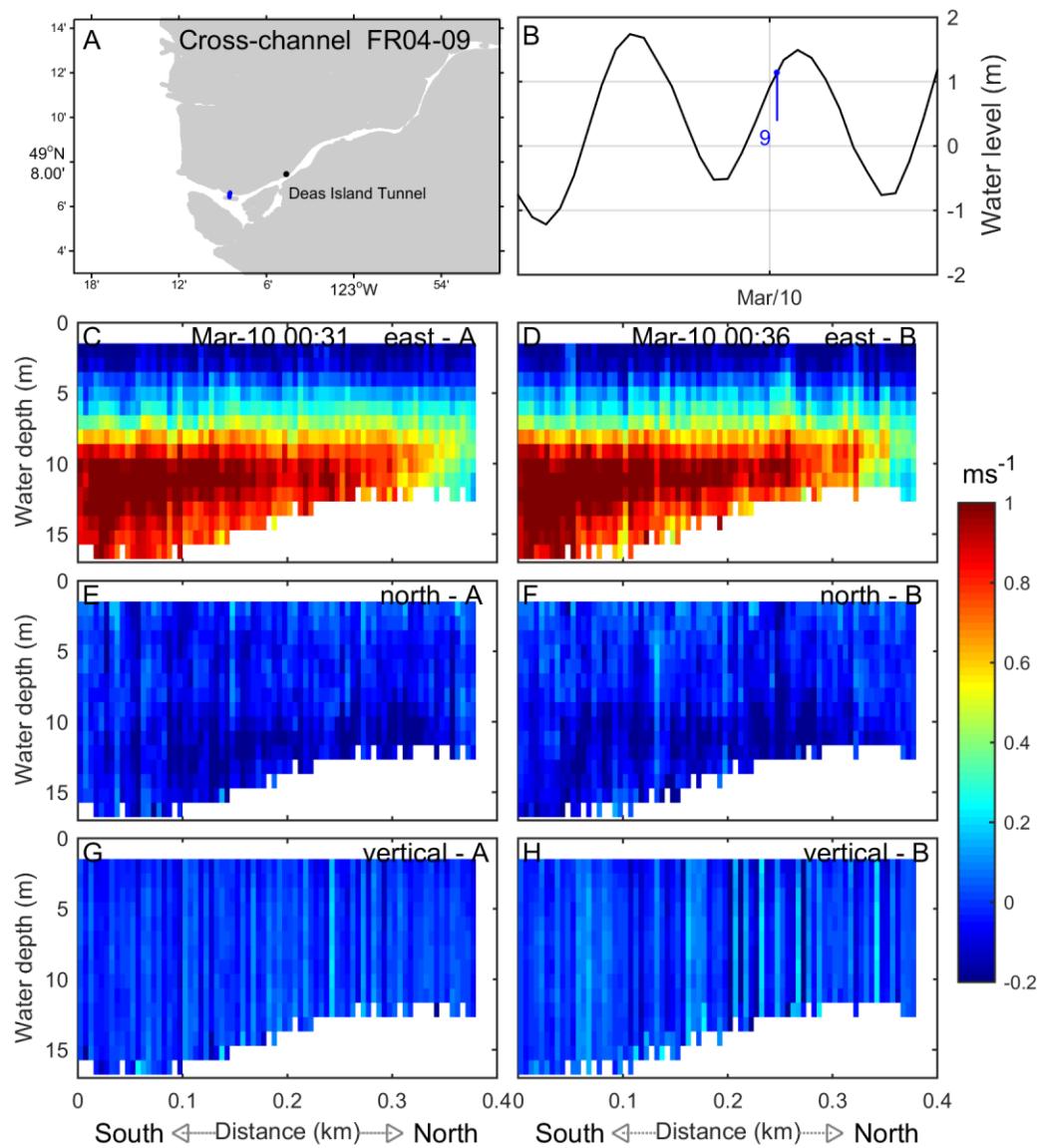


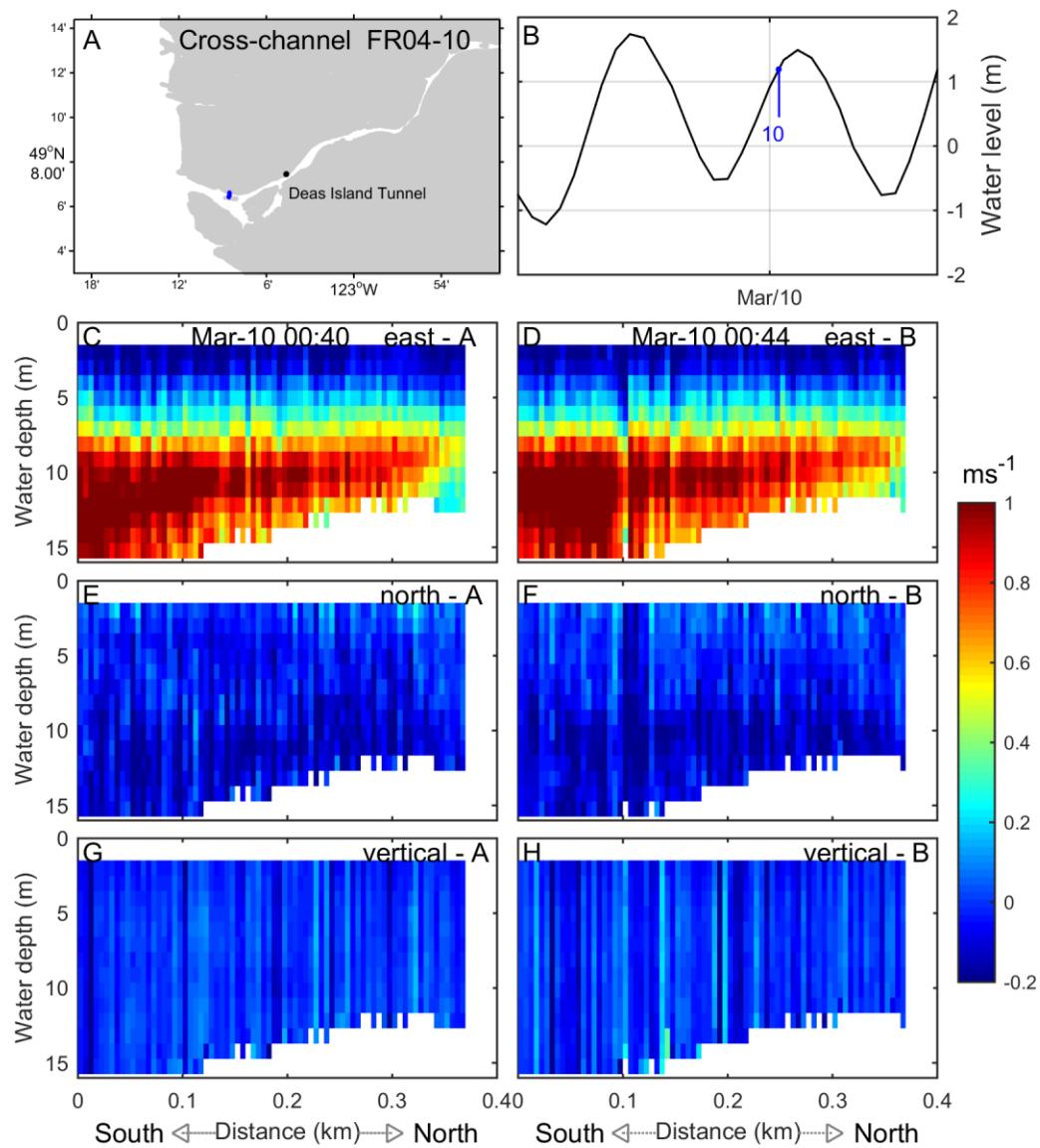


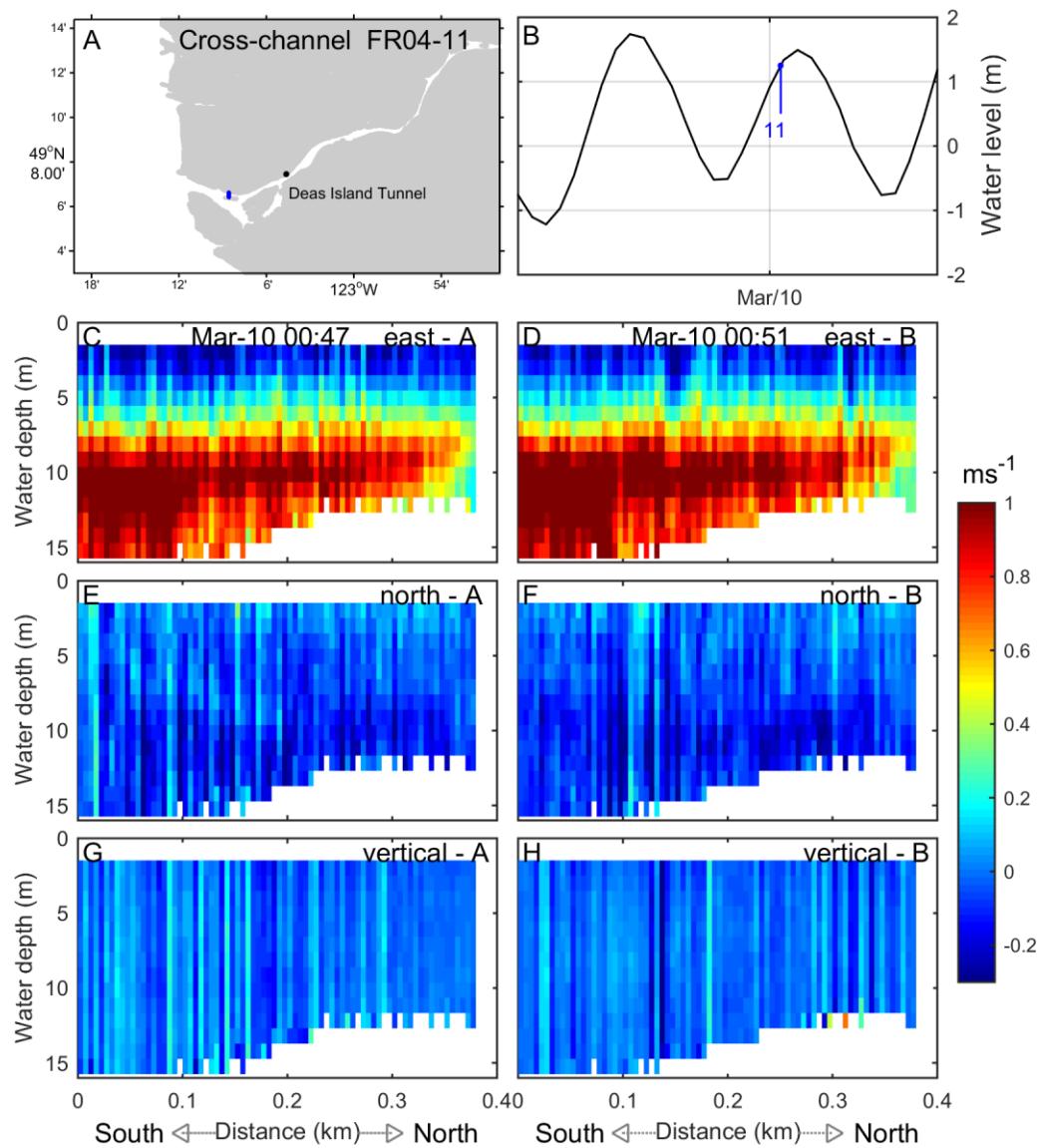


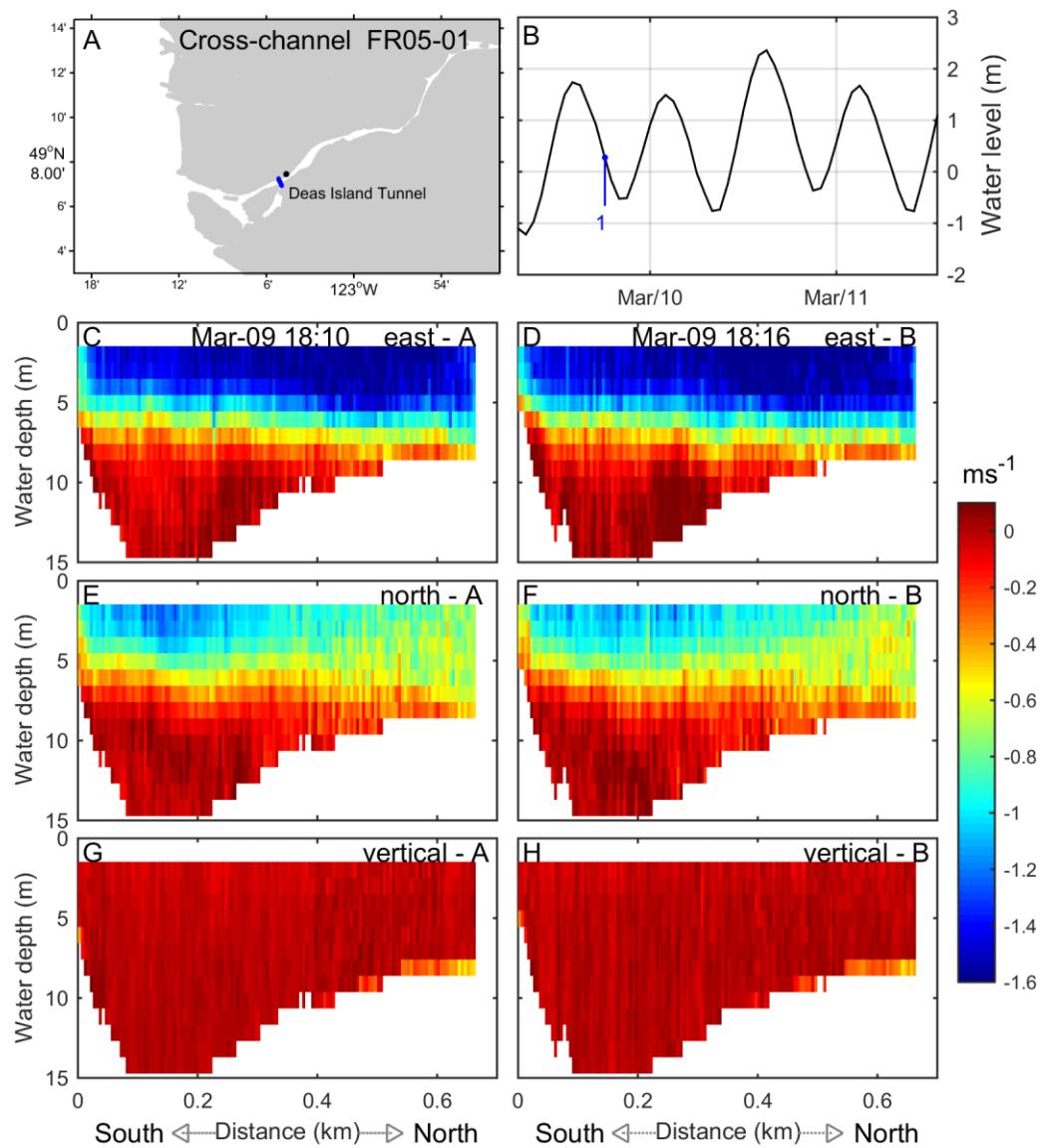


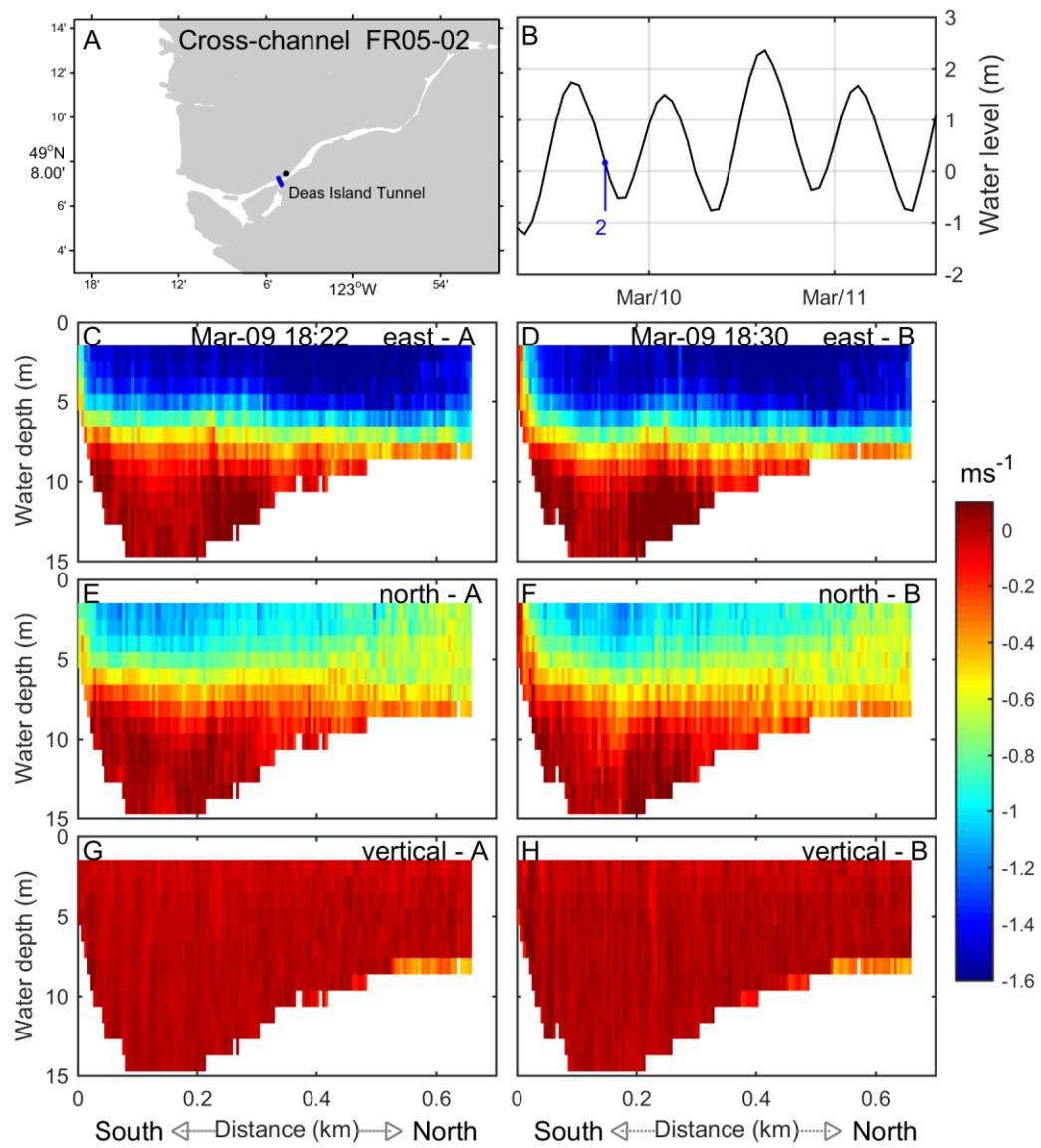


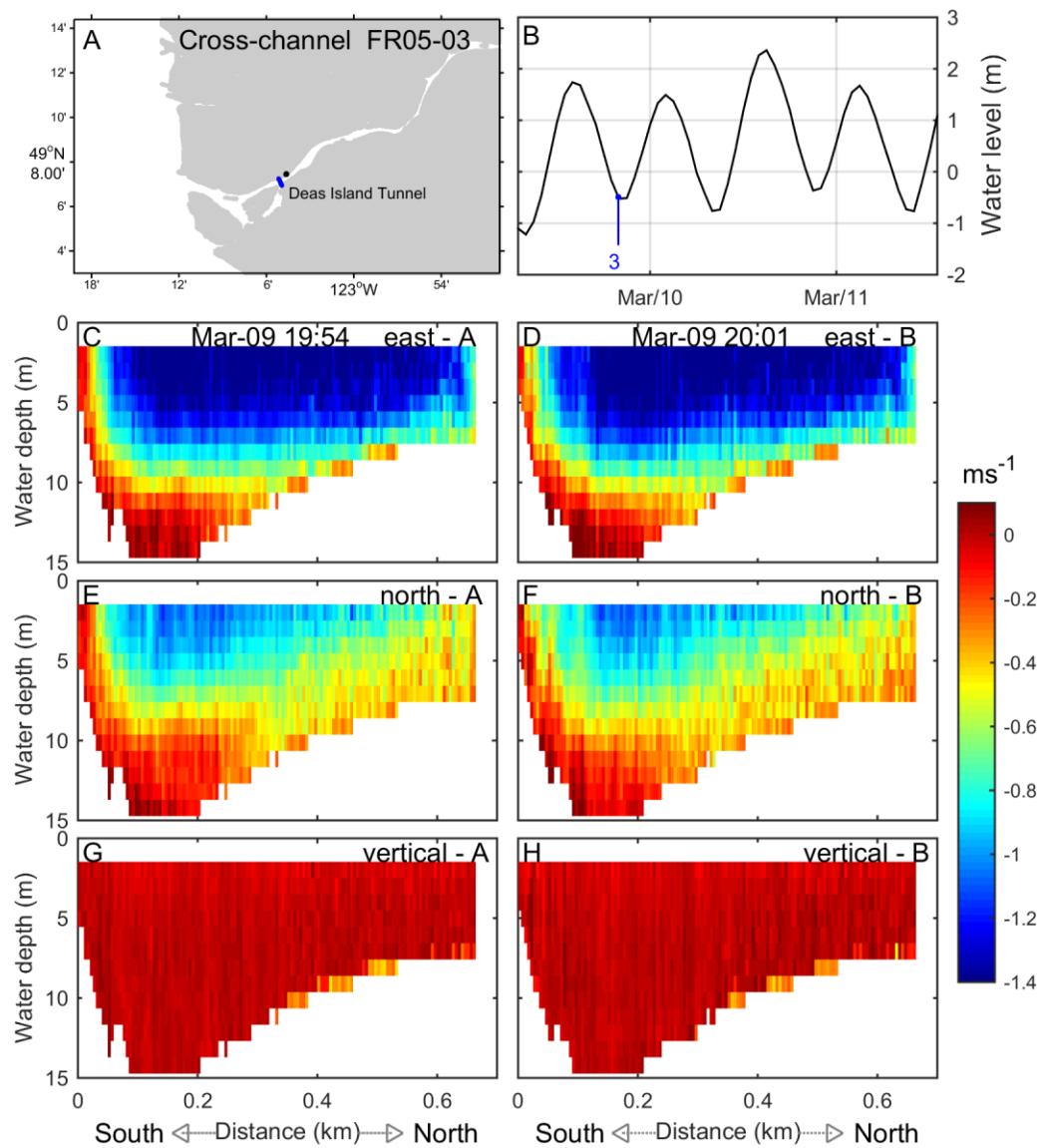


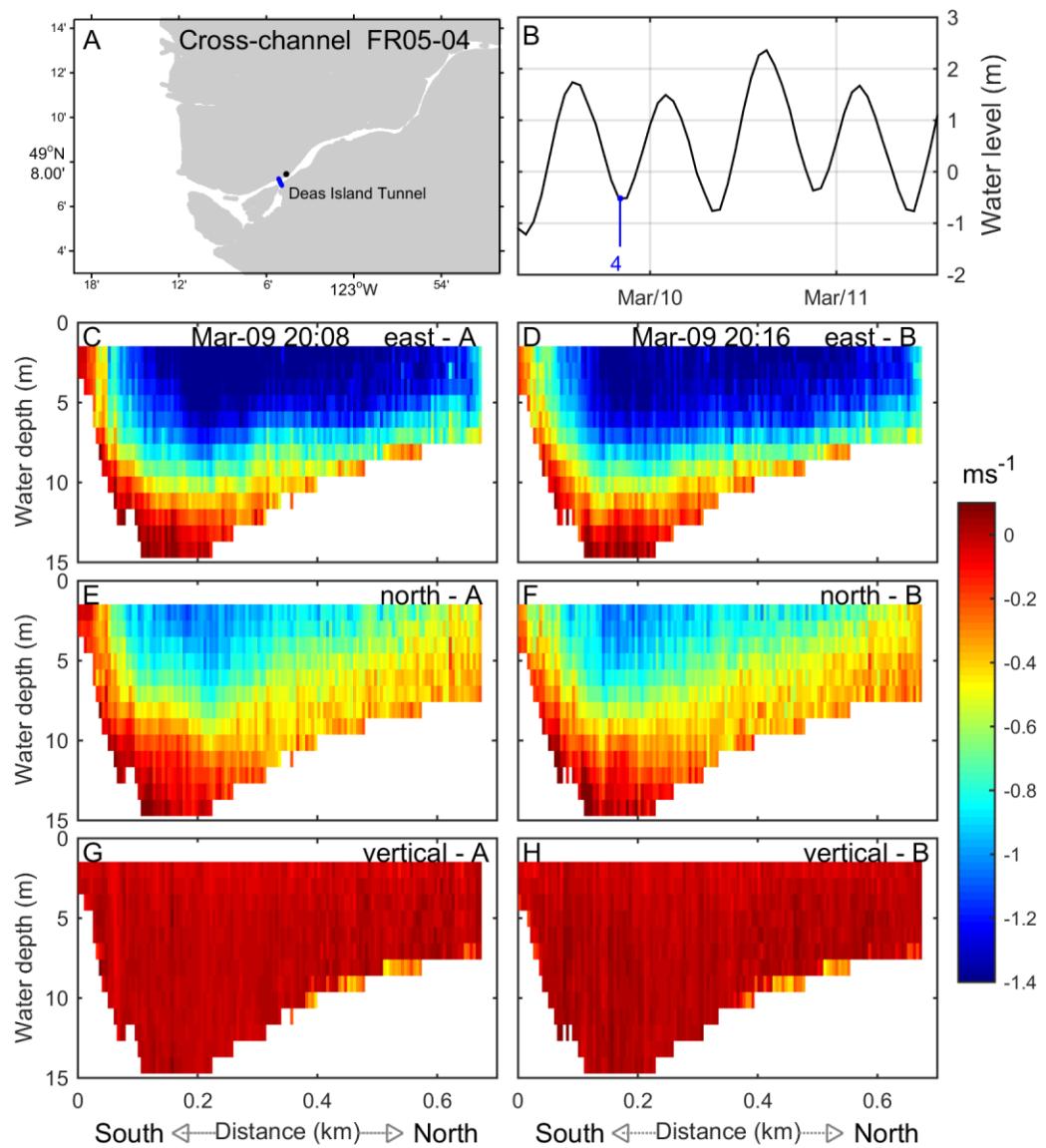


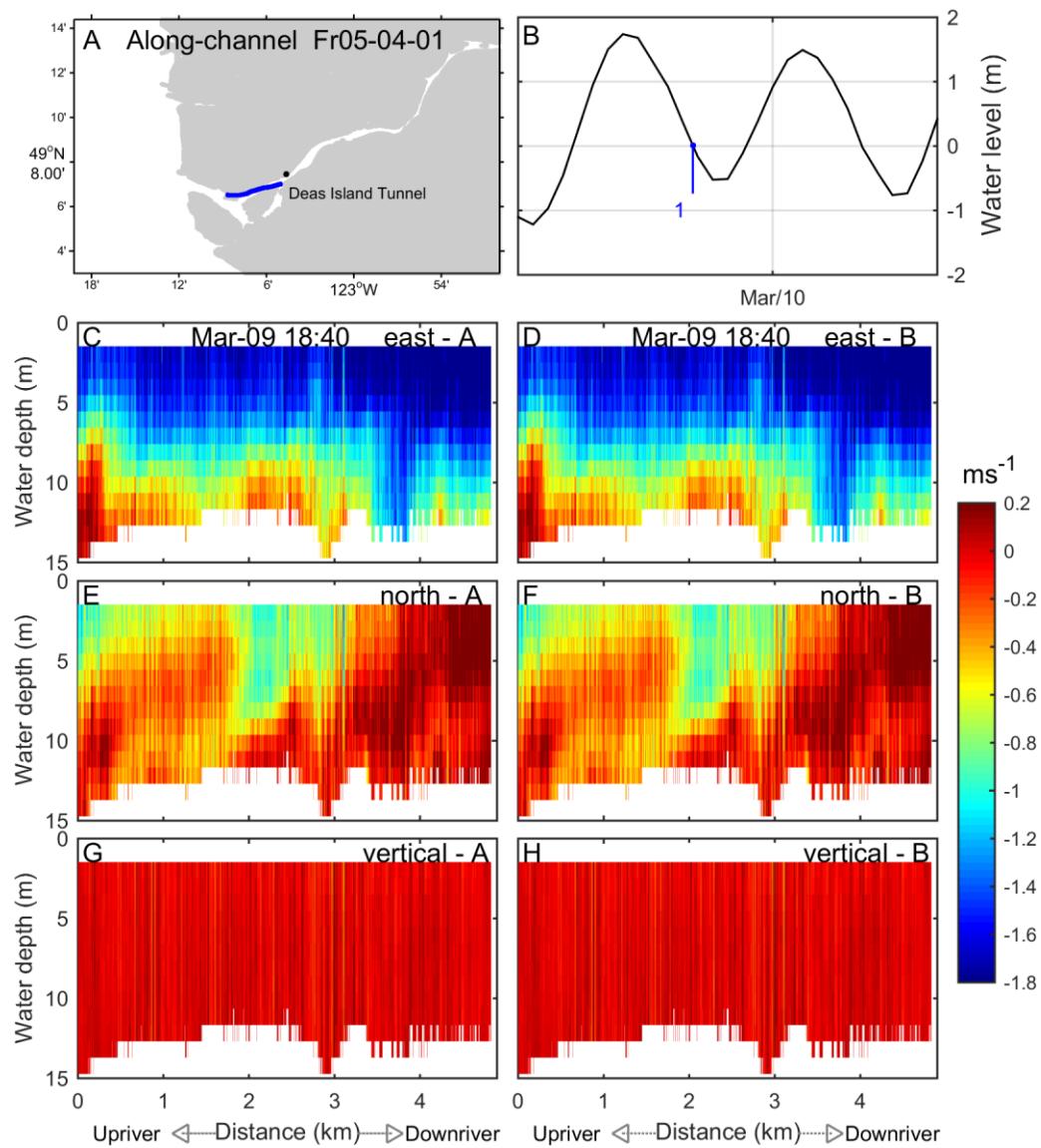


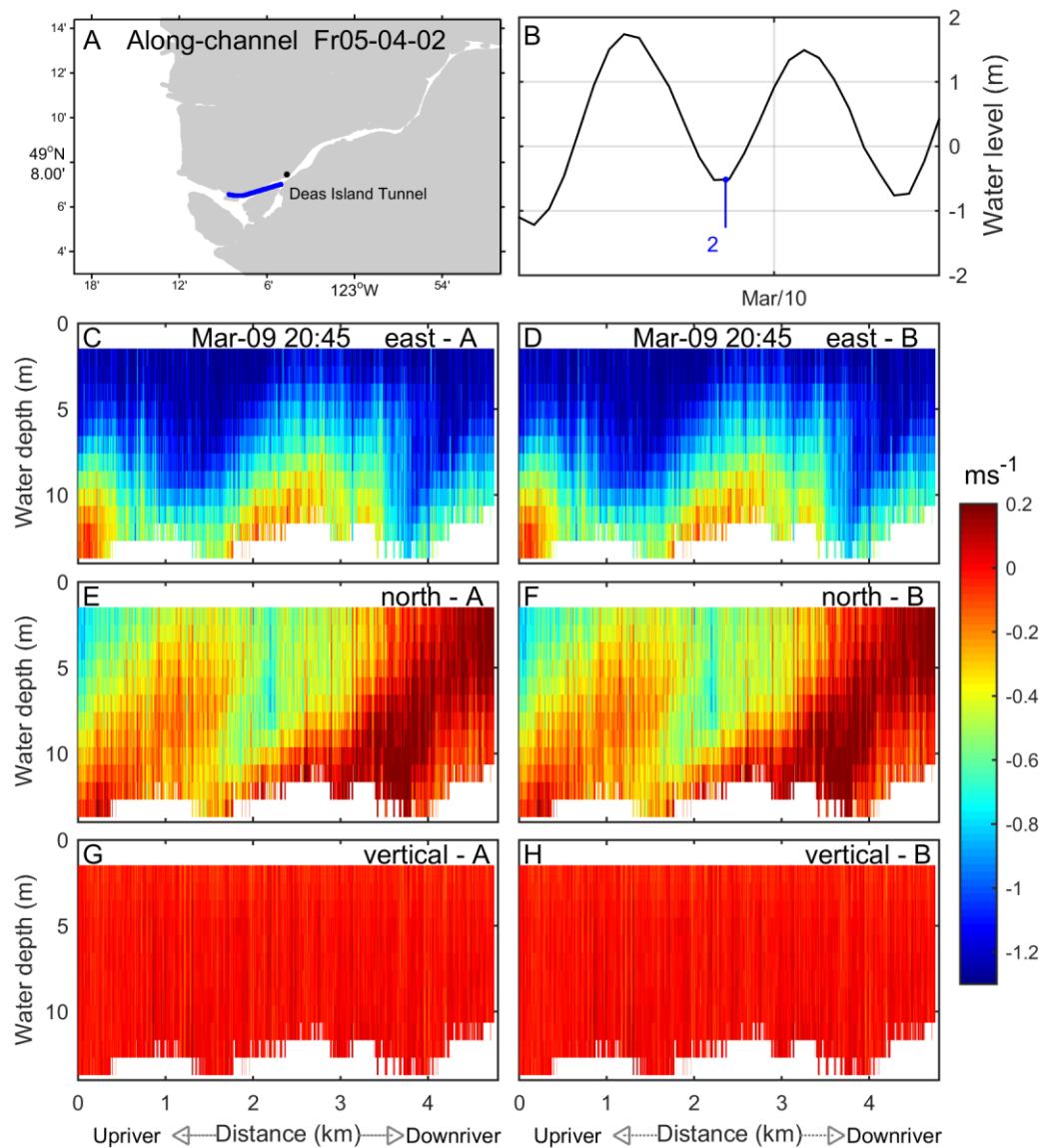


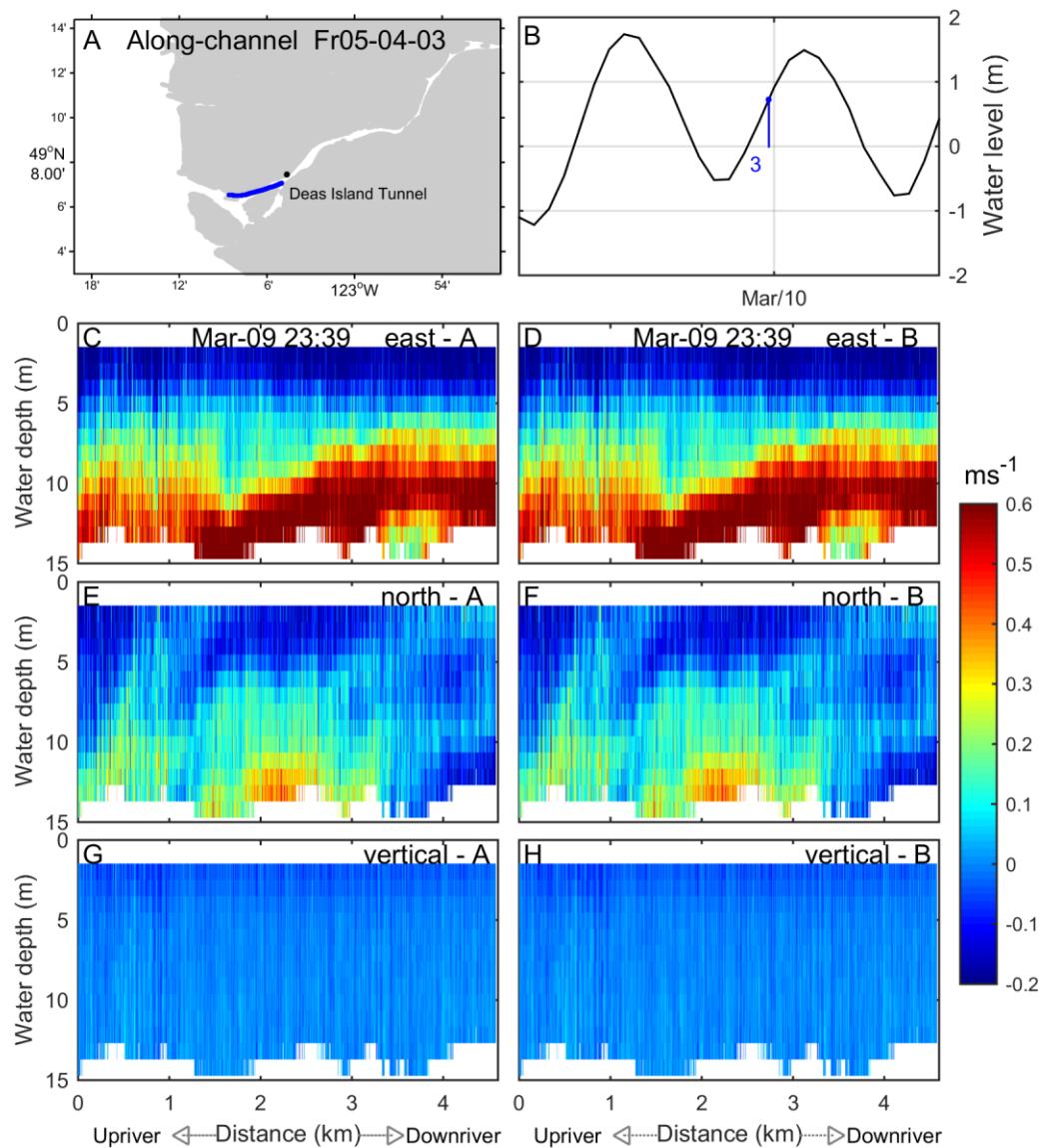


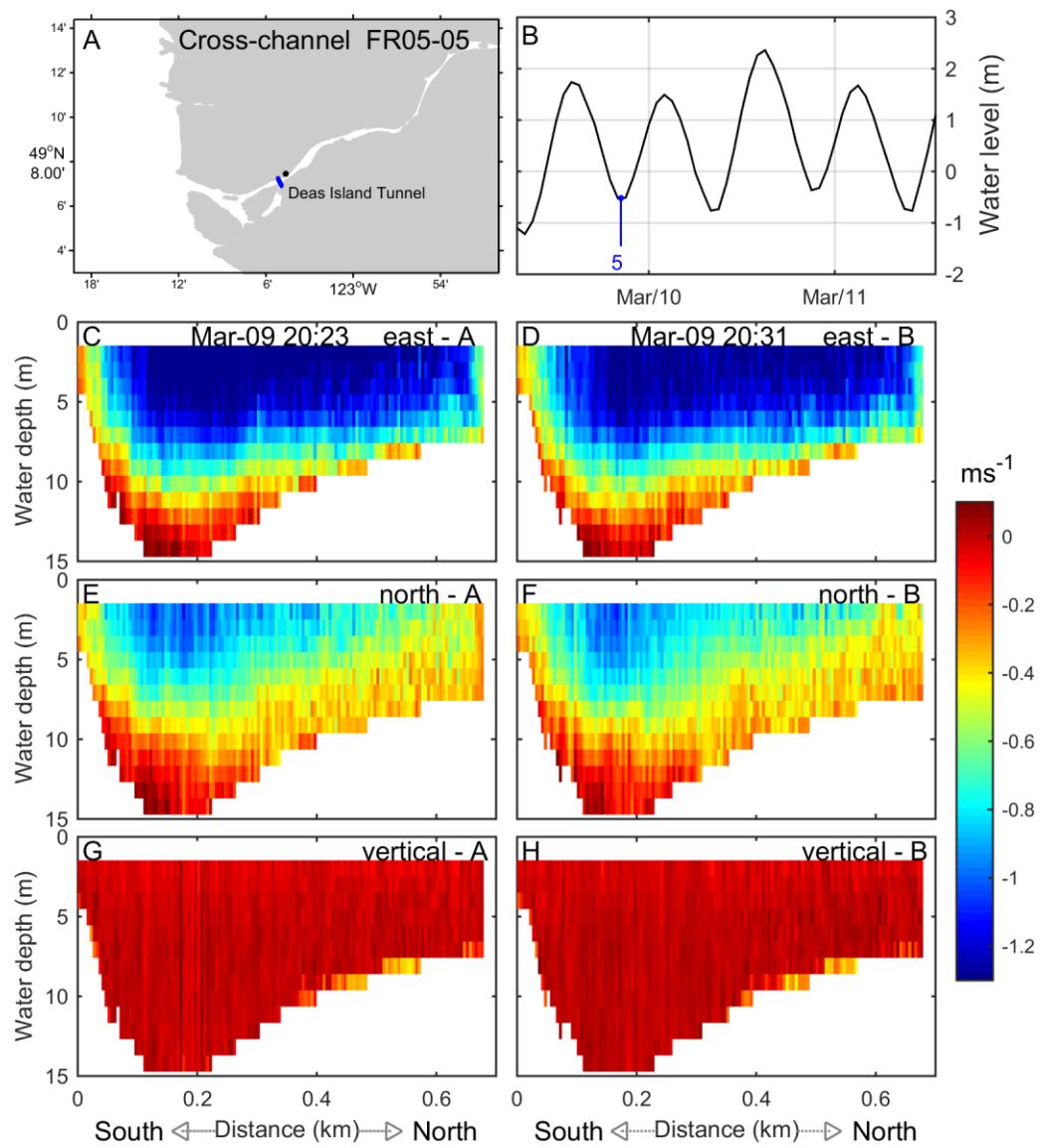


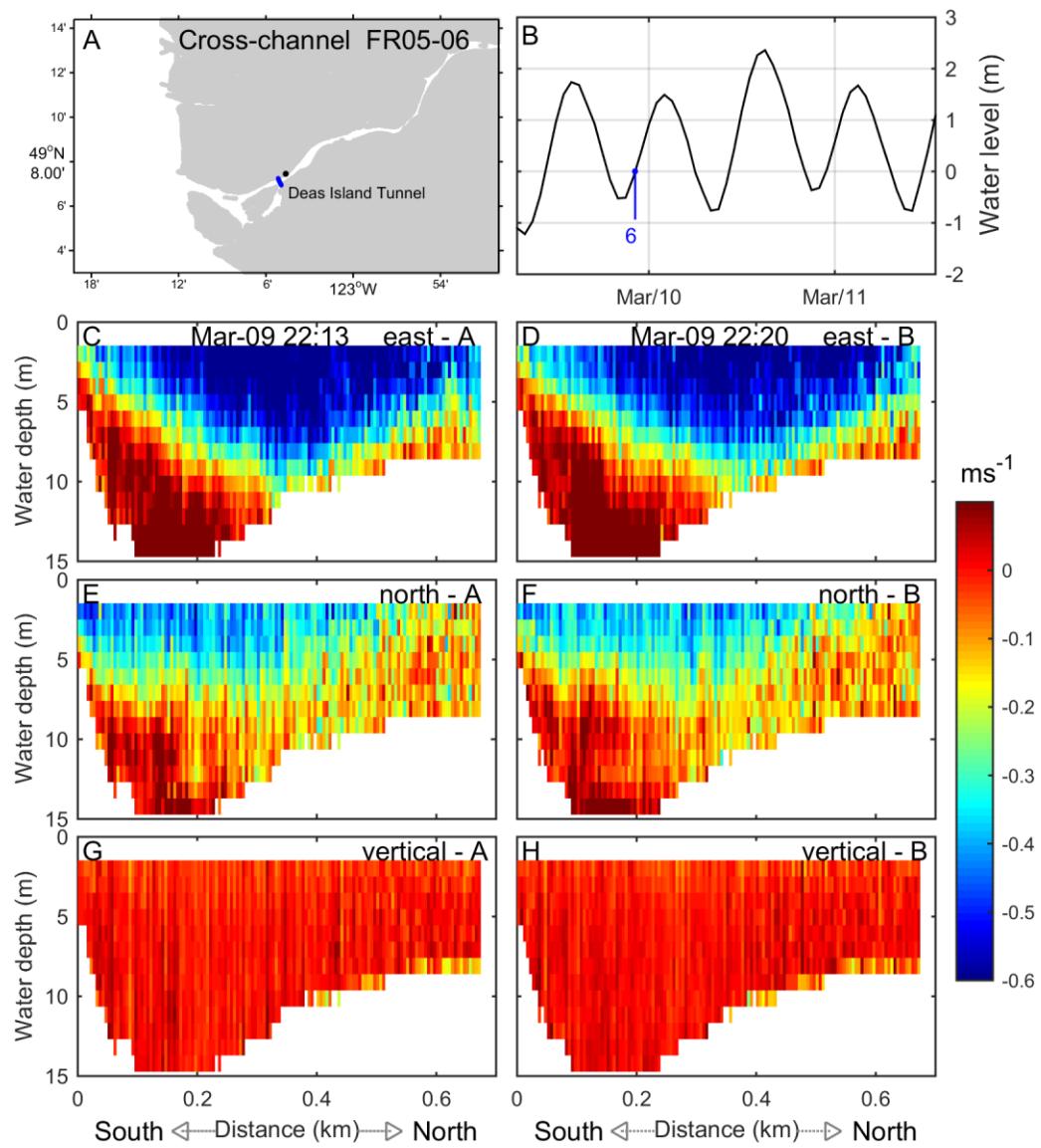


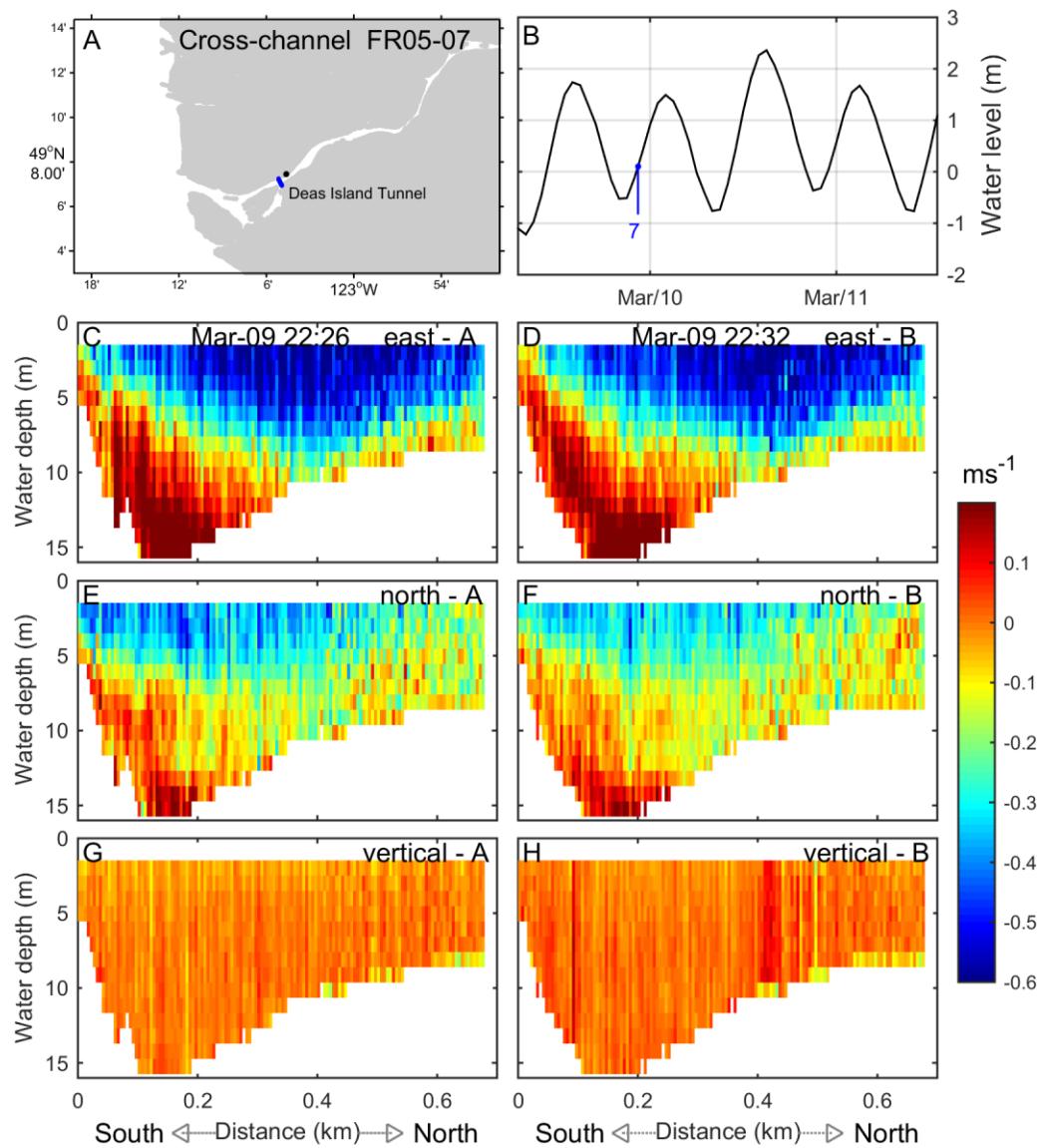


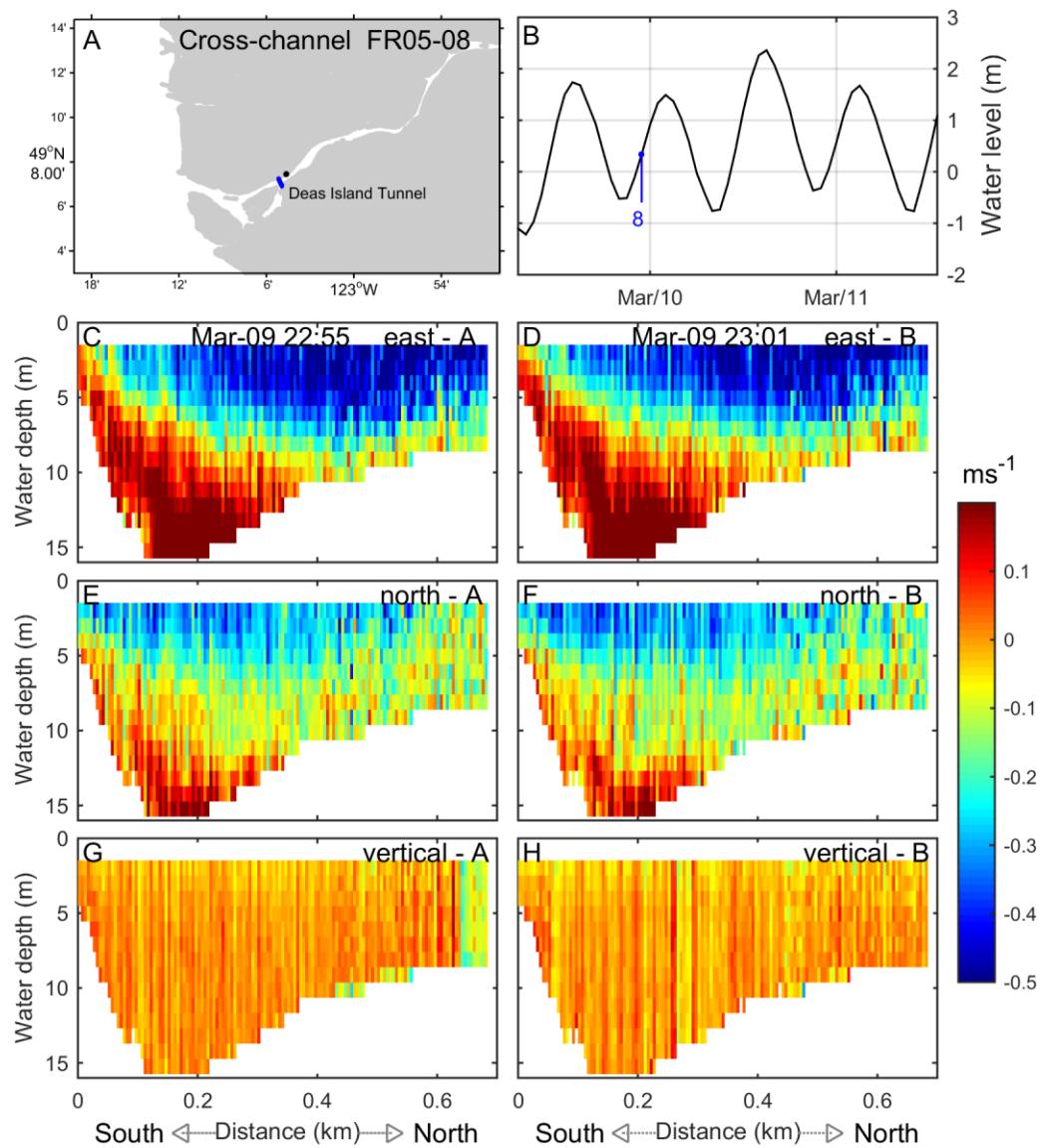


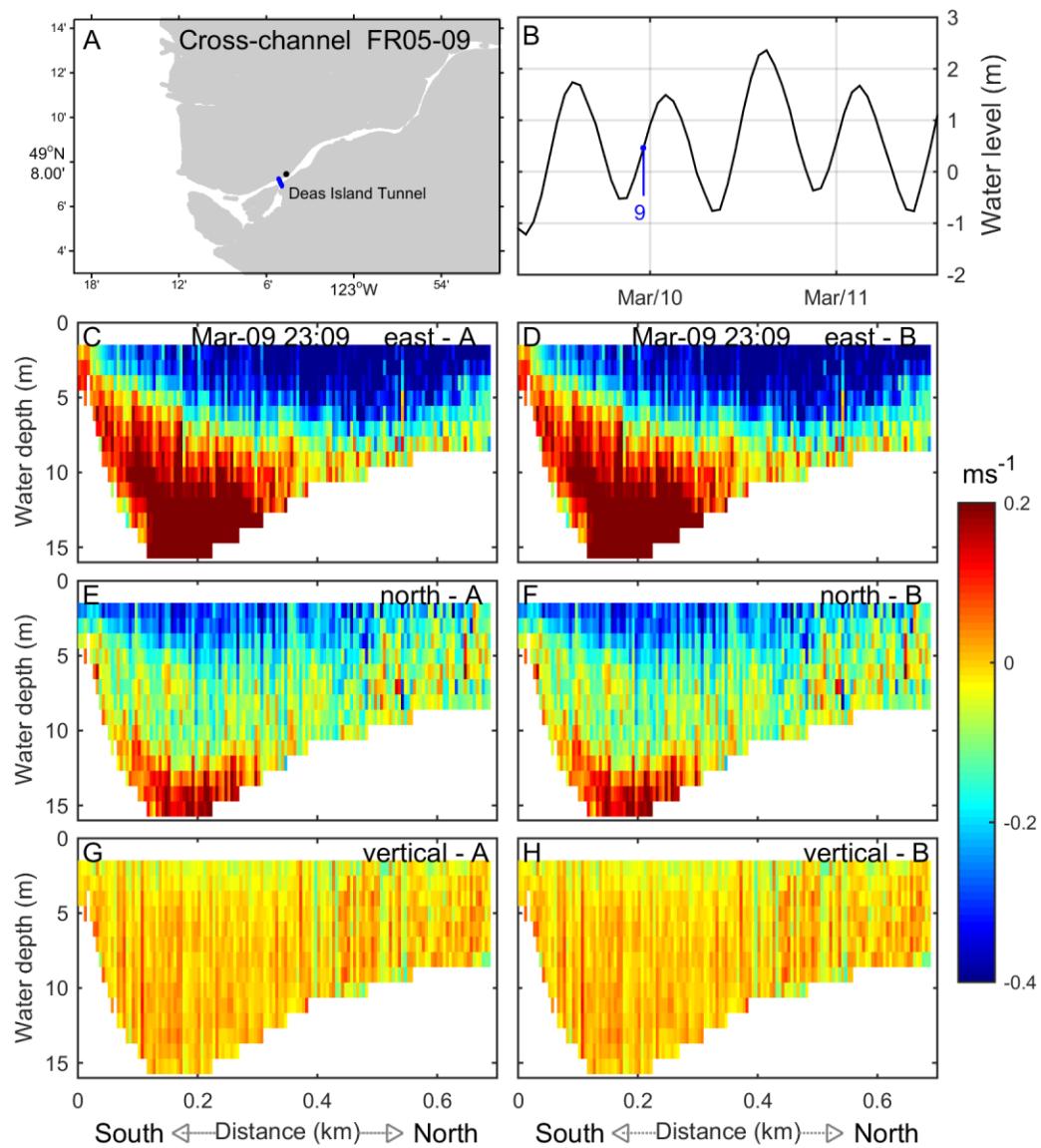


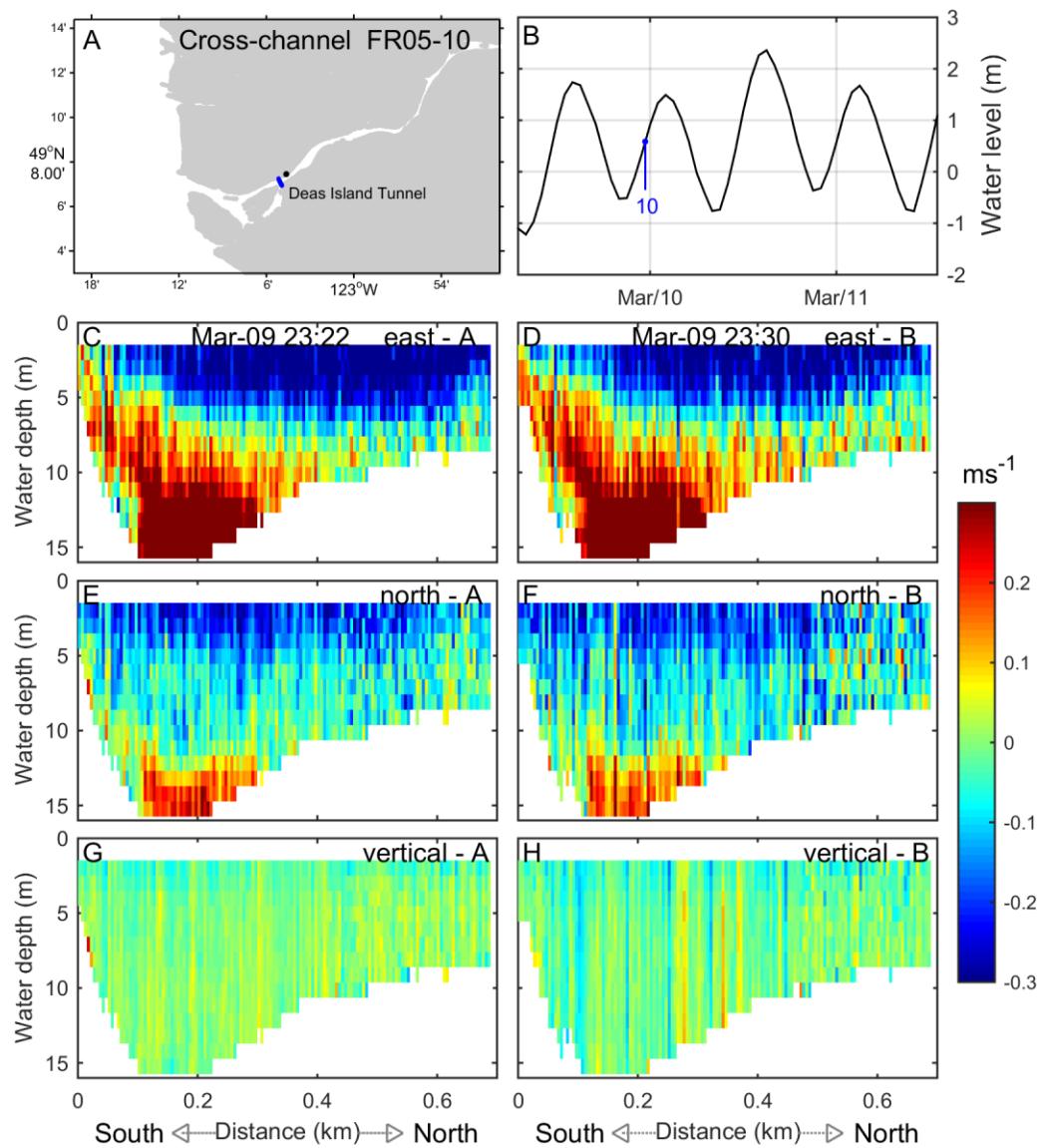


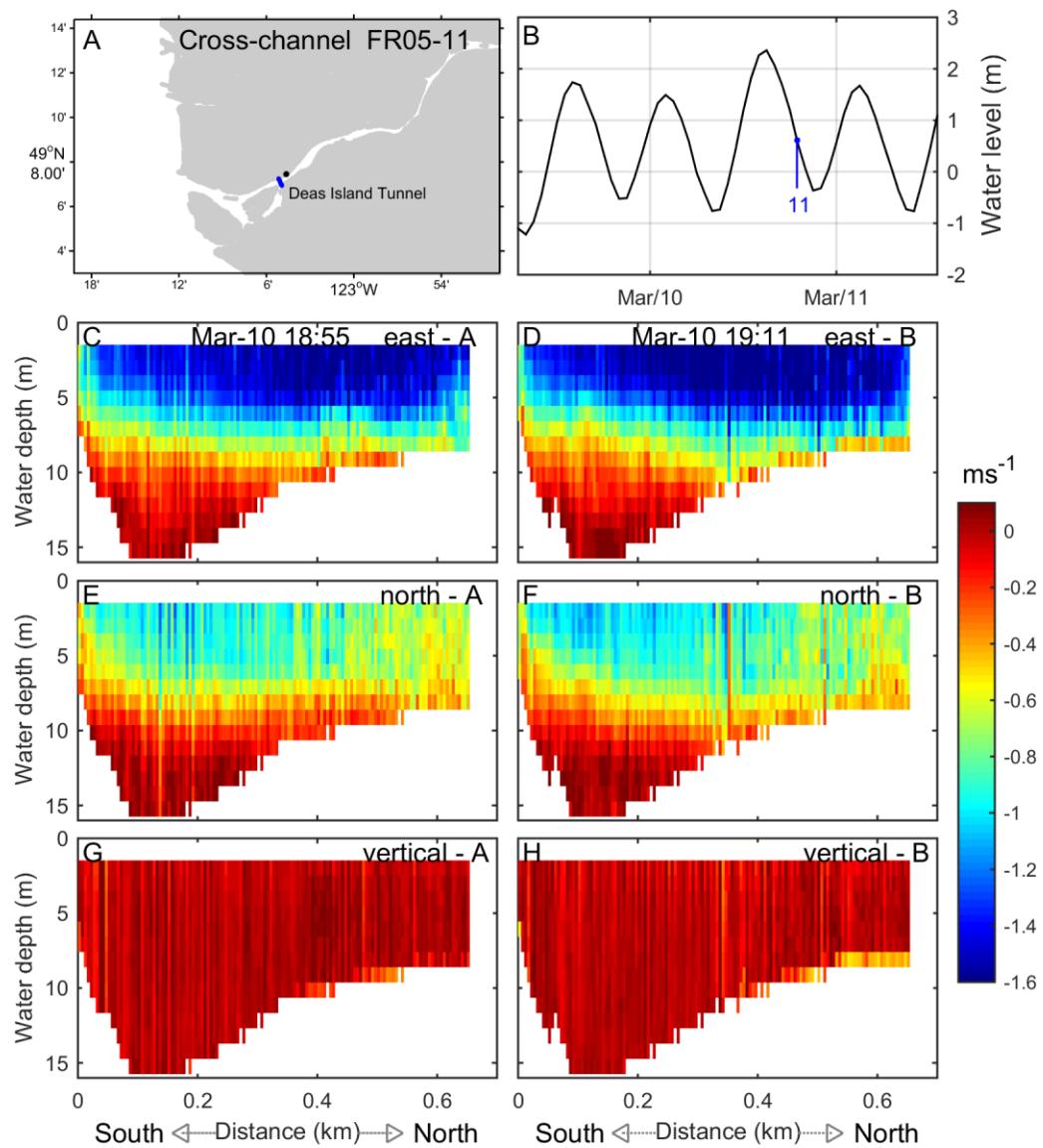


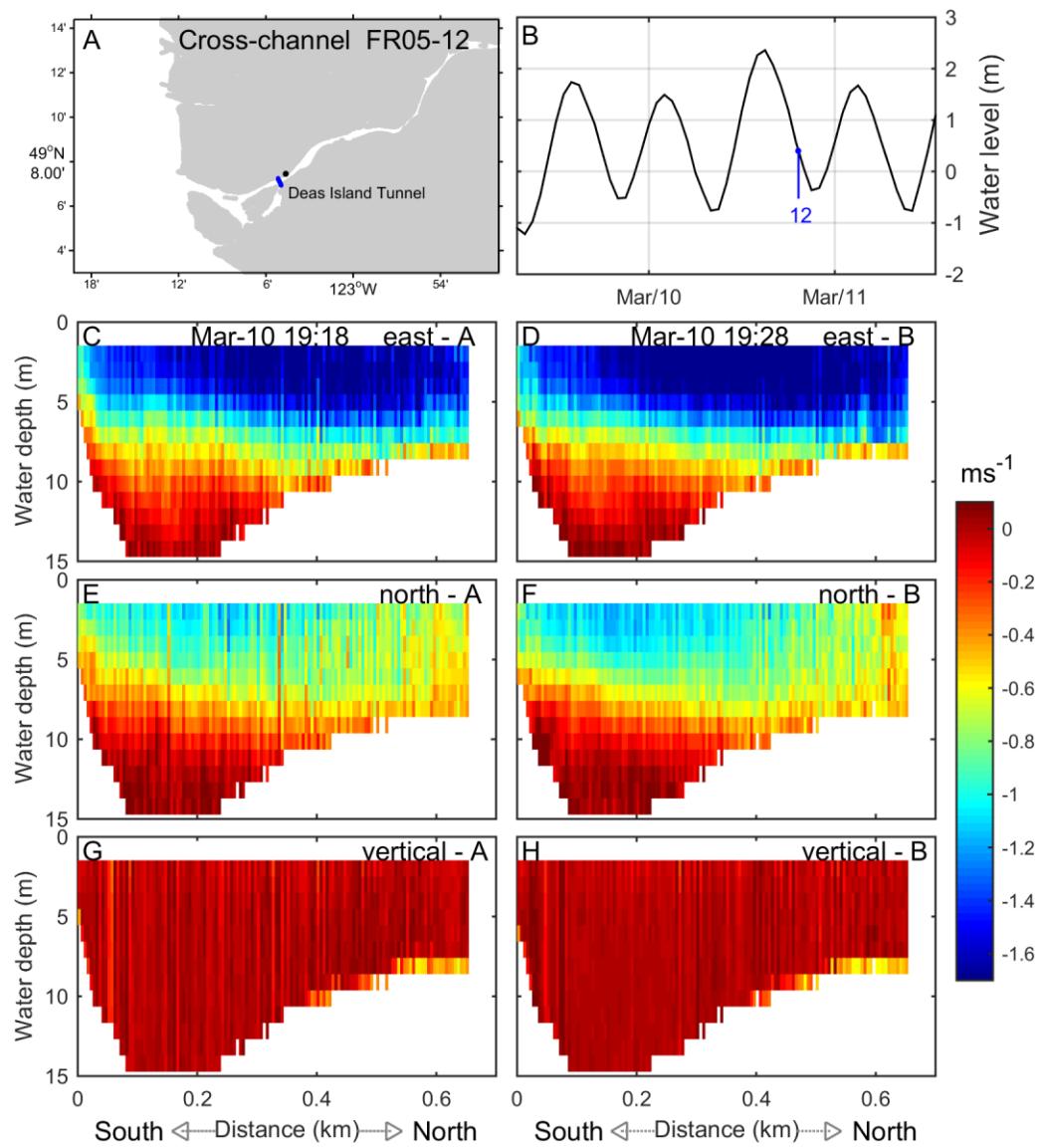


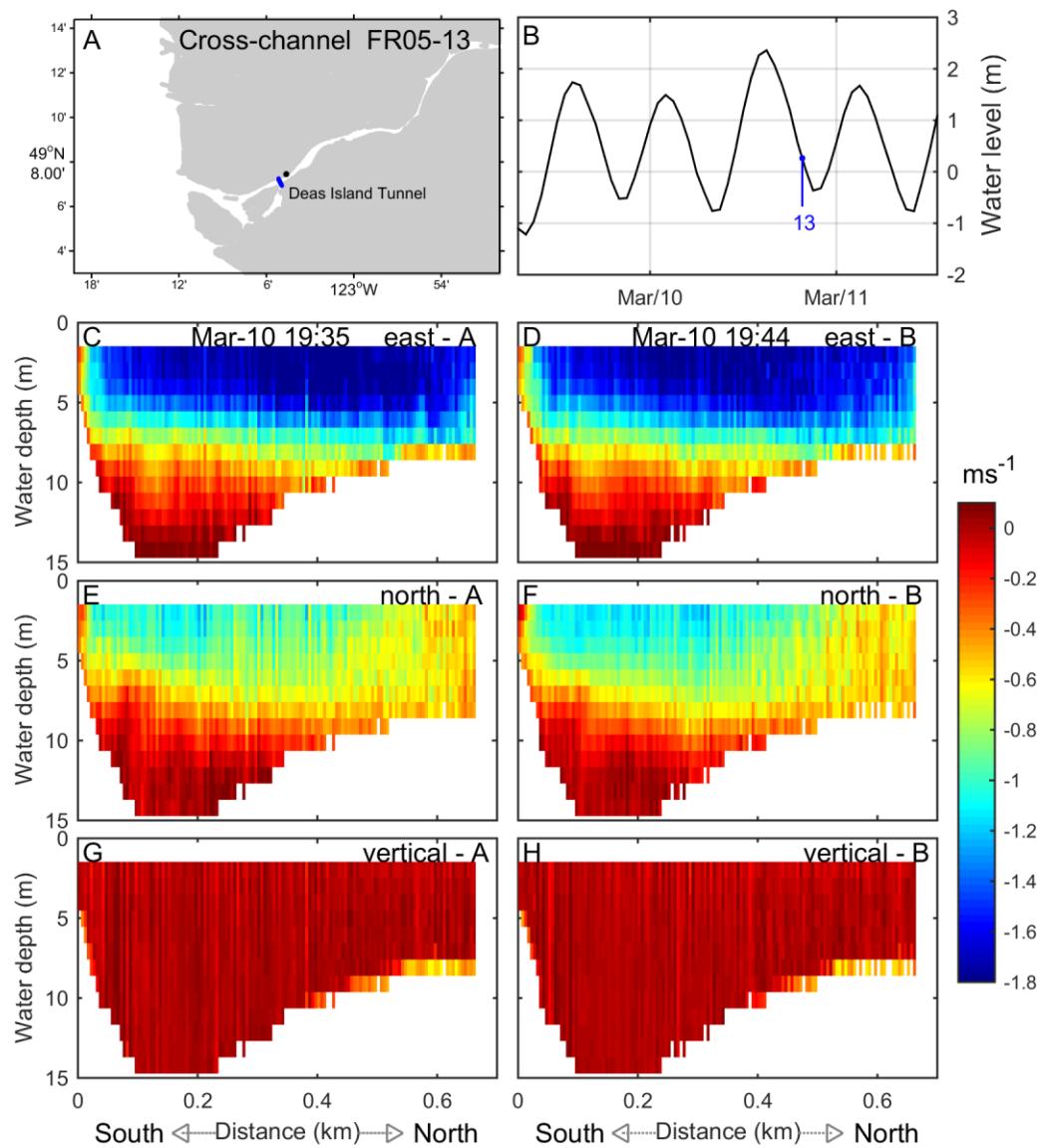


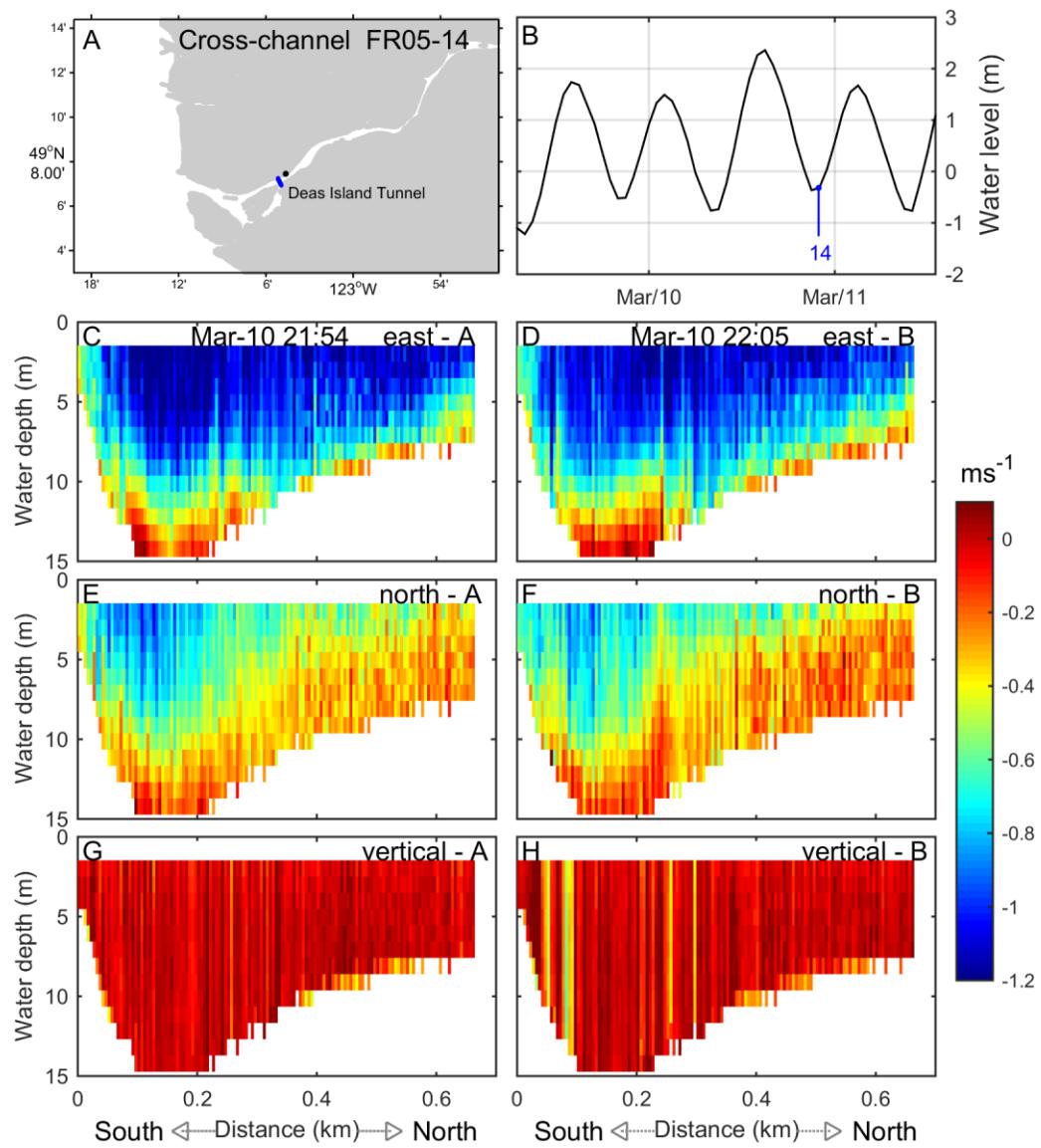


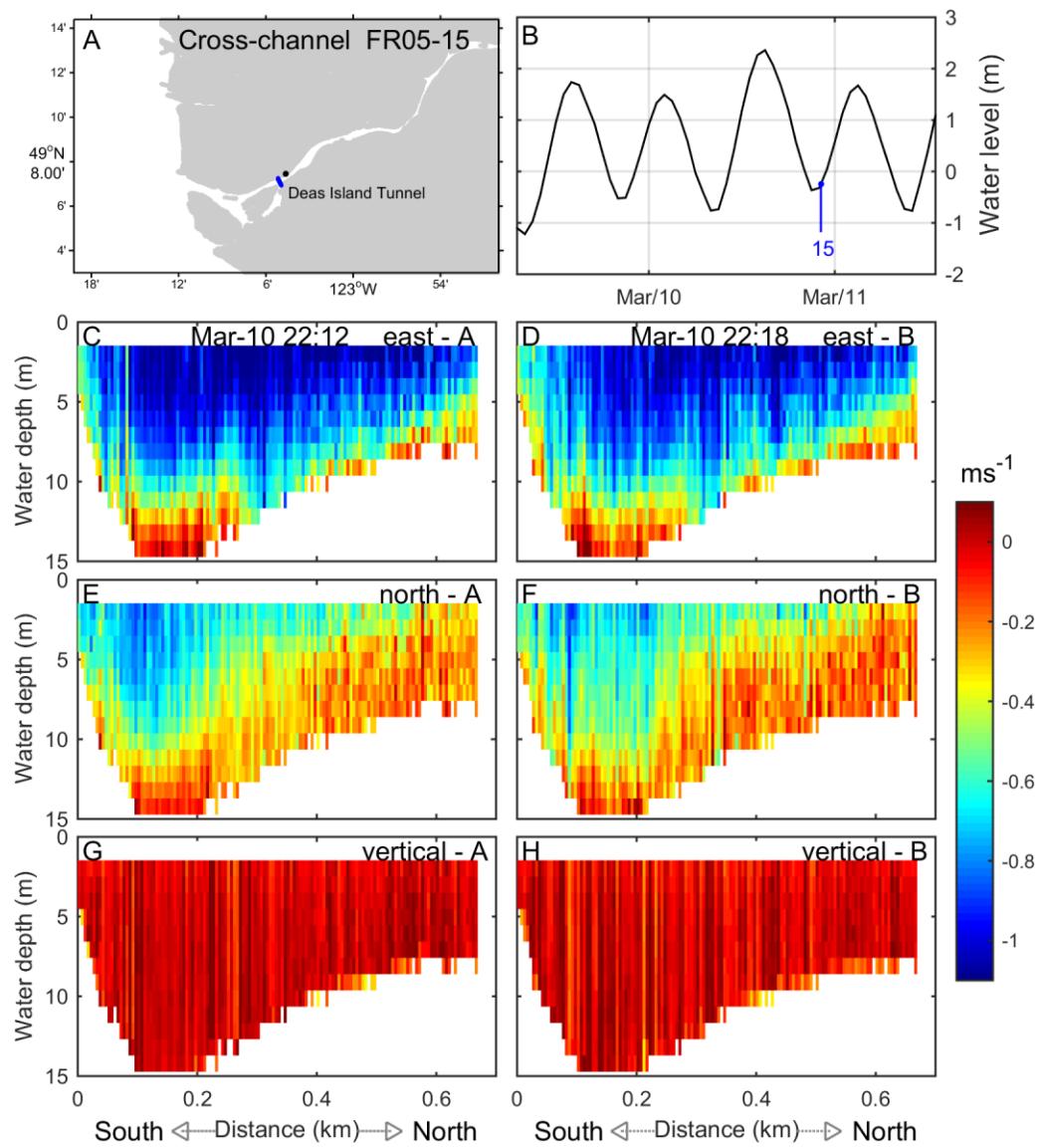


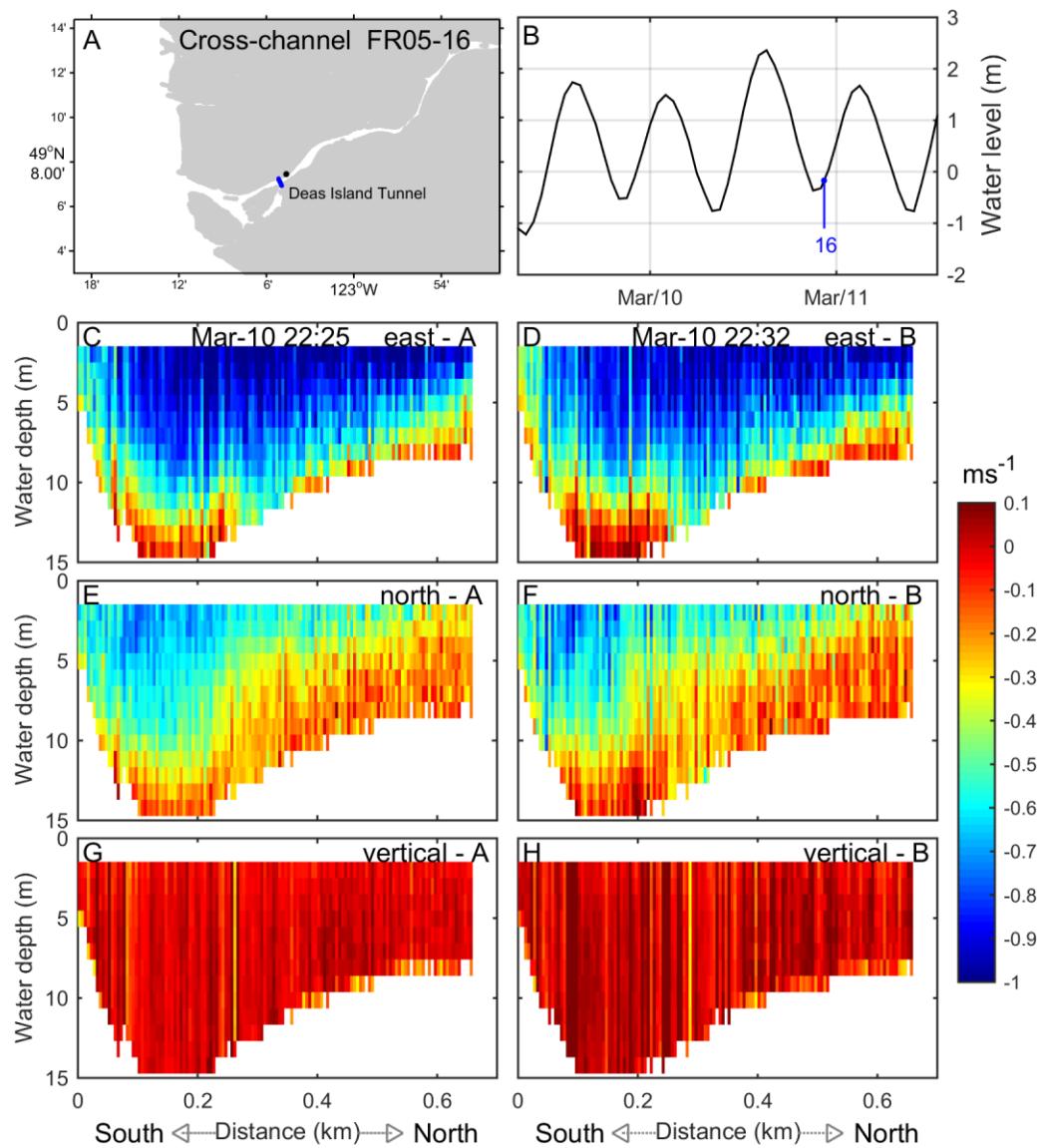


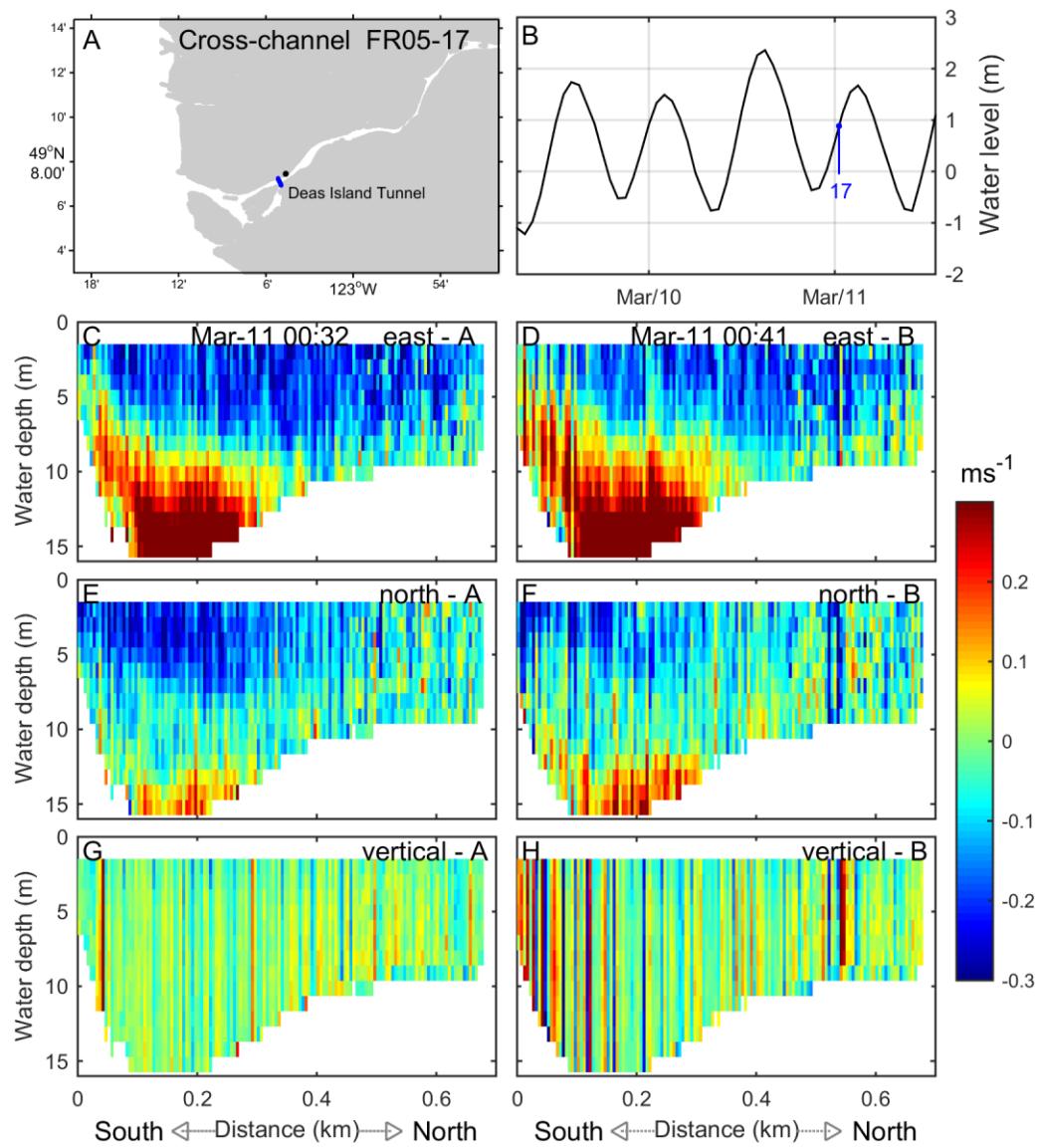


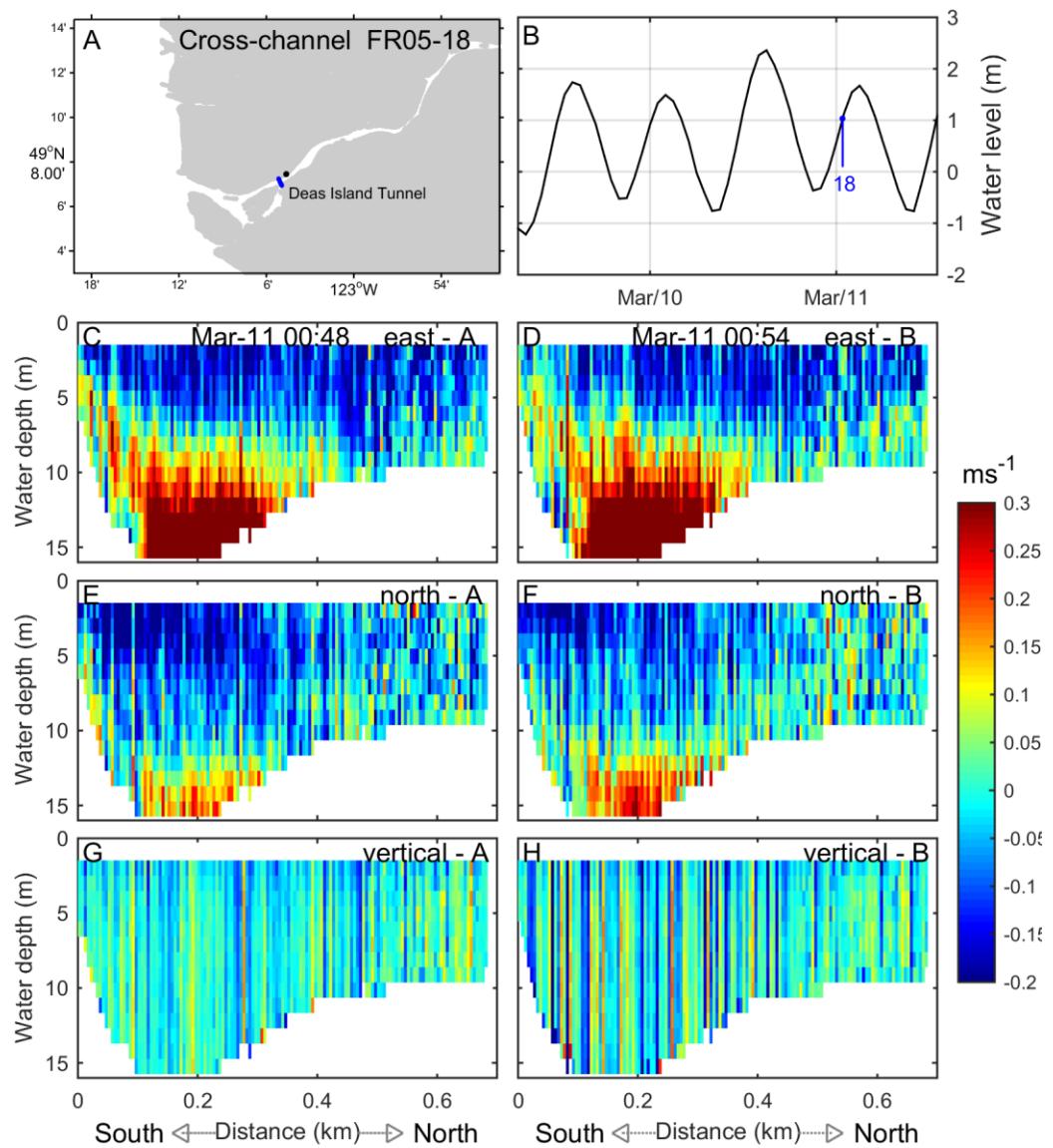


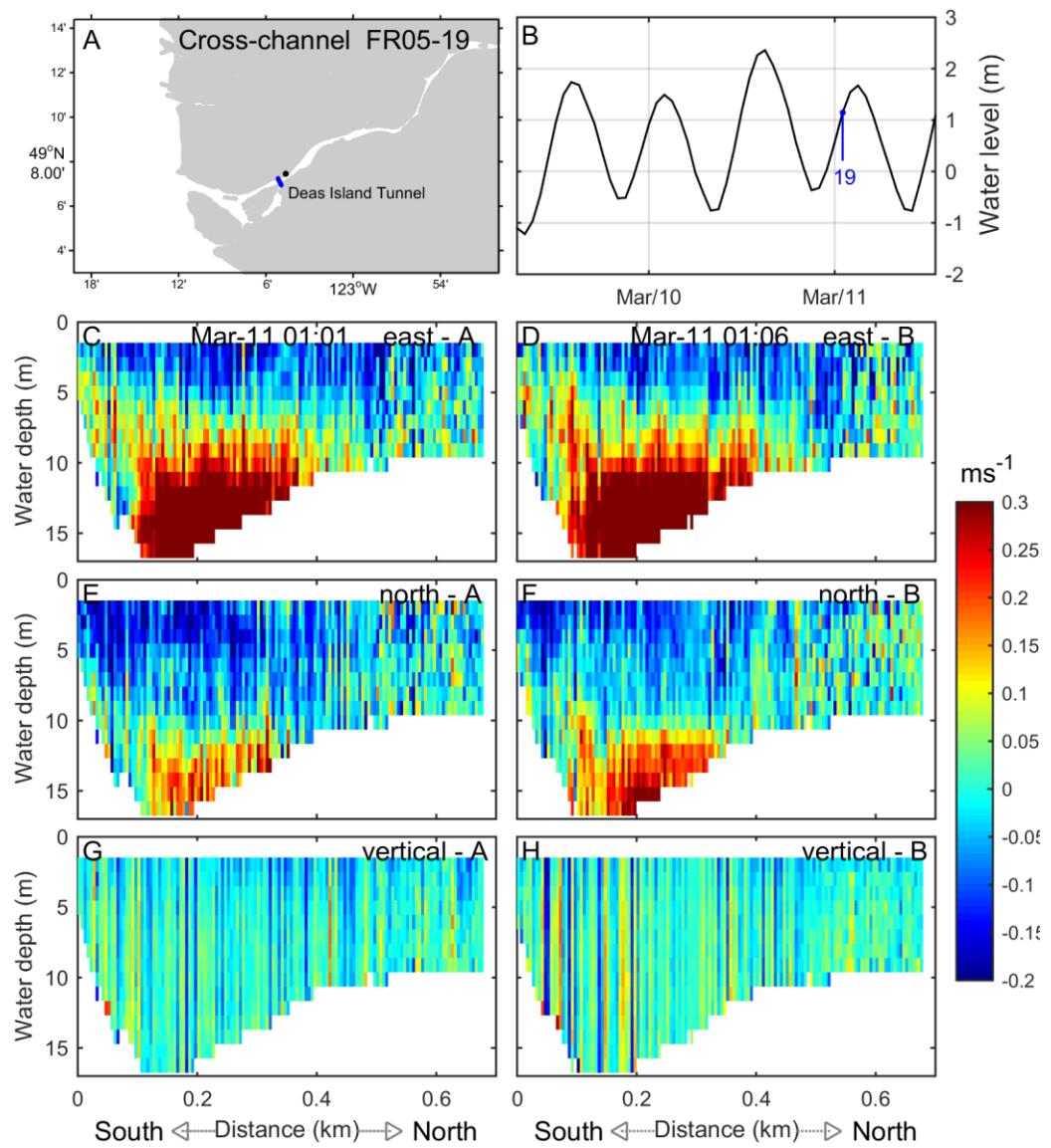


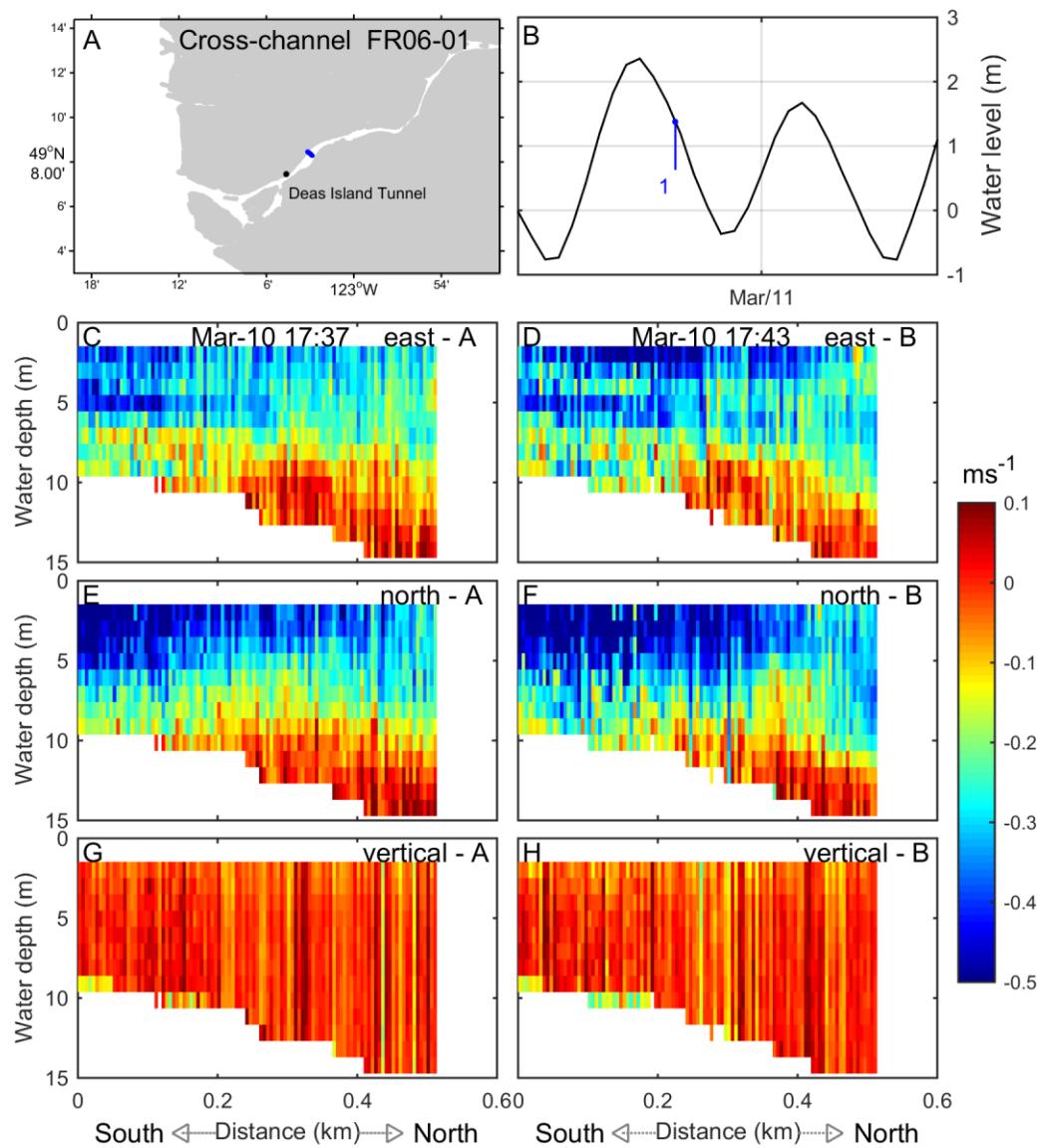


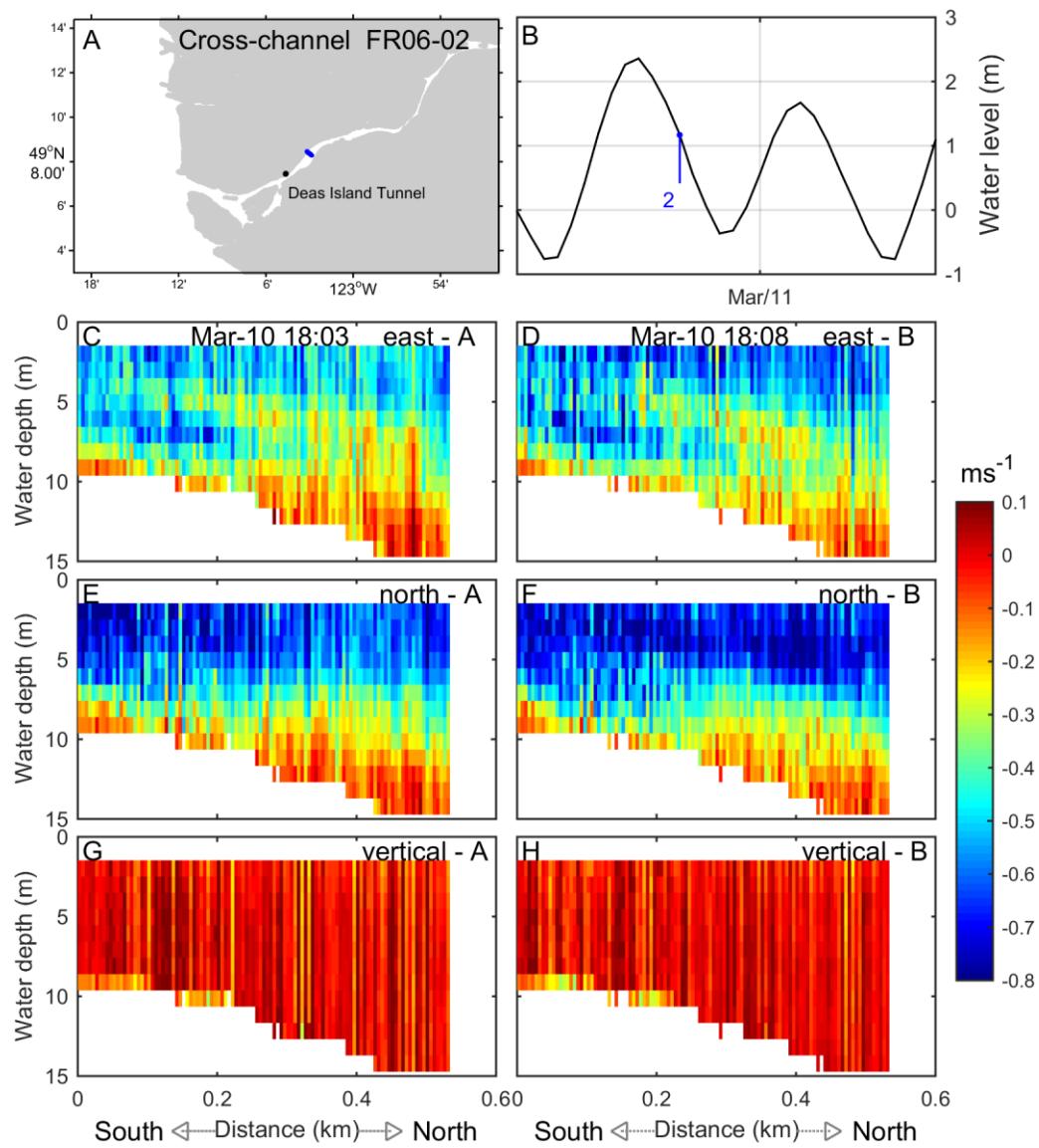


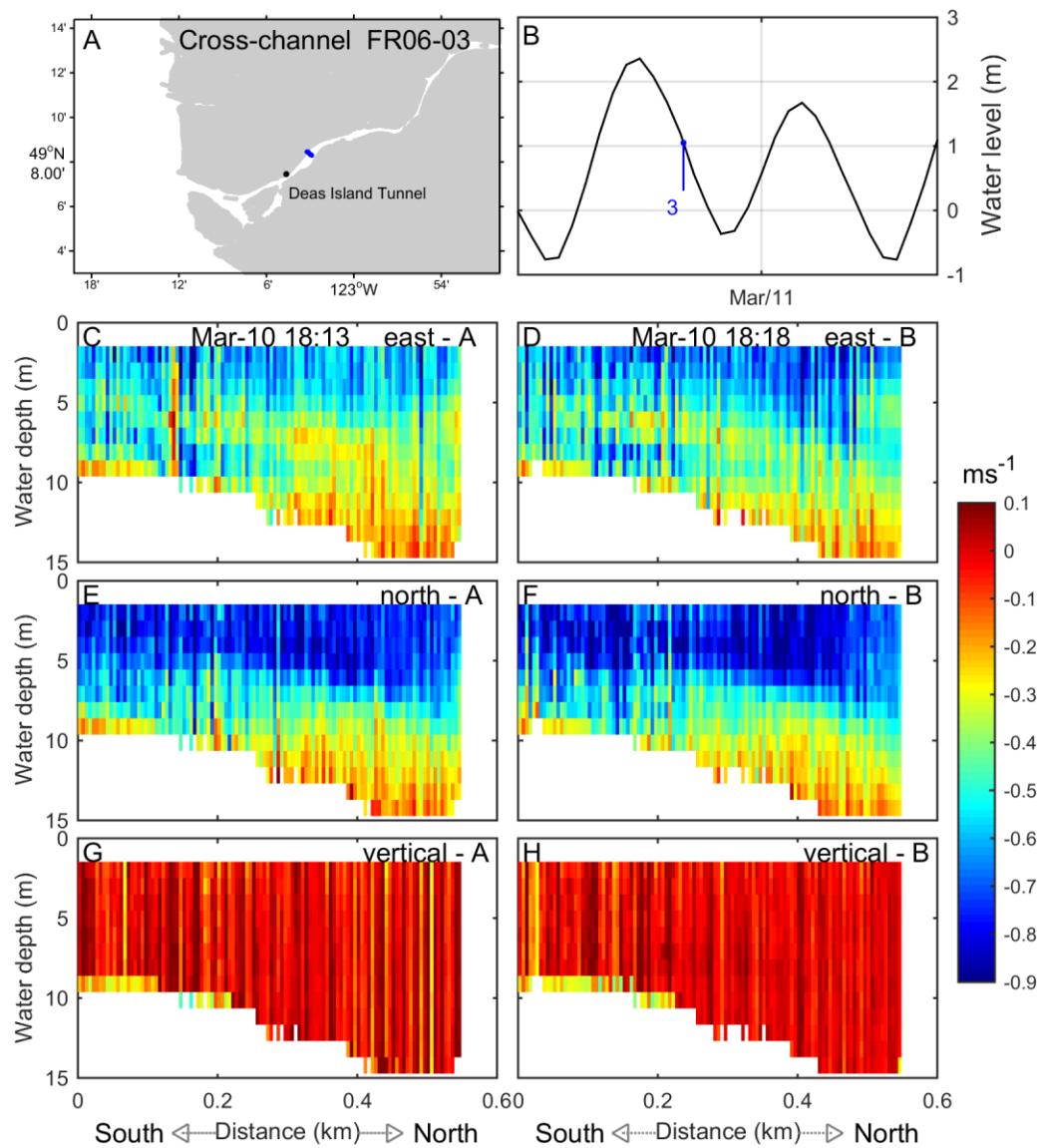


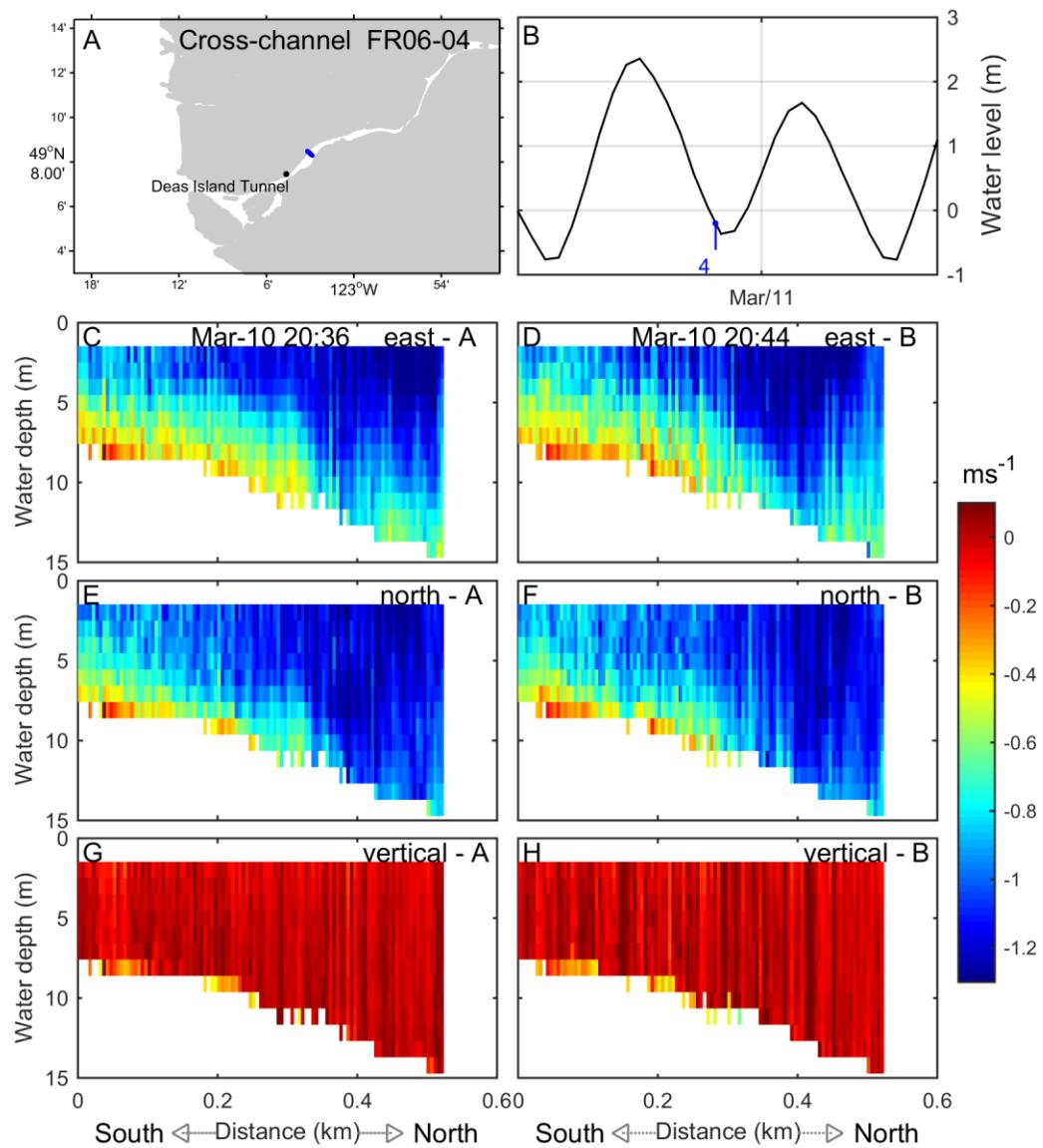


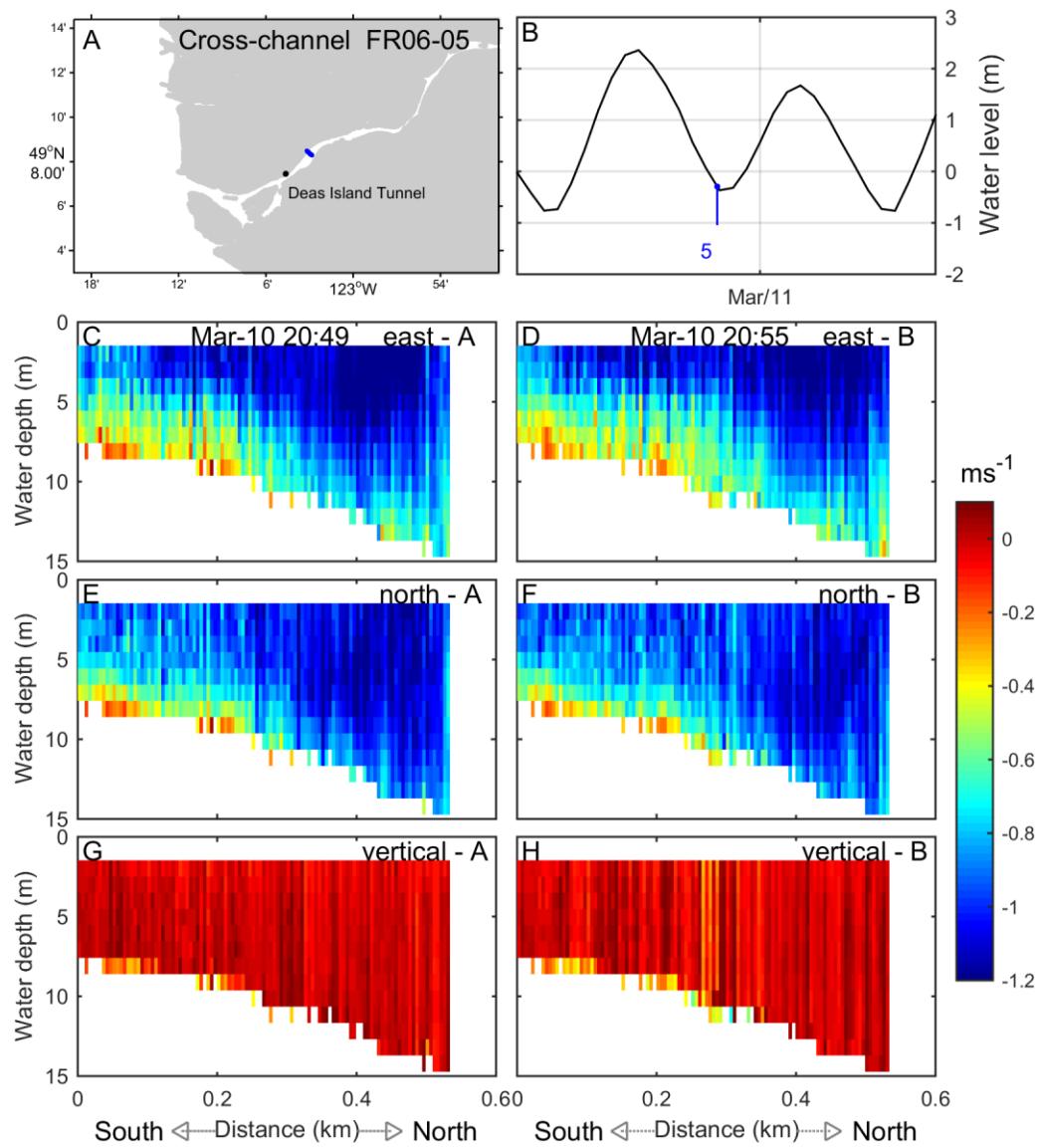


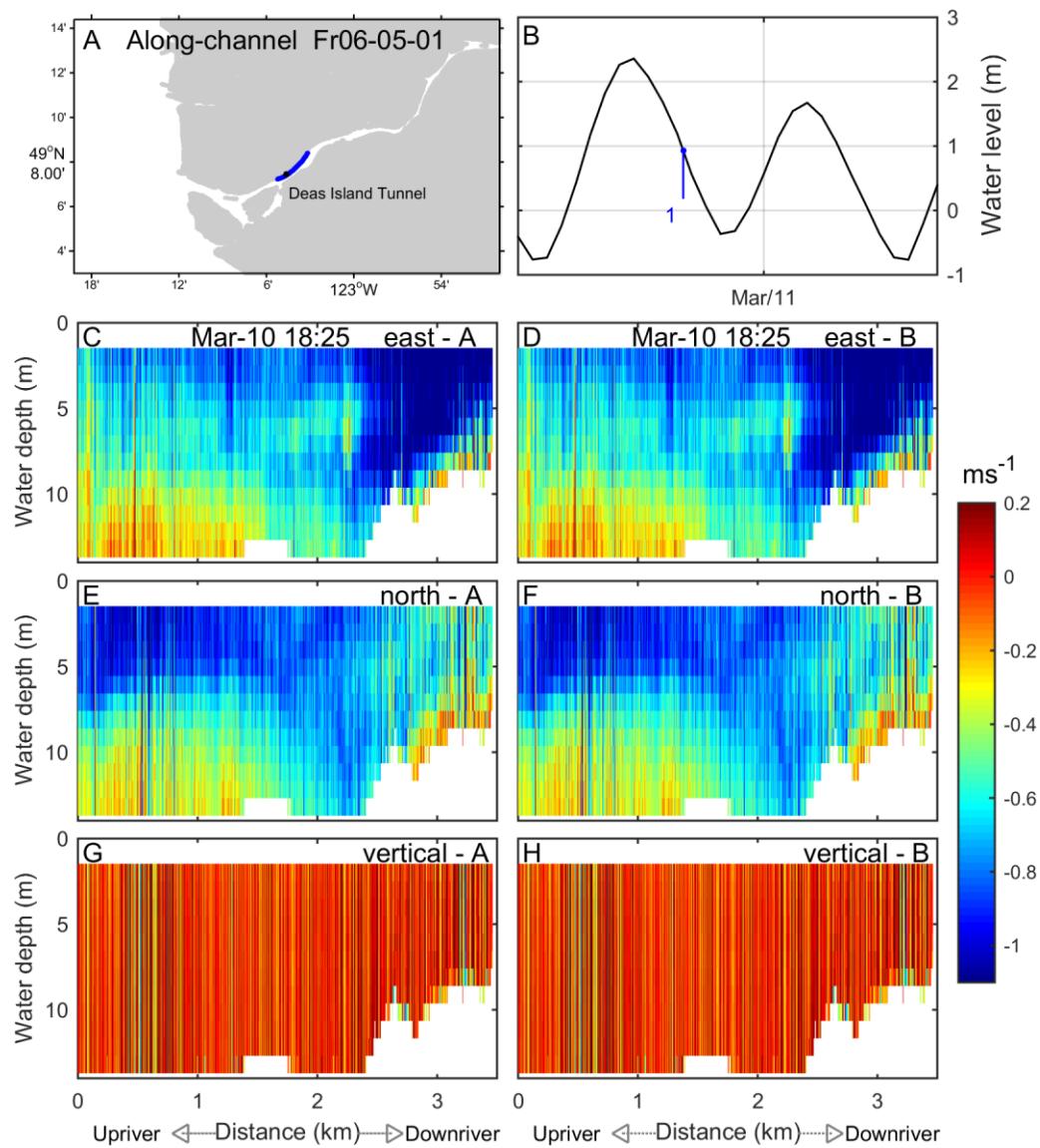


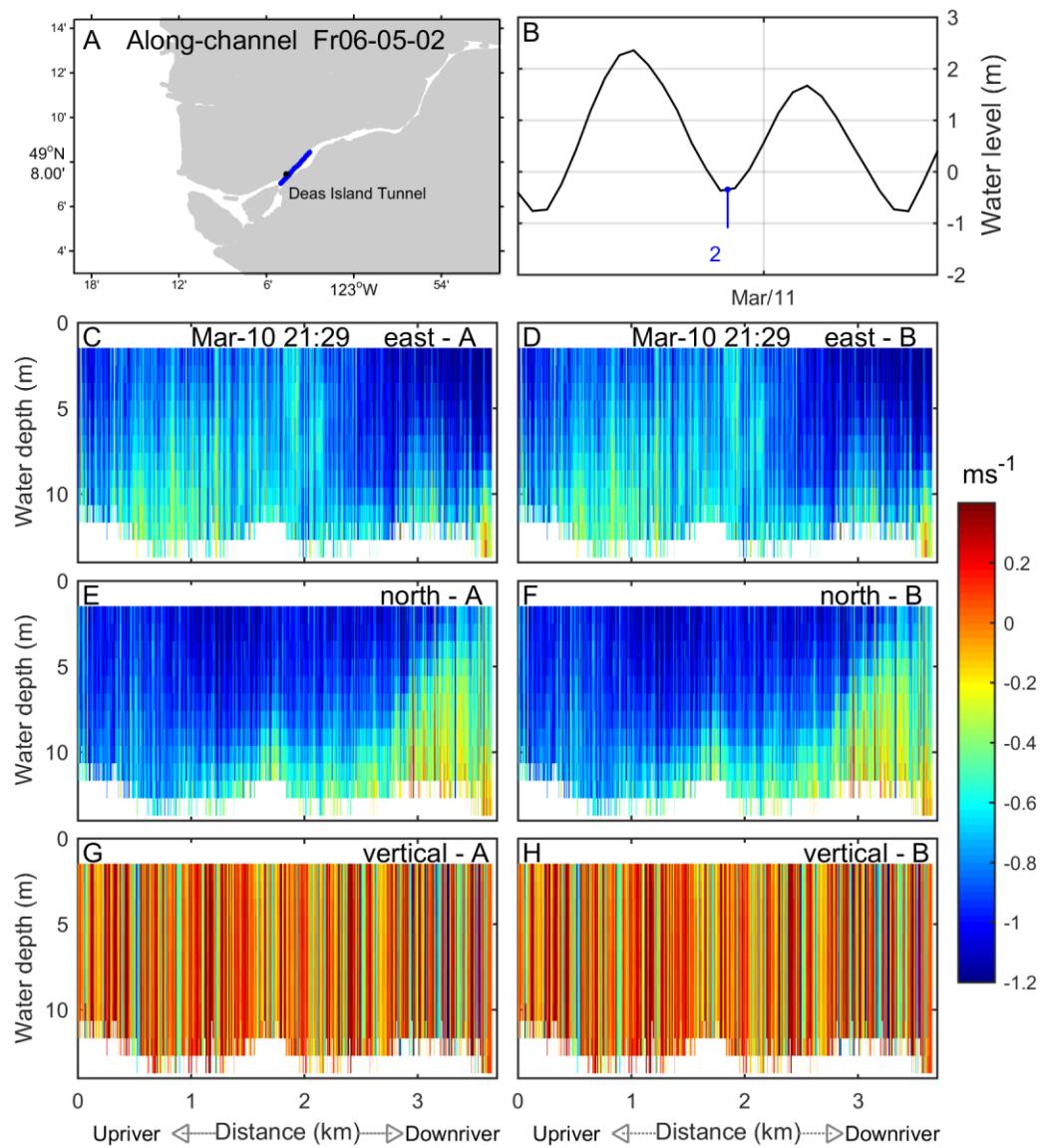


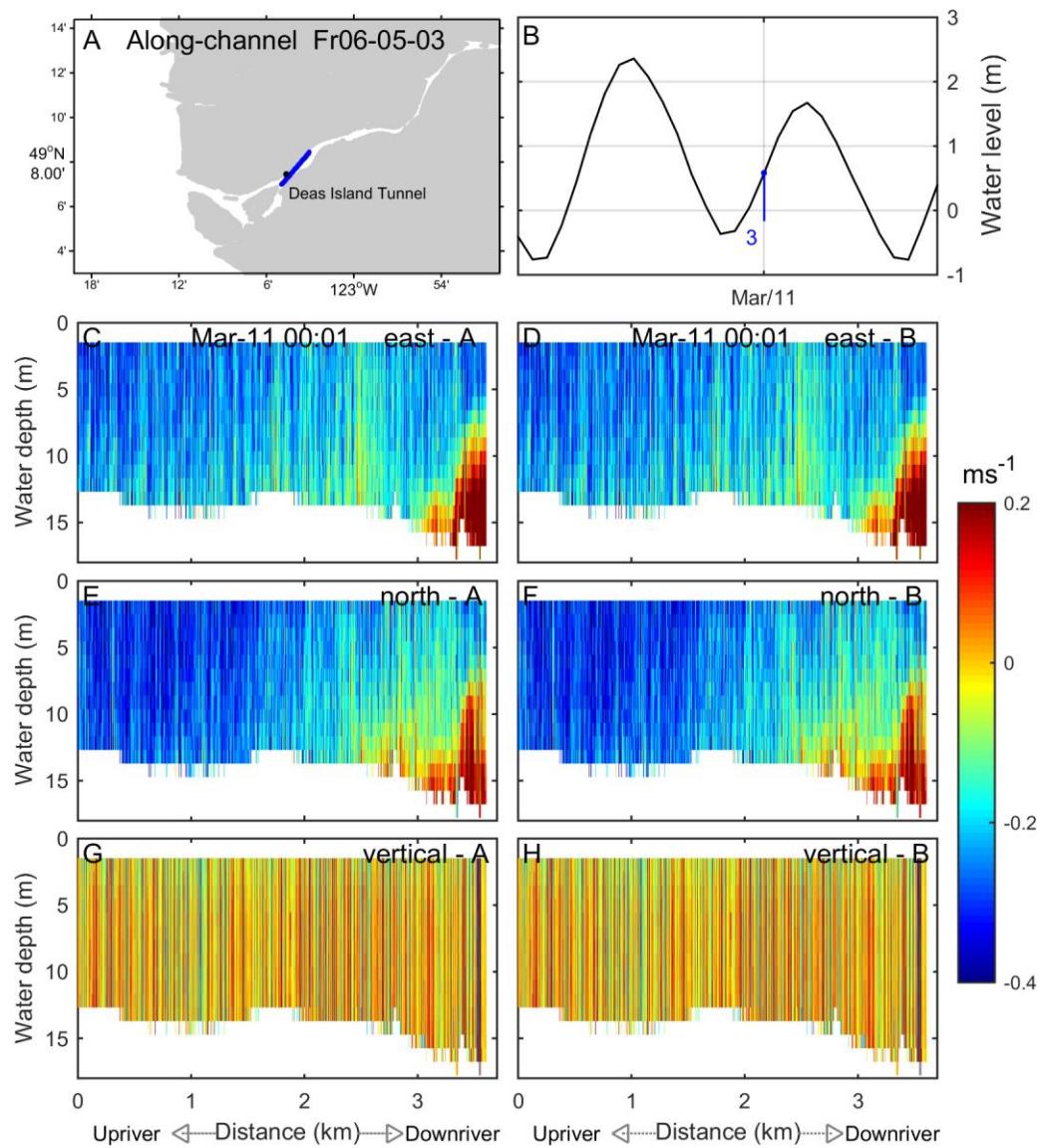


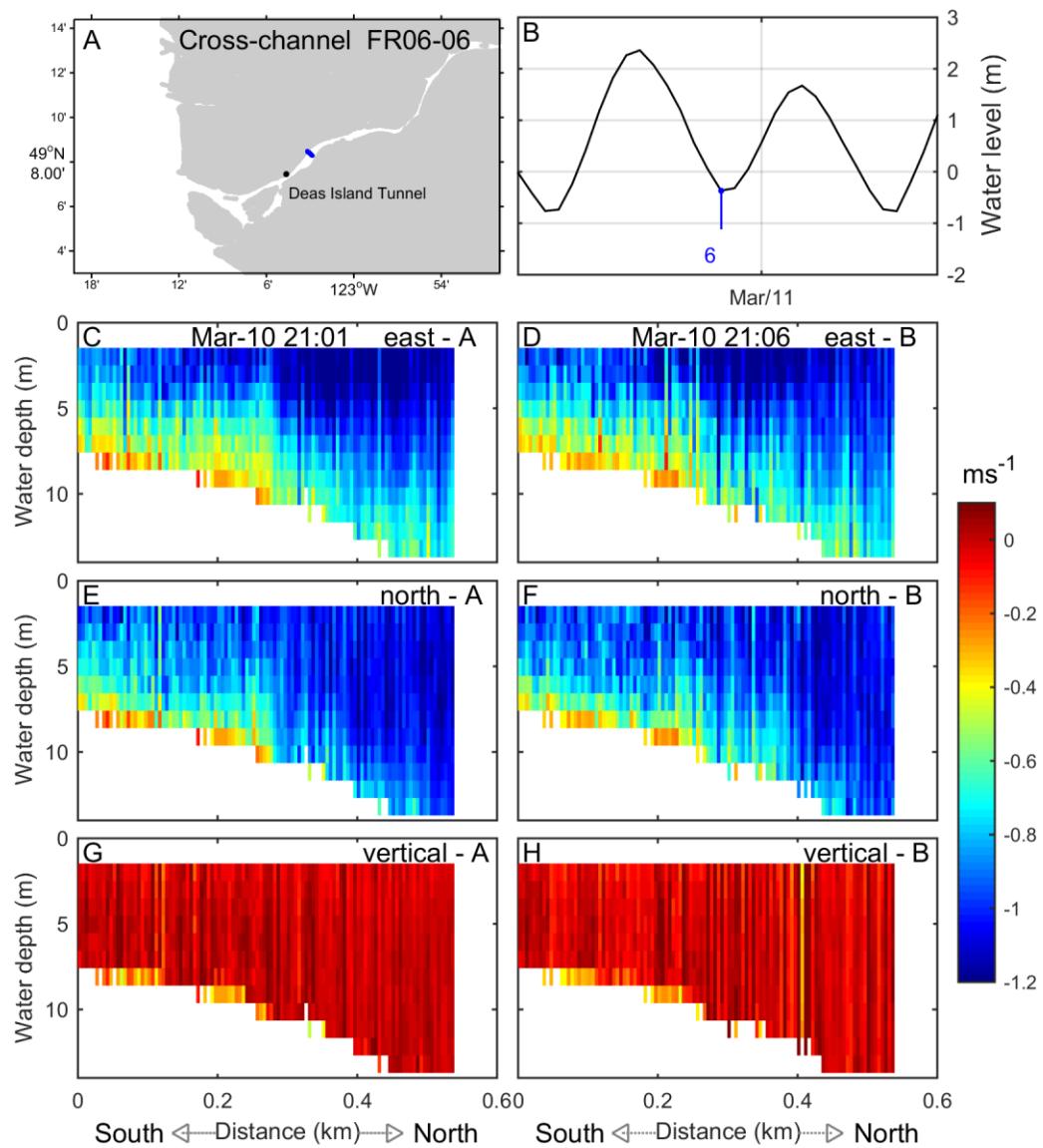


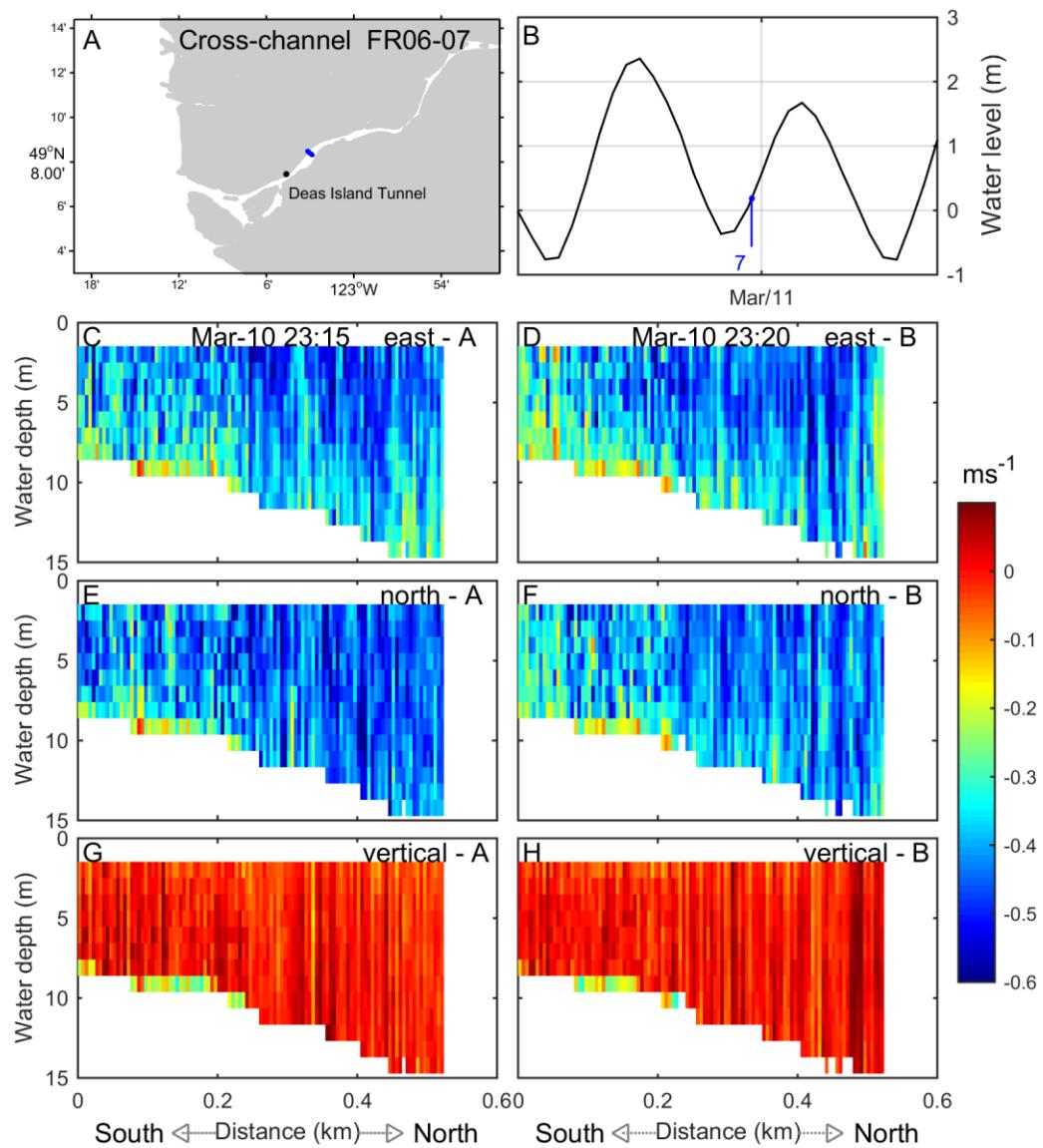


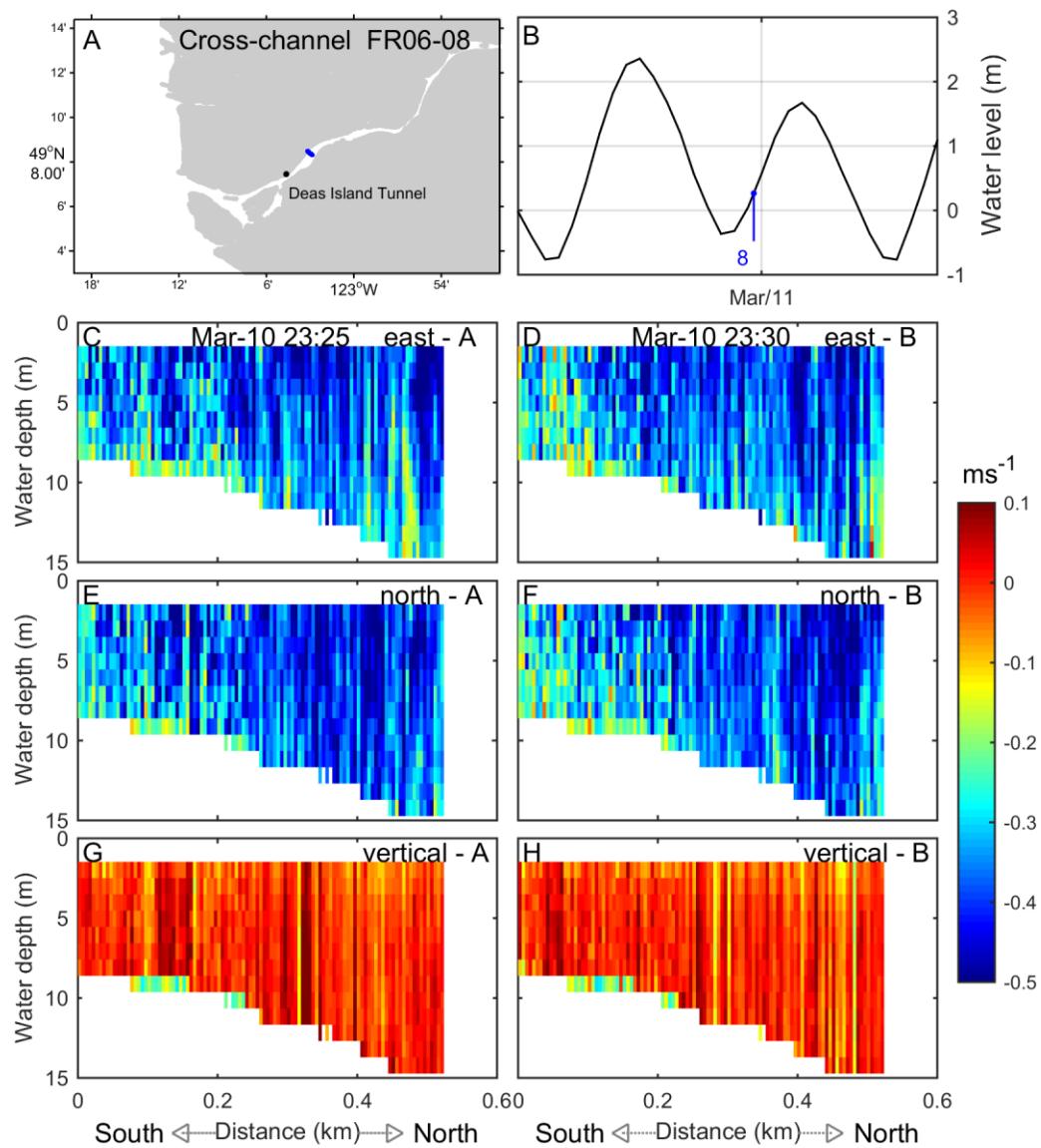


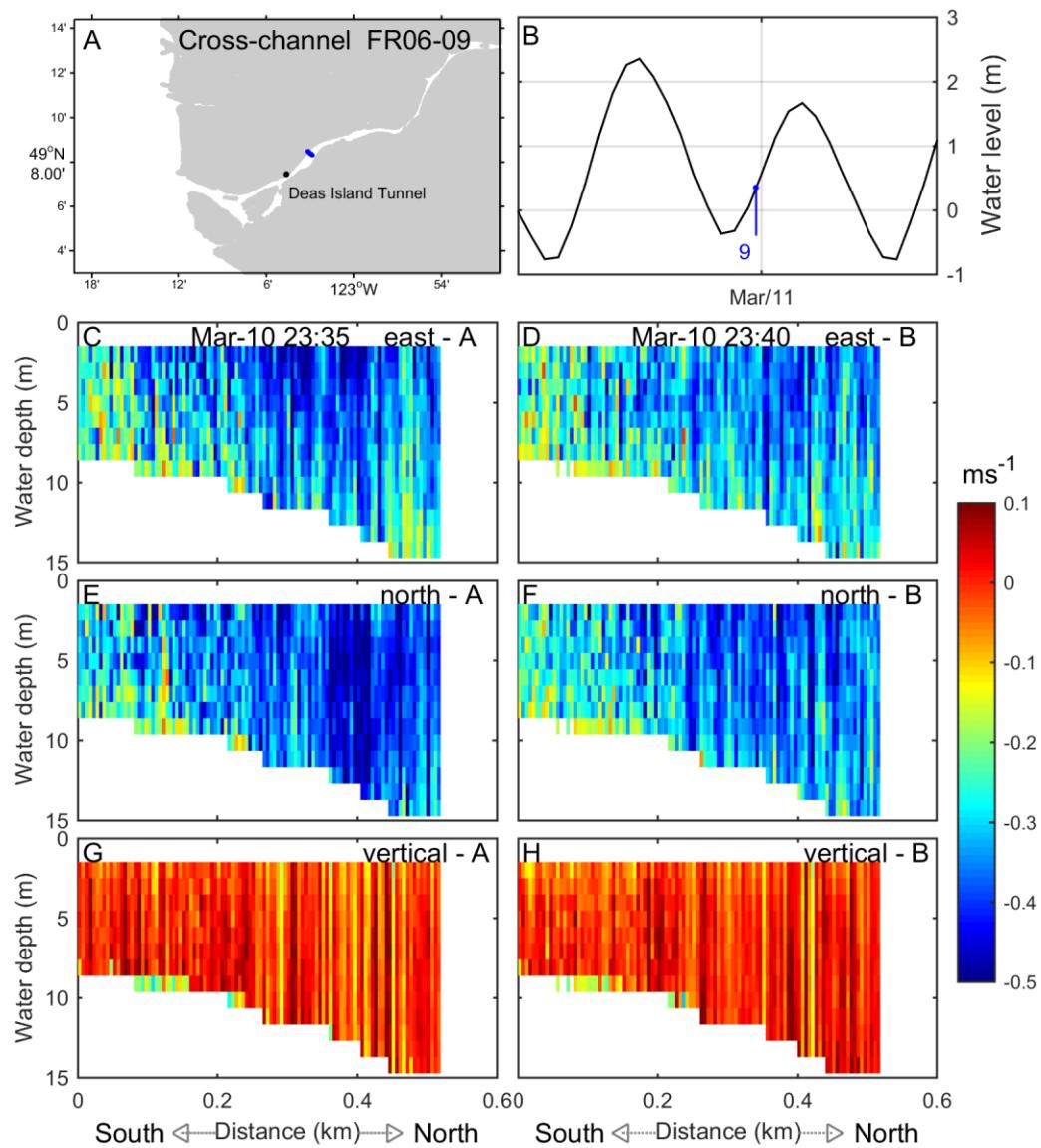


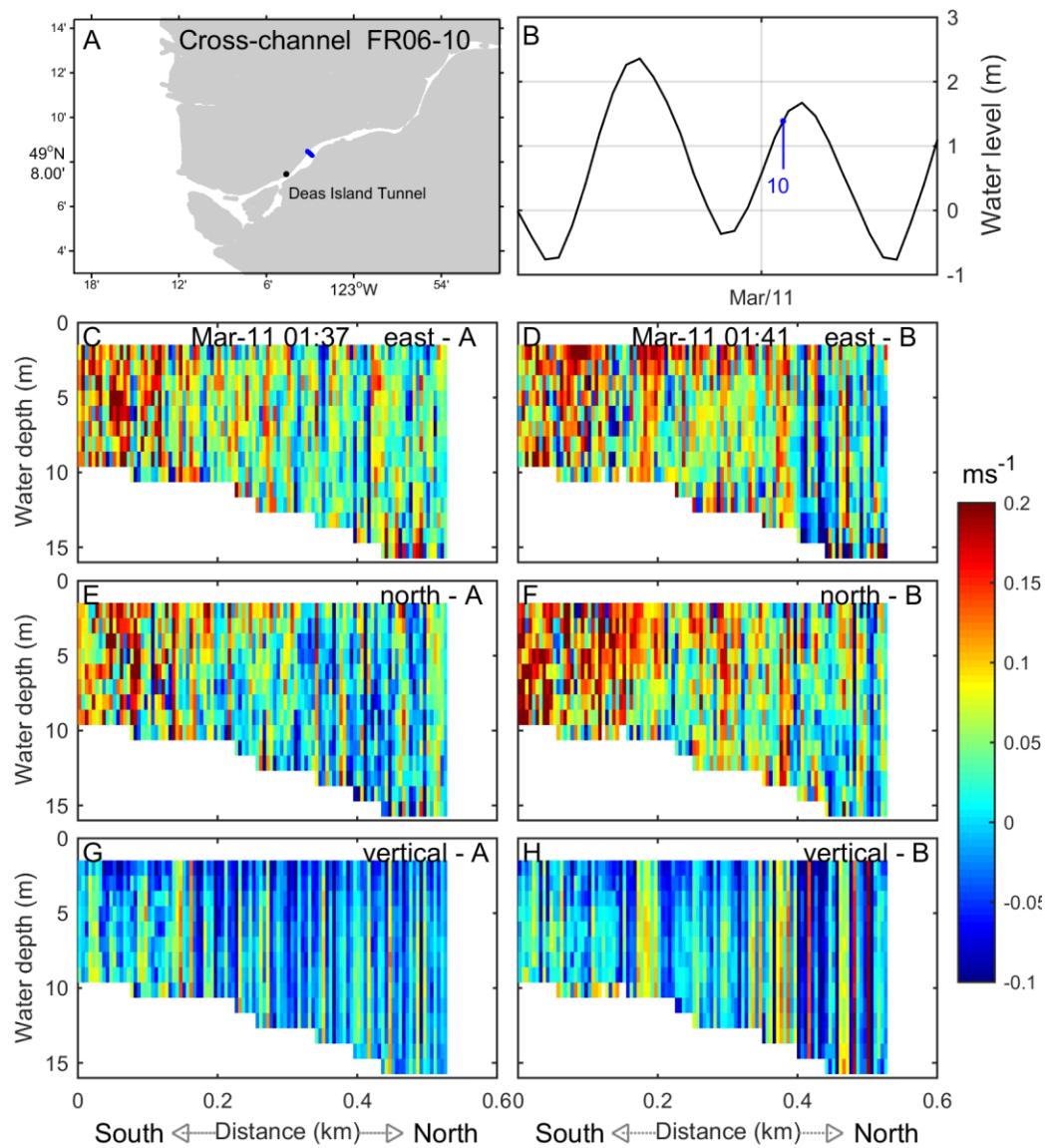


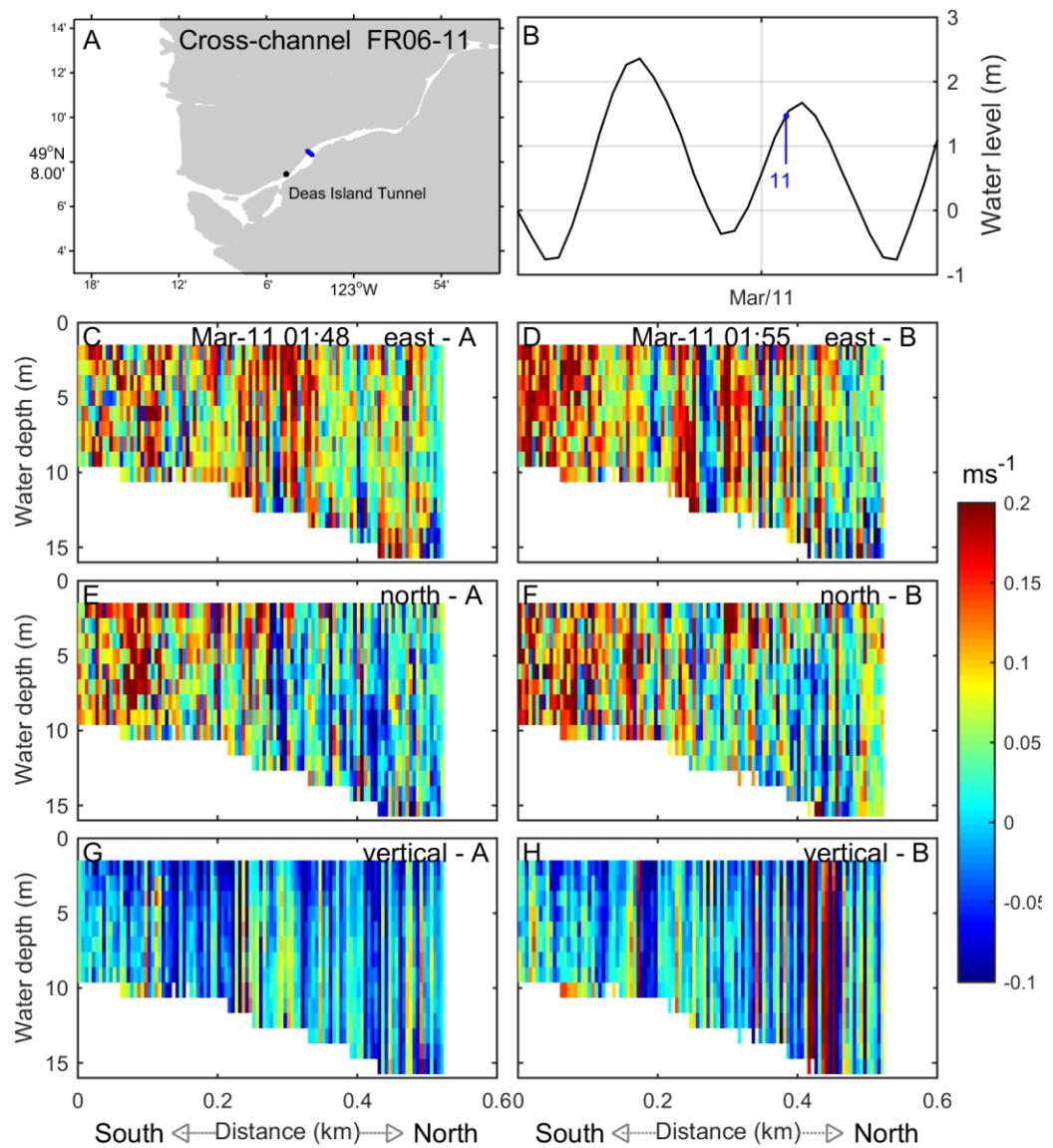


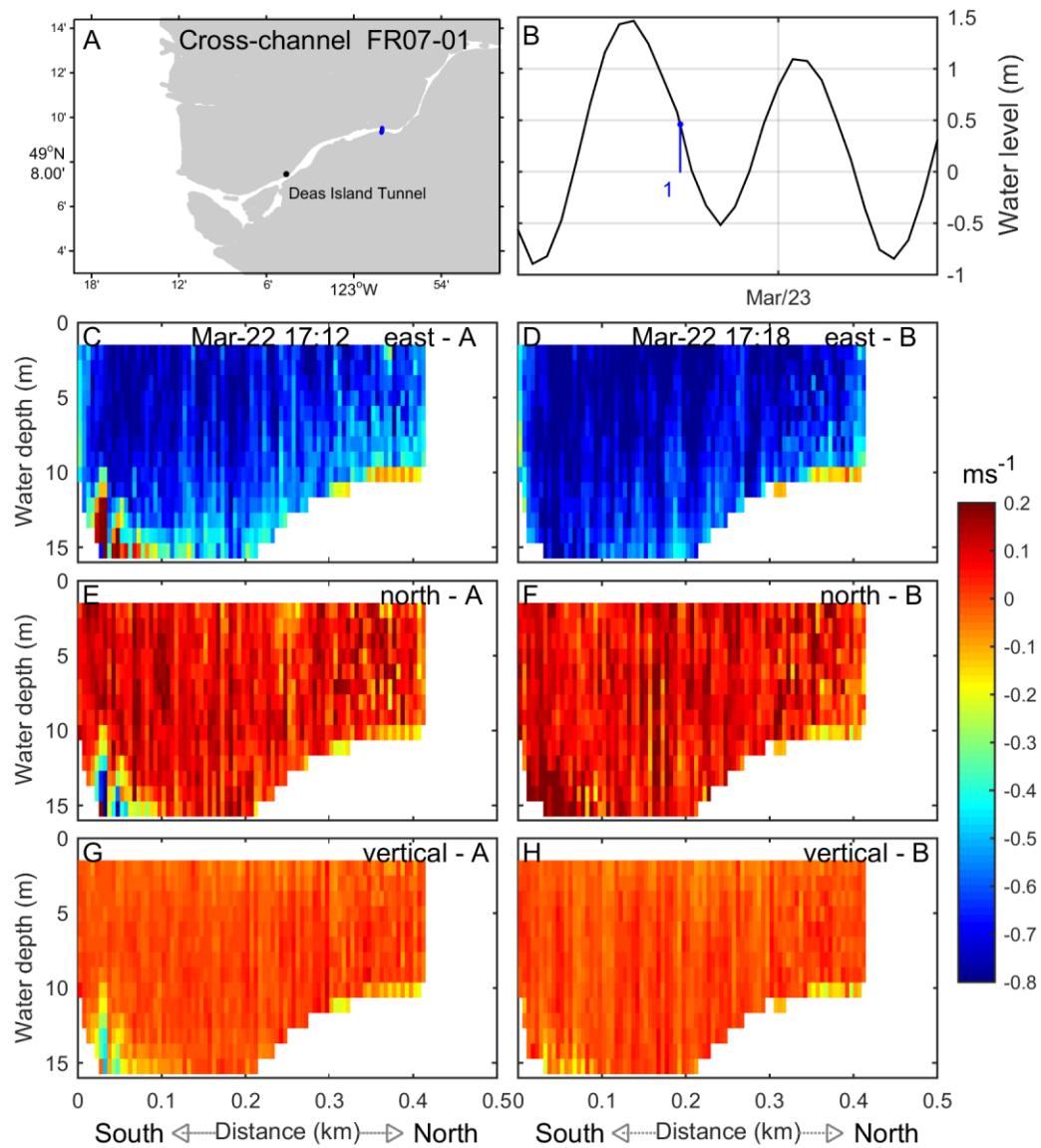


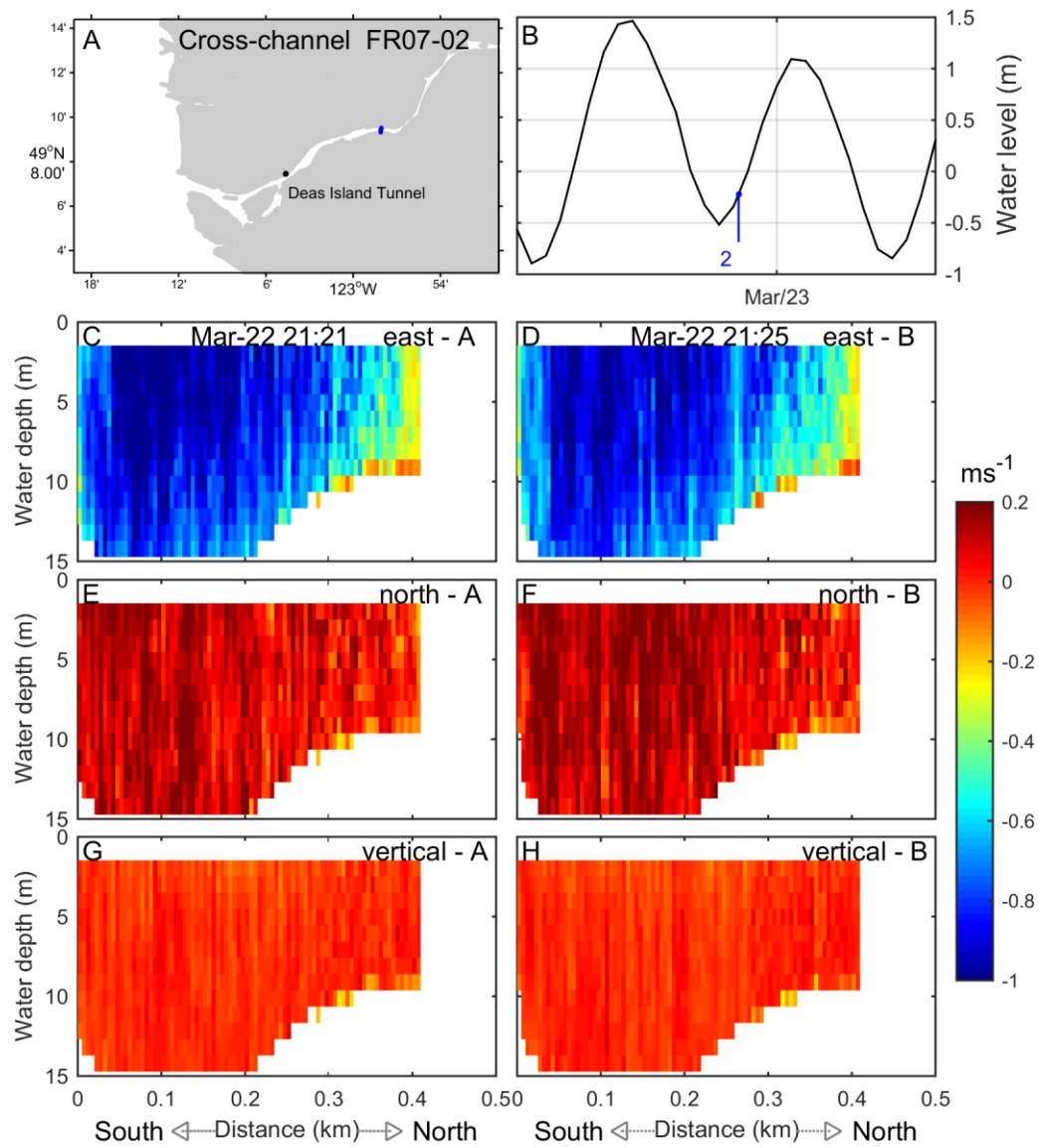


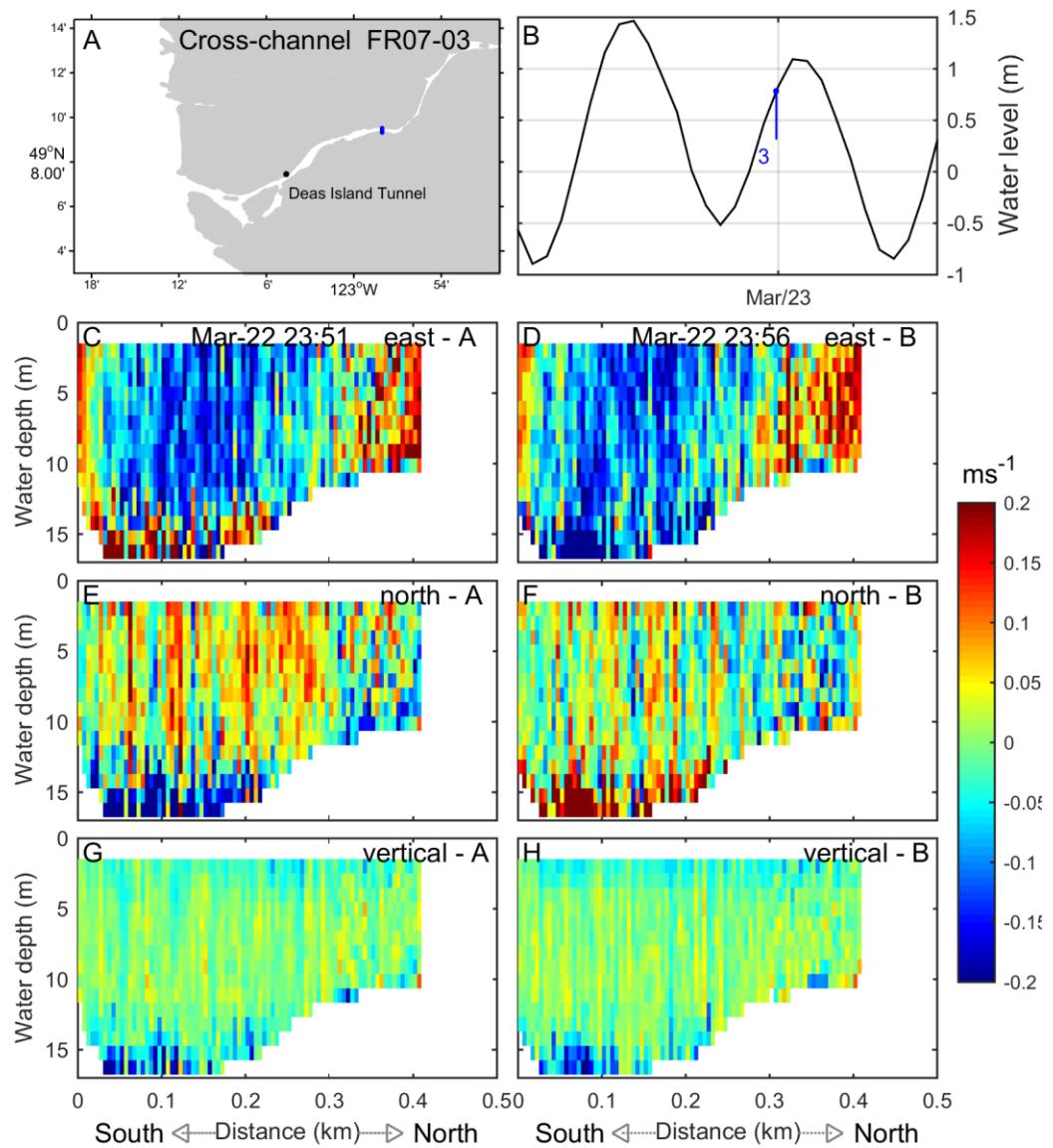


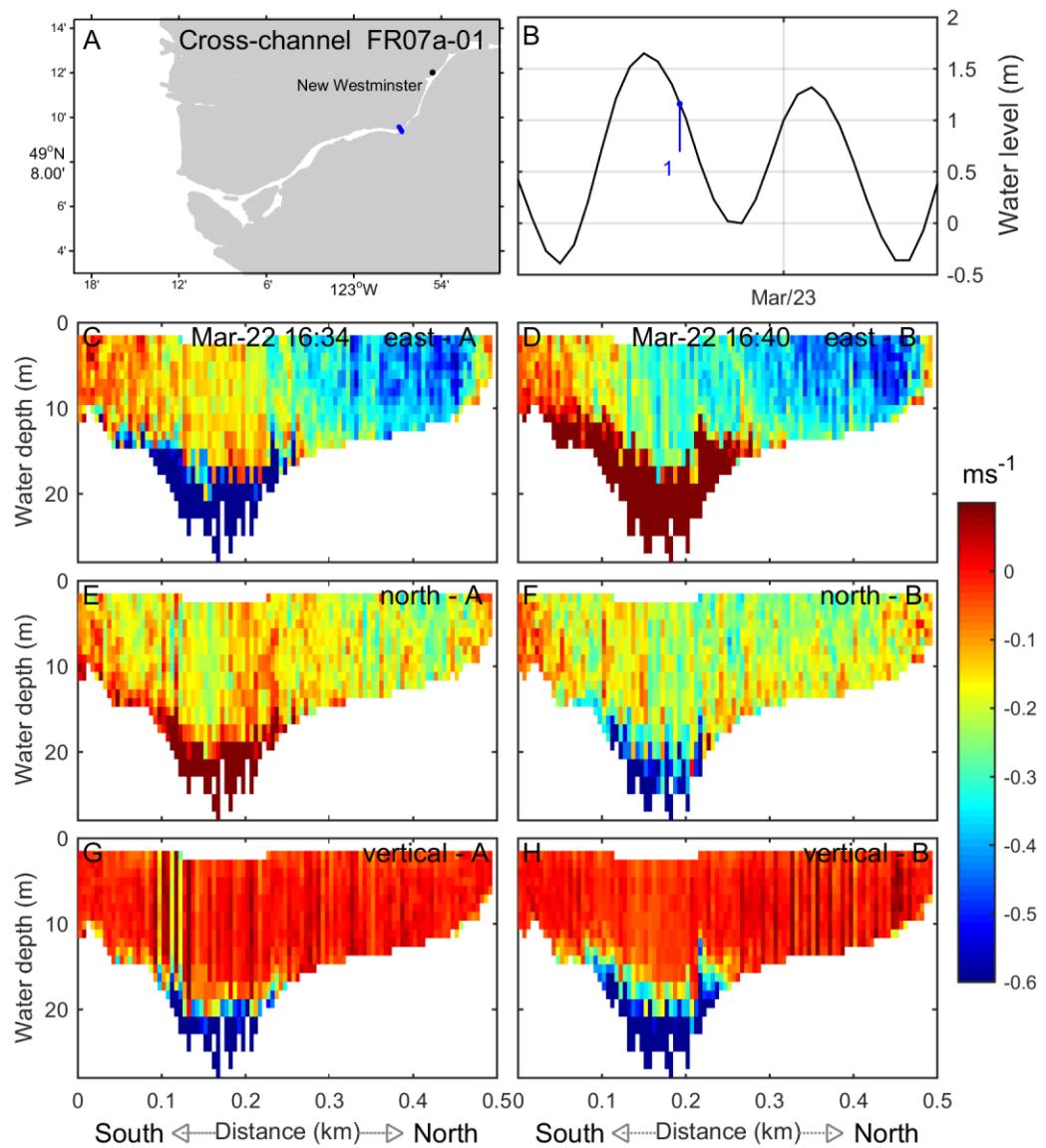


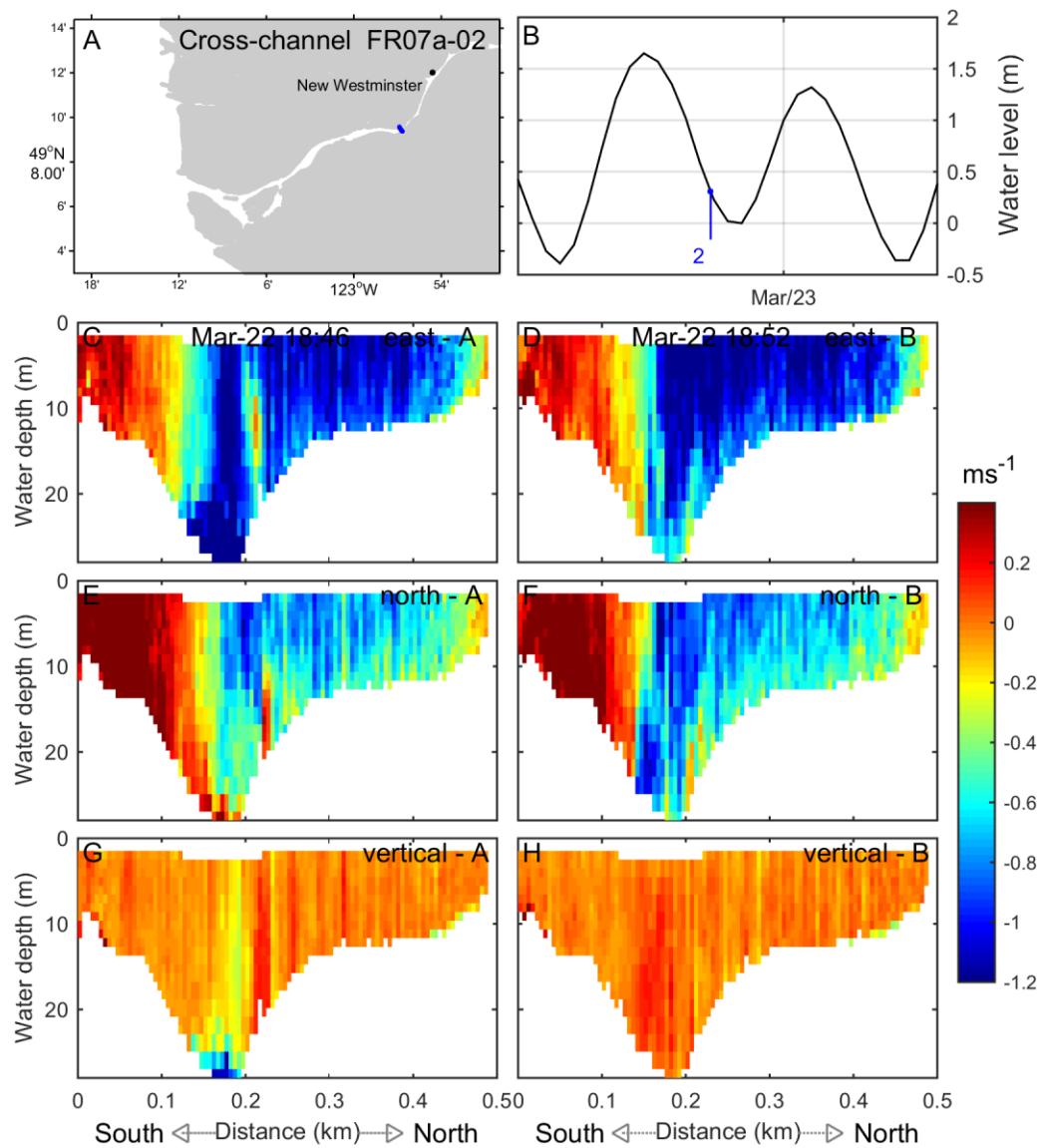


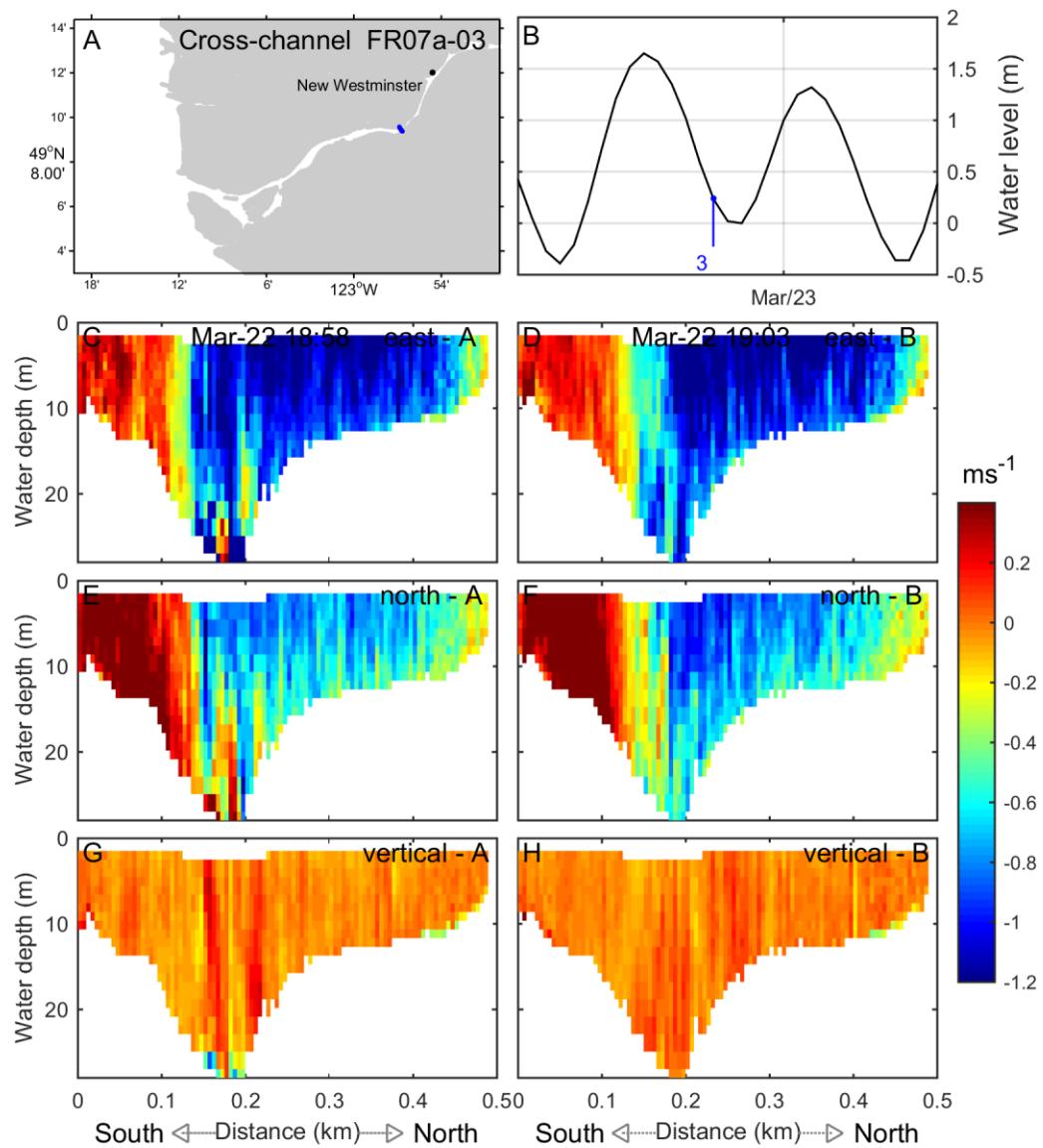


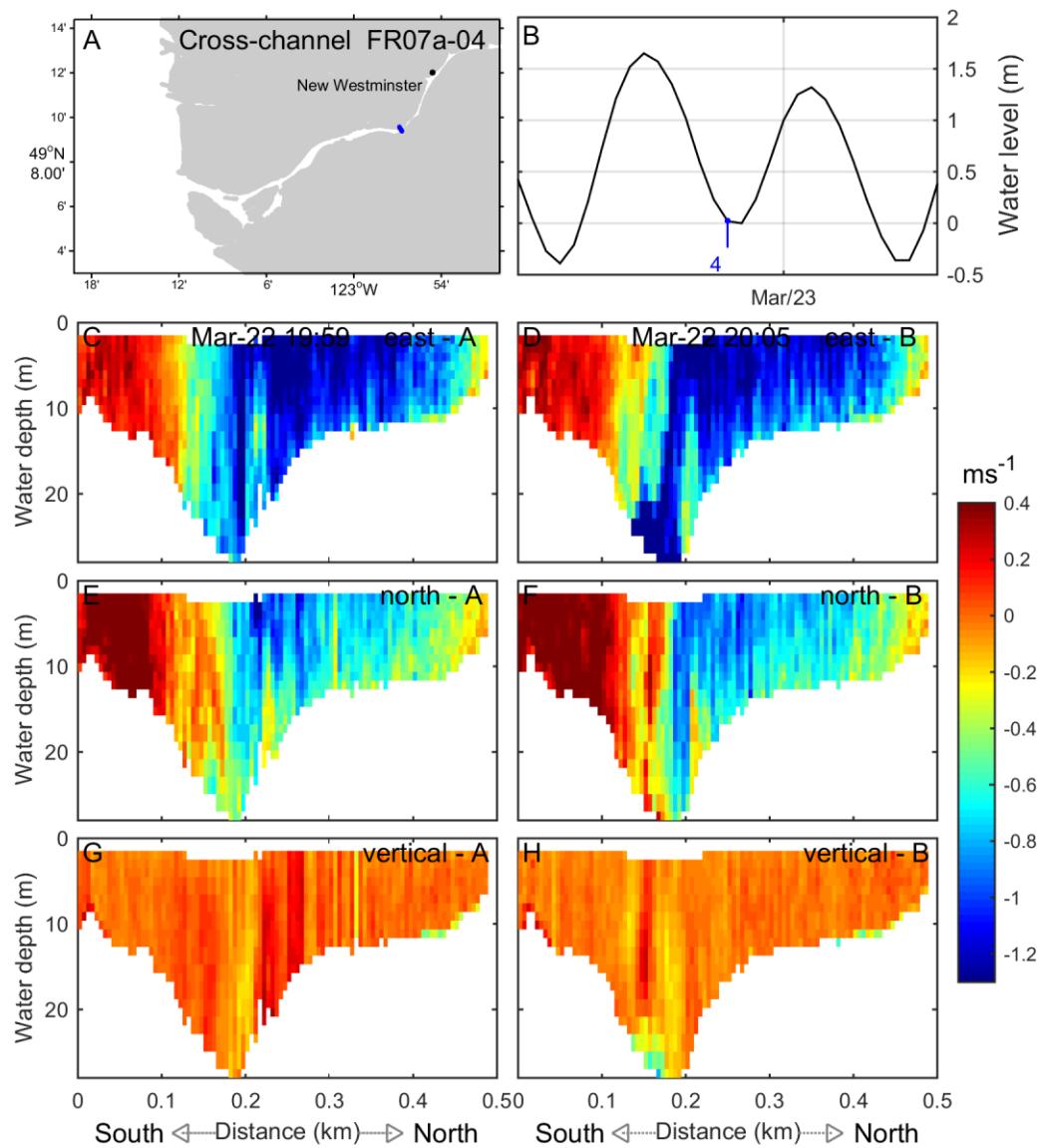


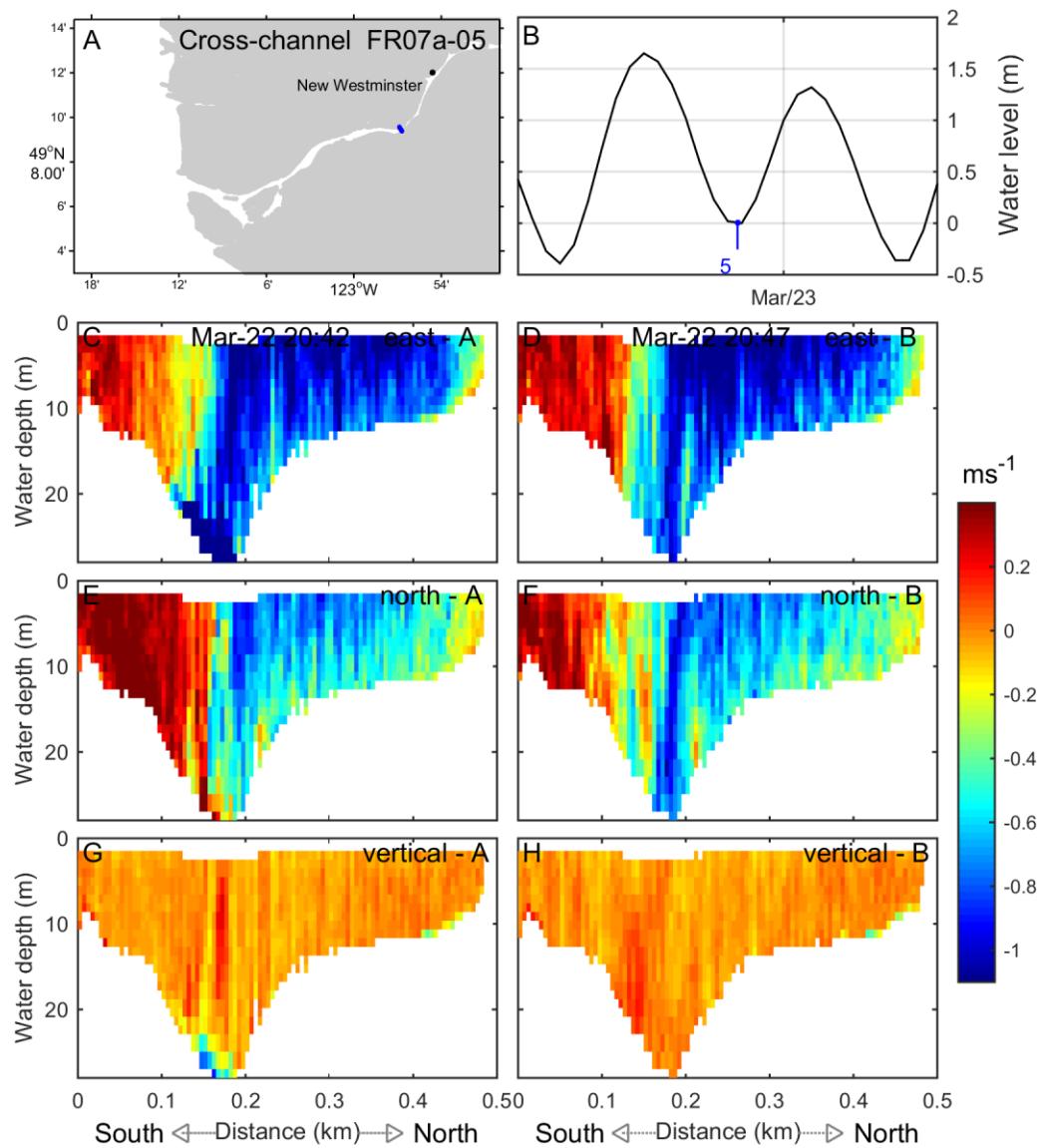


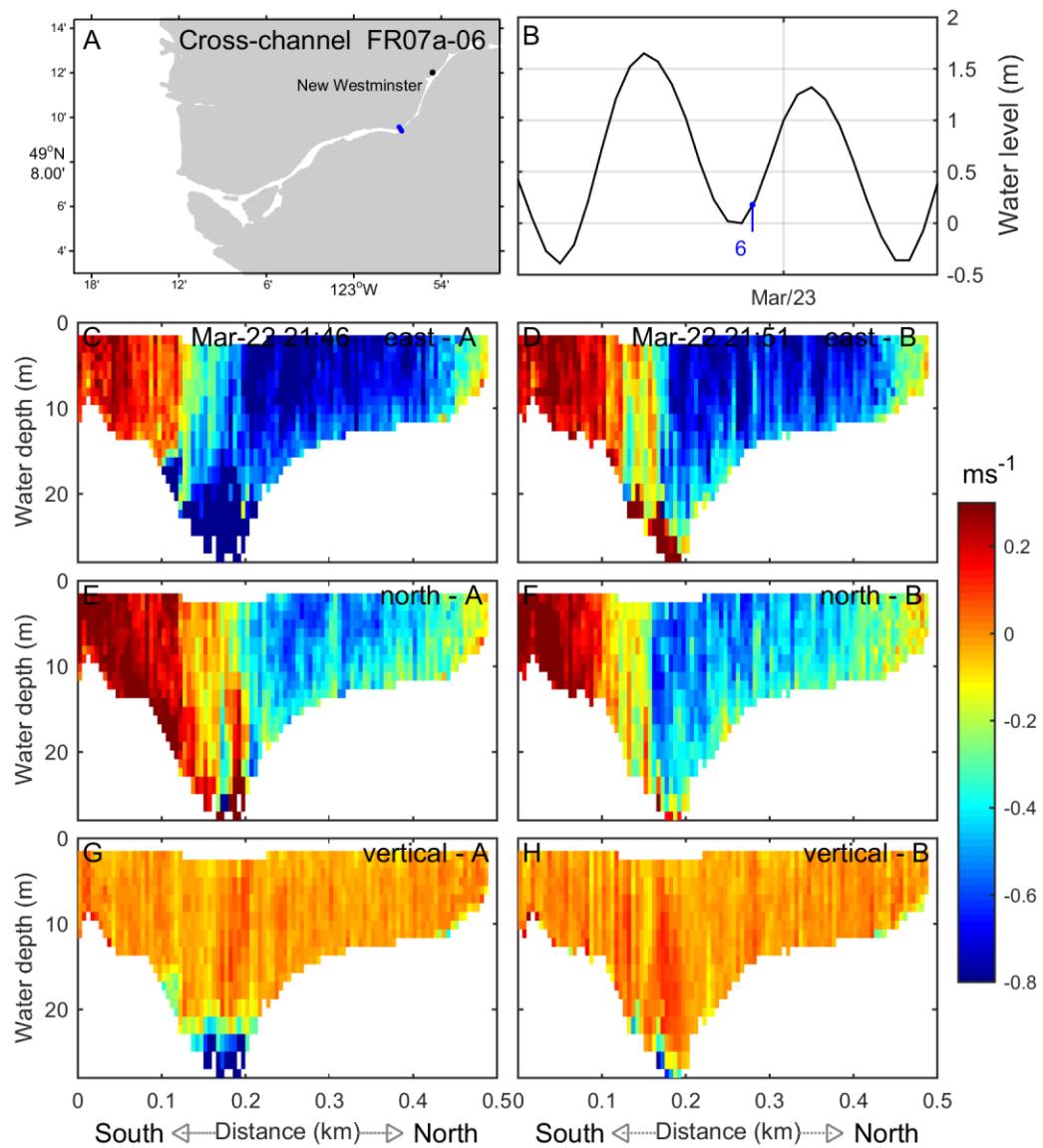


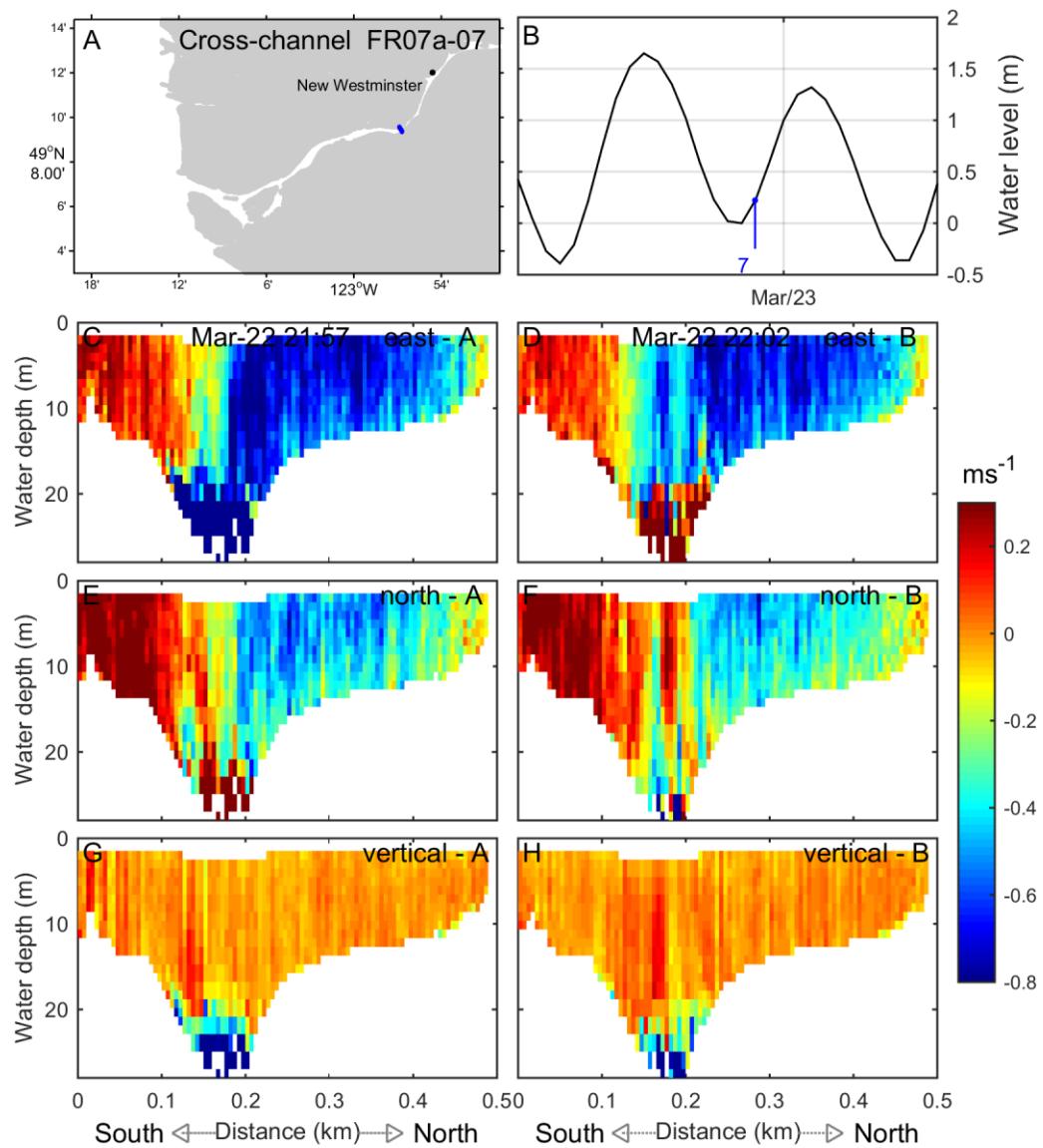


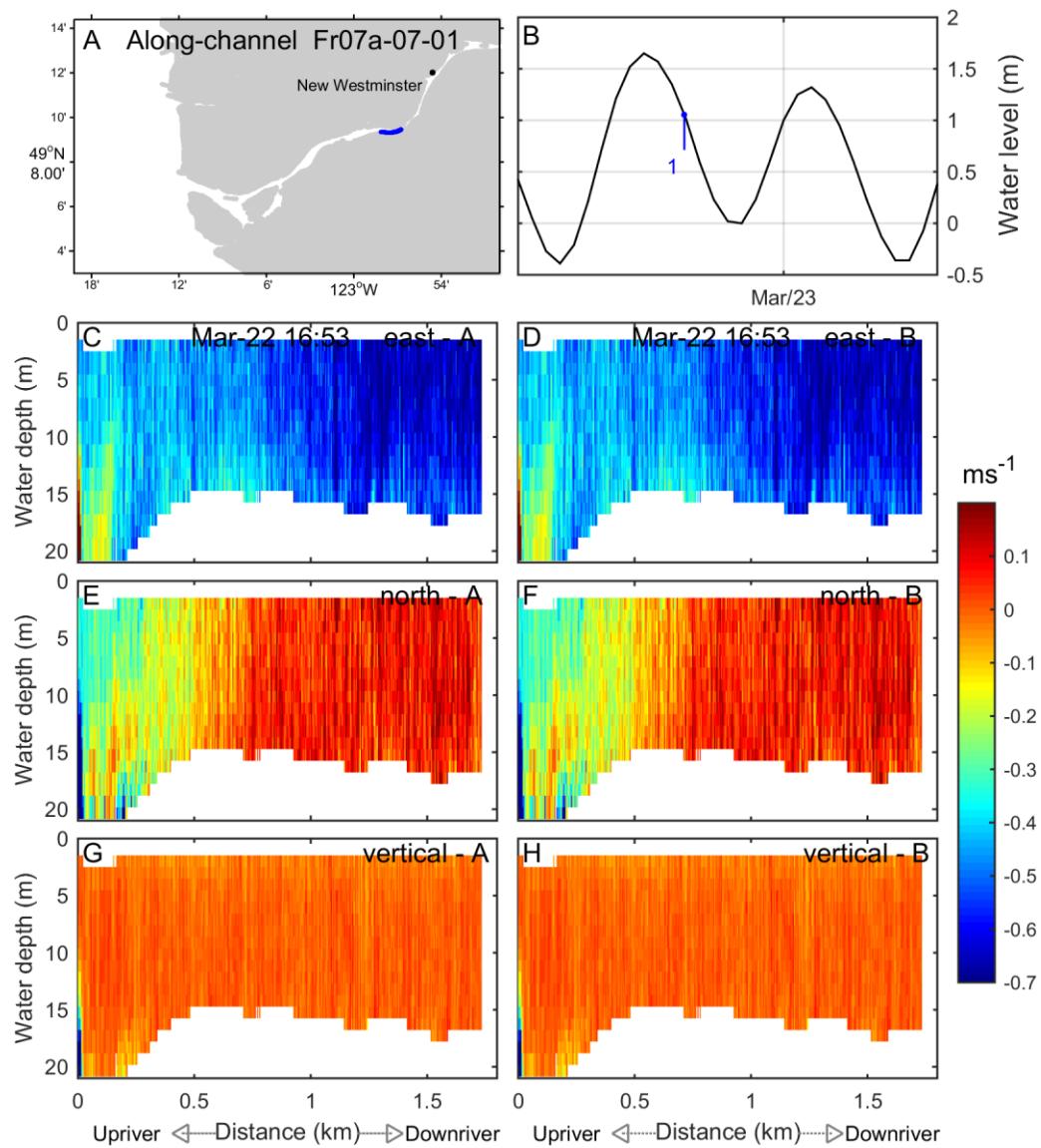


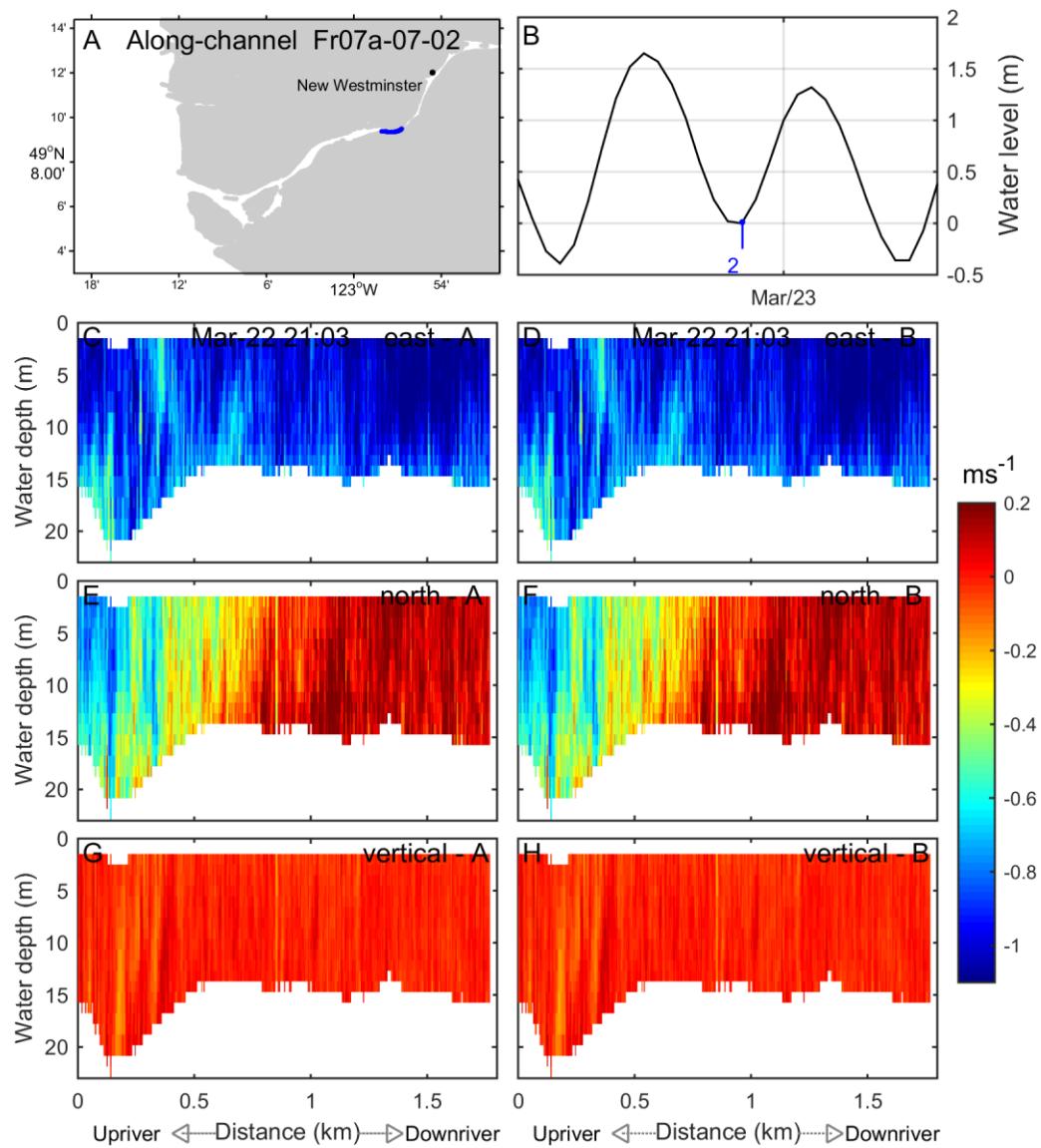


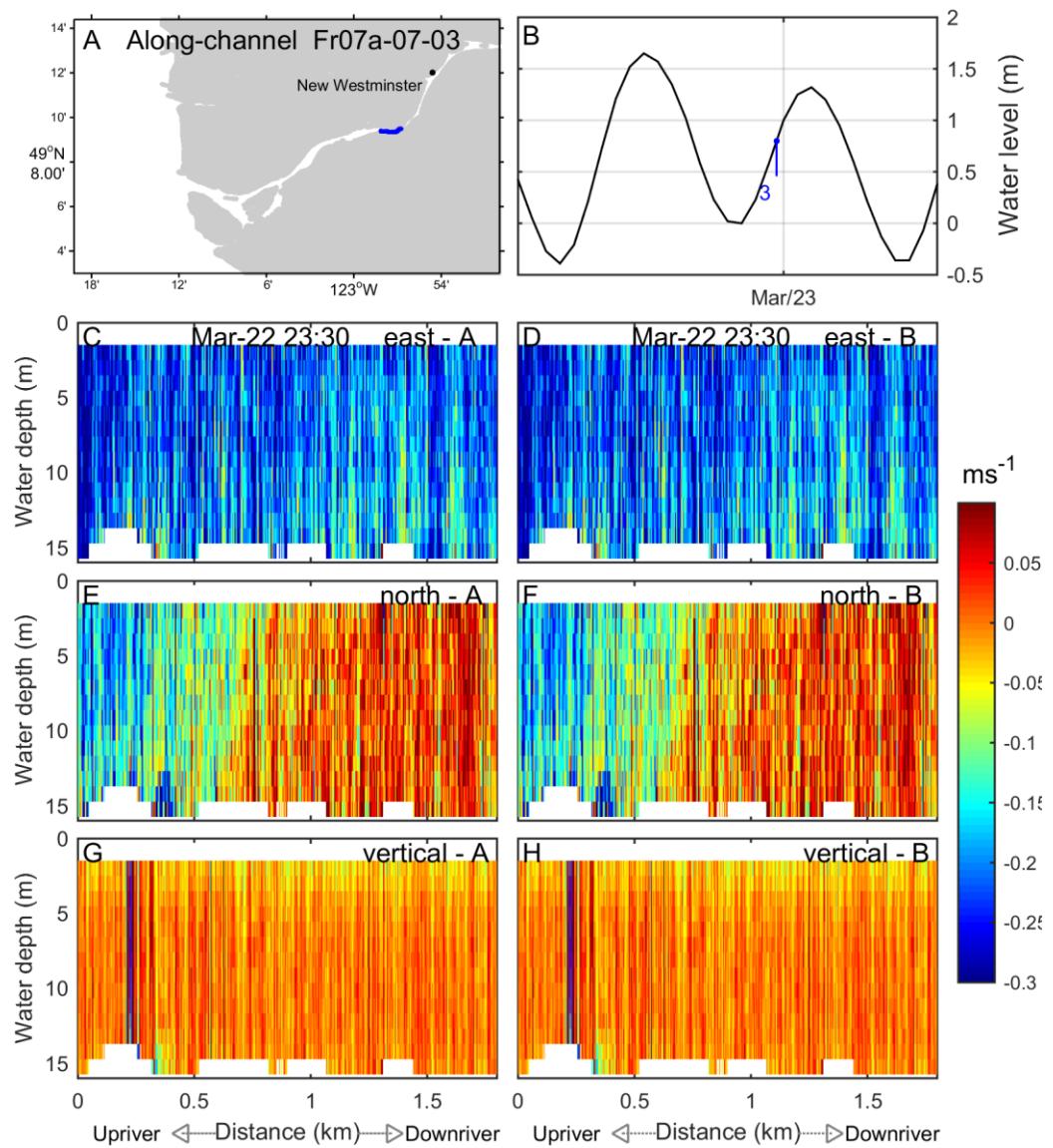


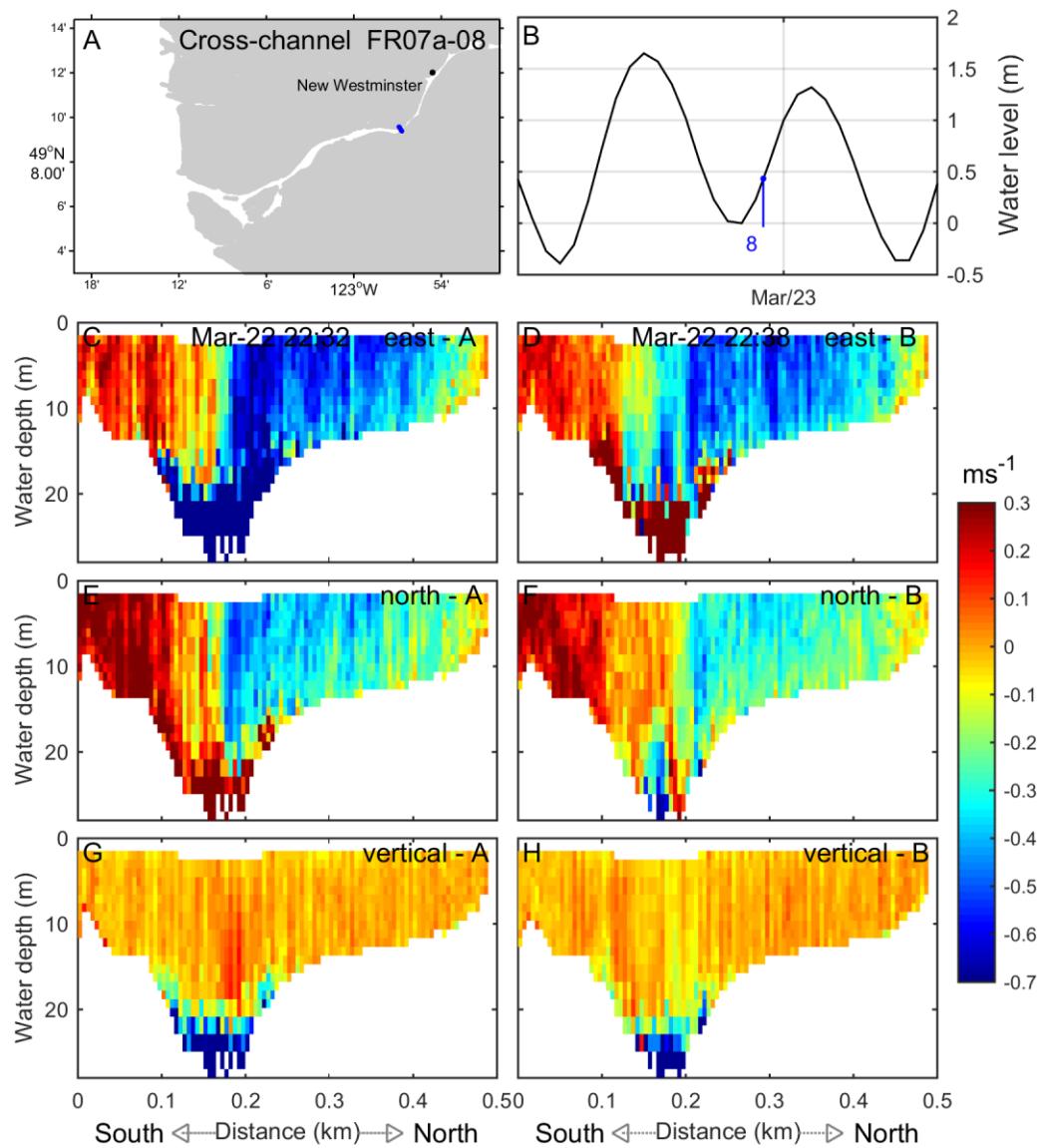


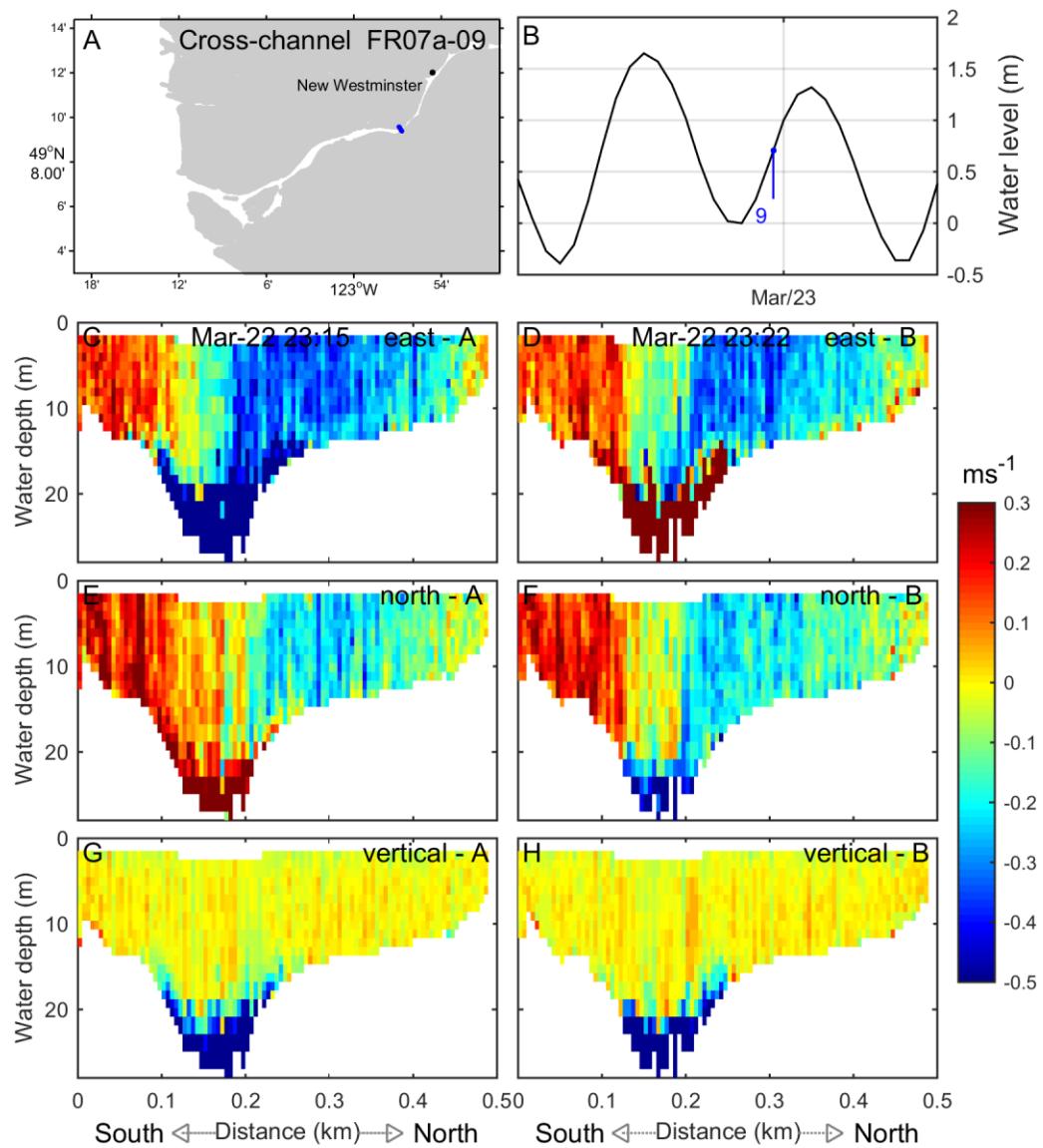


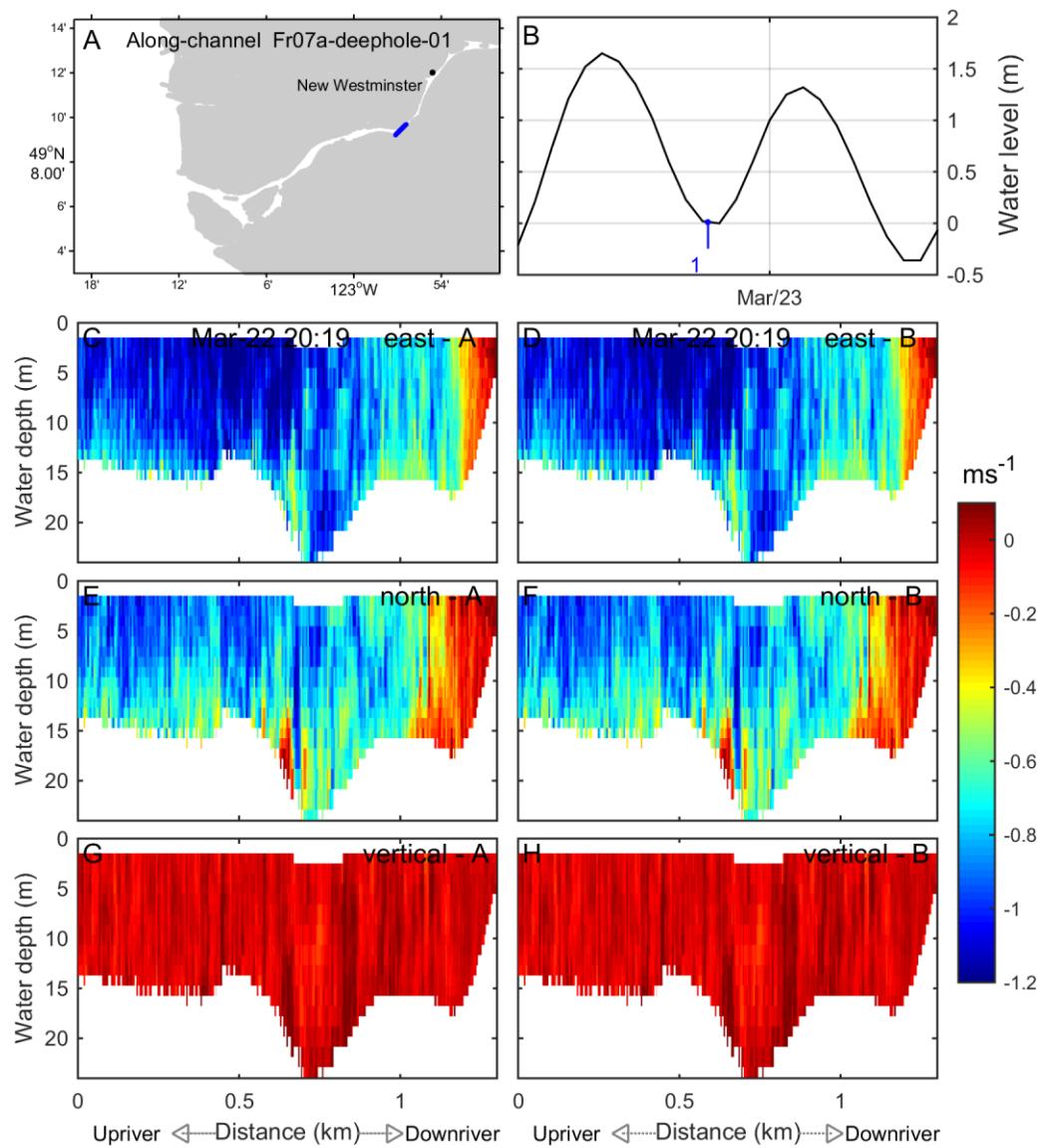


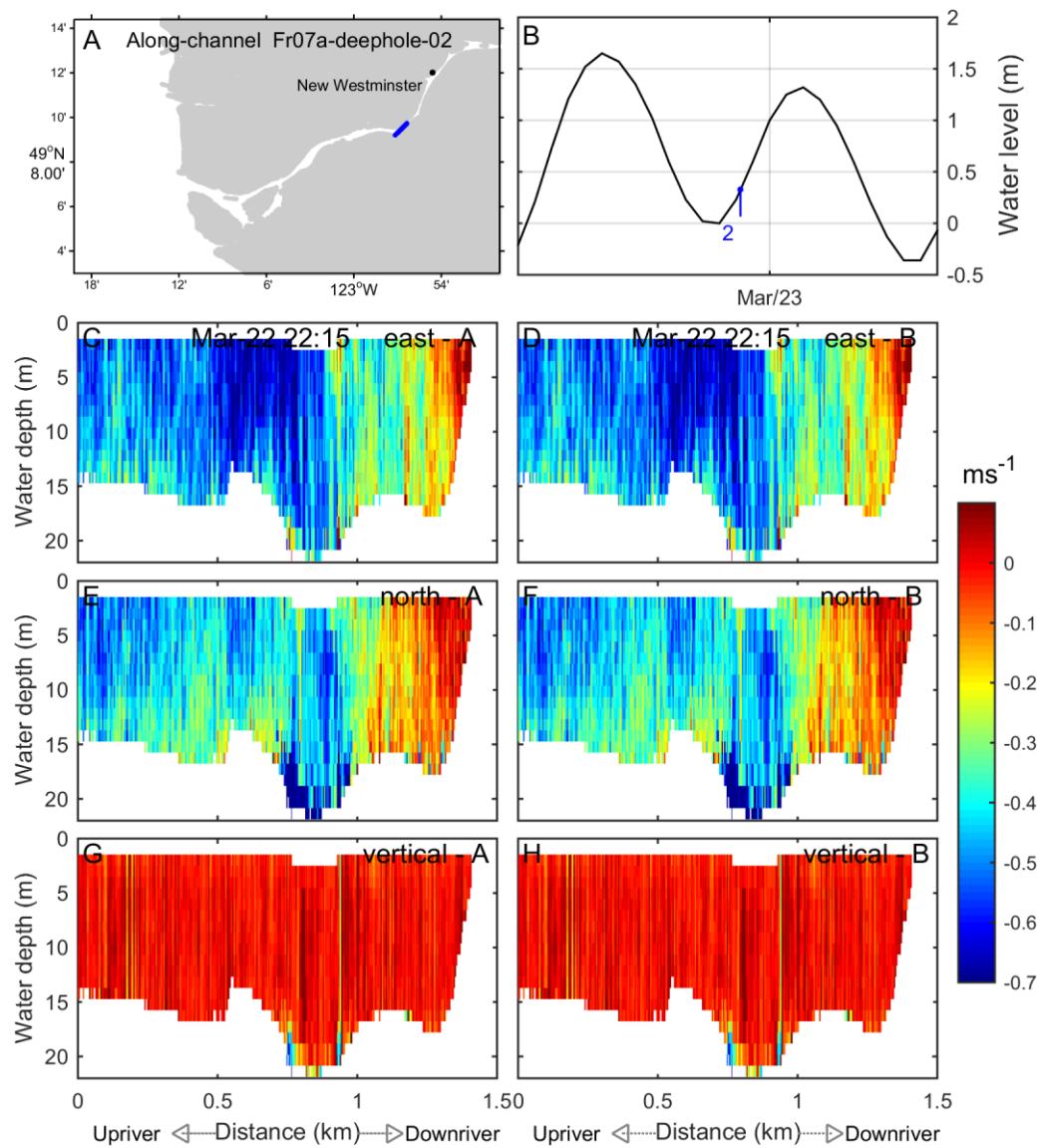


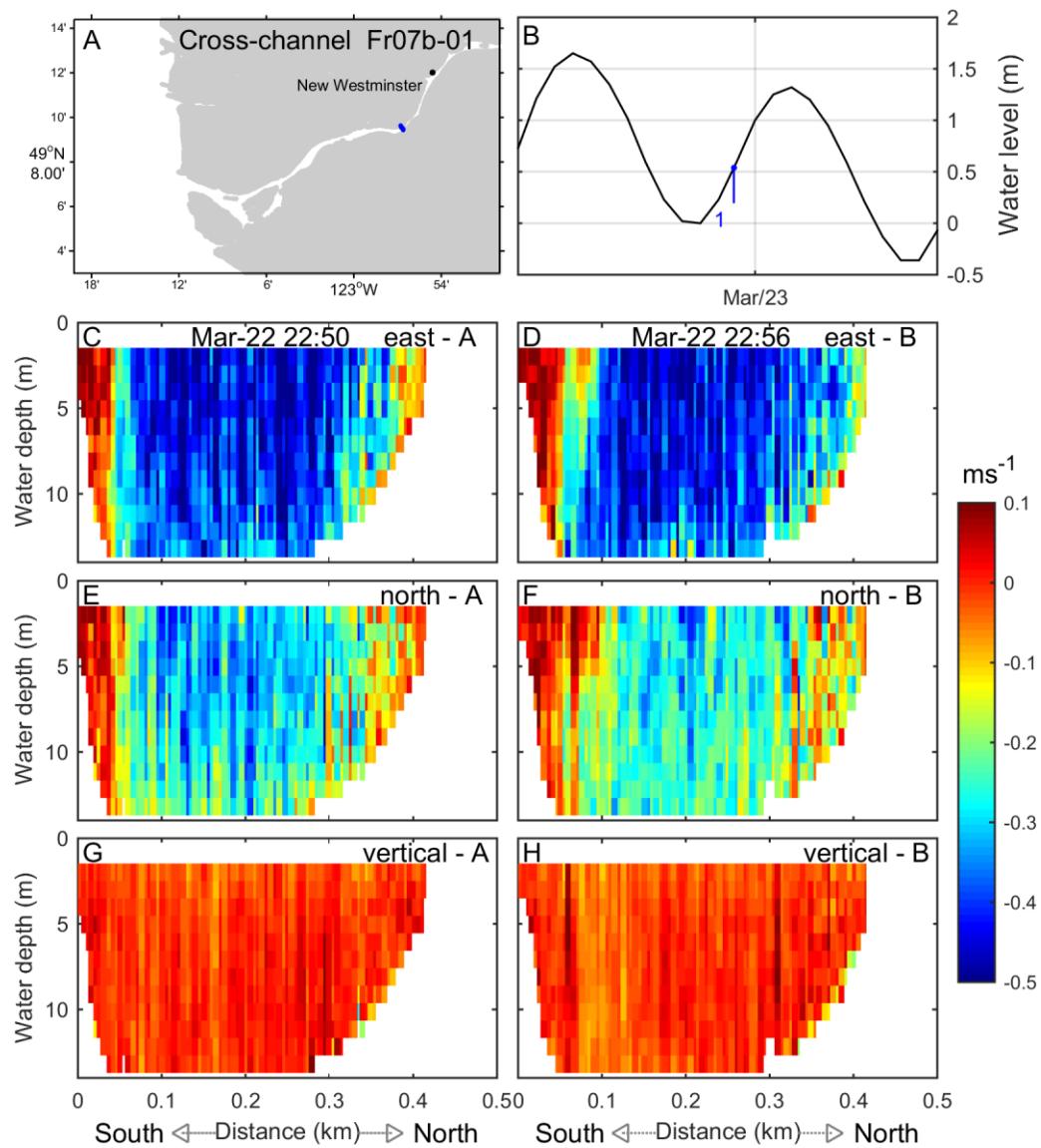


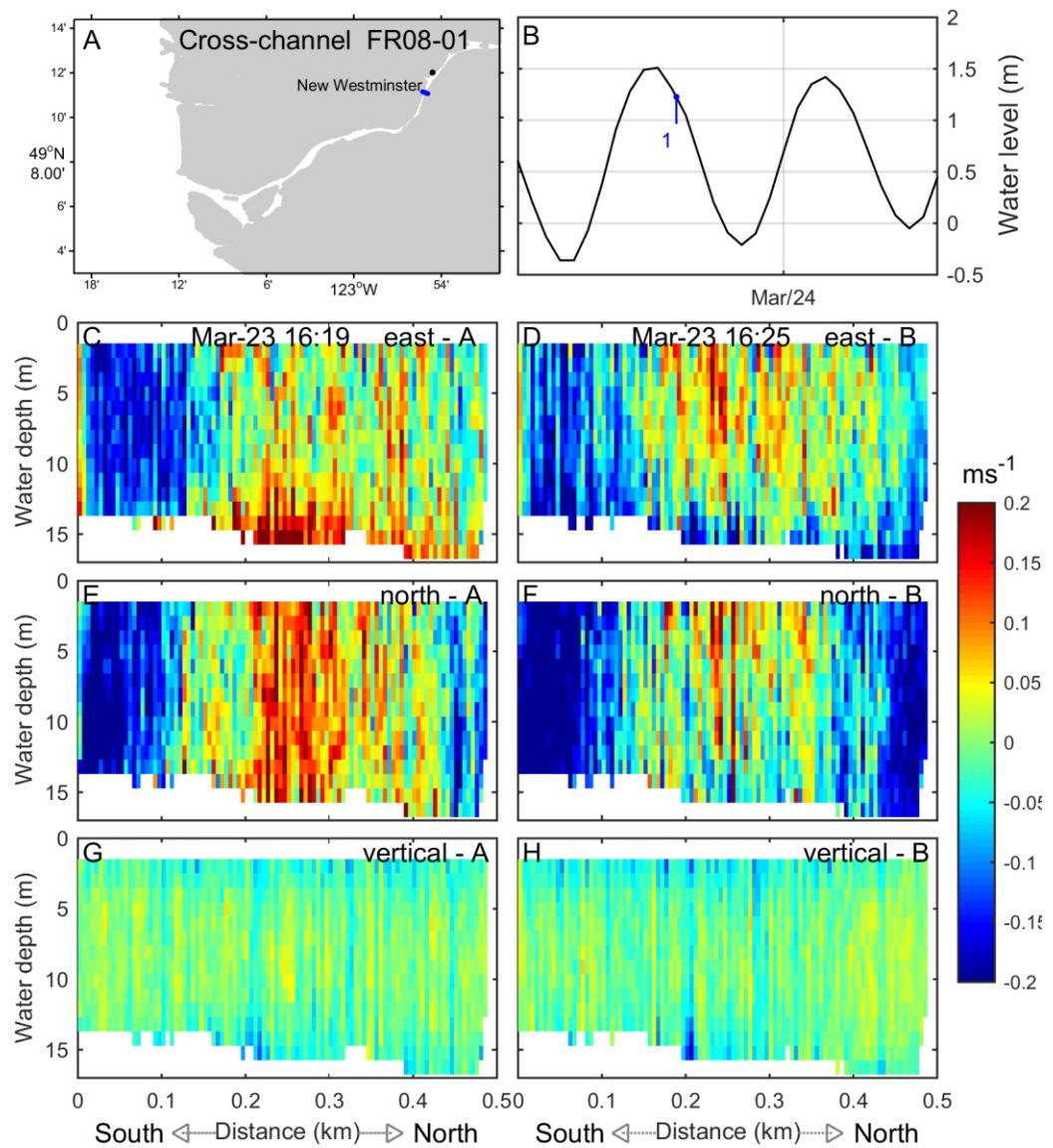


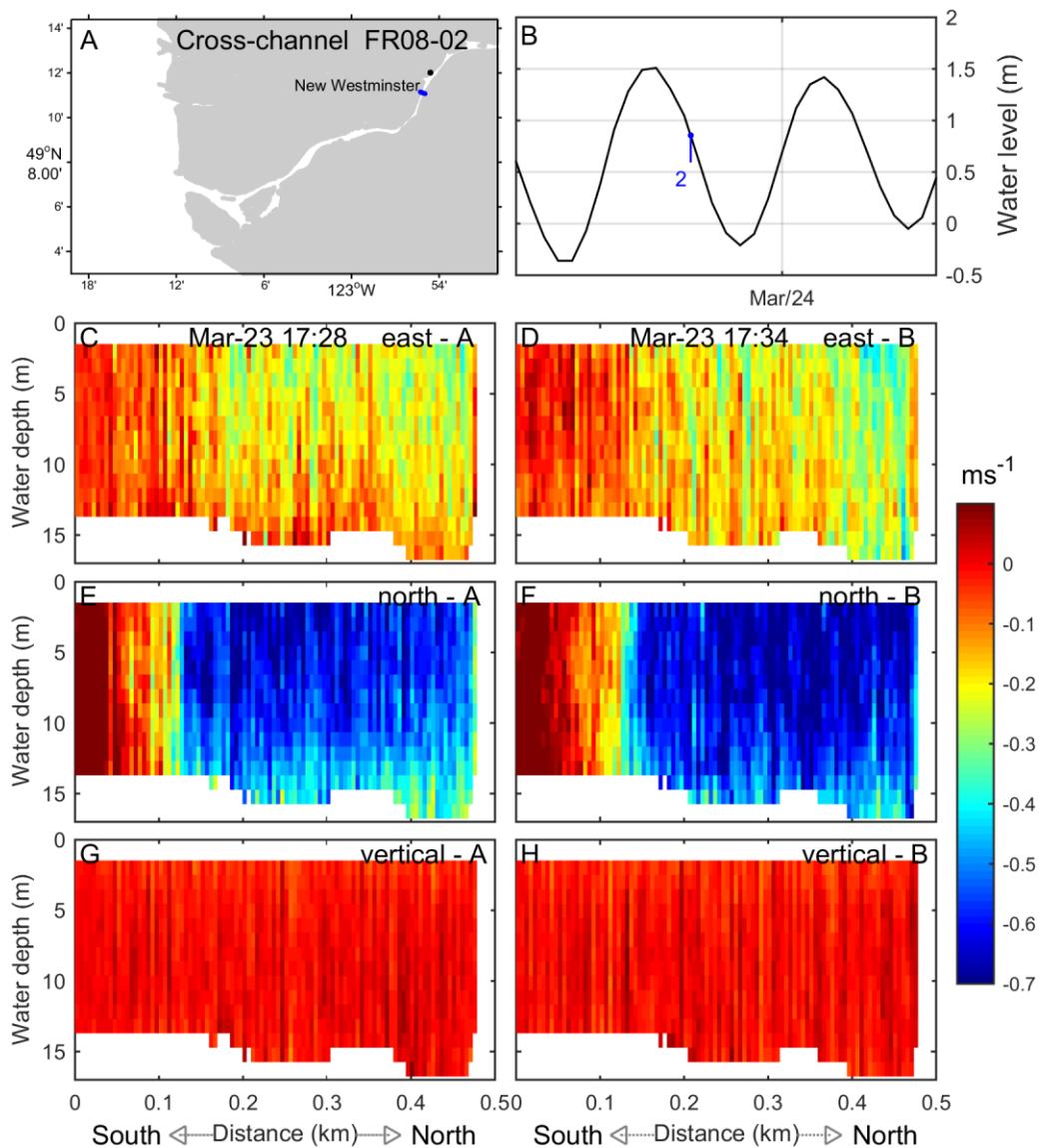


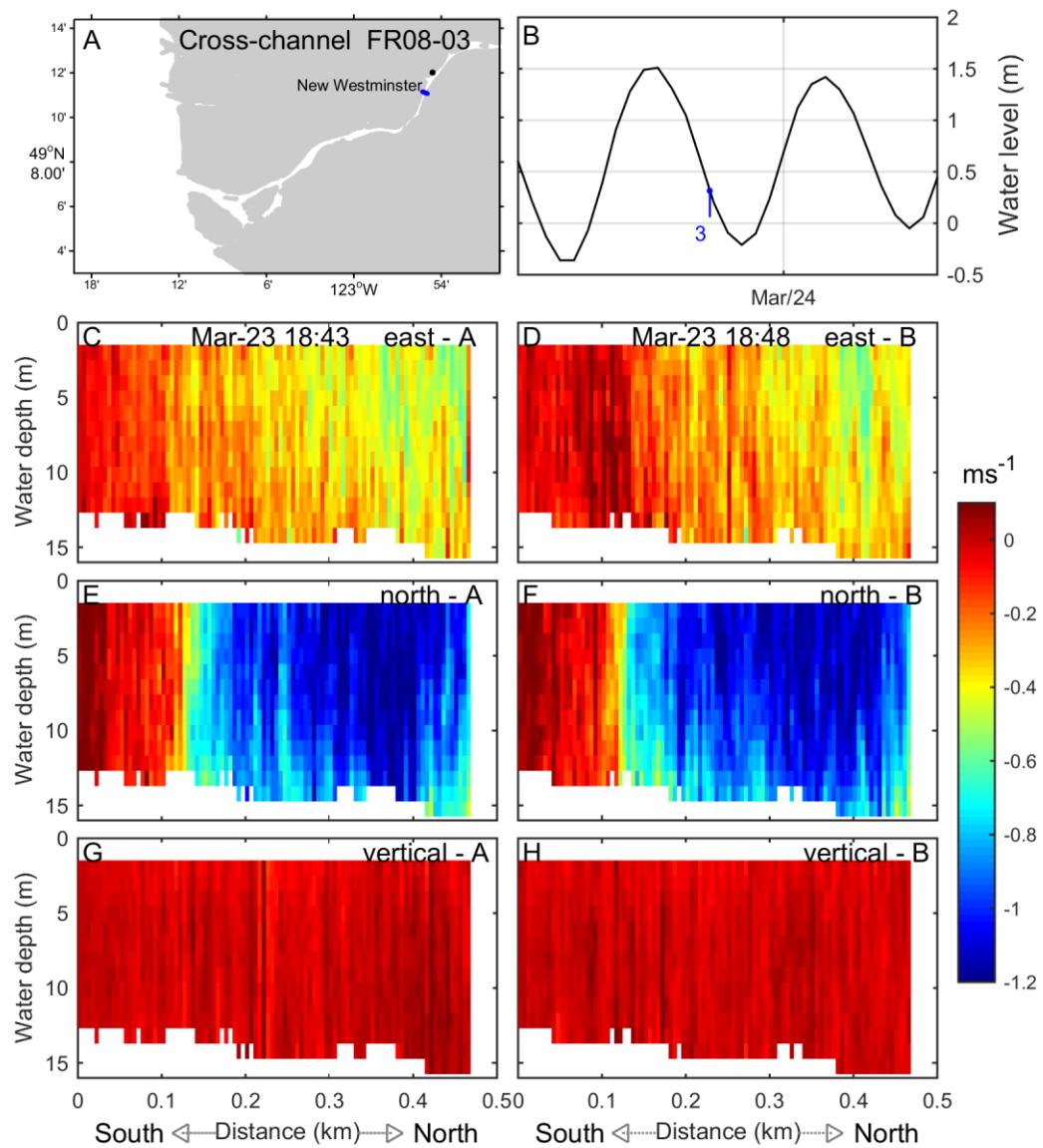


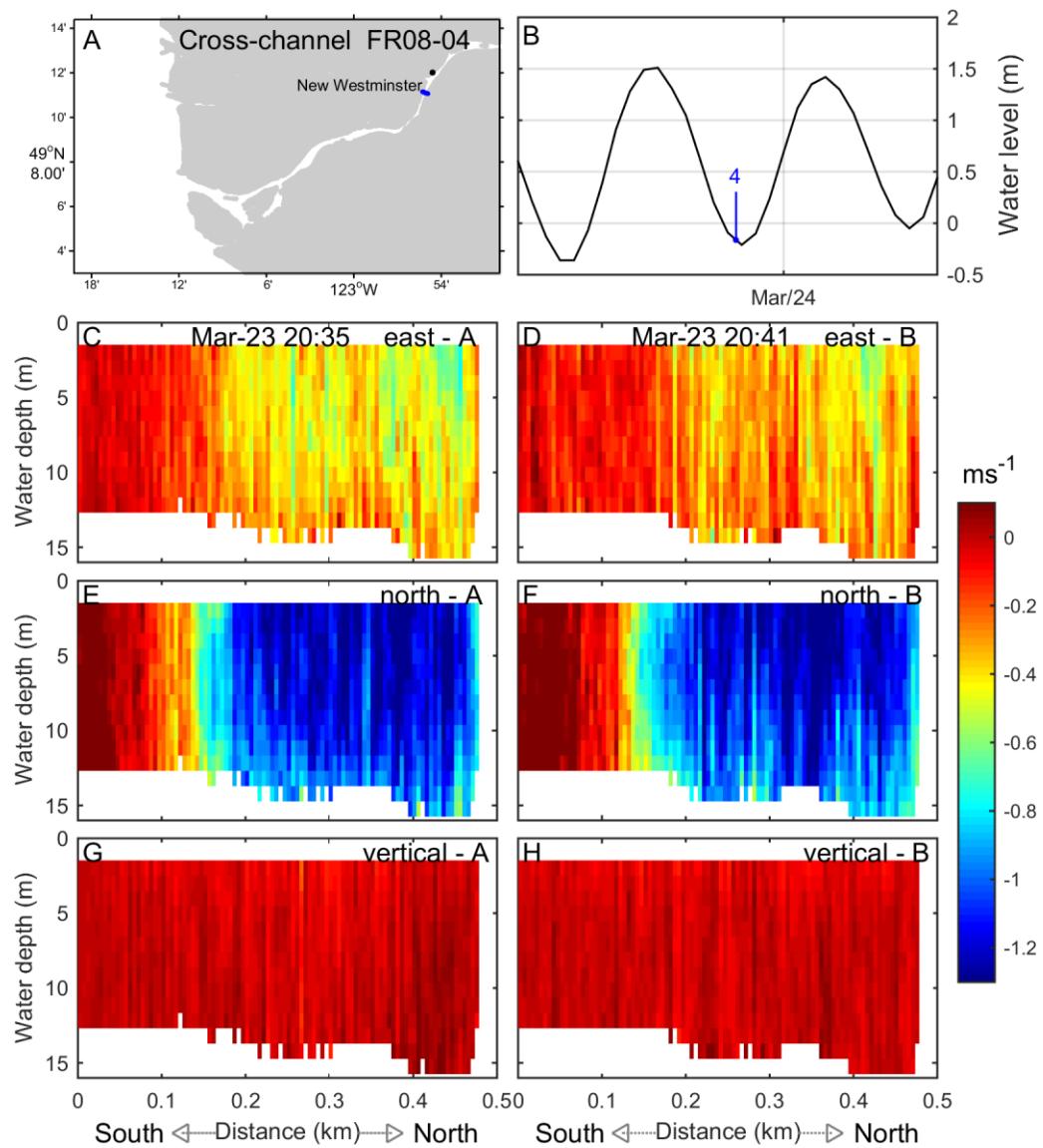


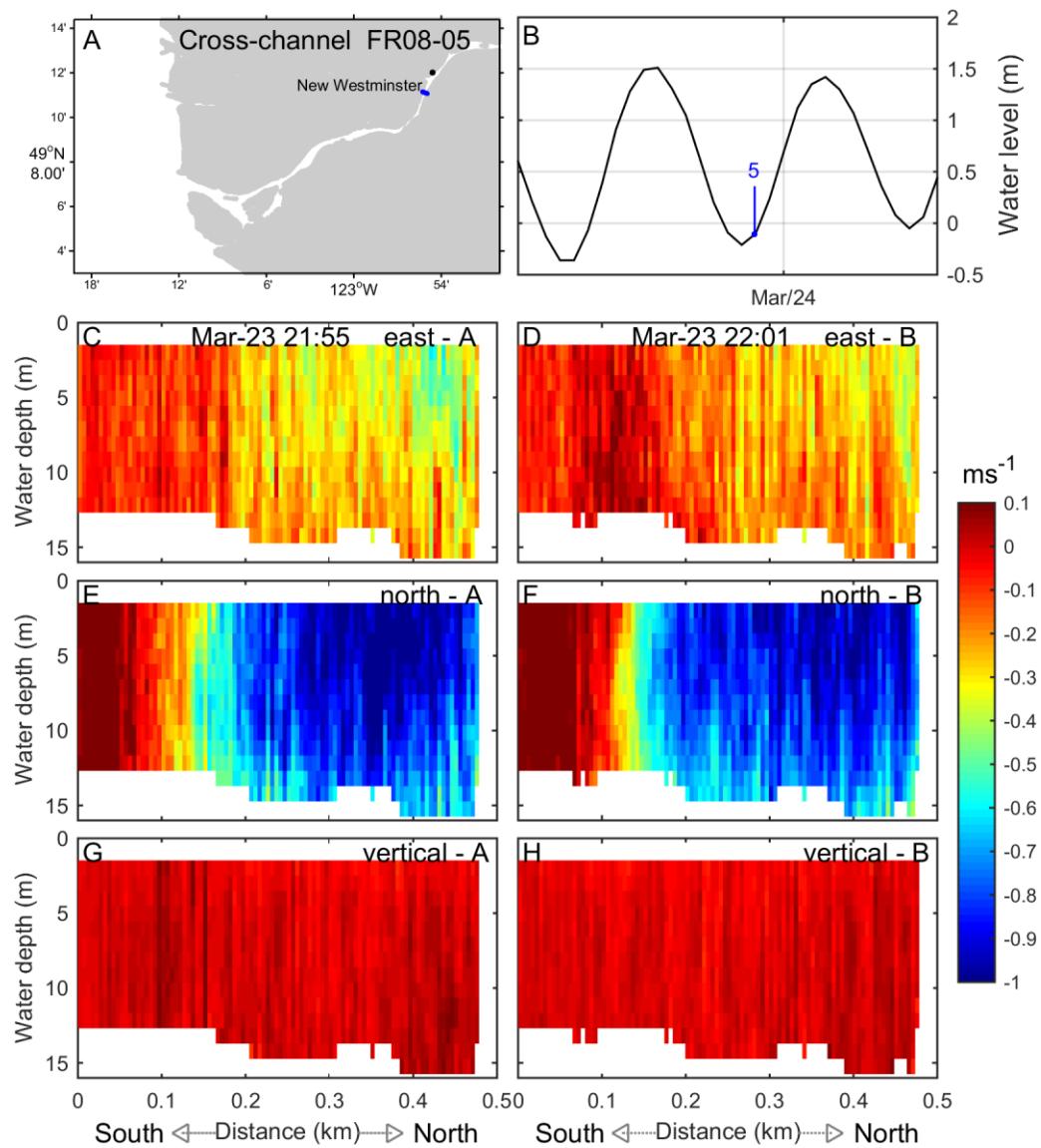


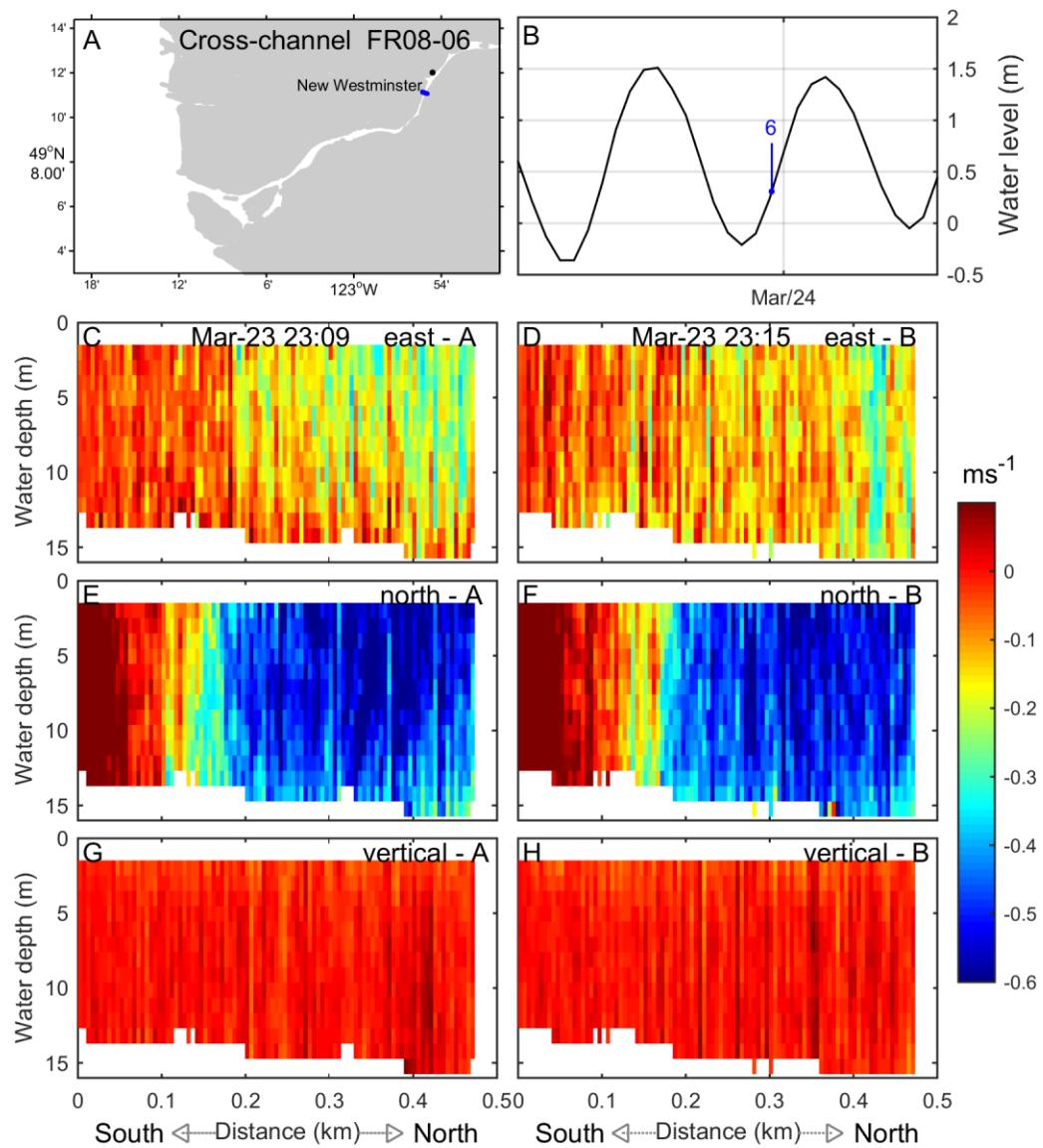


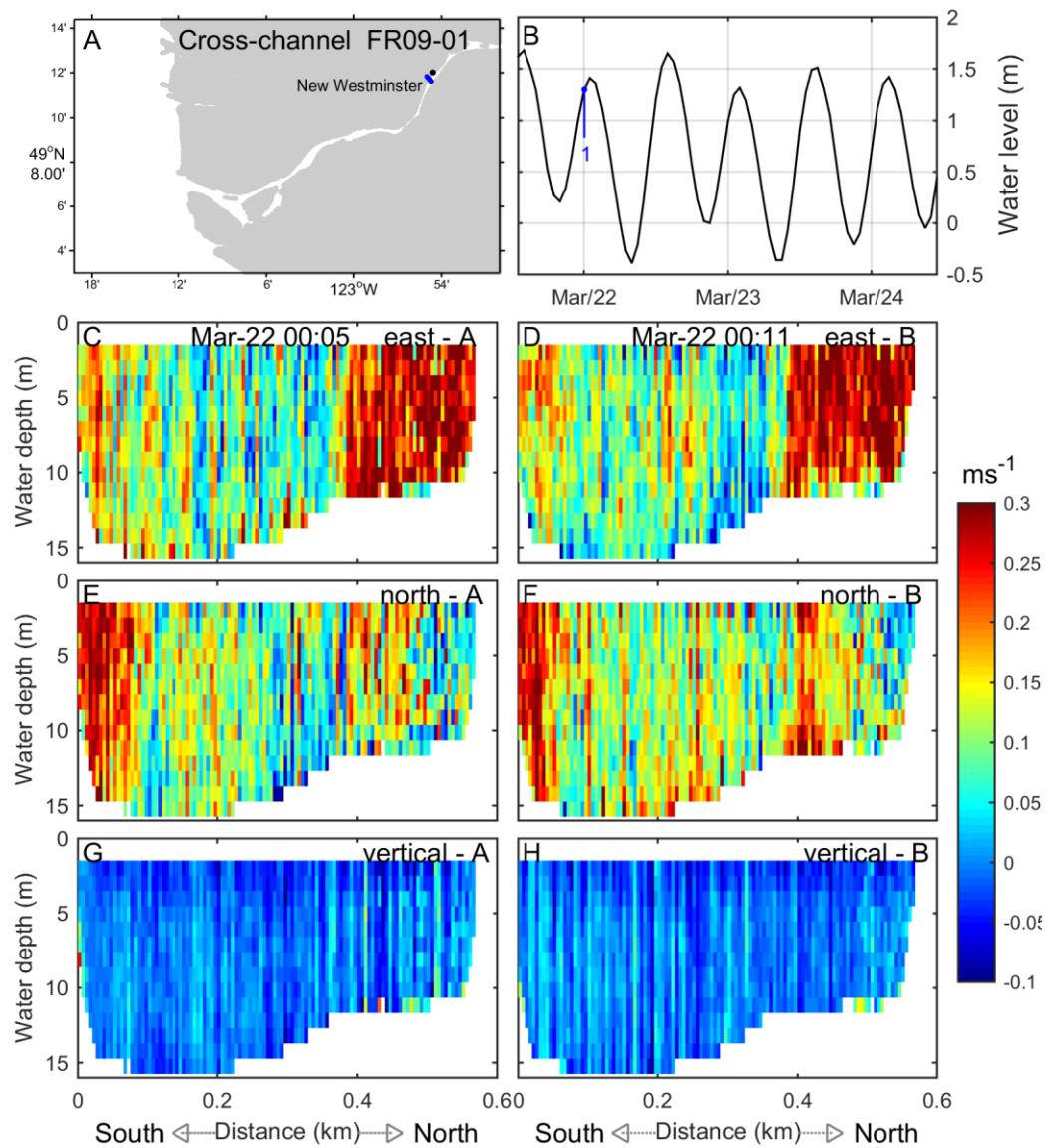


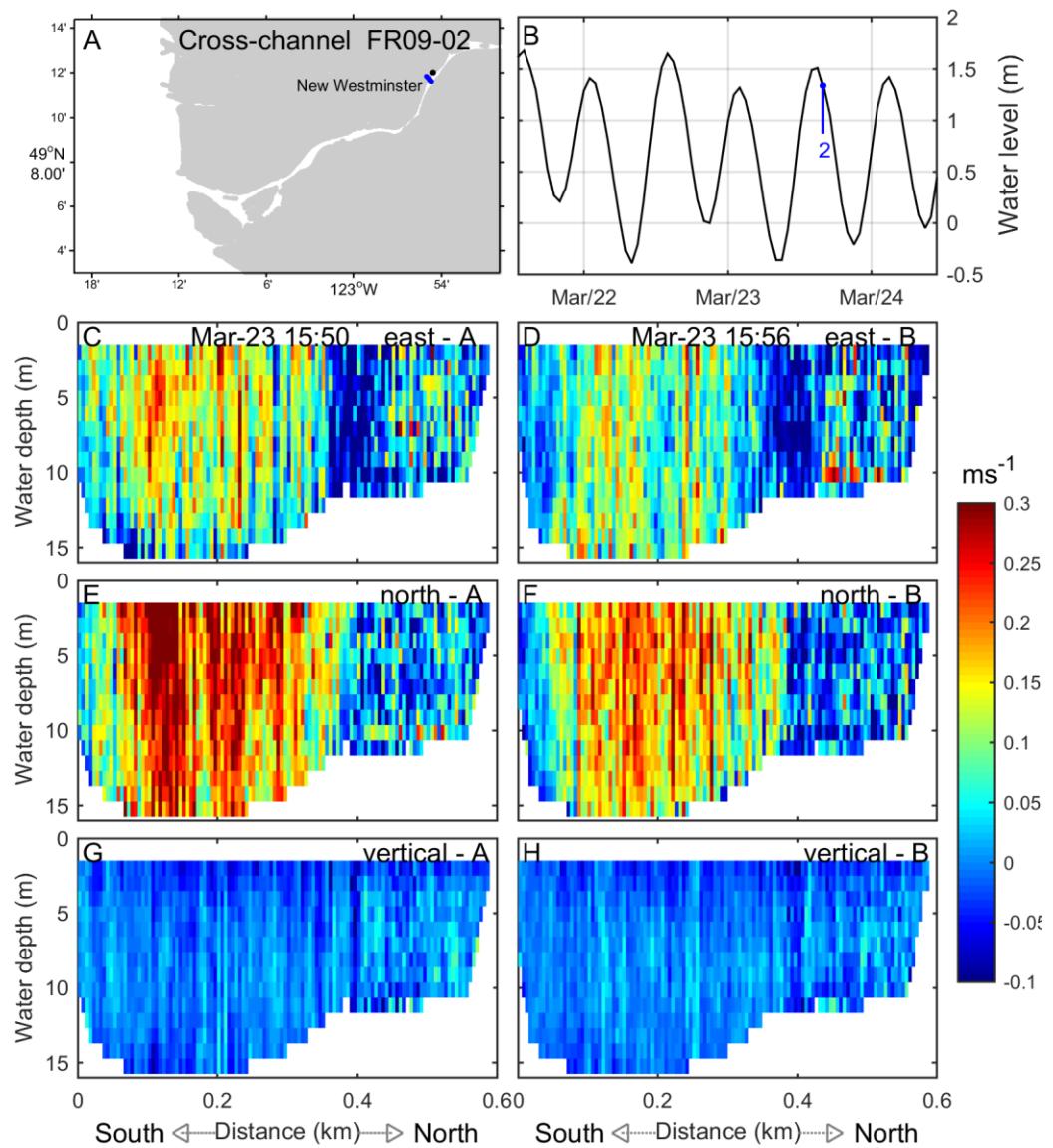


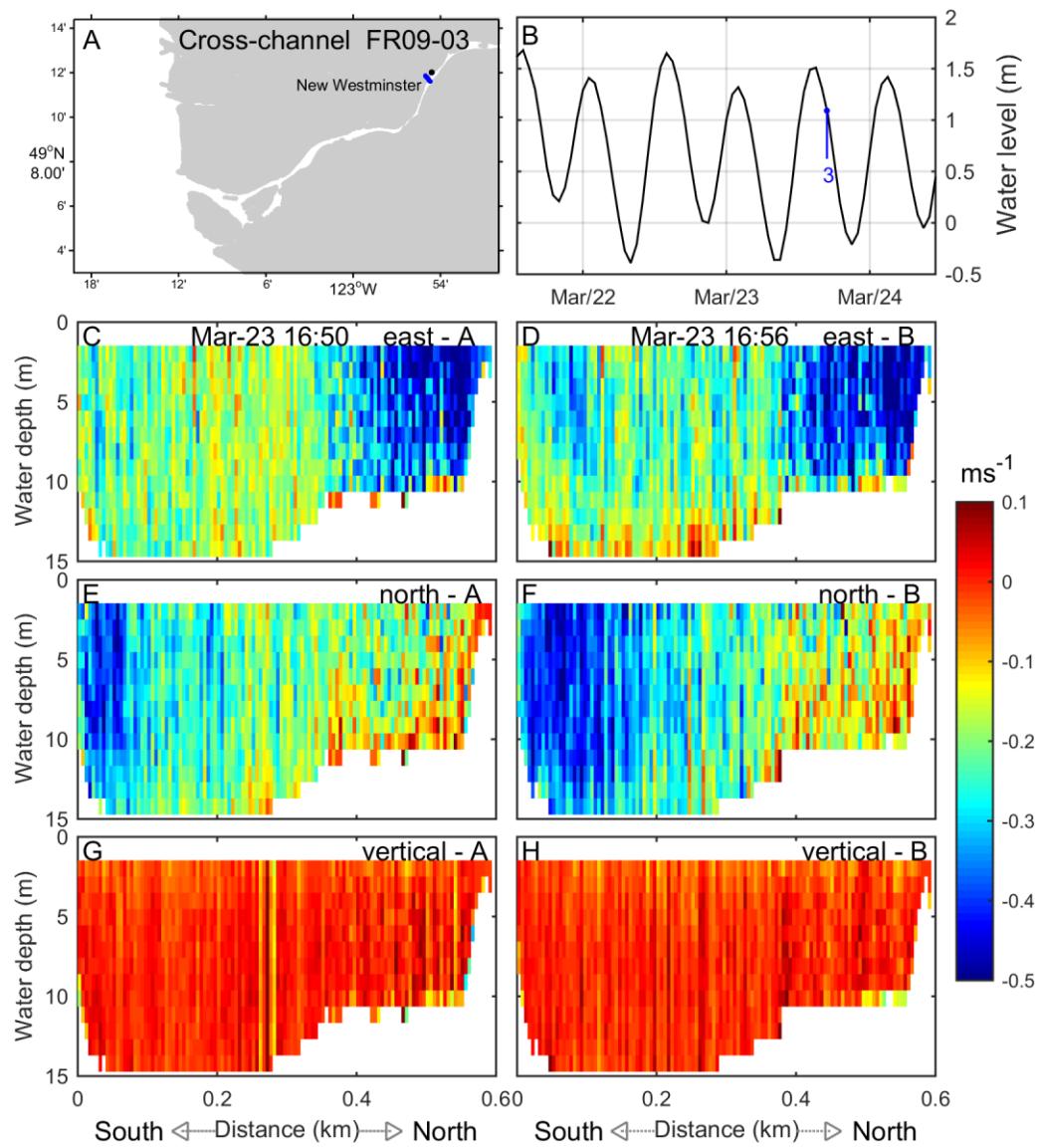


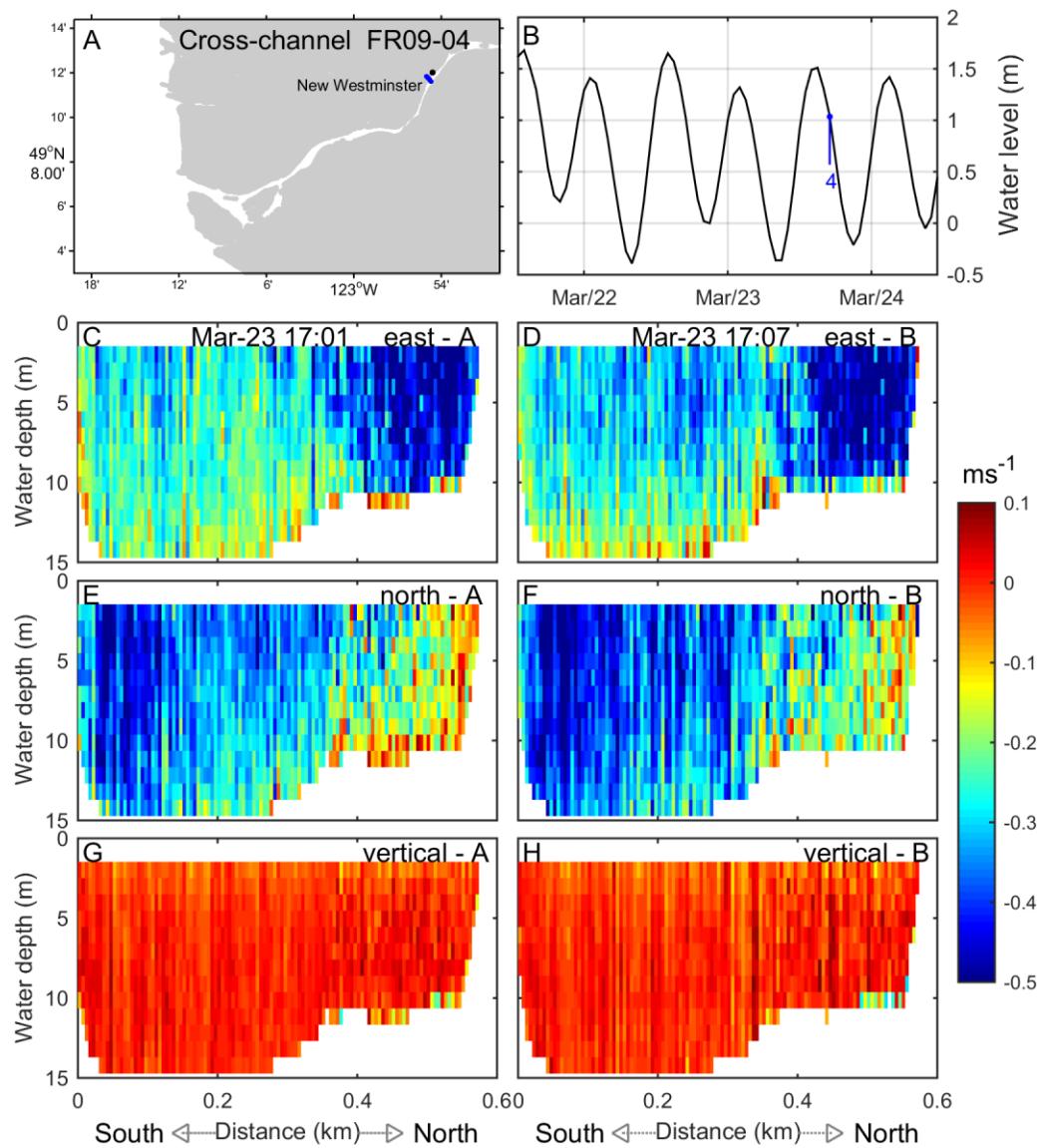


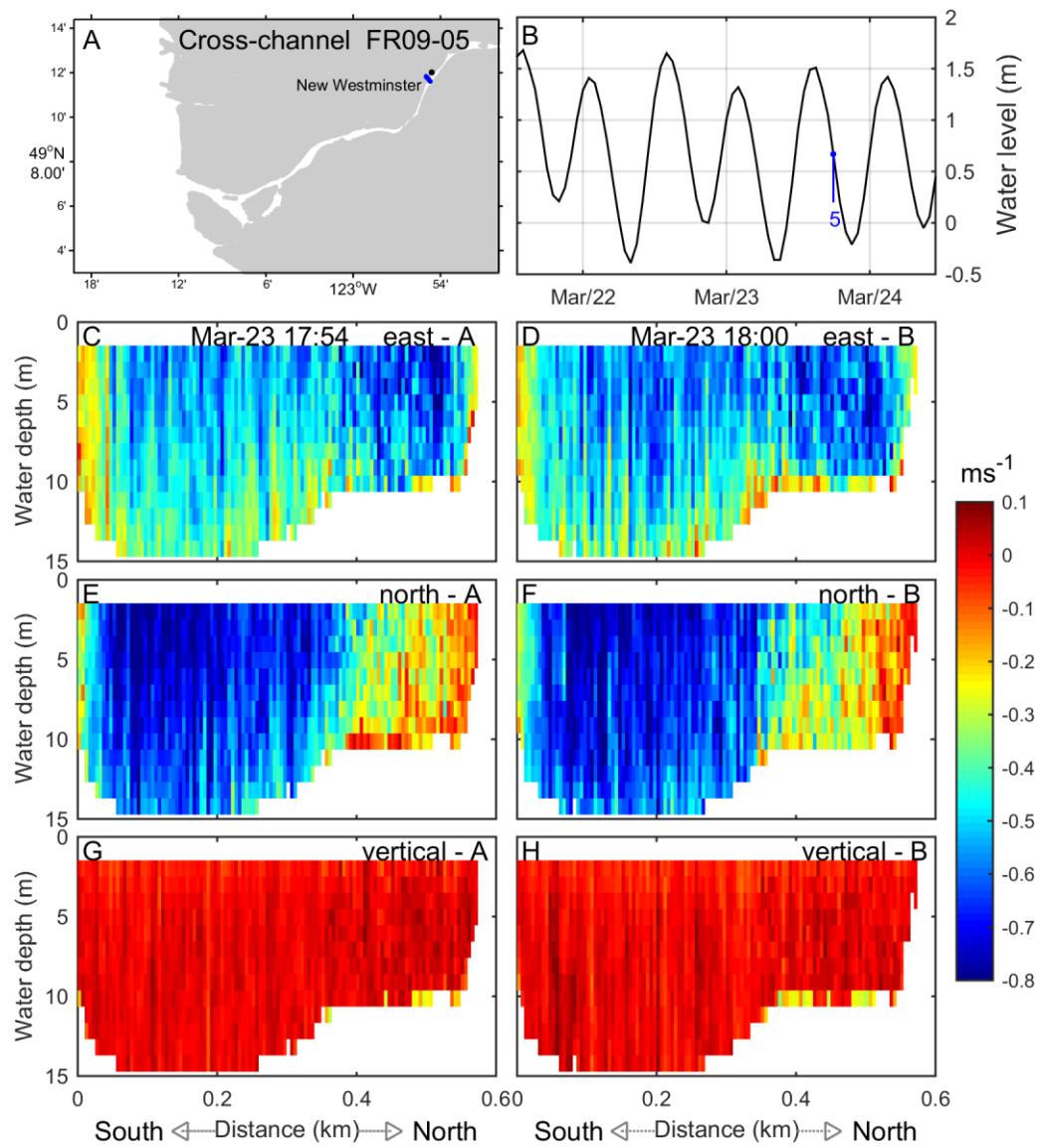


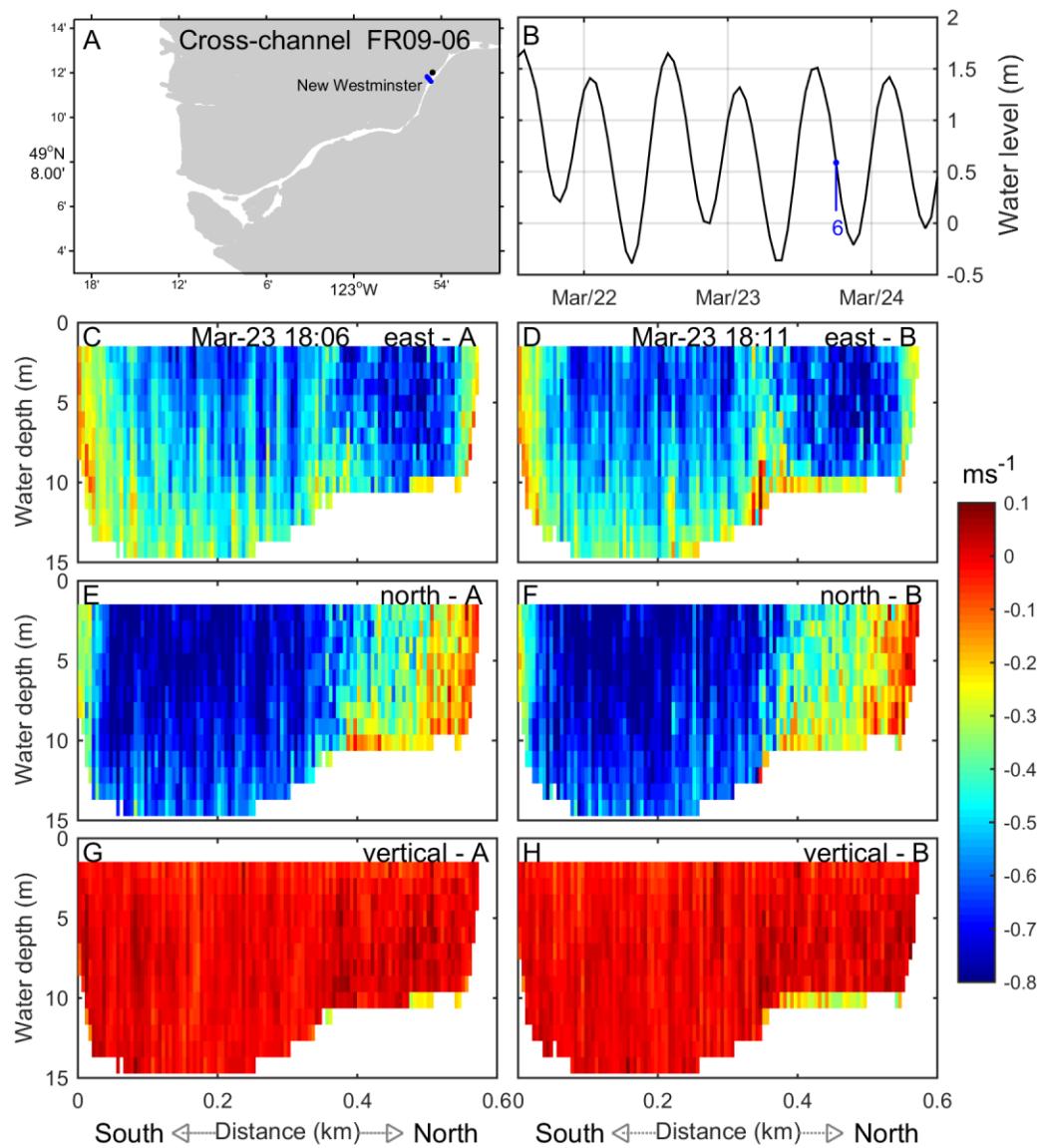


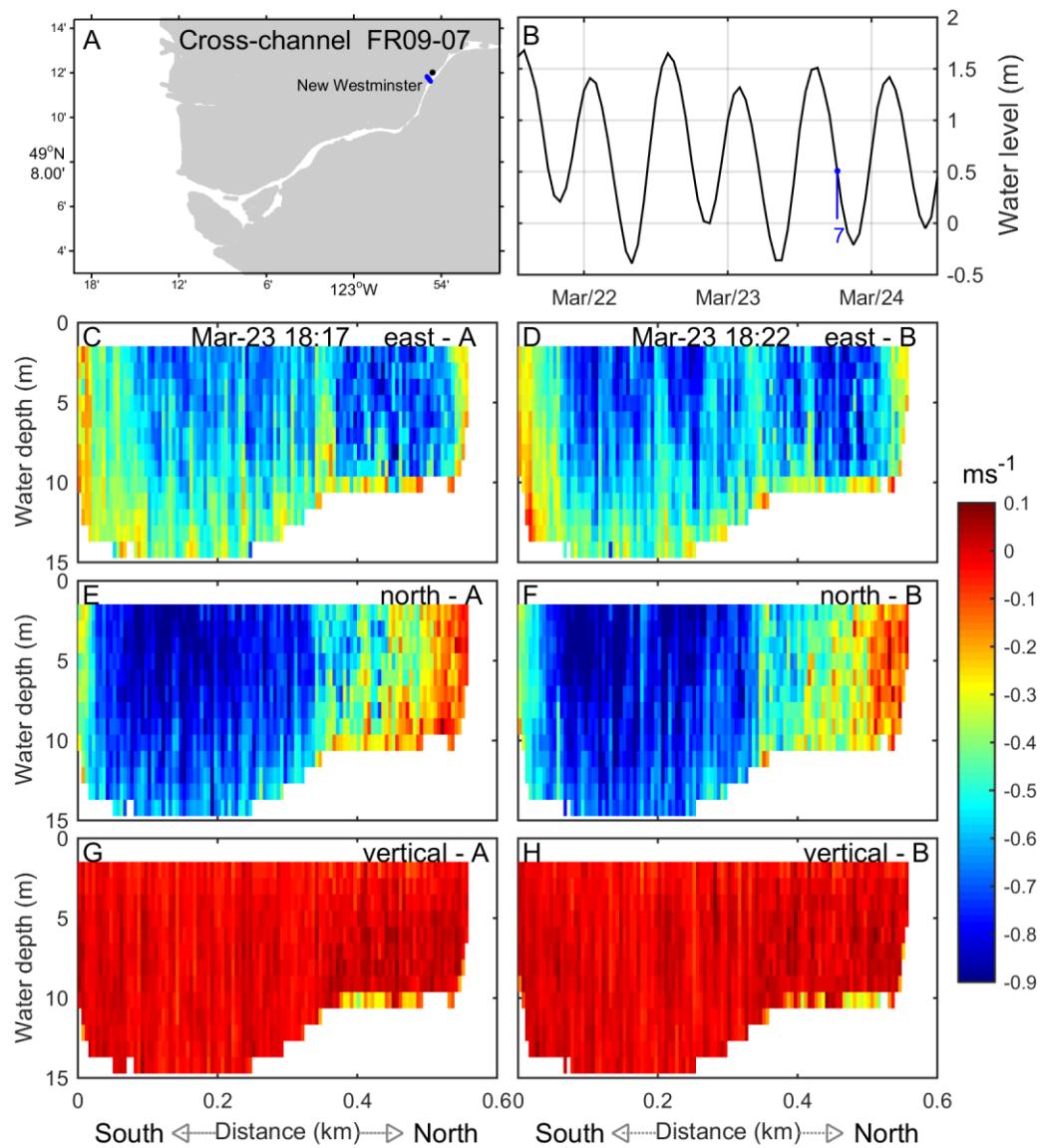


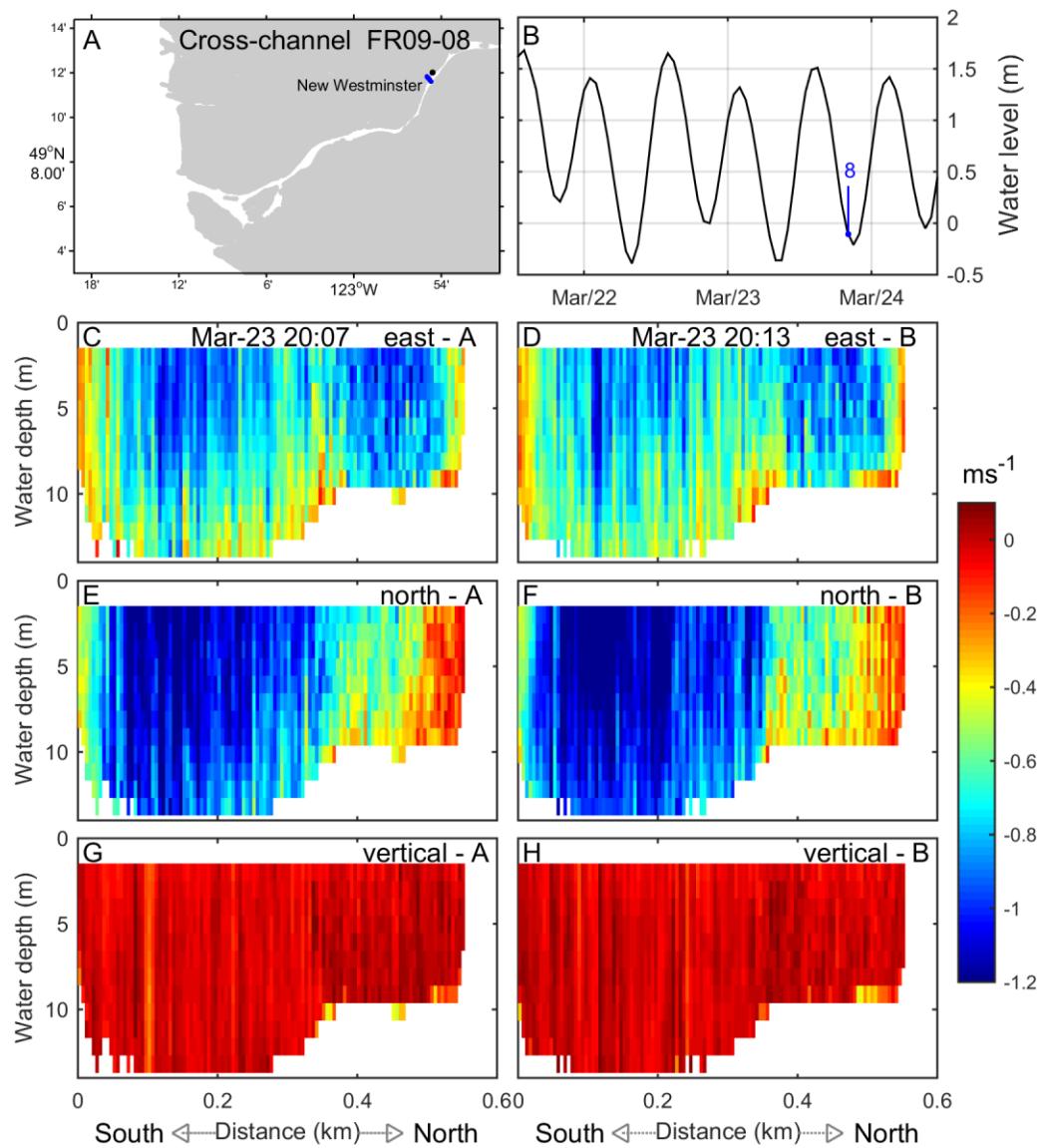


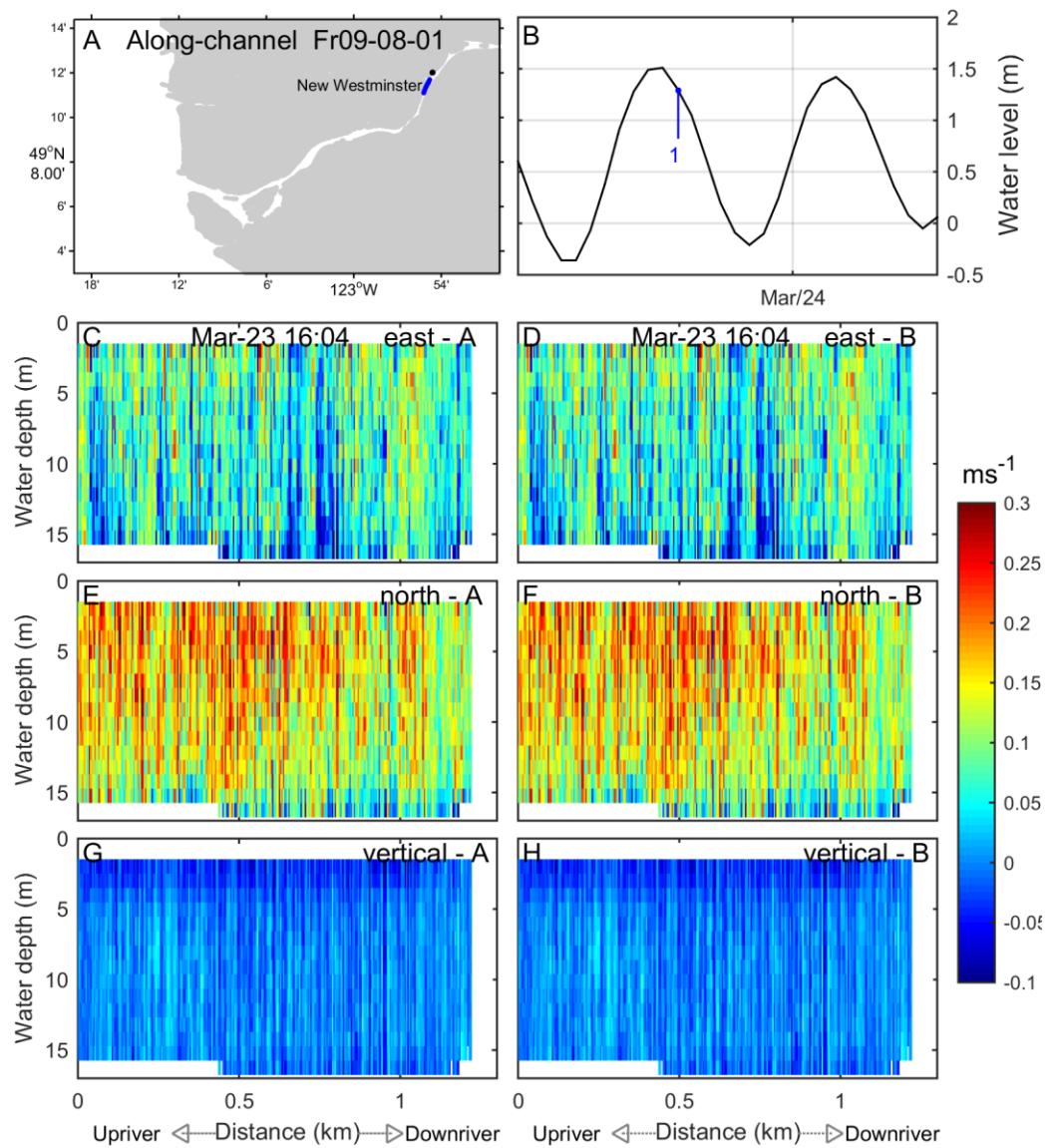


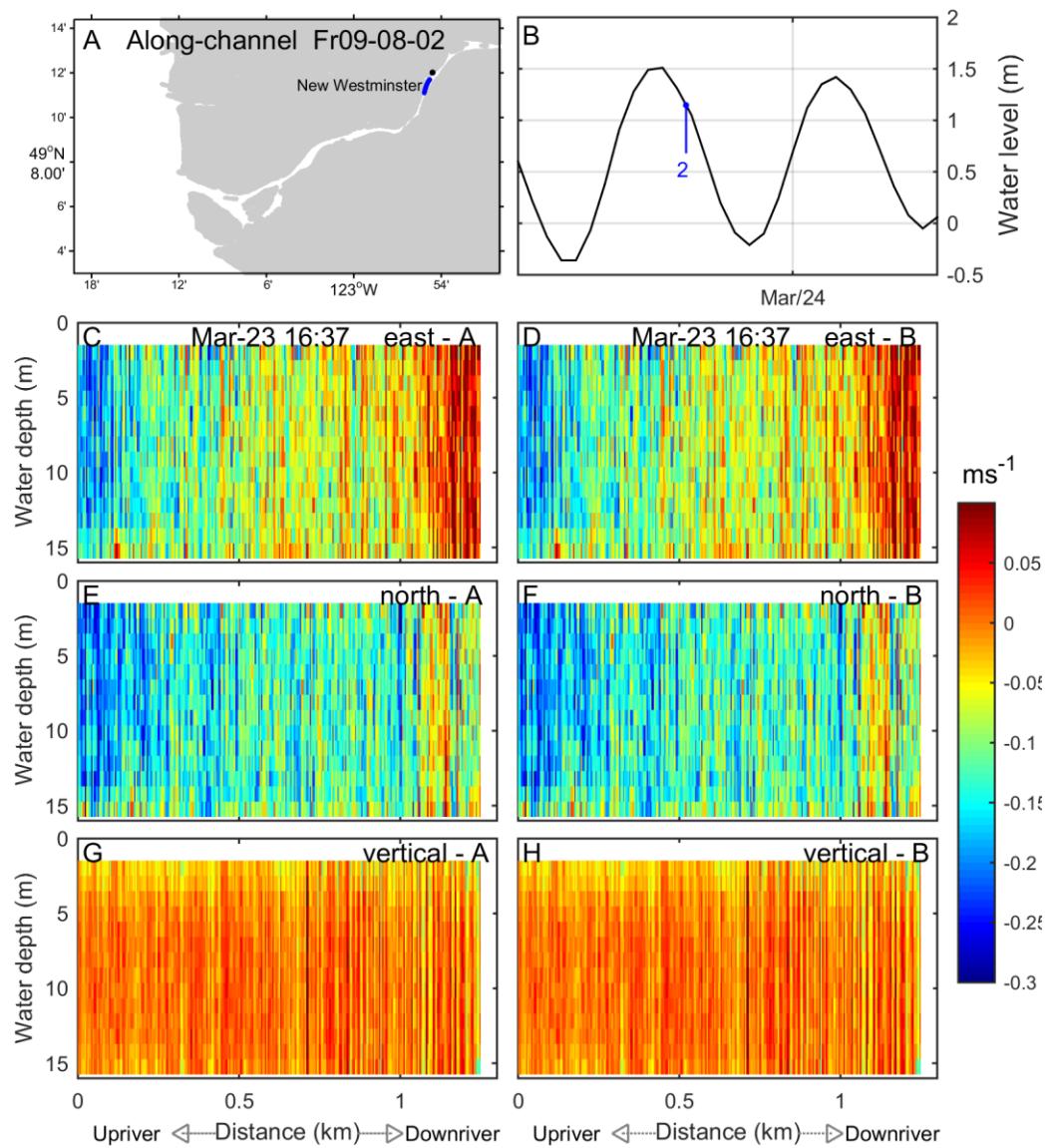


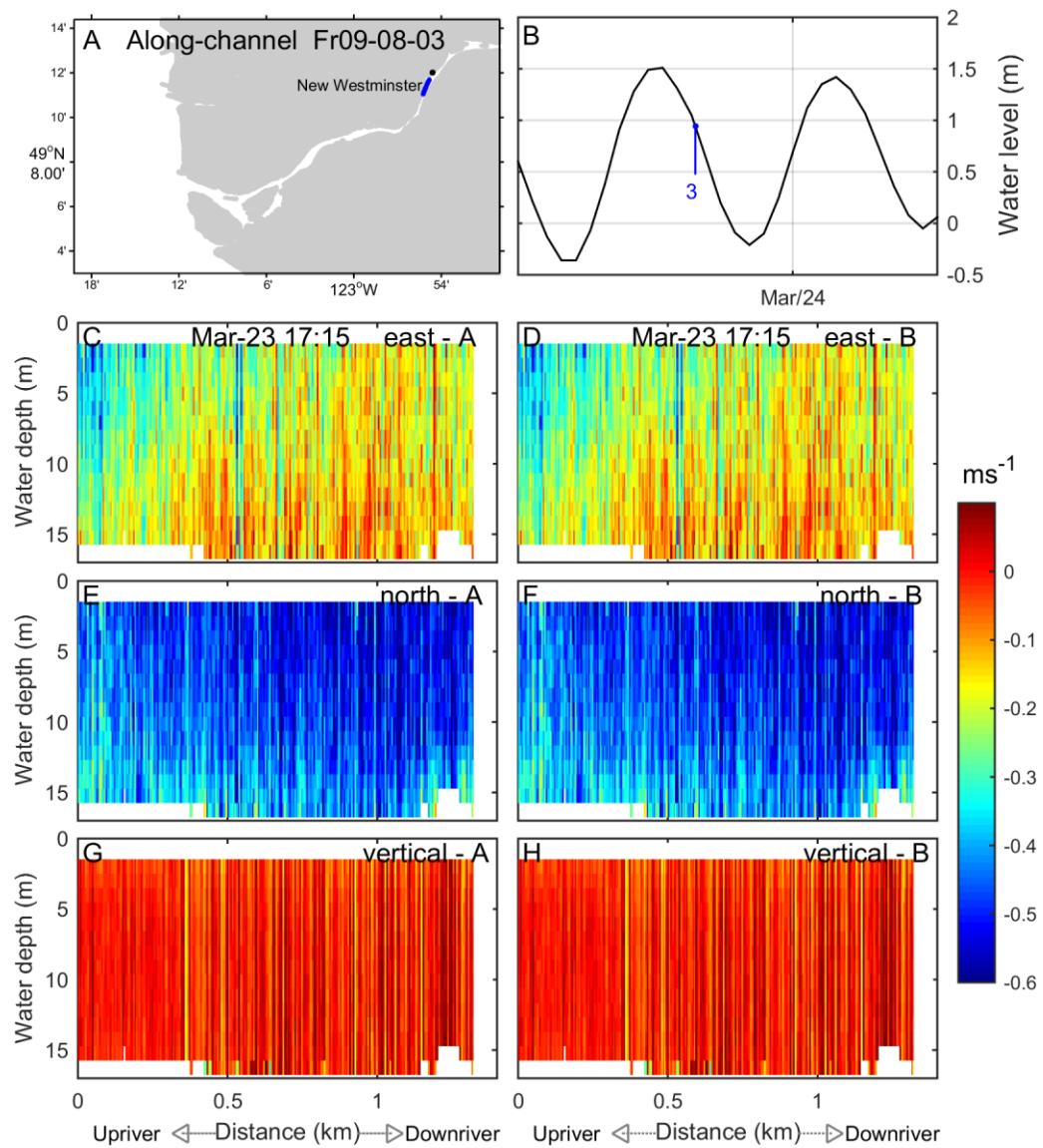


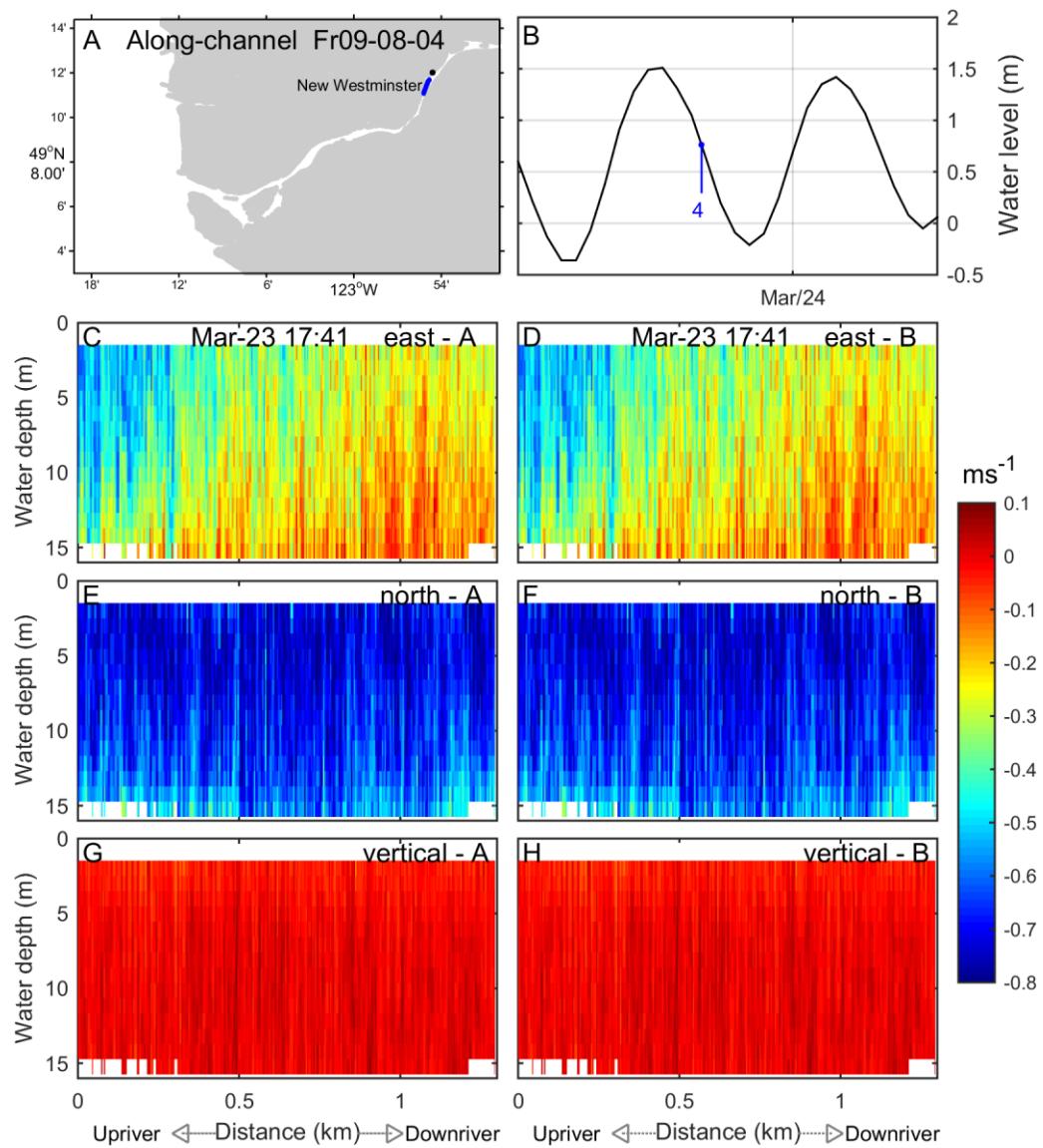


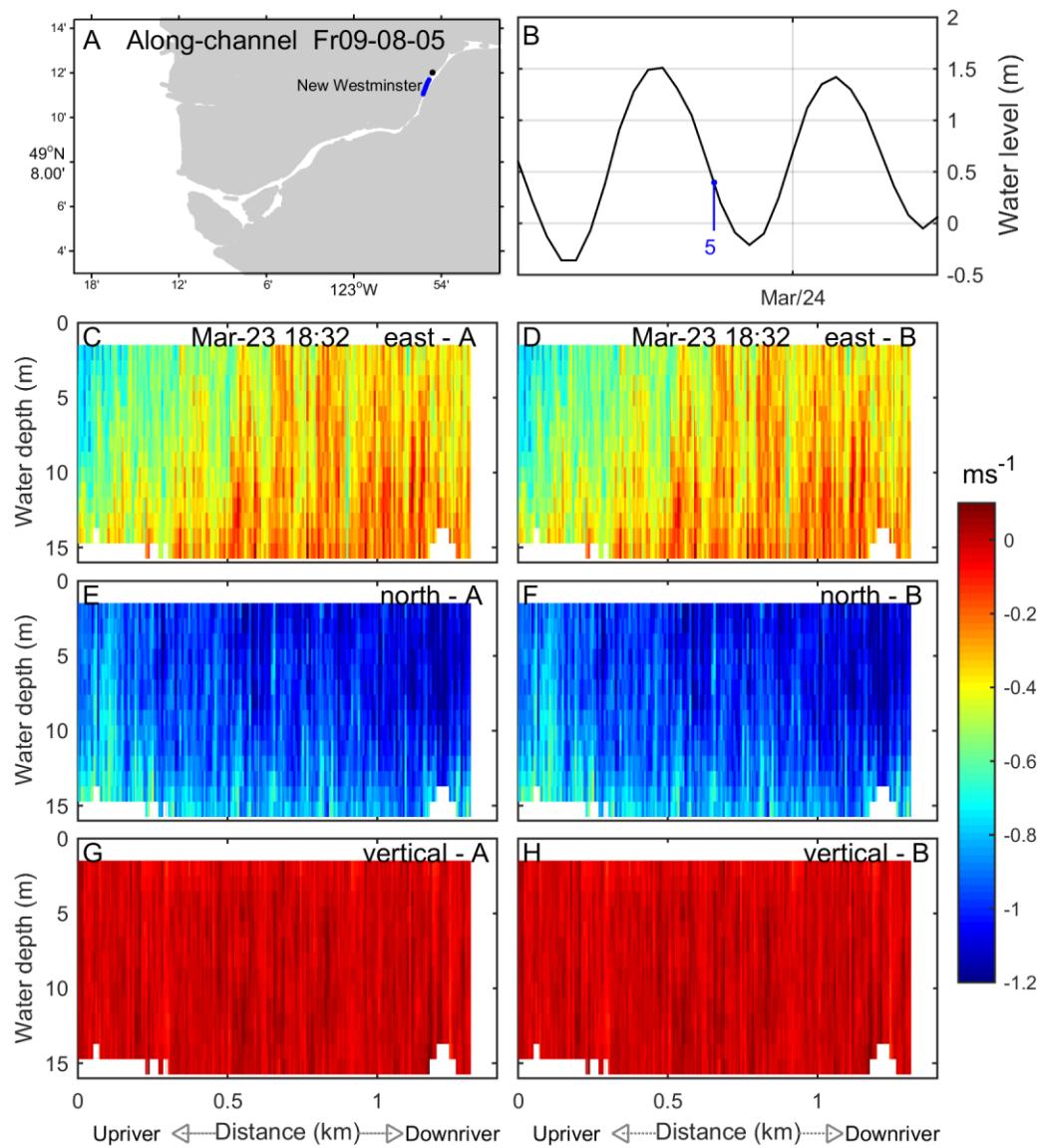


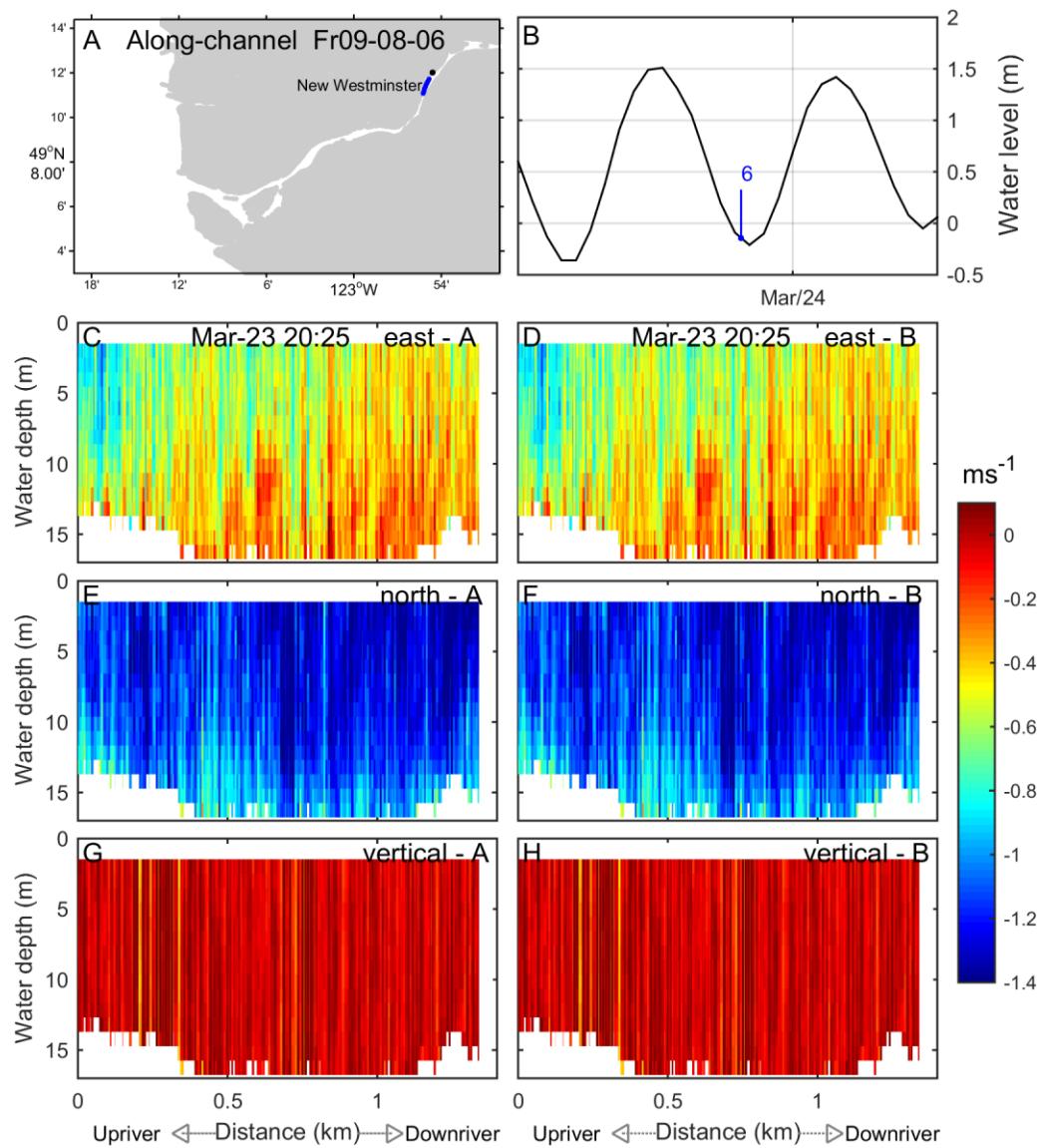


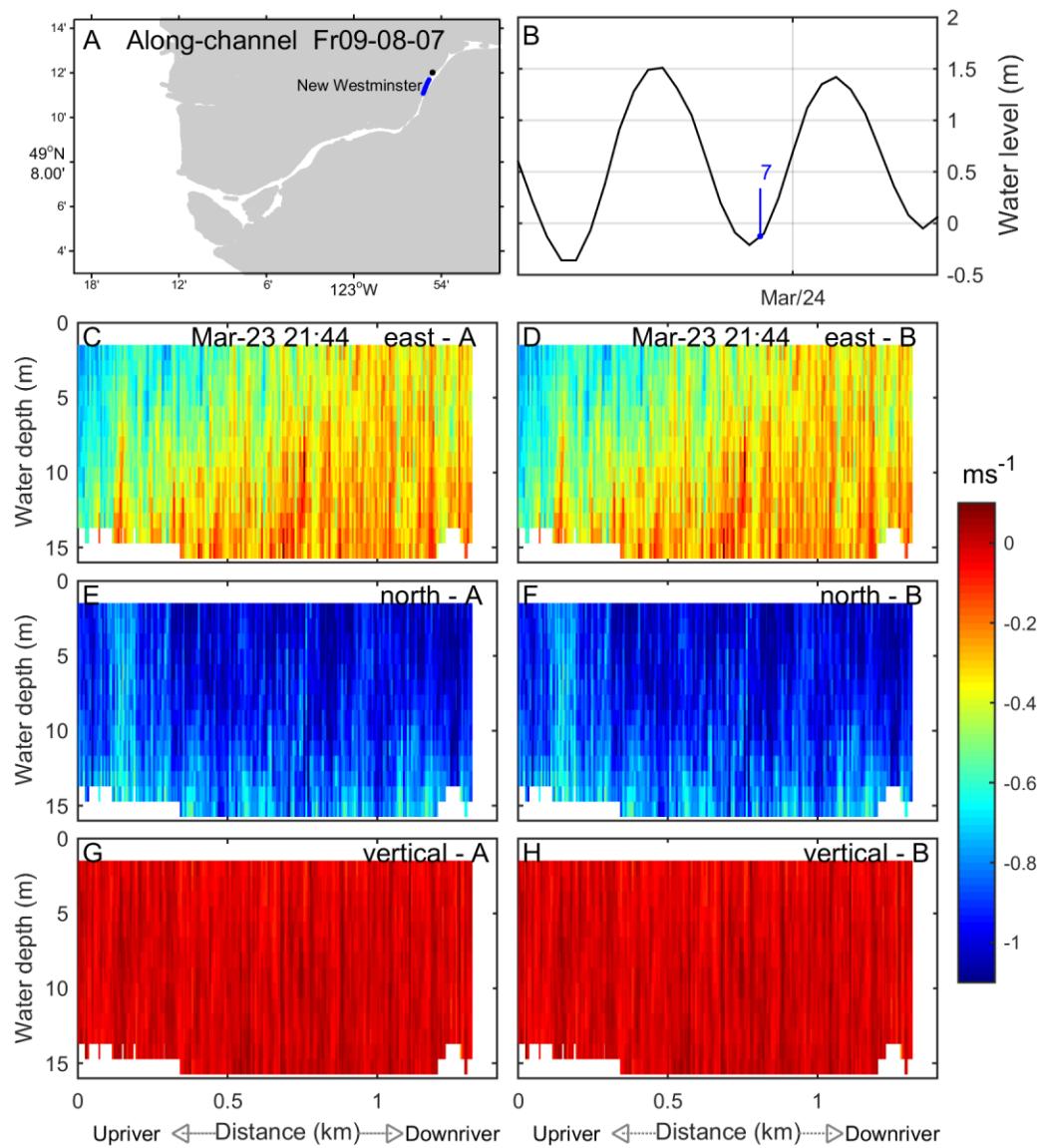


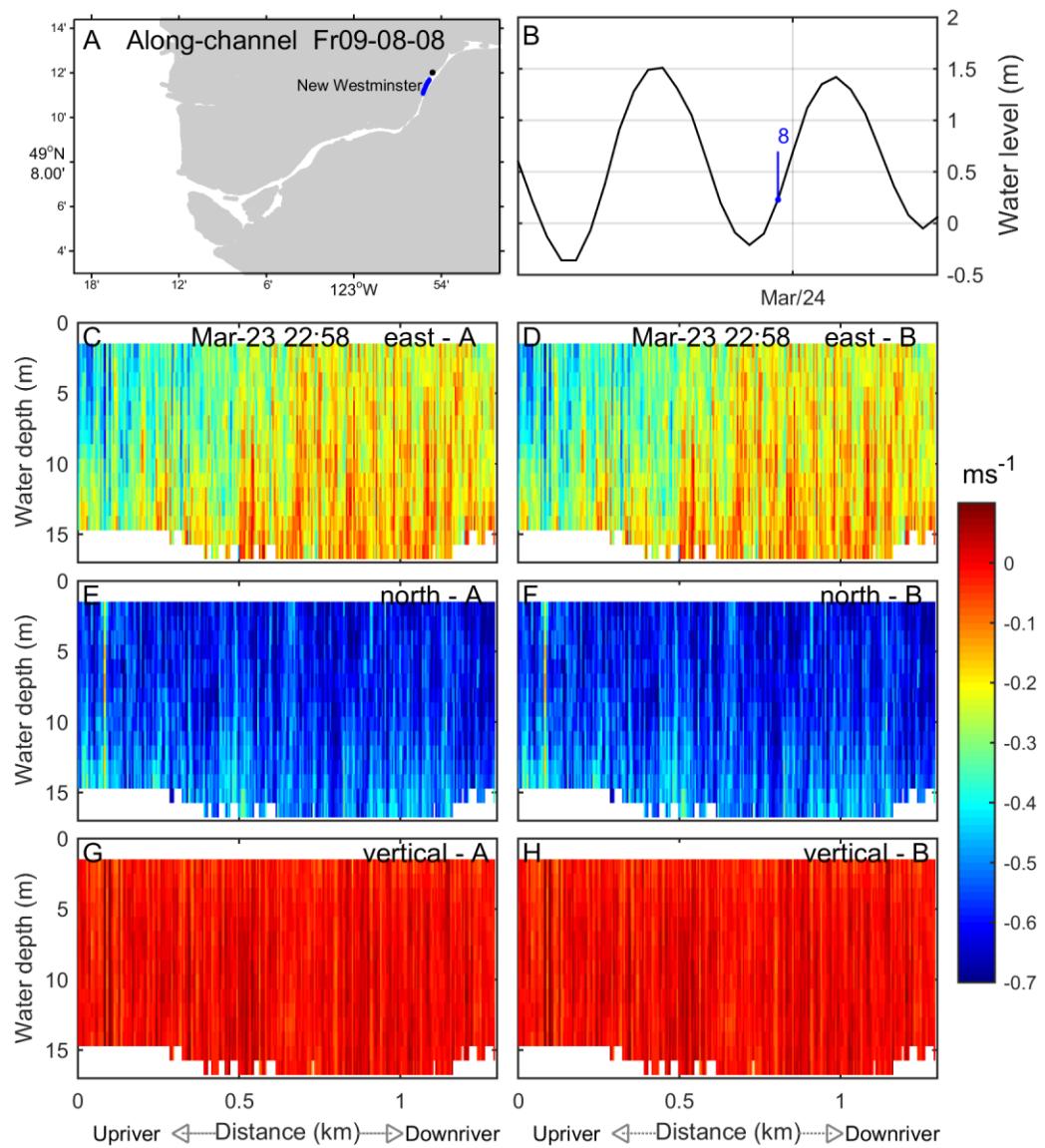


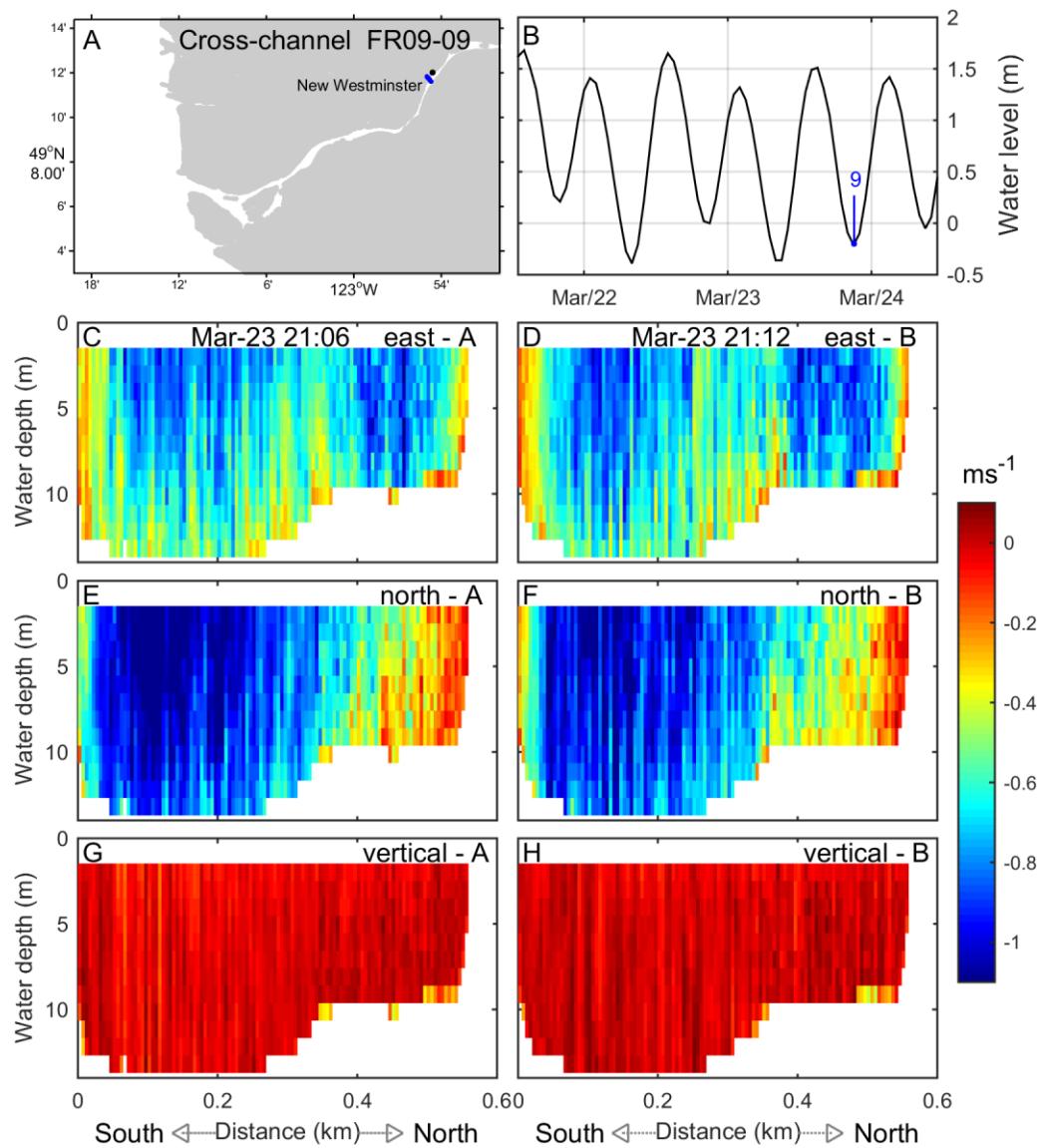


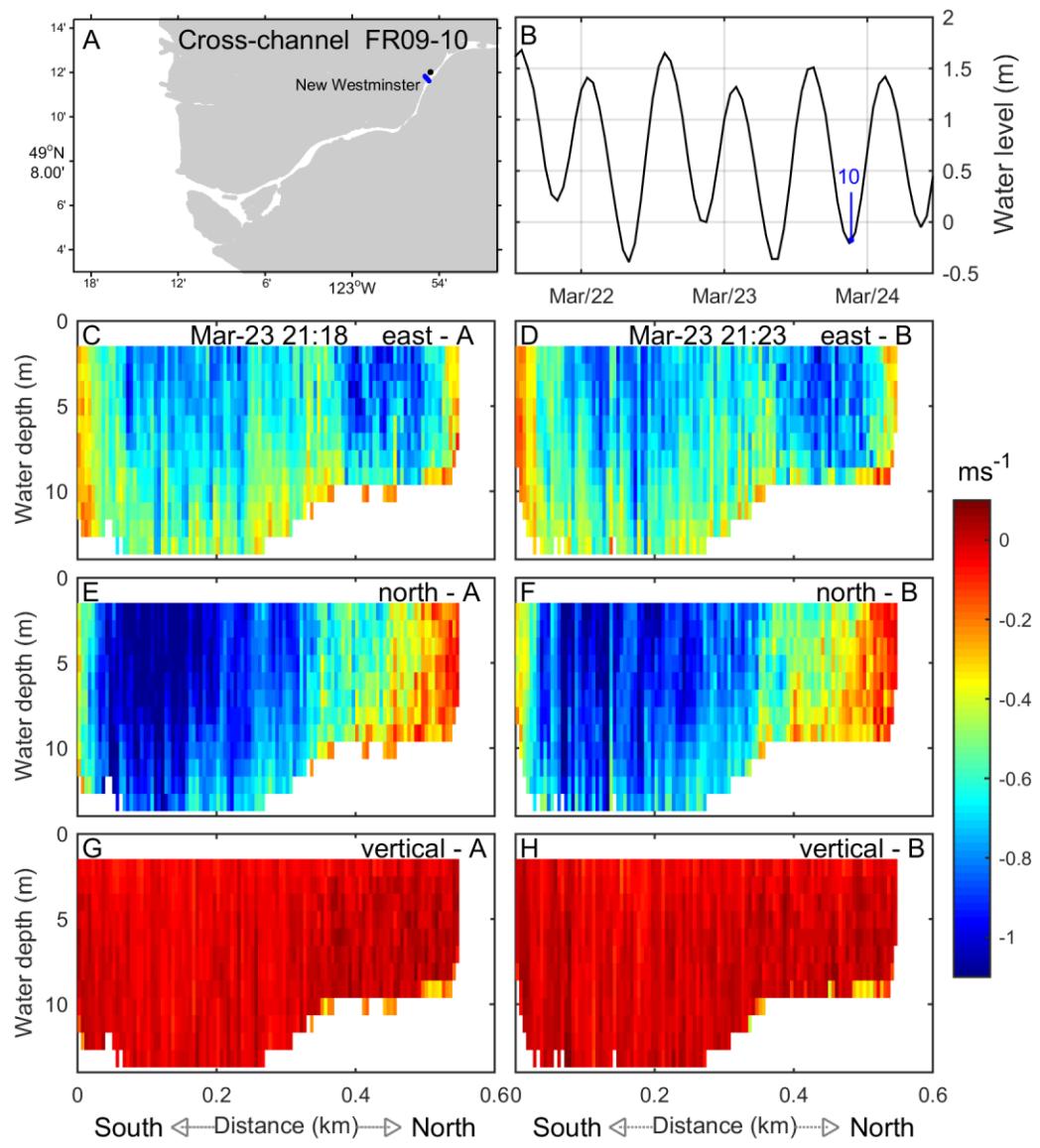


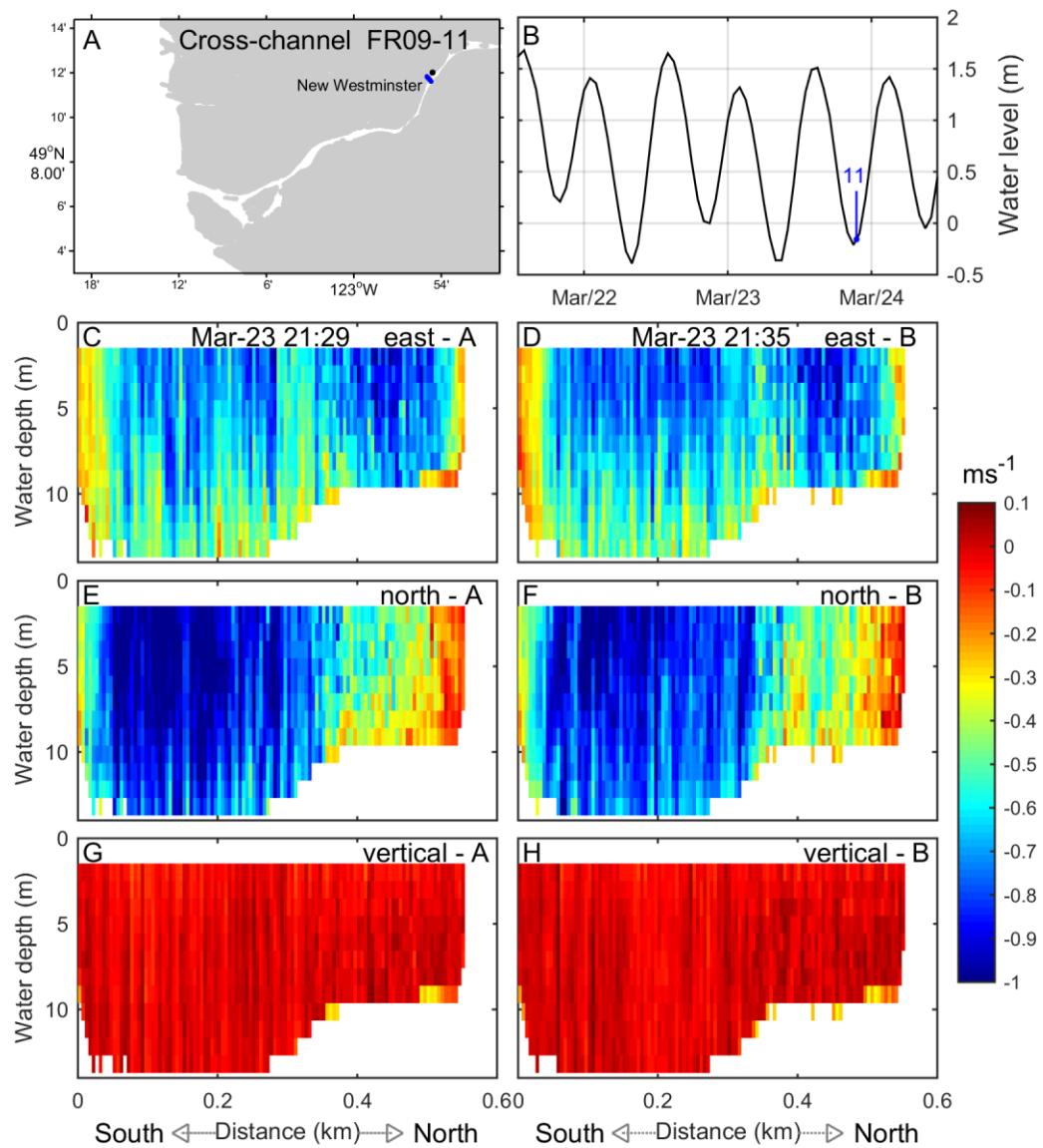


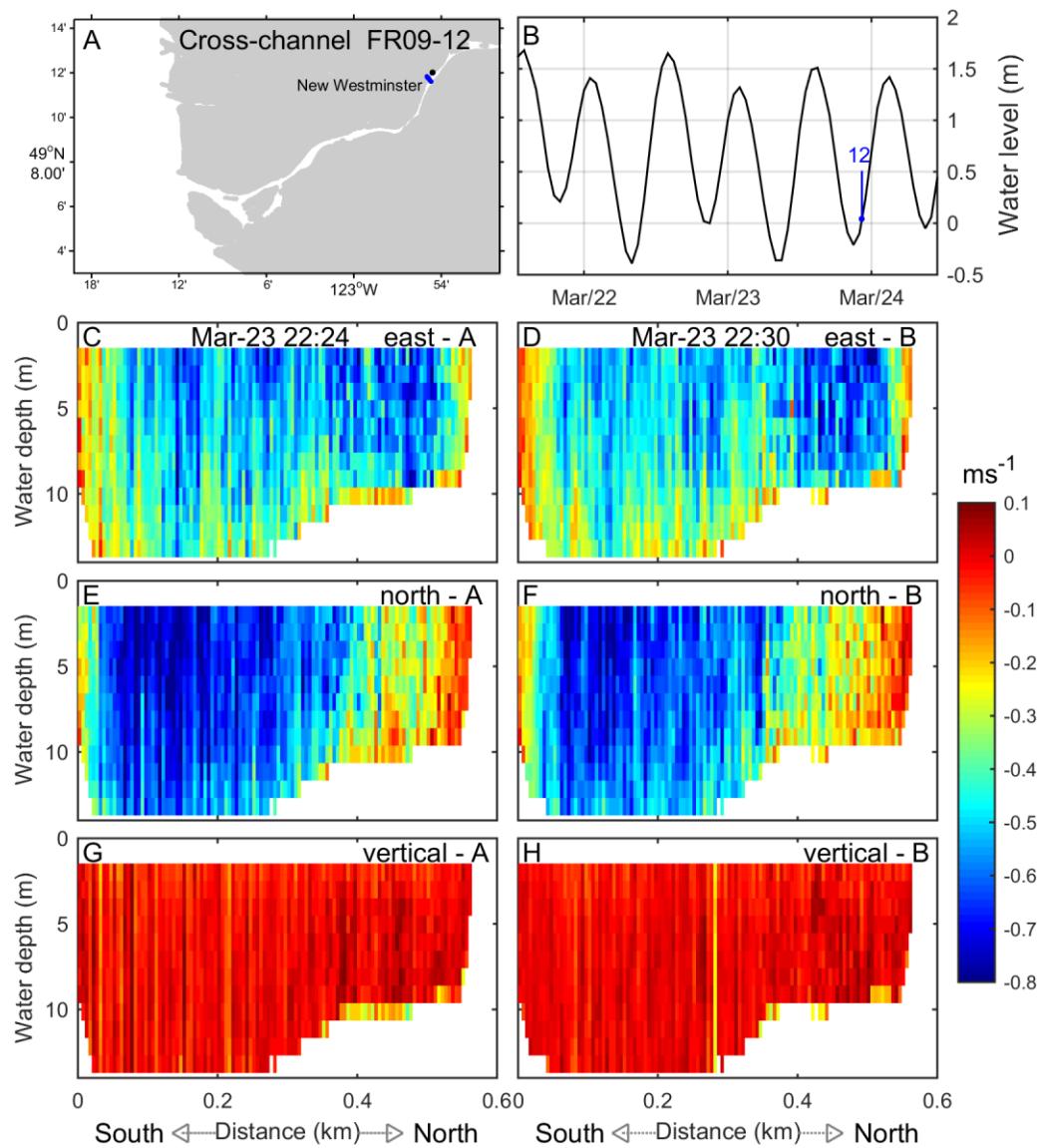


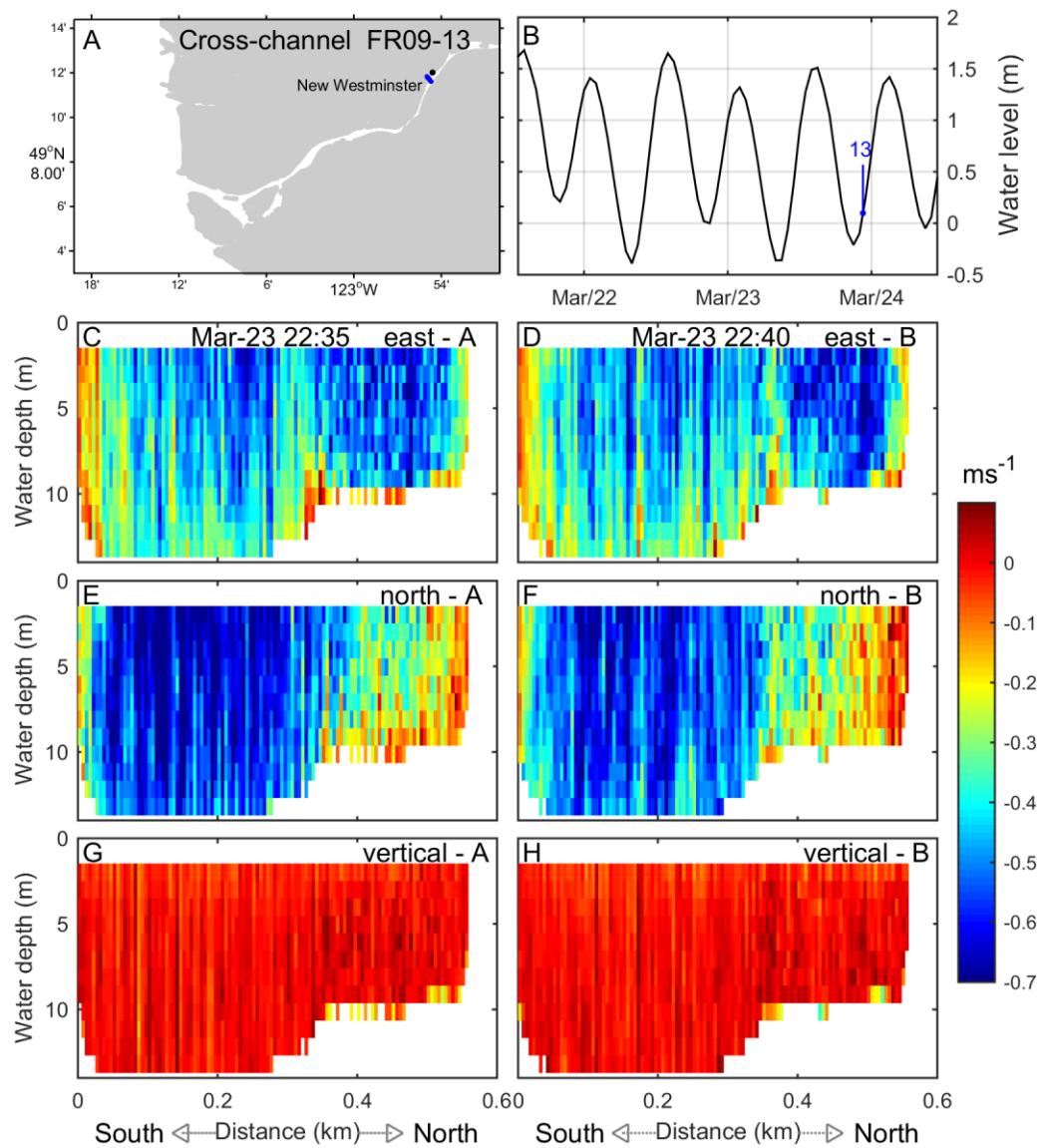


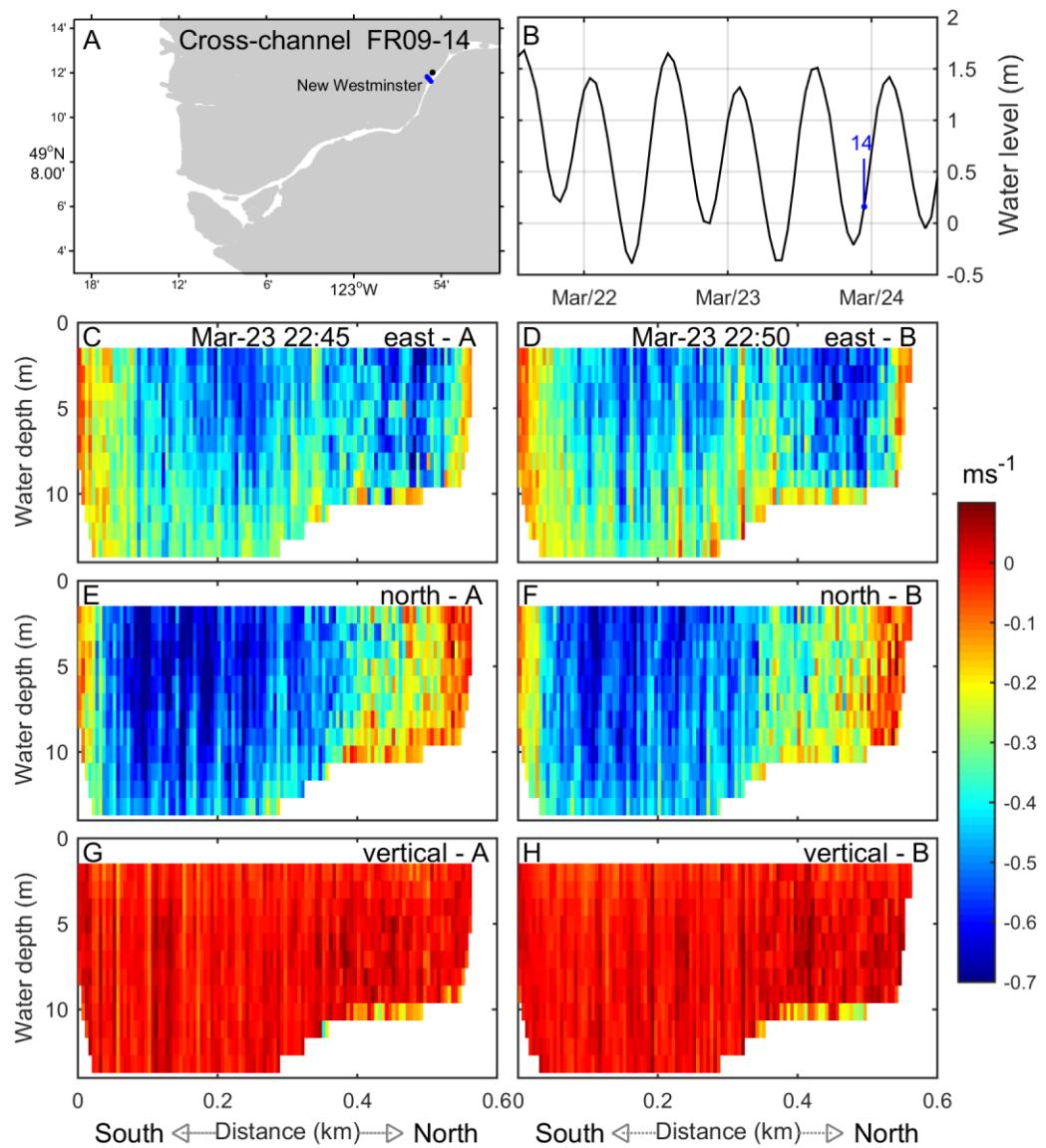


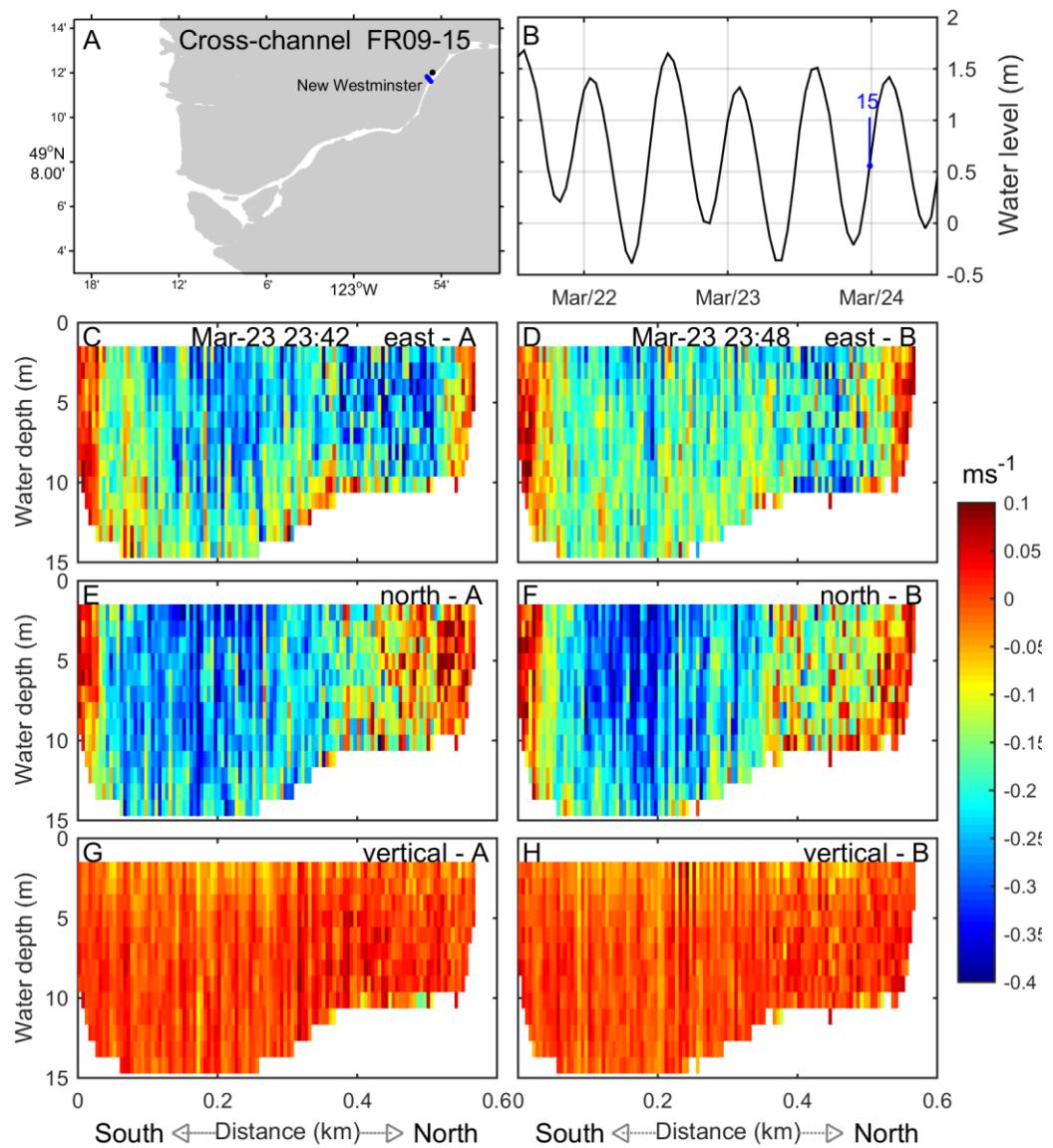


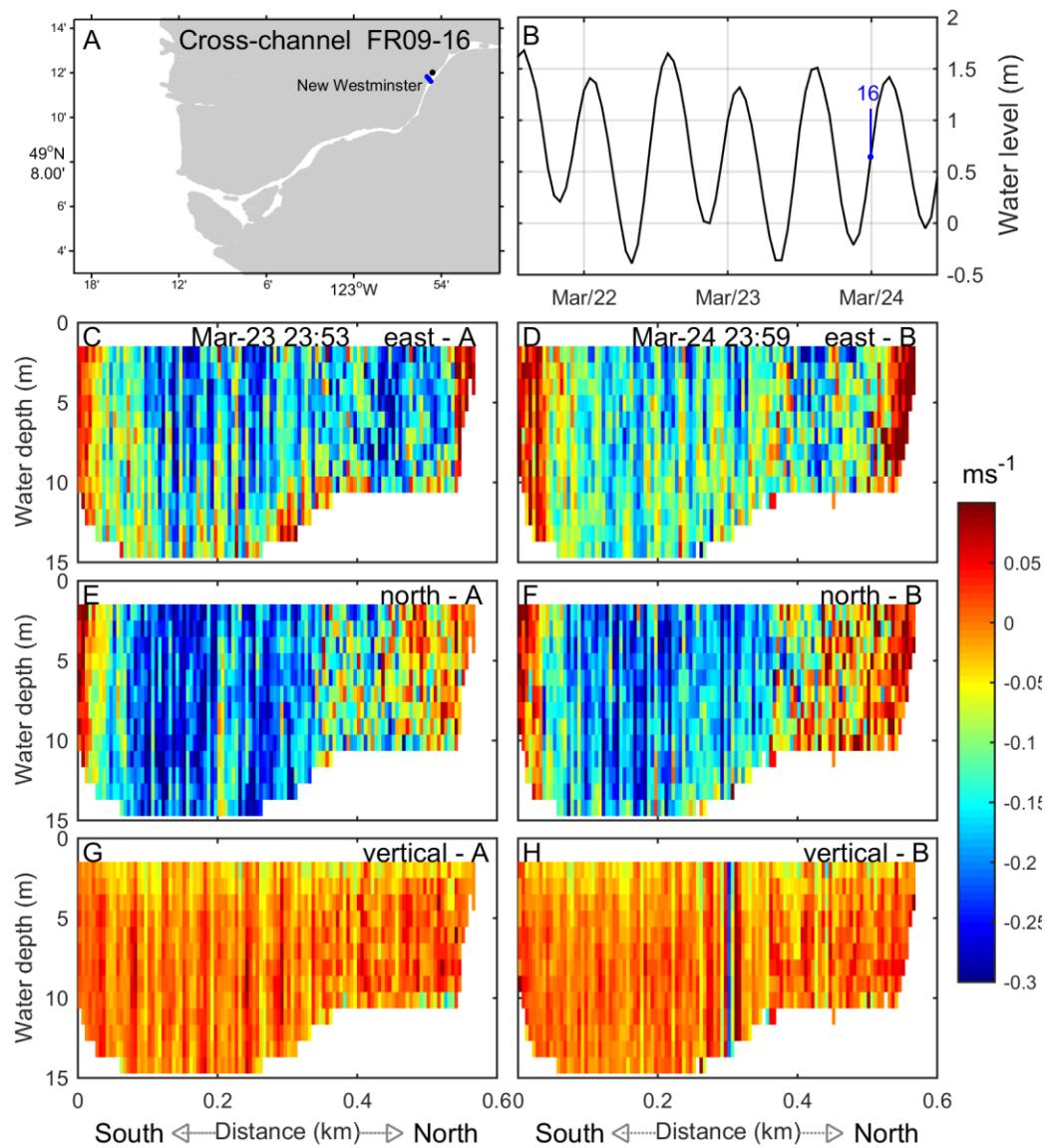


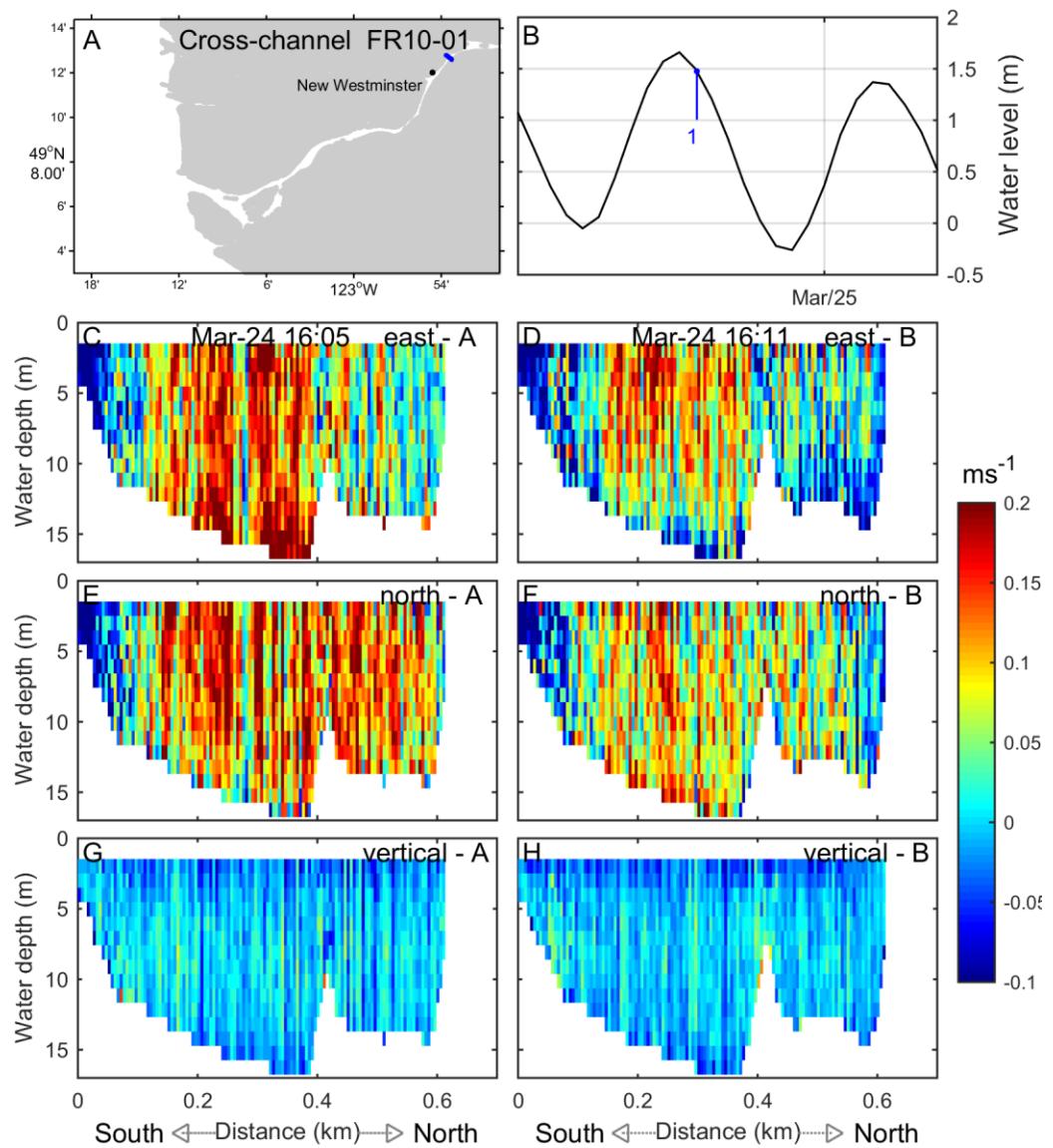


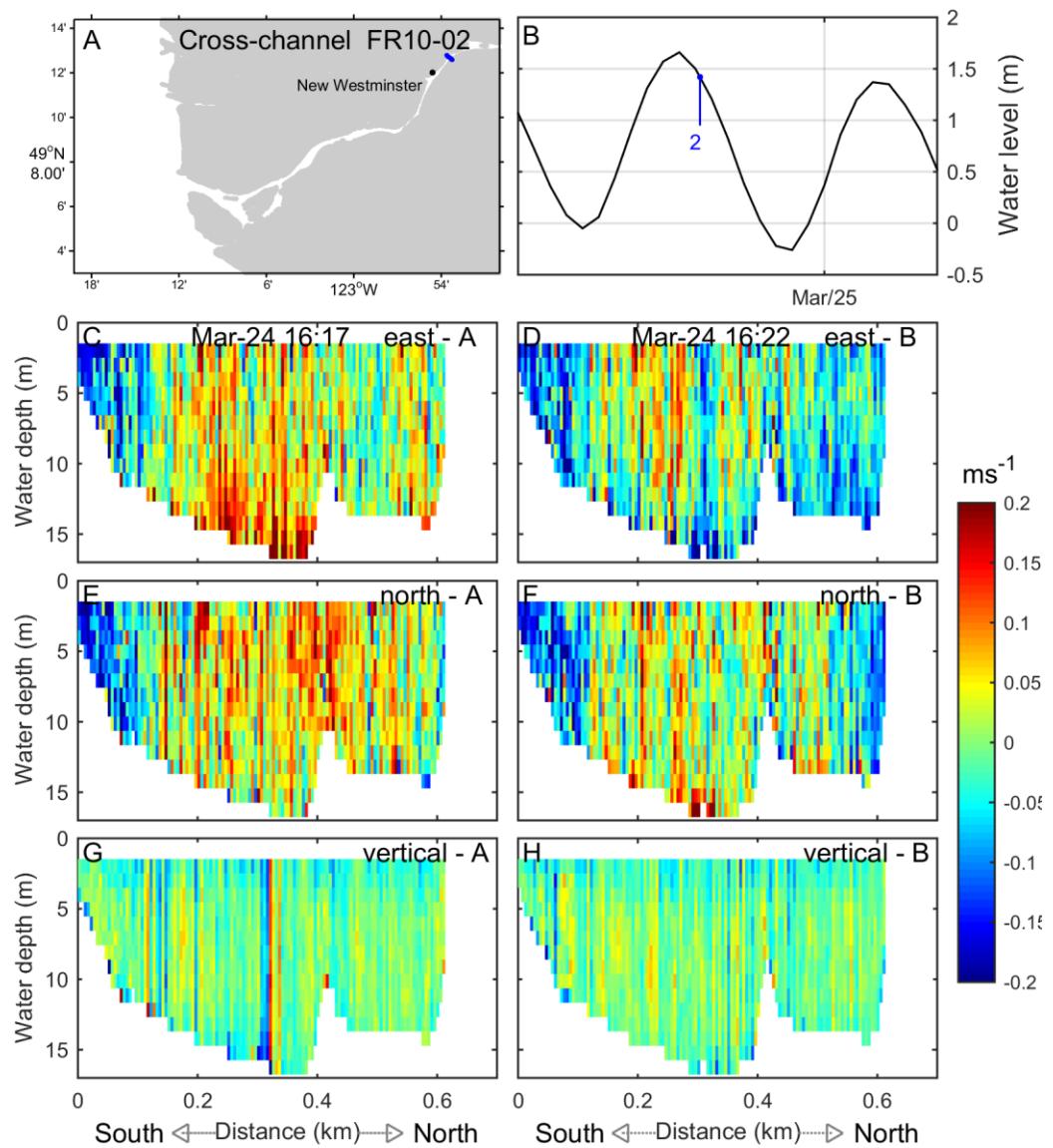


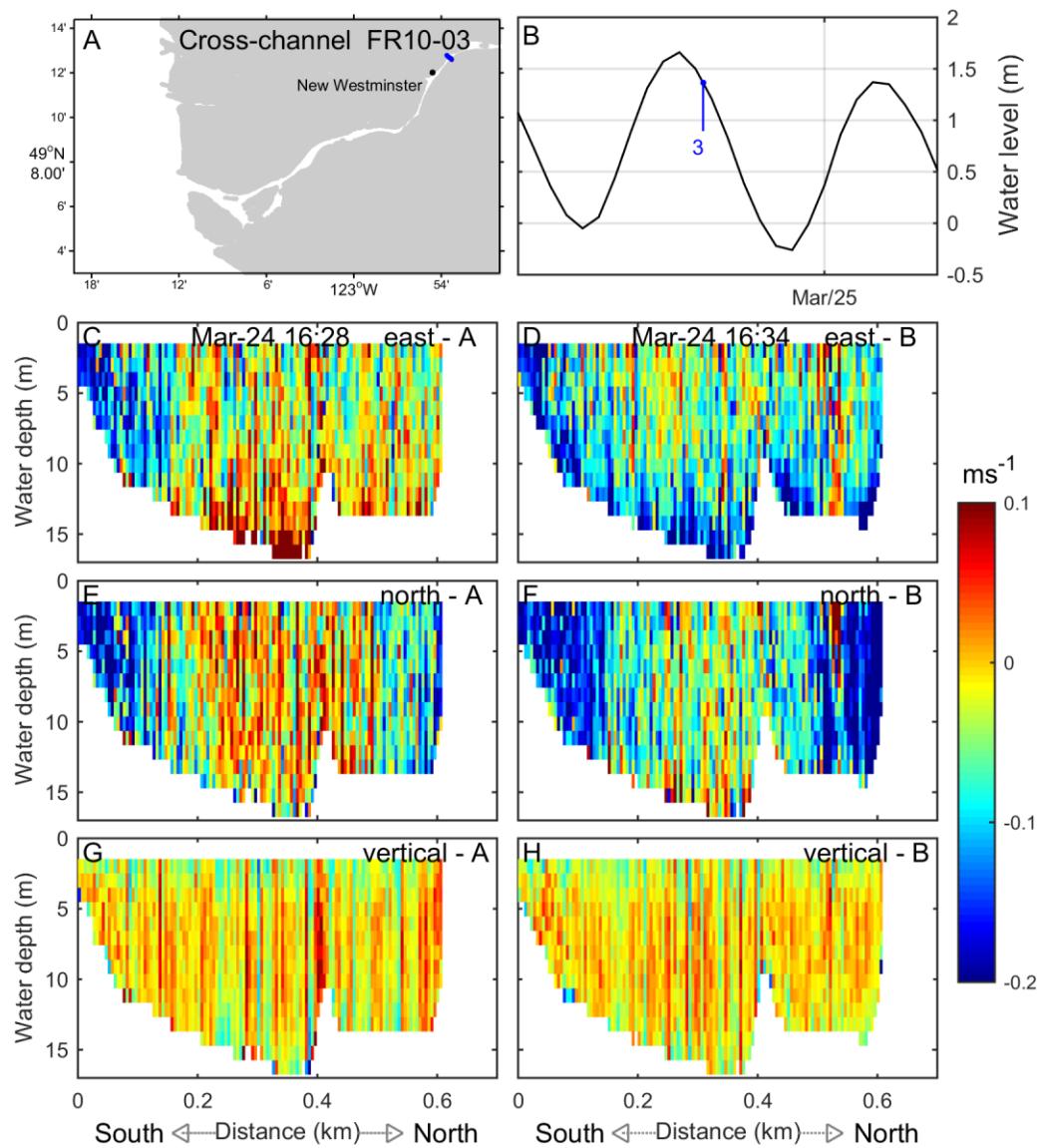


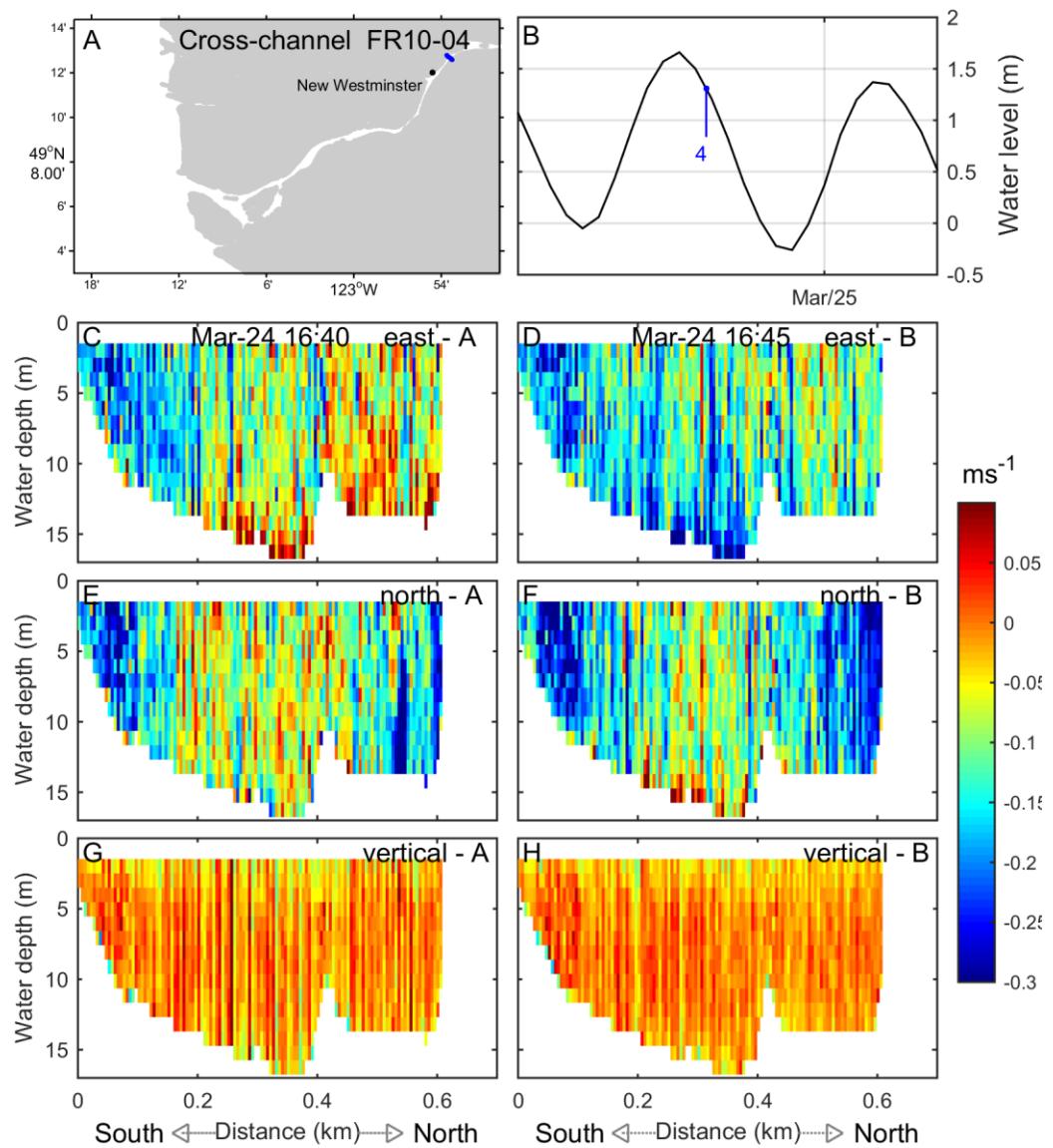


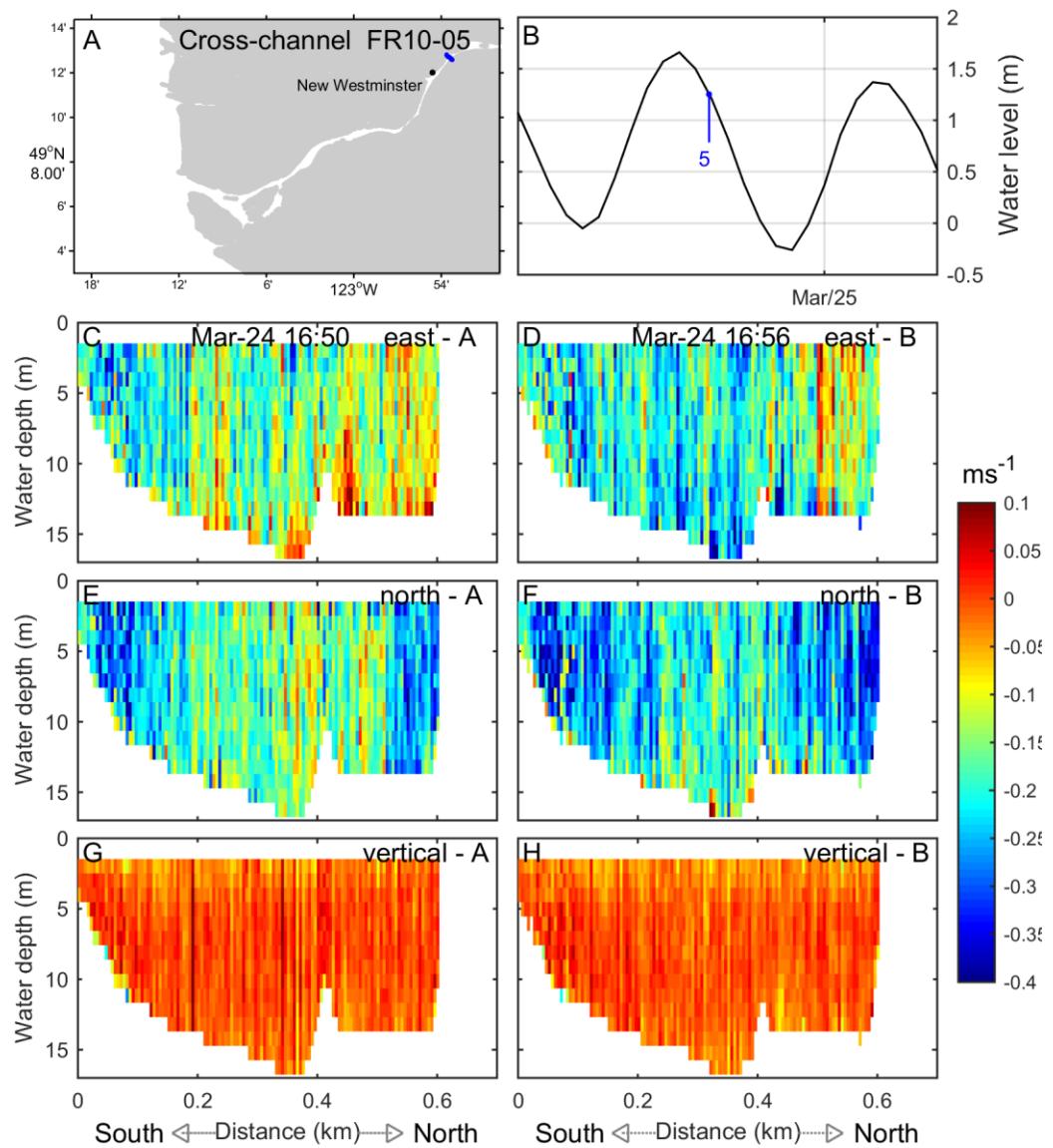


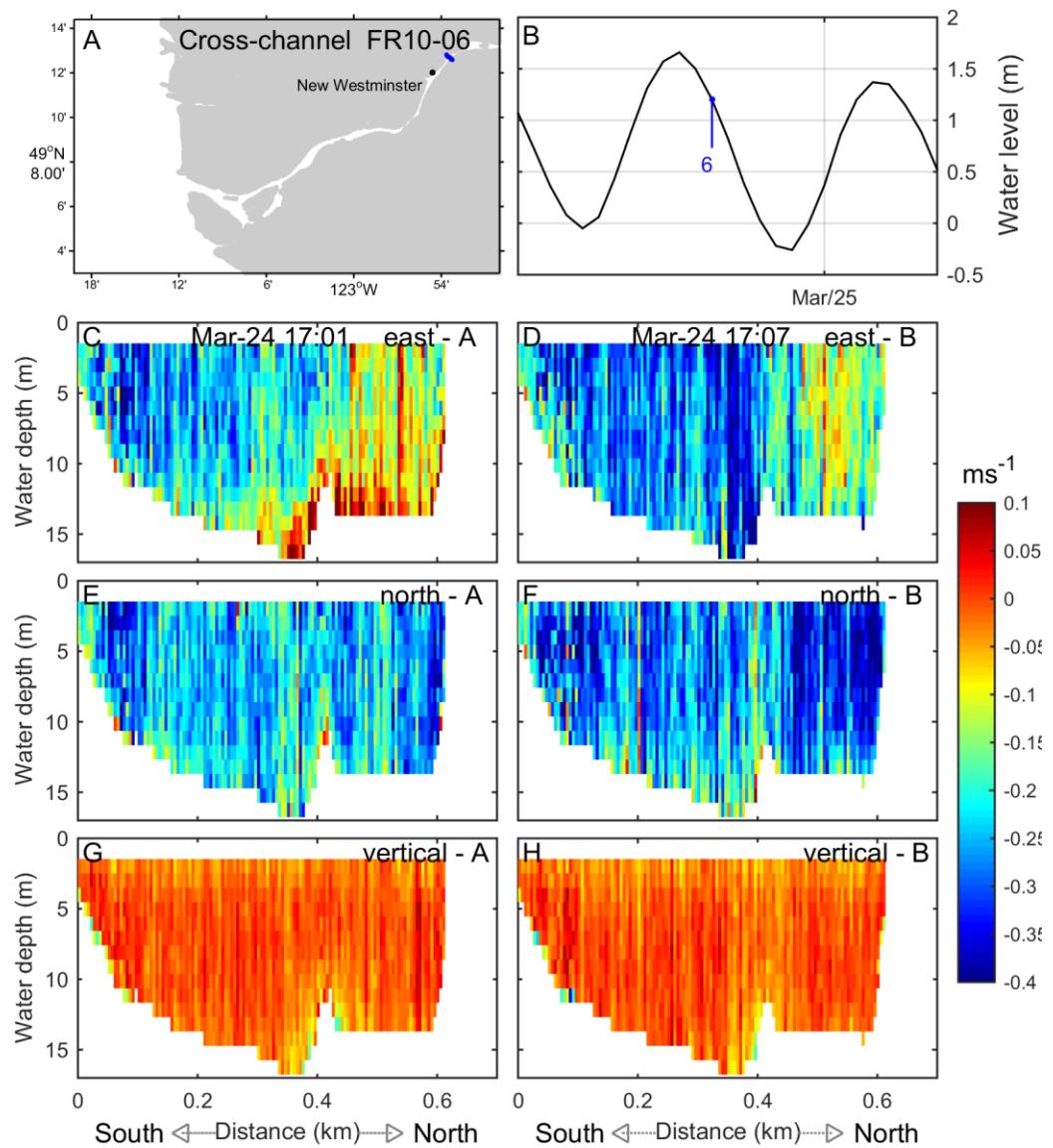


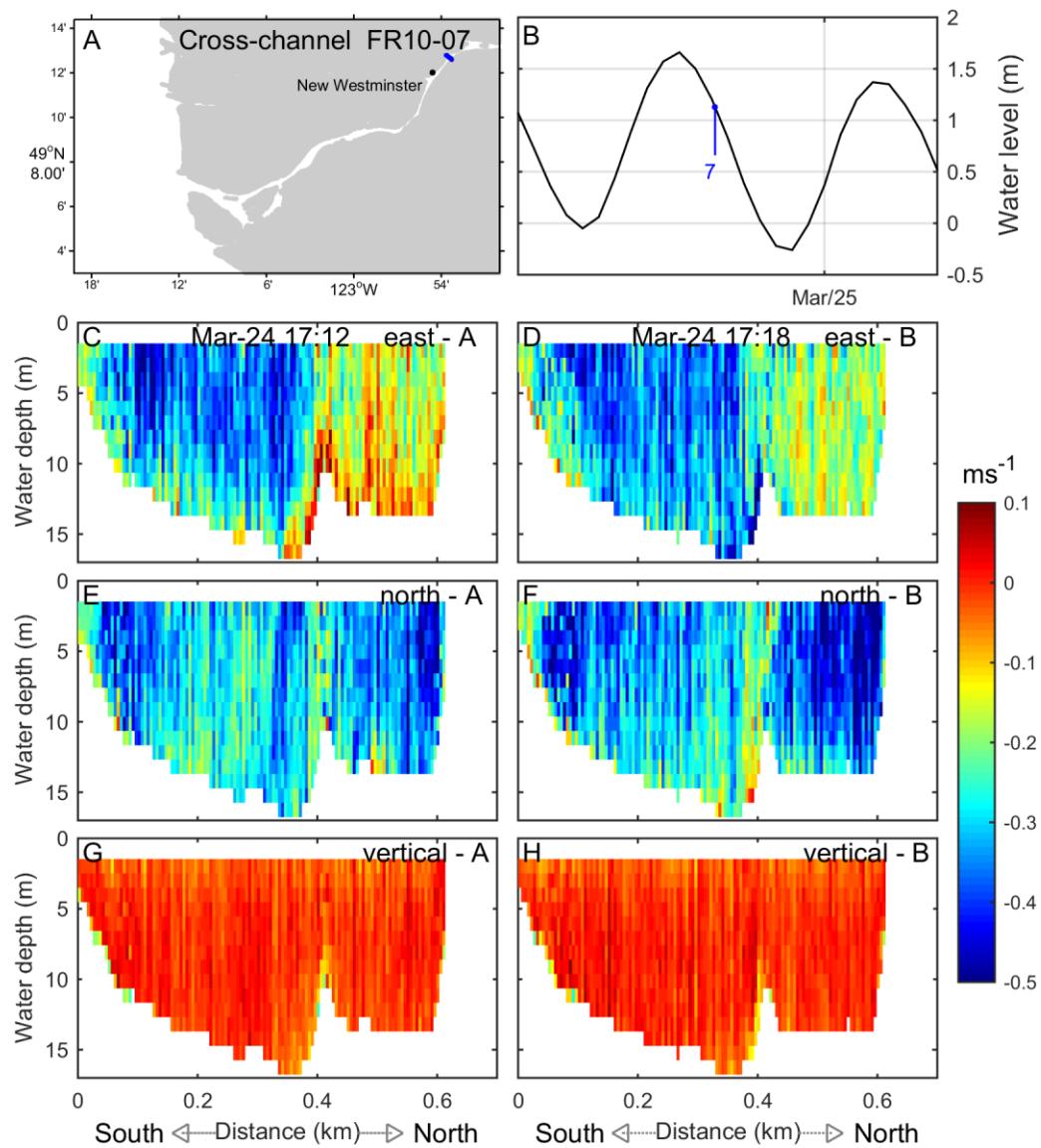


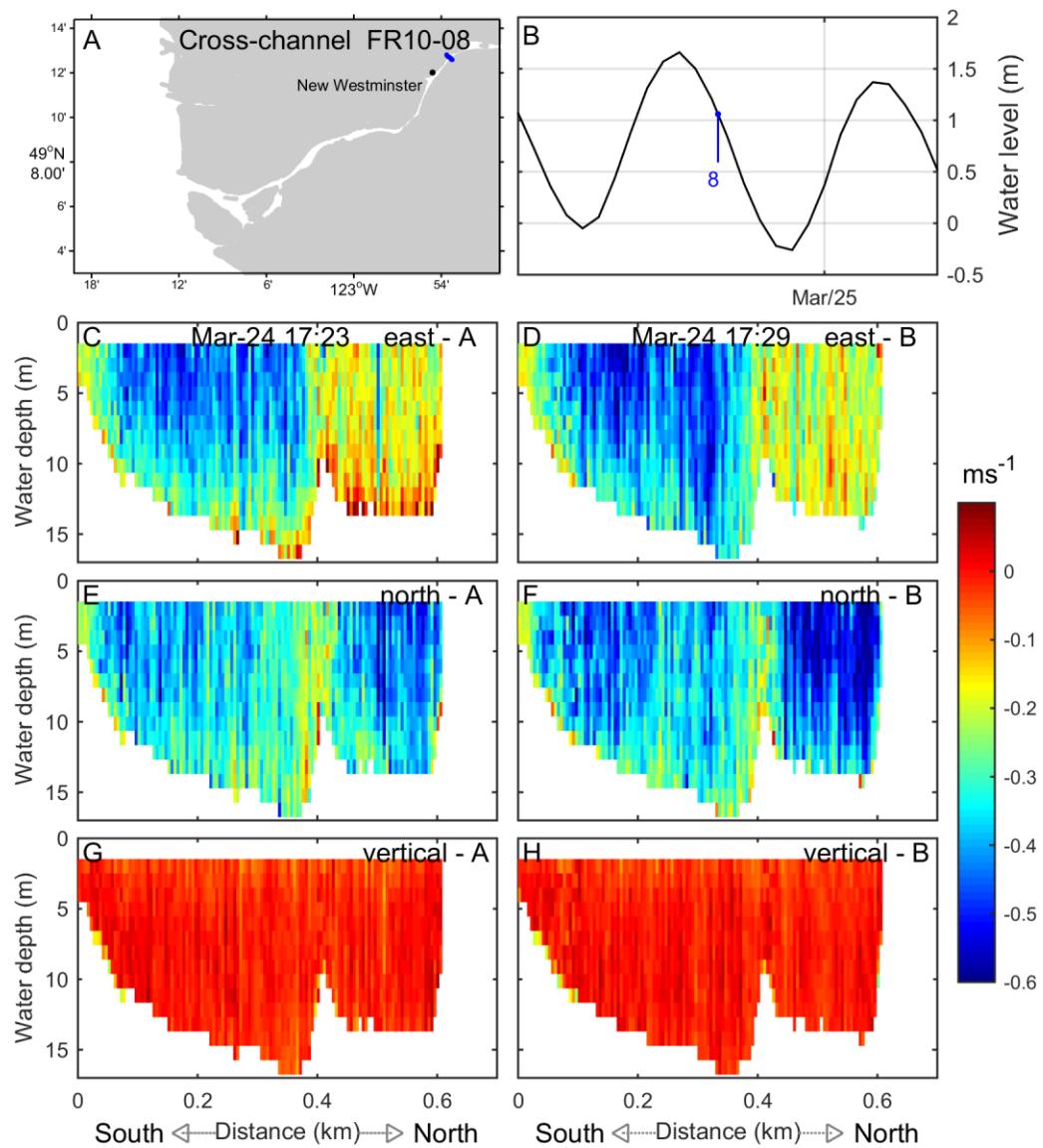


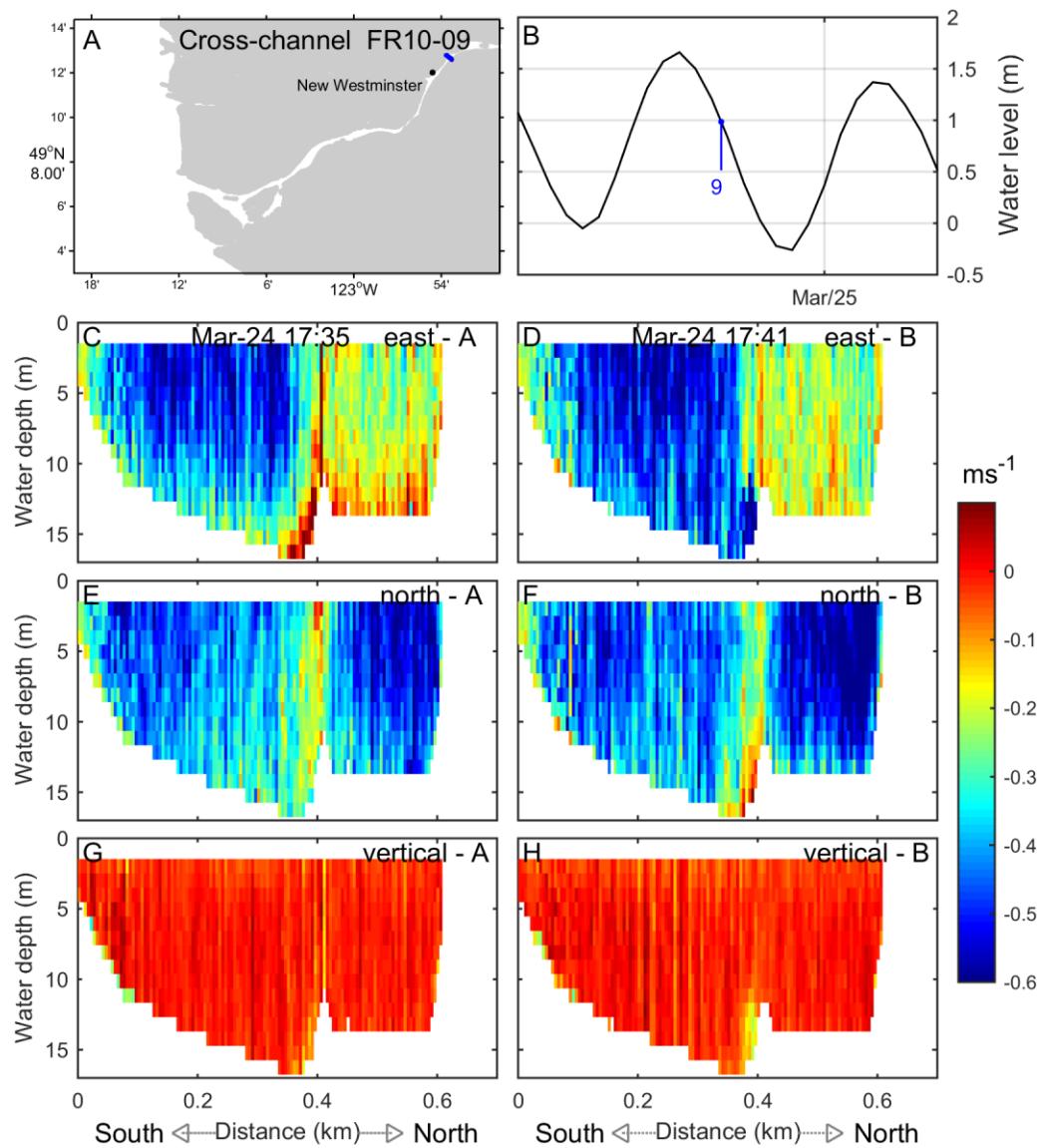


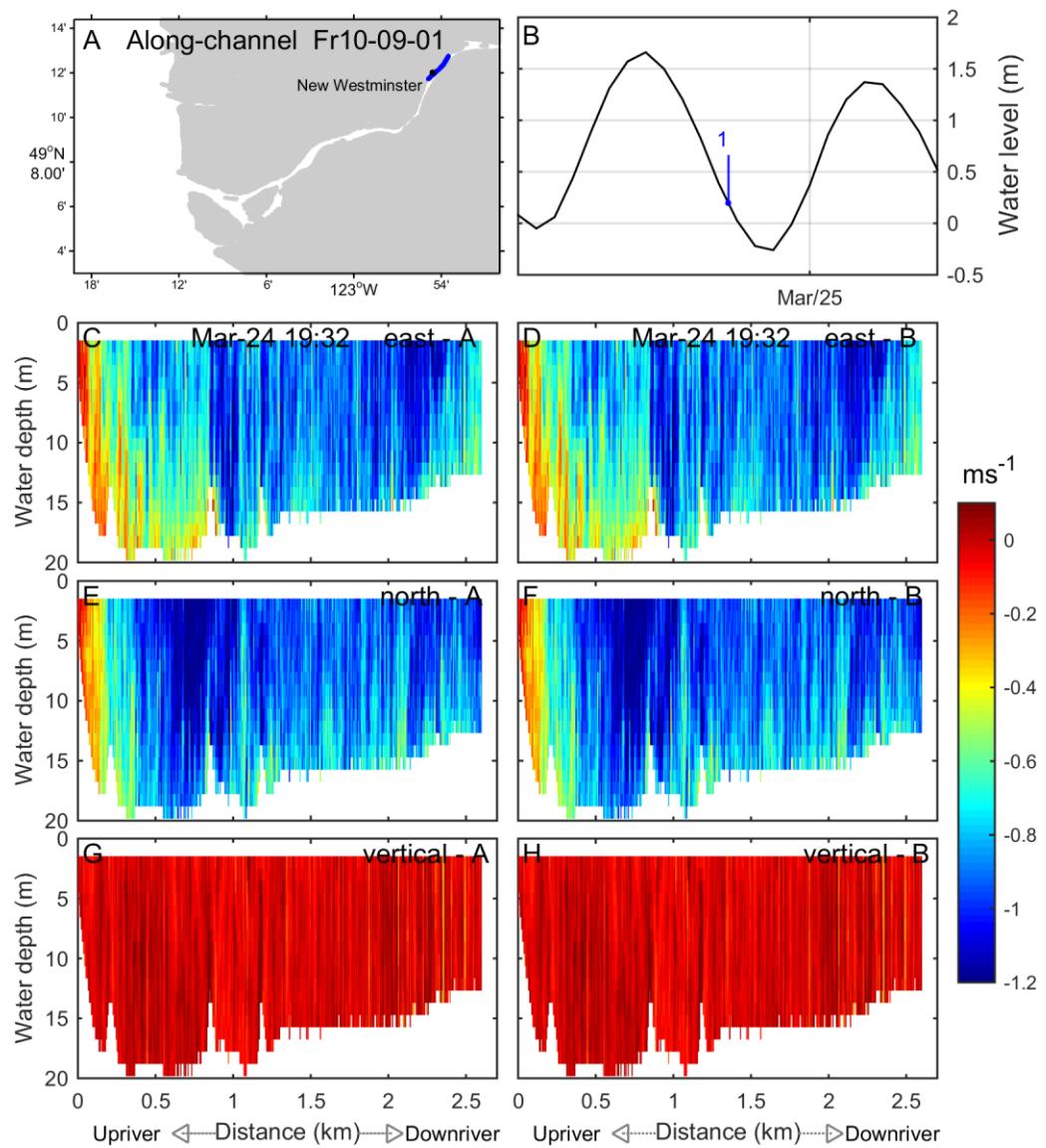


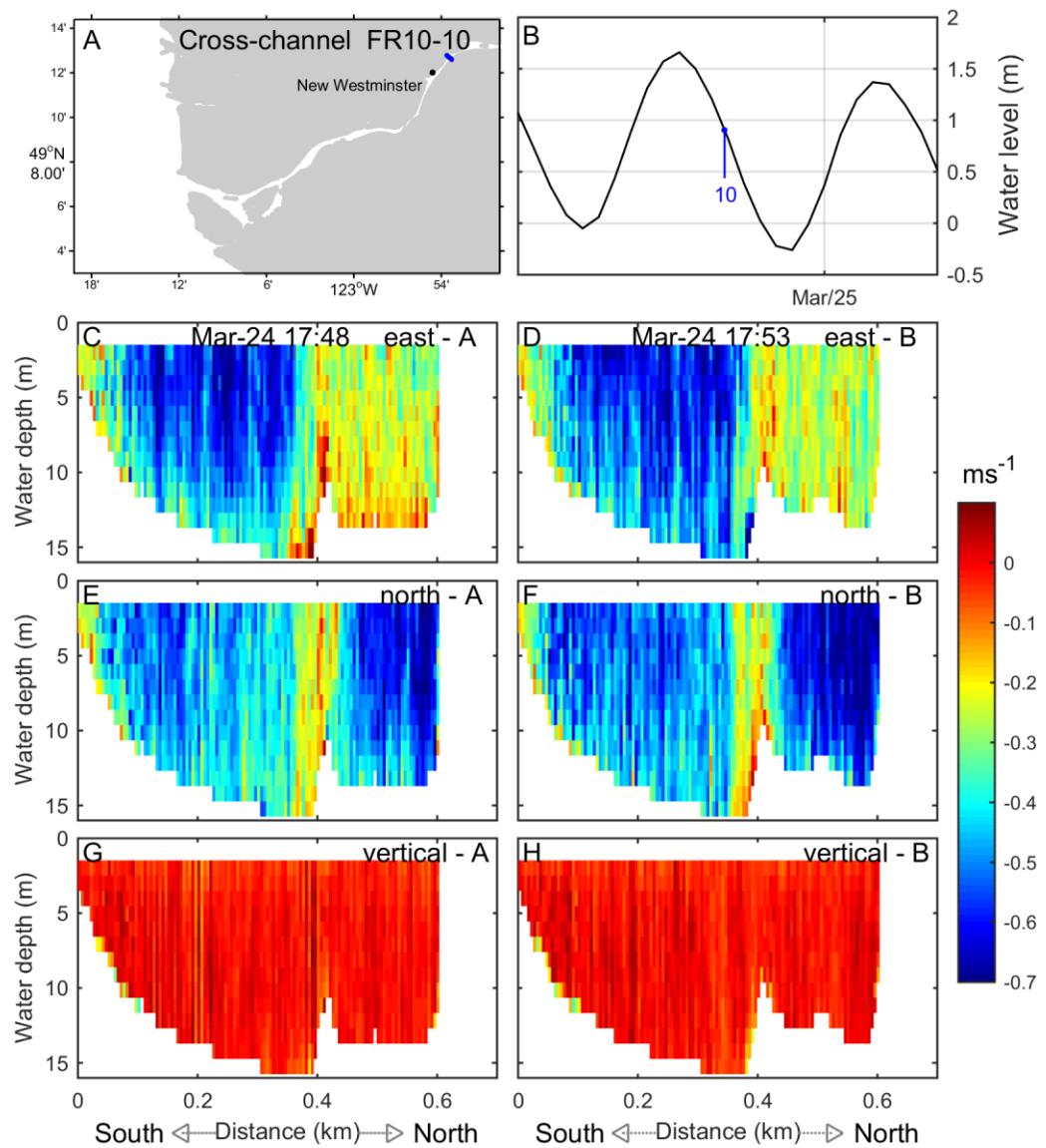


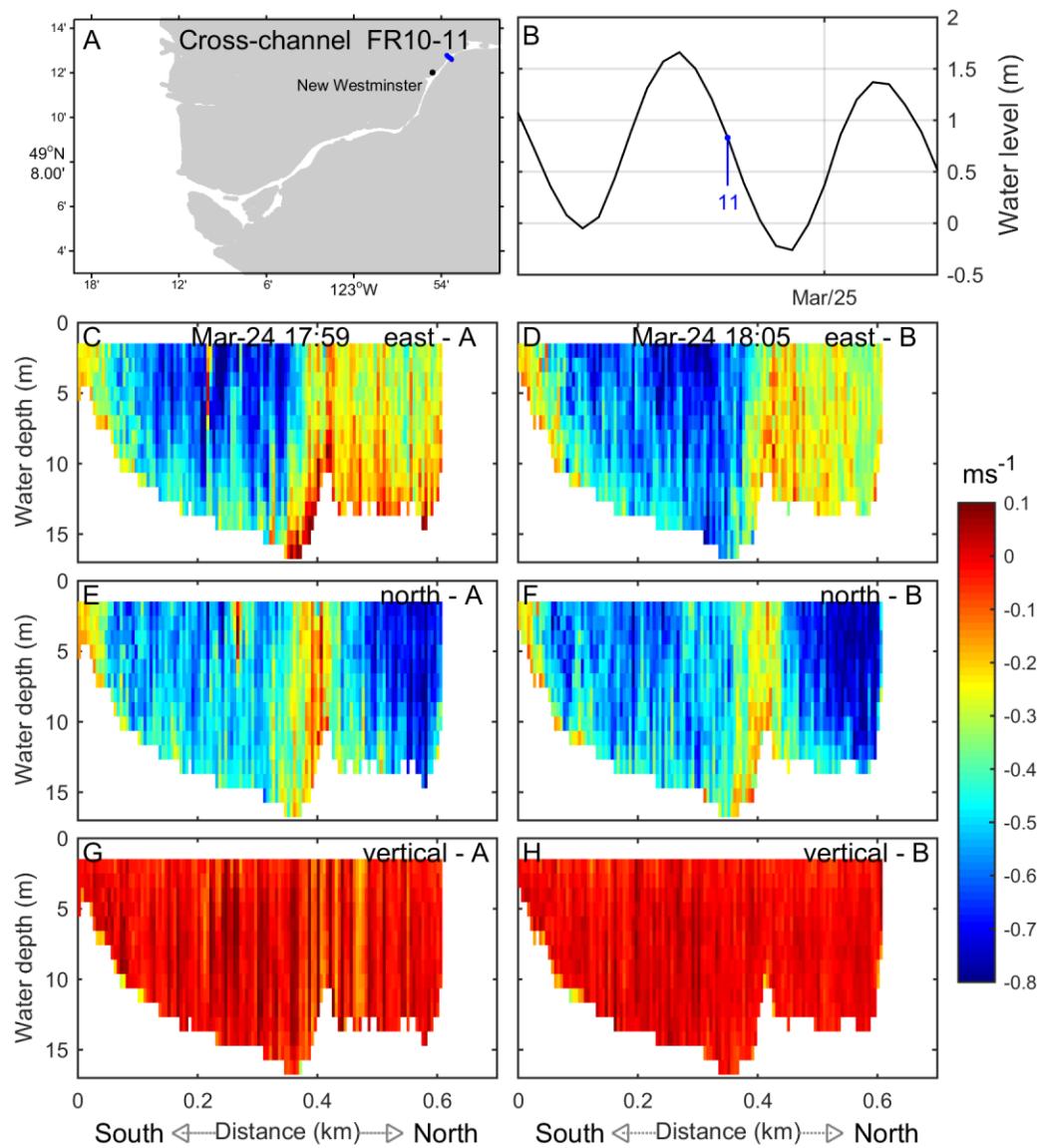


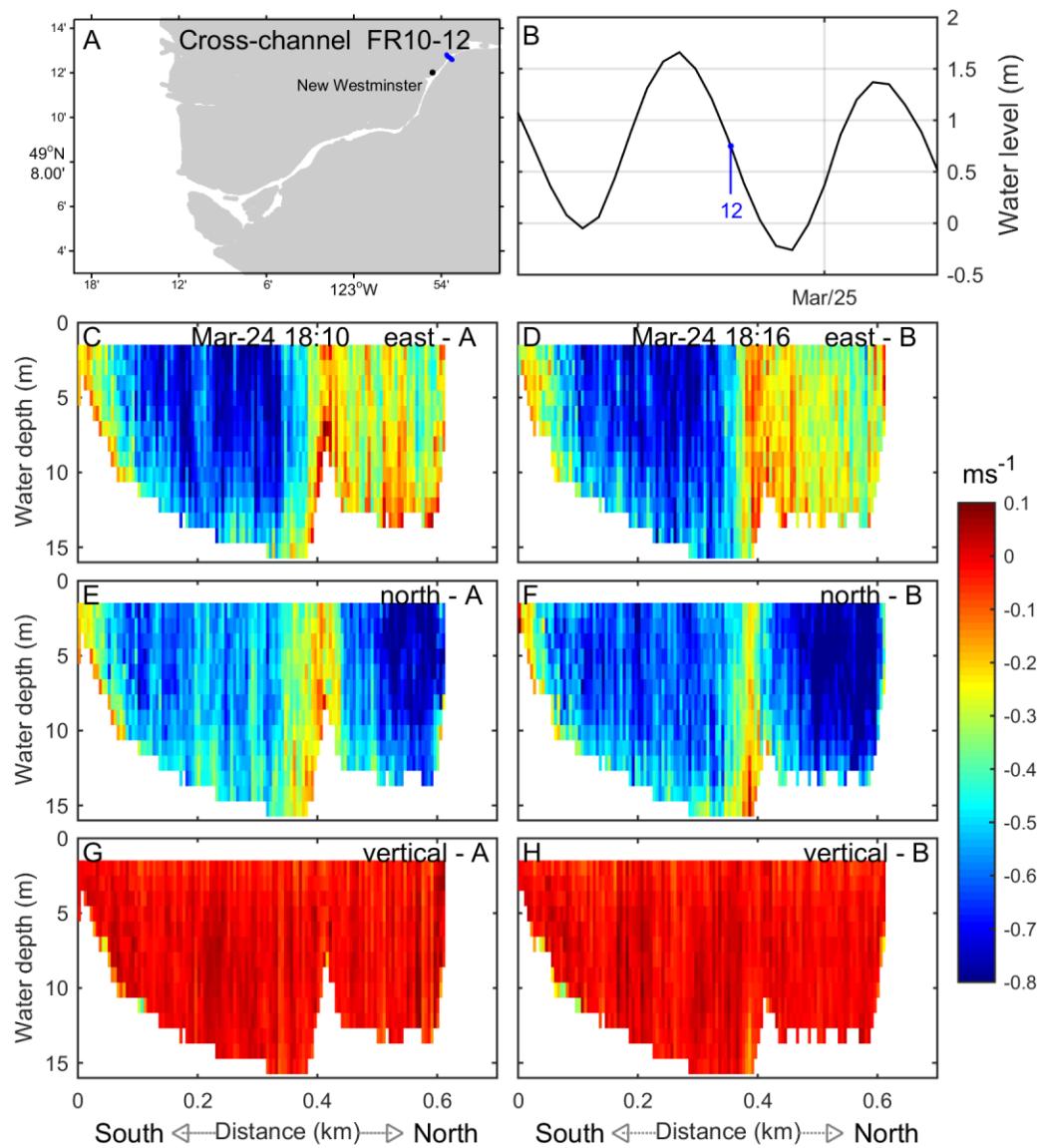


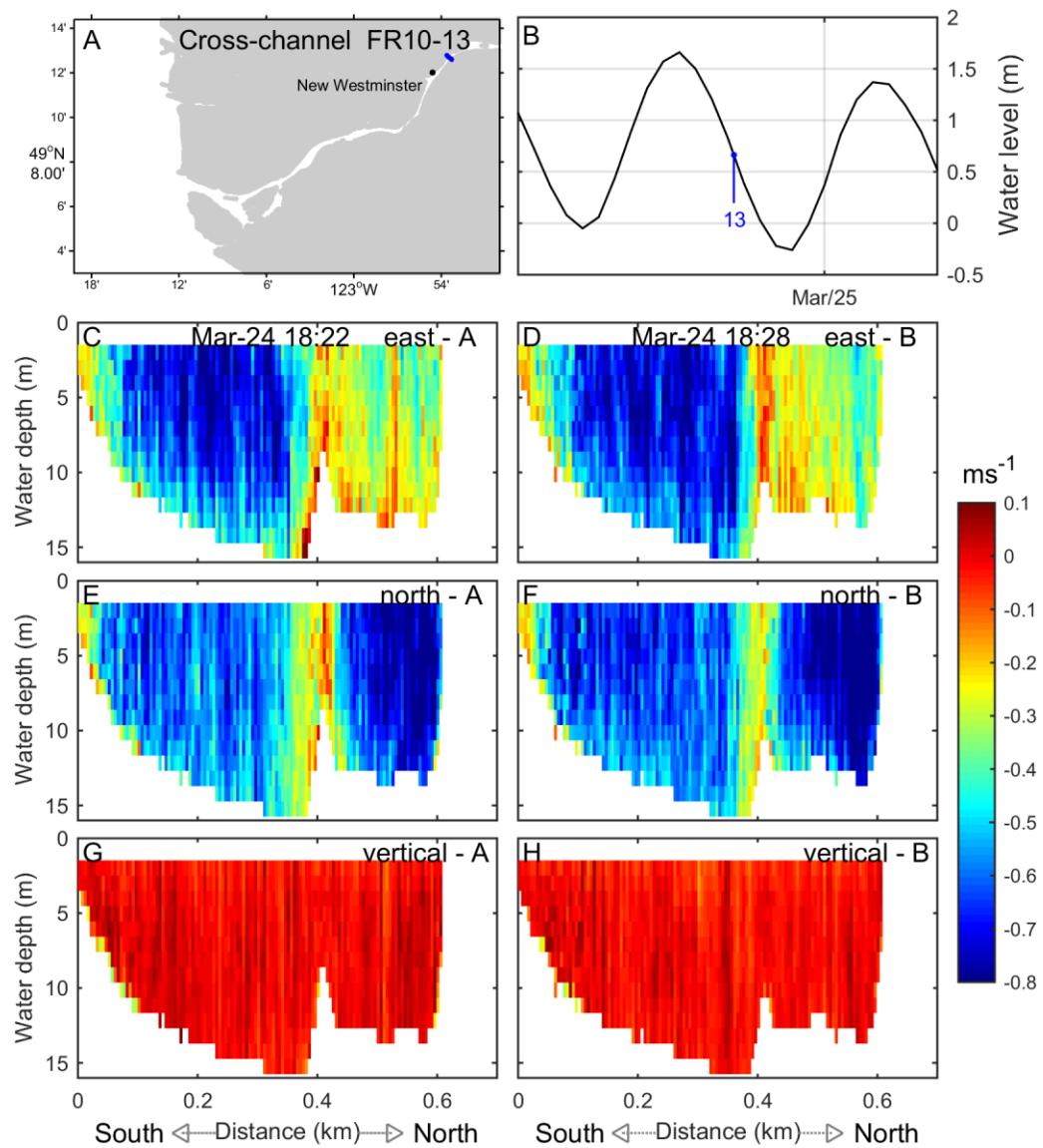


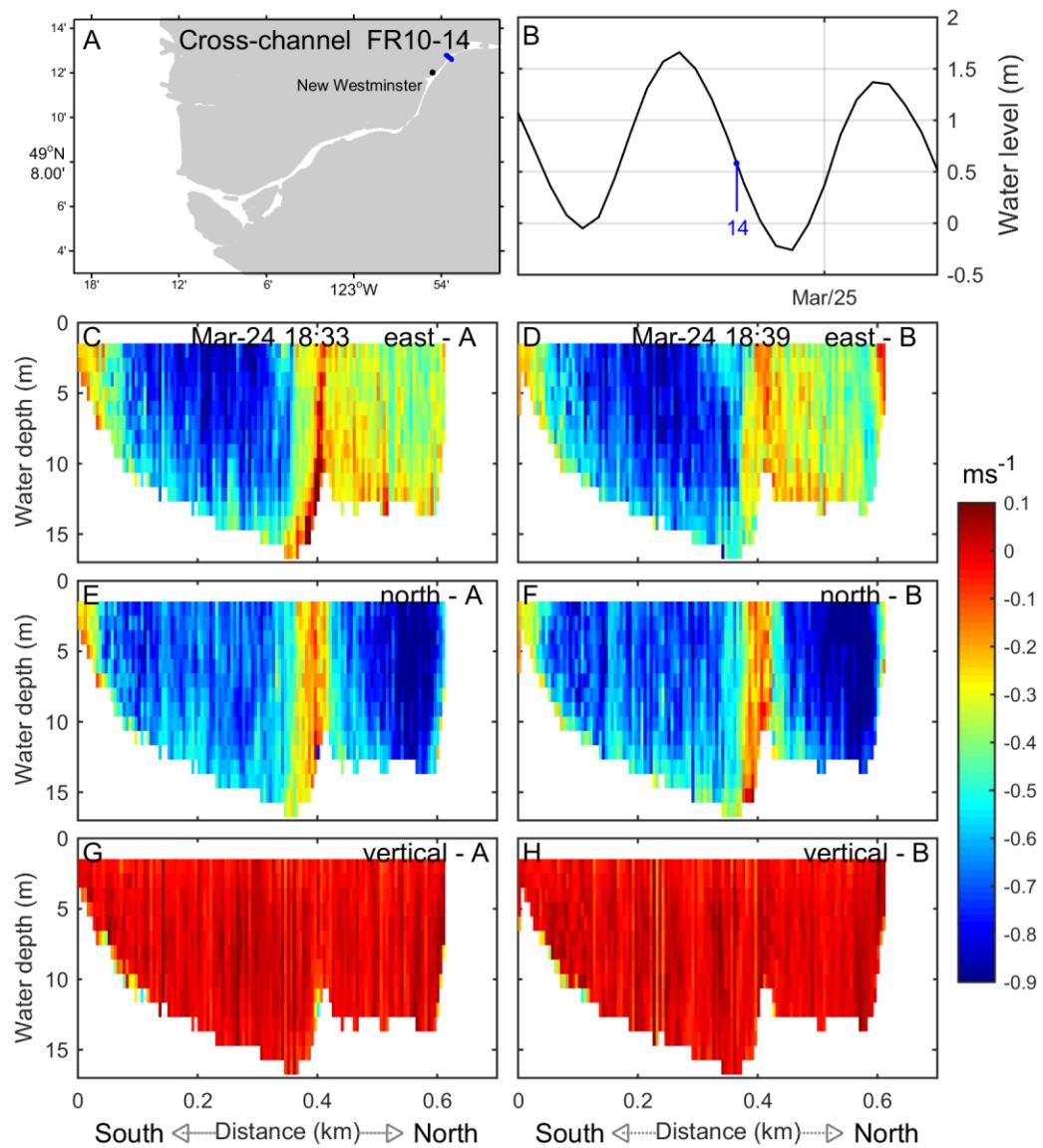


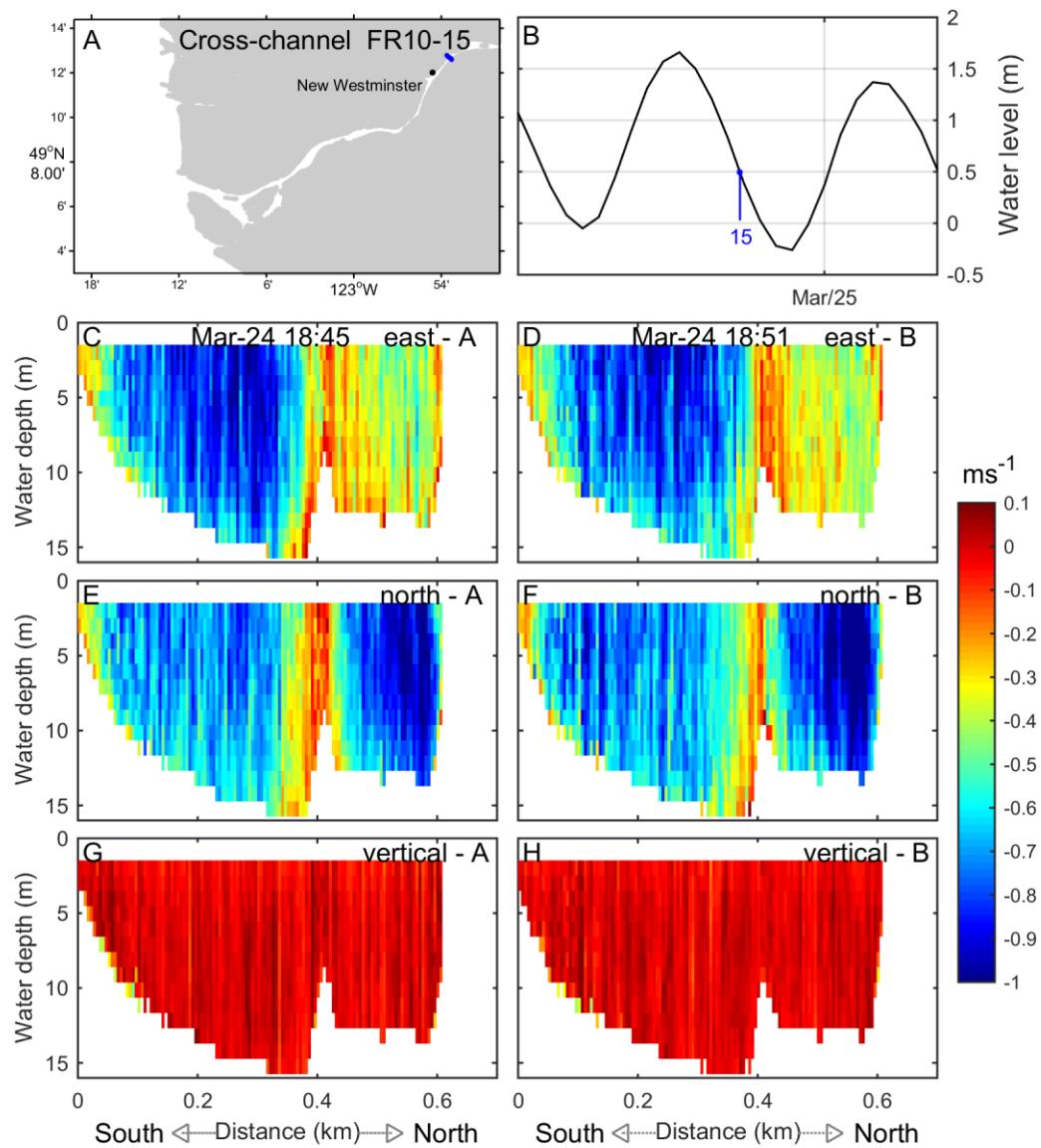


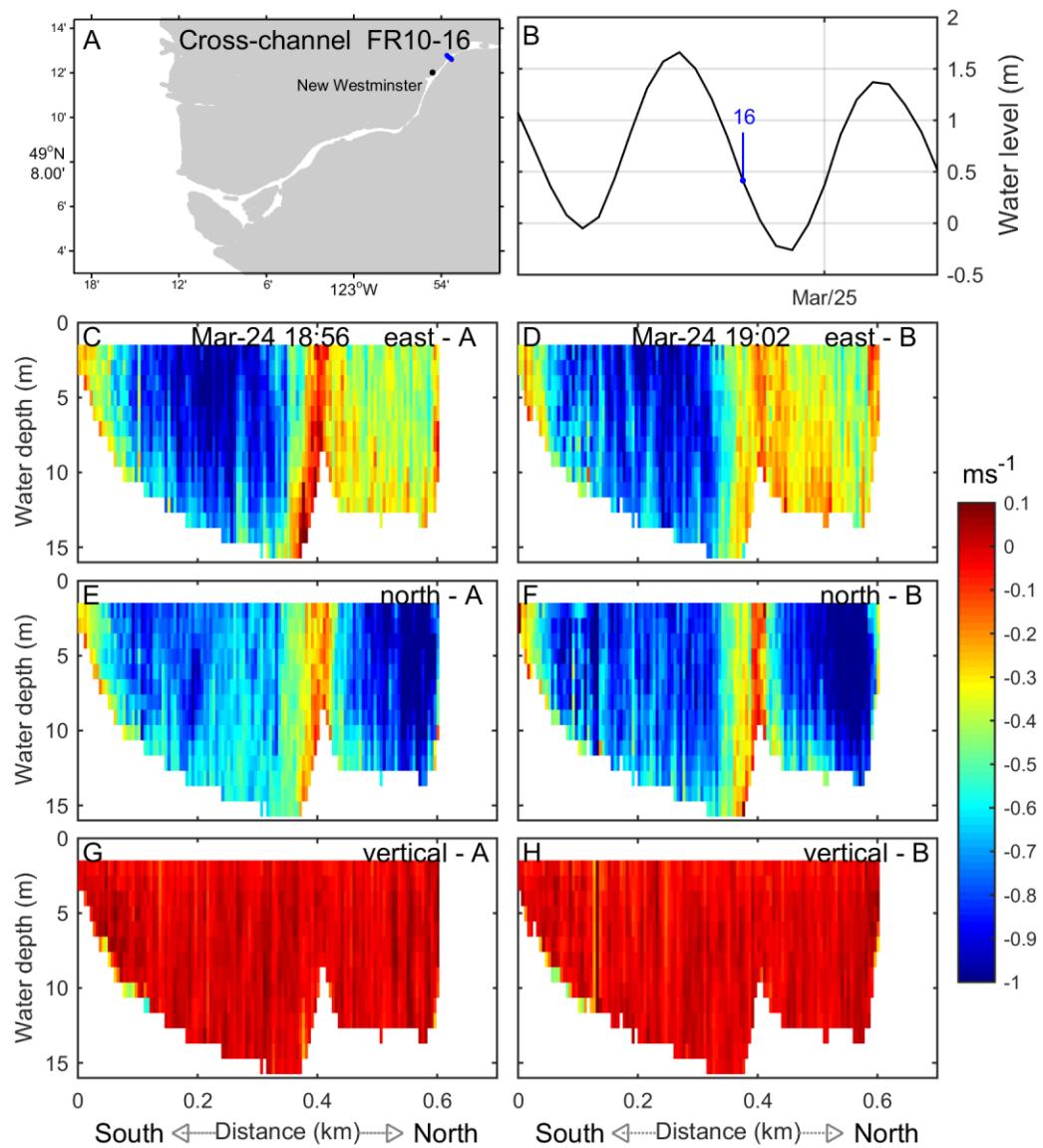


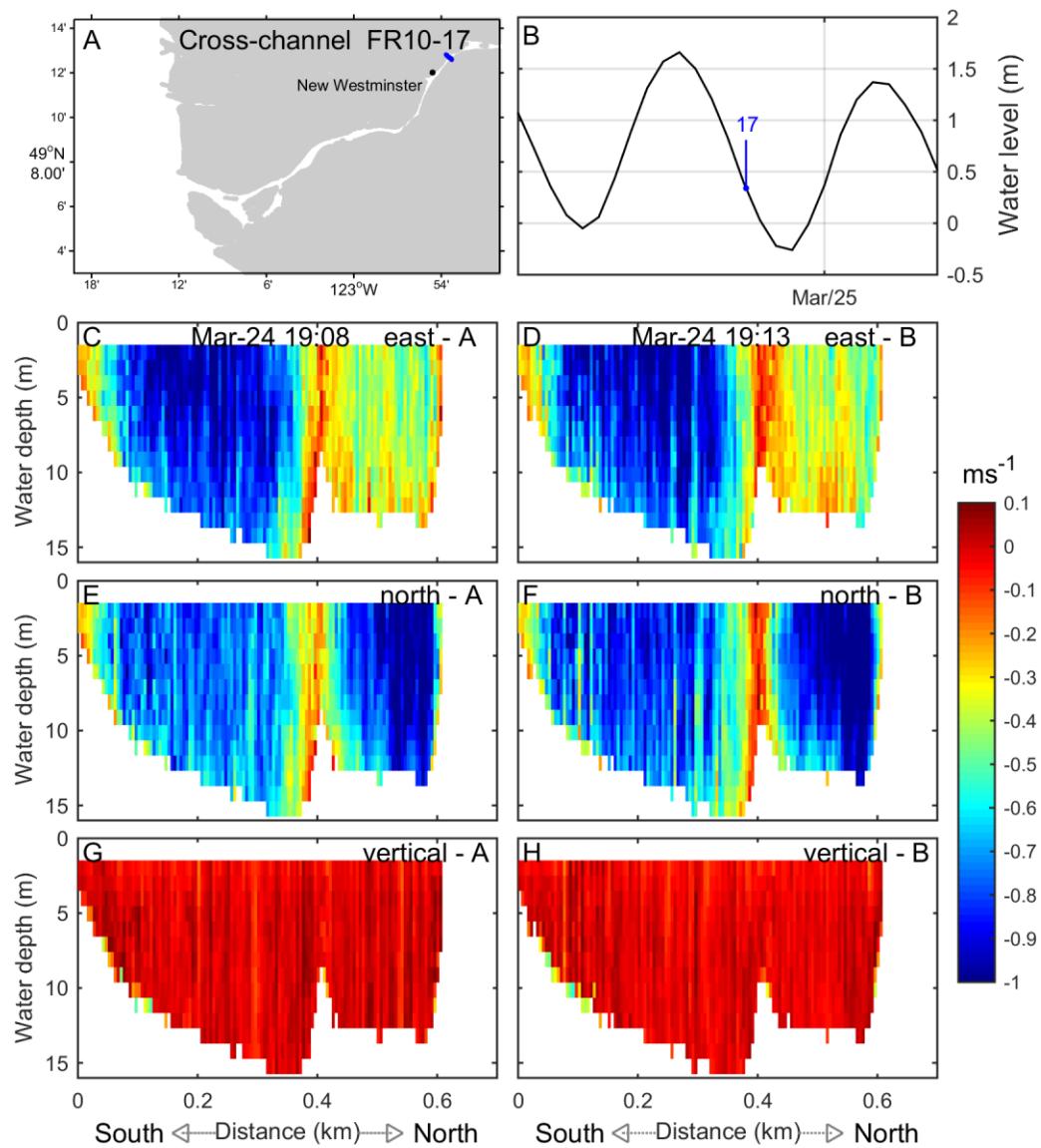


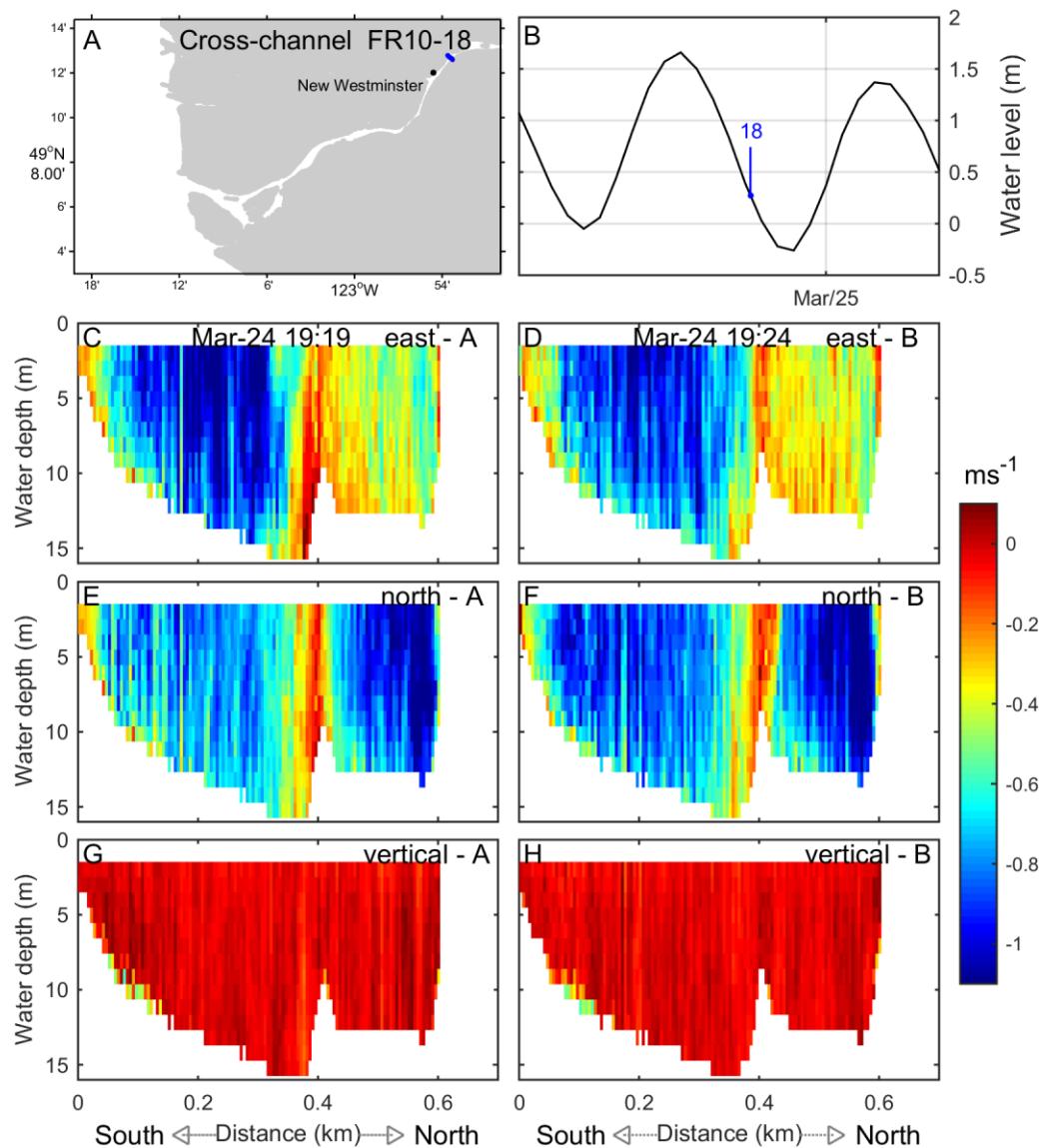






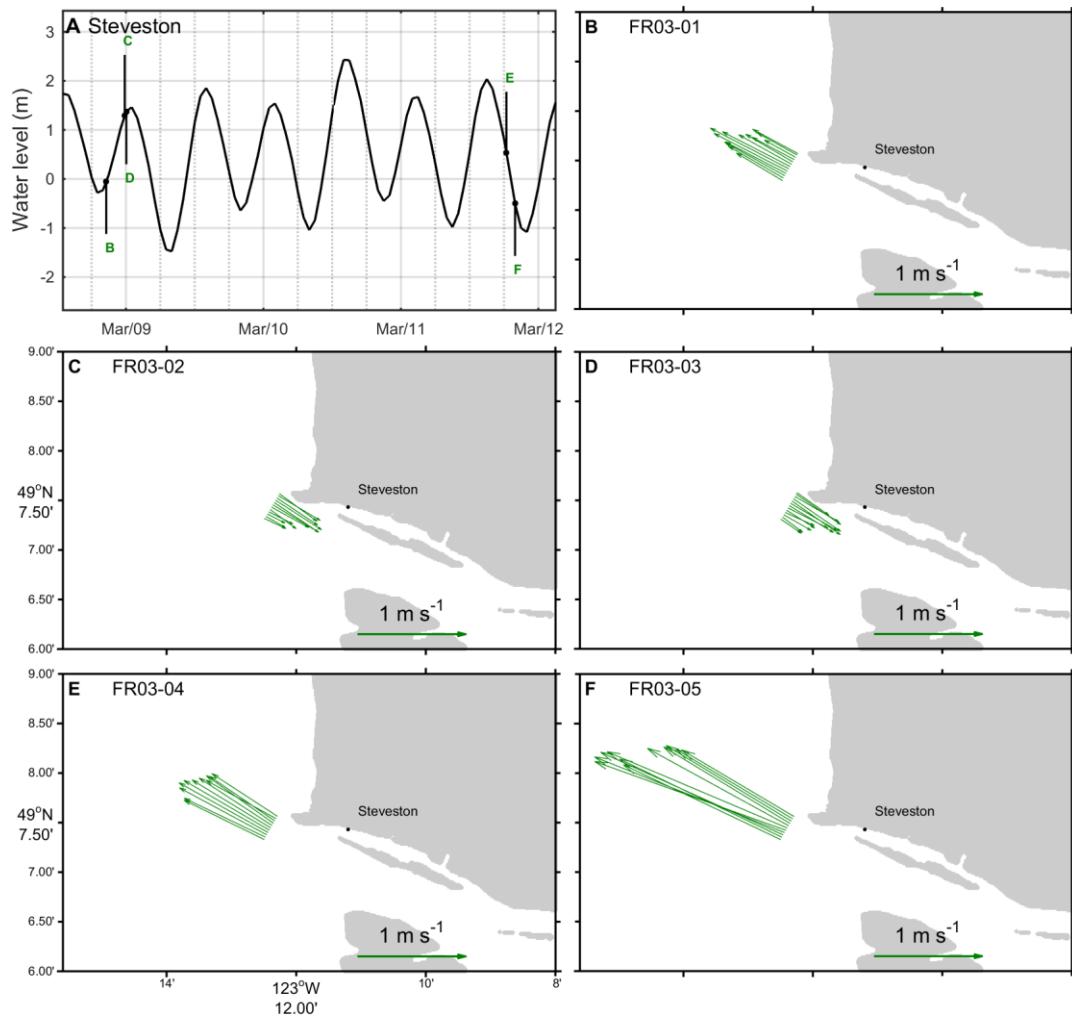


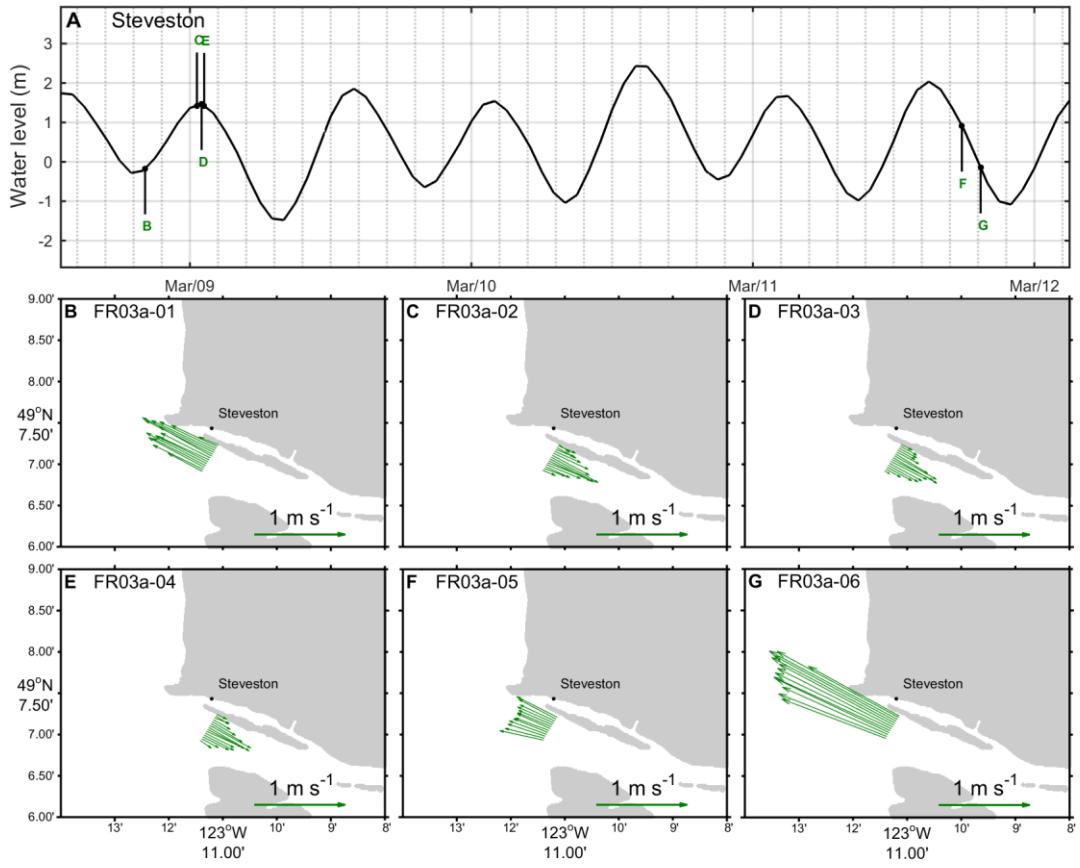


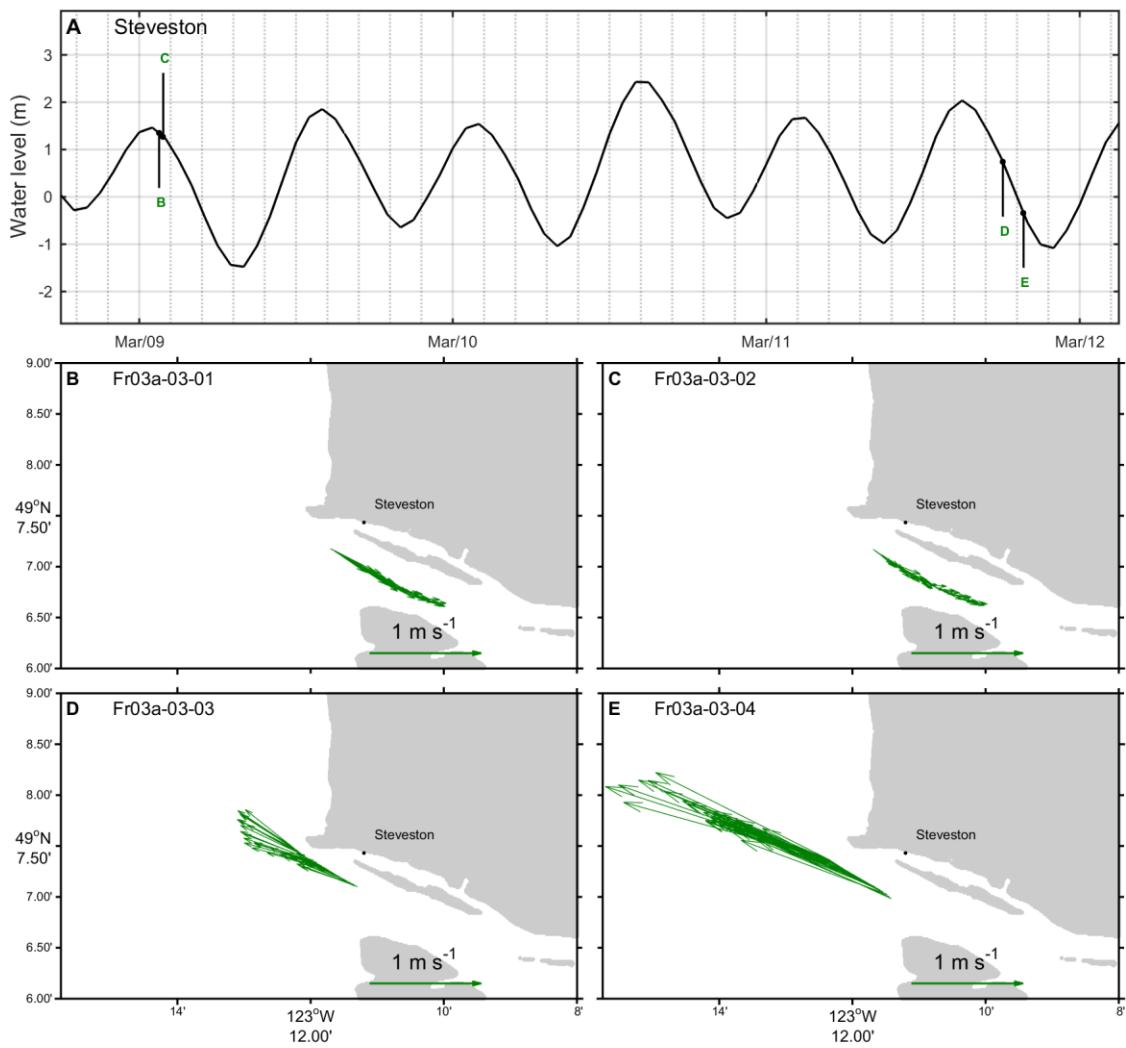


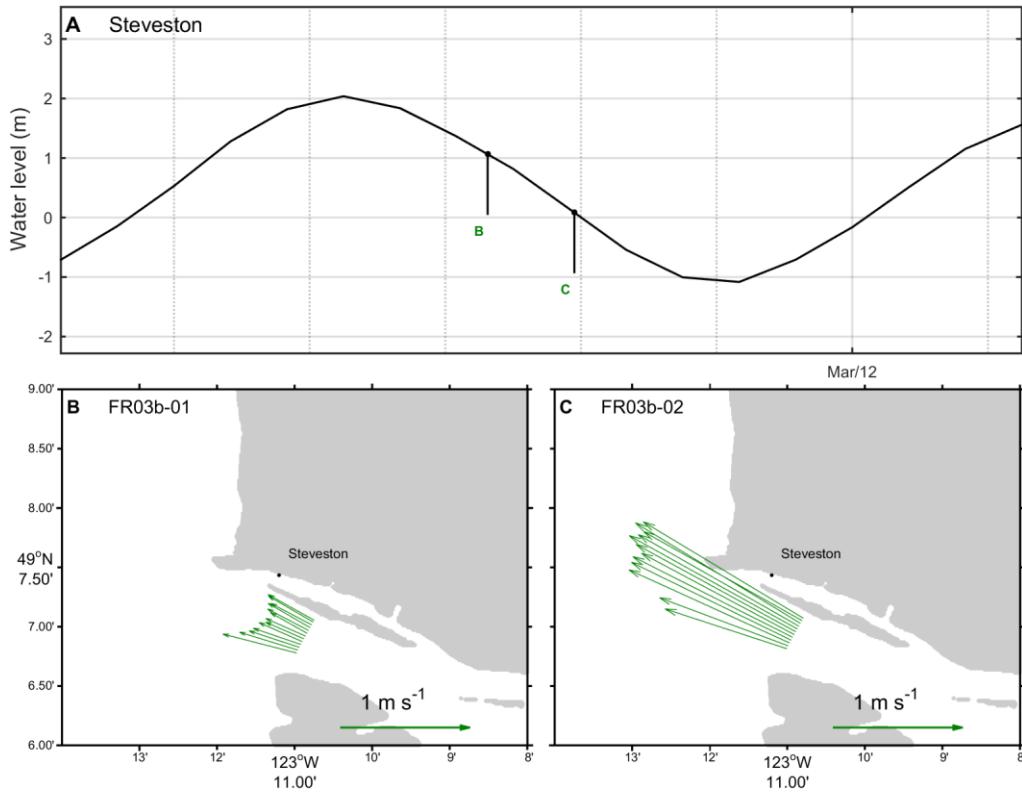
7.1.2 March Velocity Data Quiver Plots

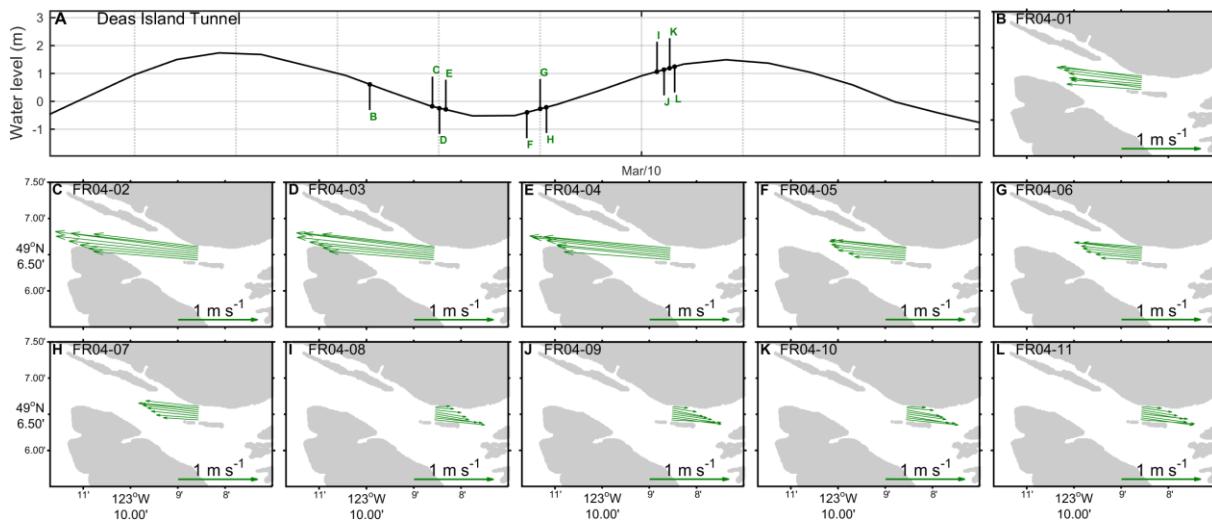
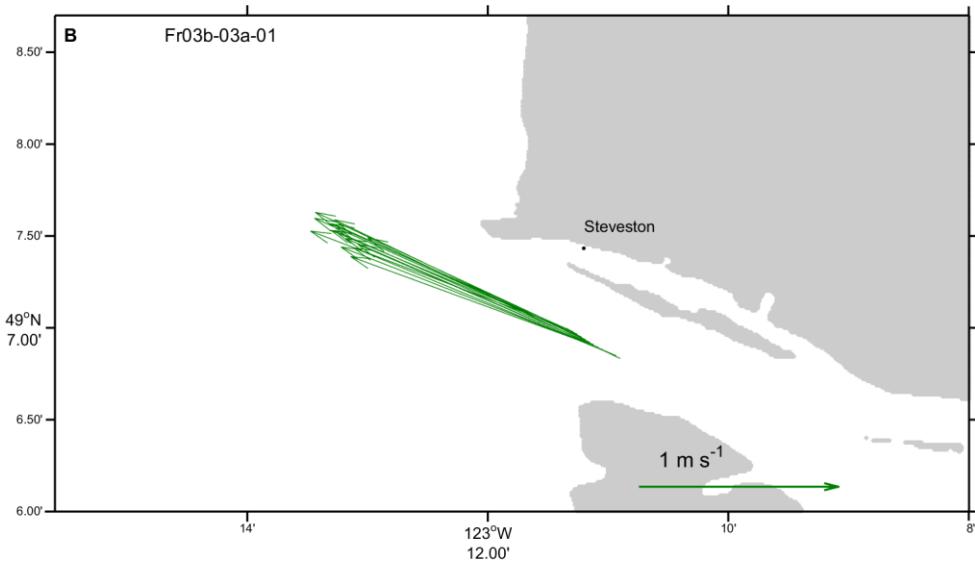
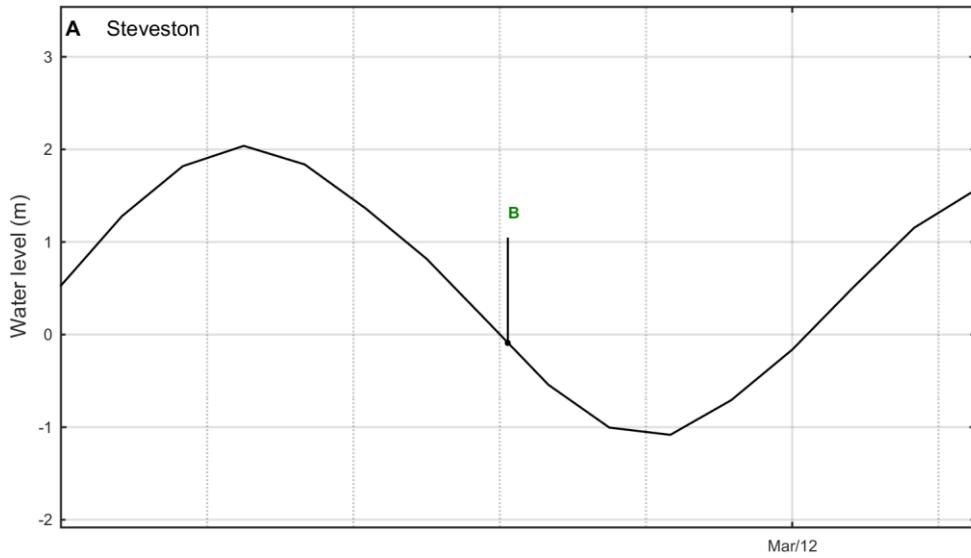
The following figures contain quiver plots (subplots B and above) for different sampling days at a single location. The plots show surface velocity for alongshore transects measured in March 2016. The figures show the tidal cycle (subplot A) with the time of sampling depicted on the tidal cycle plot with the letter of the corresponding quiver plot. The units are in ms⁻¹.

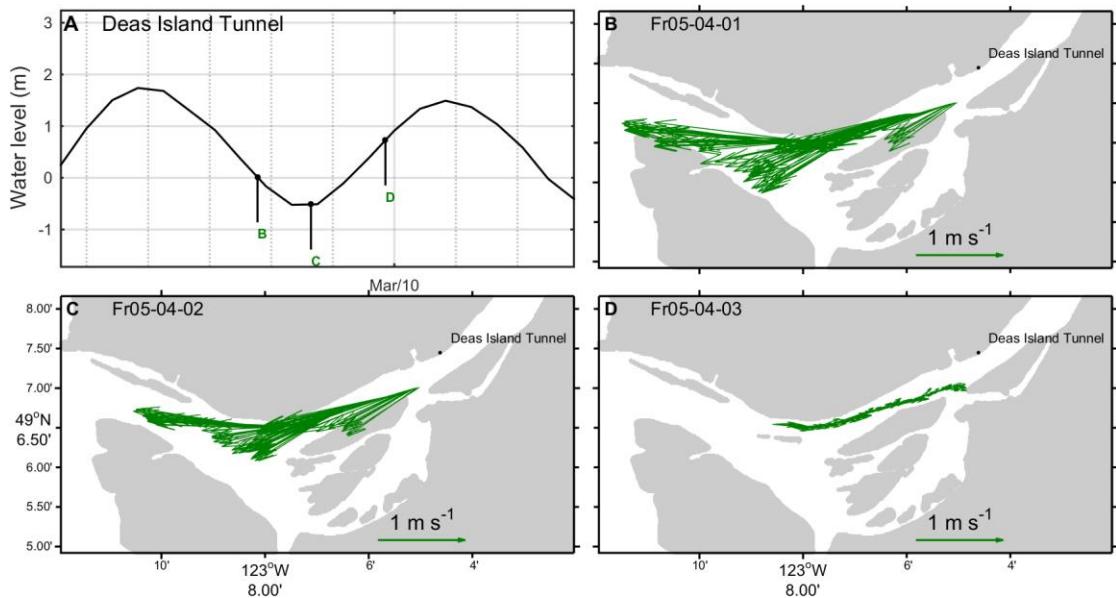
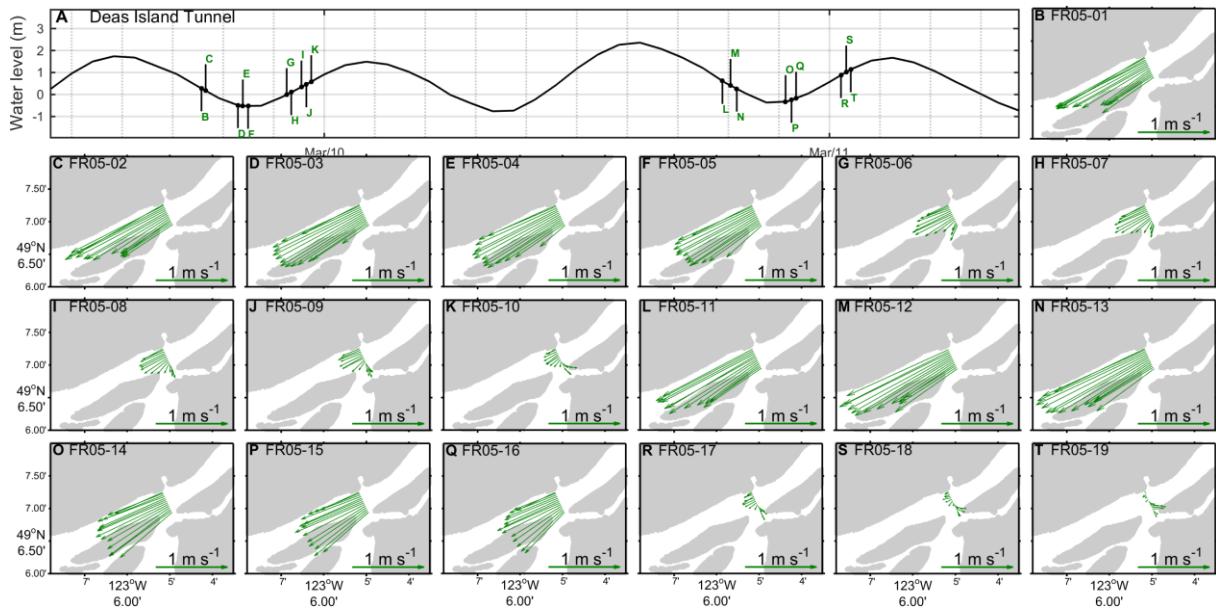


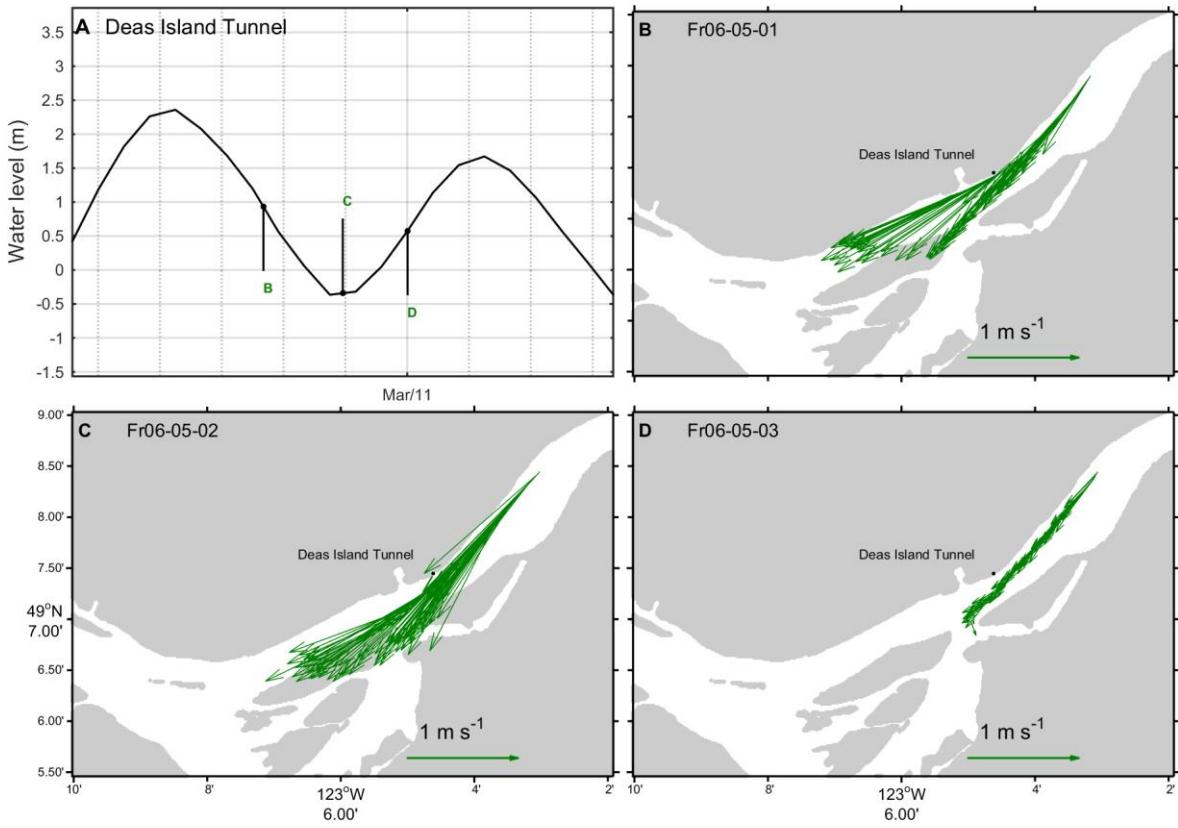
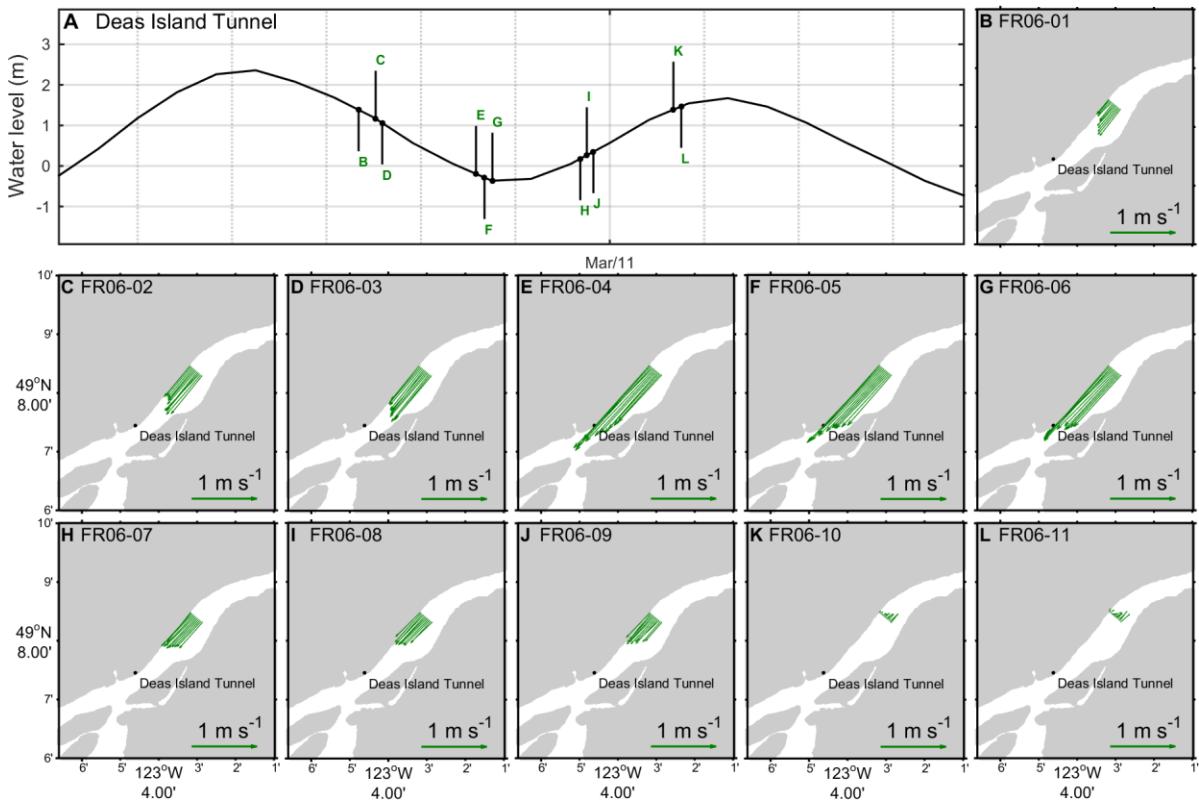


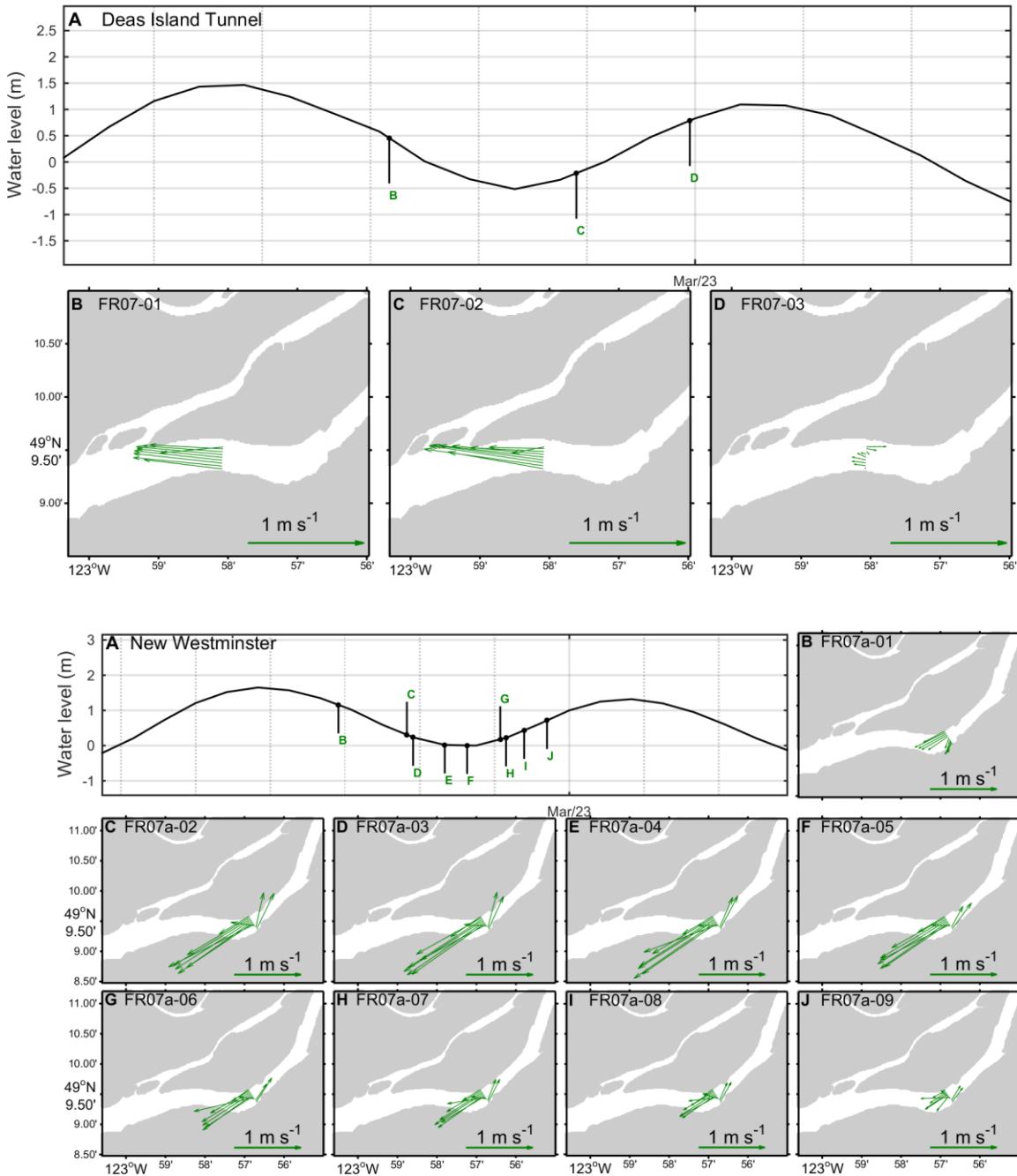


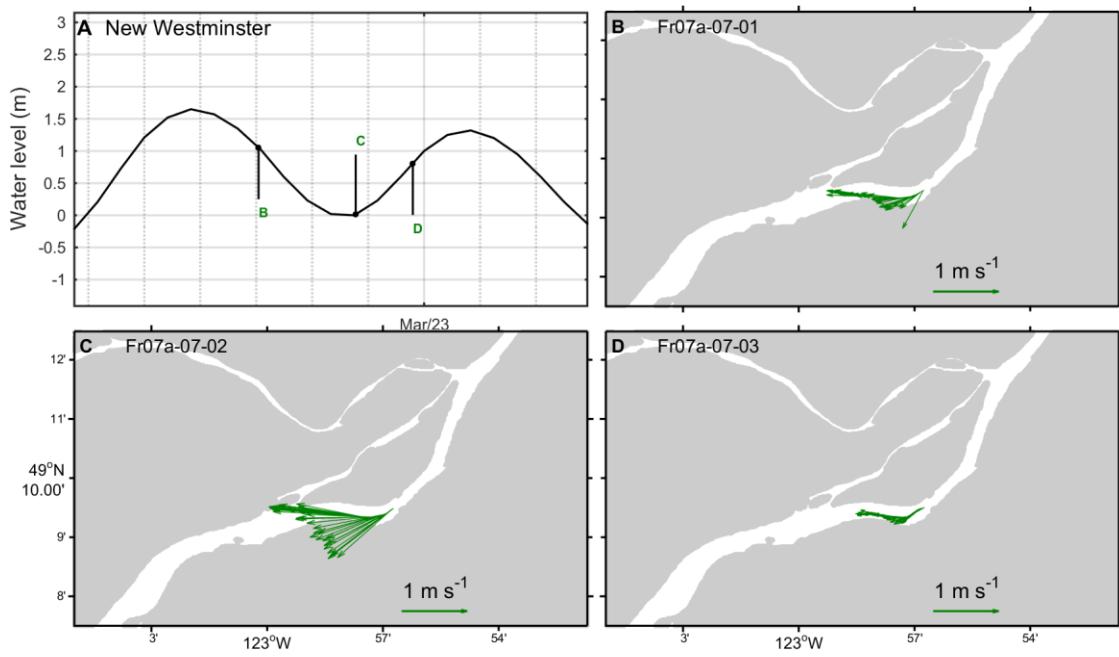


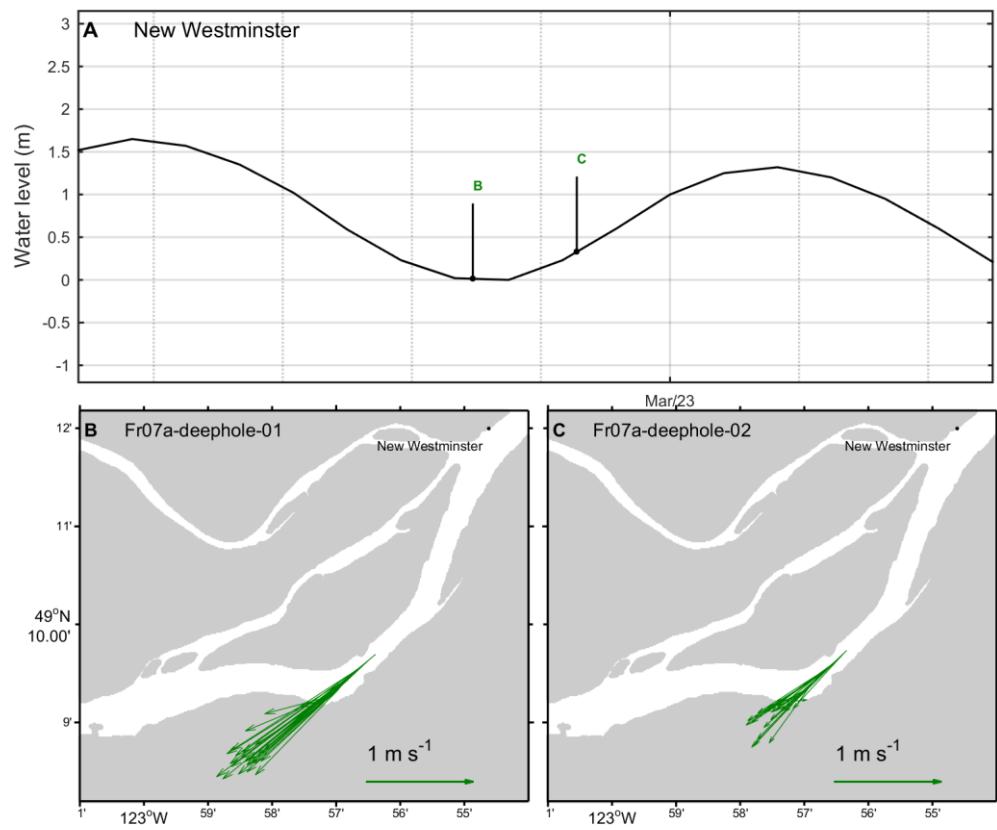


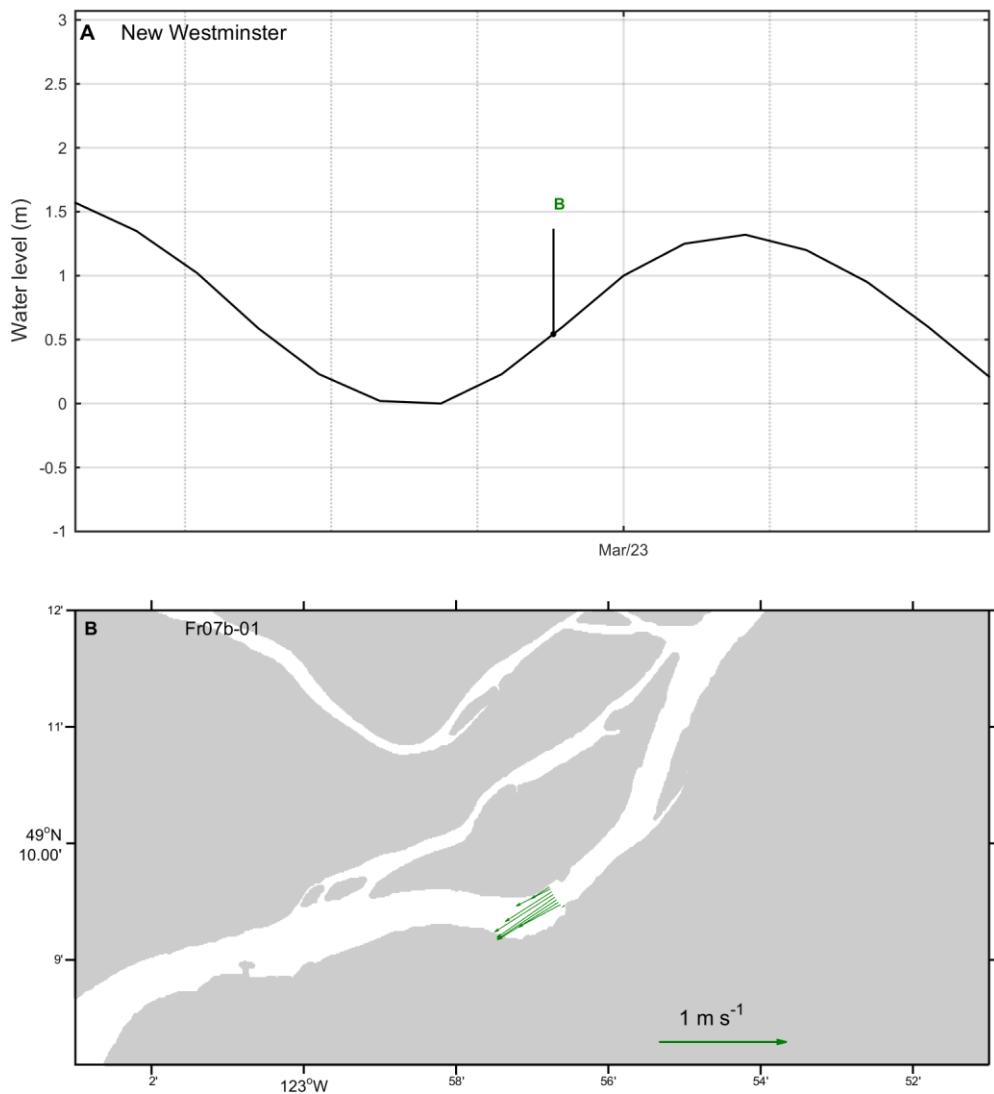


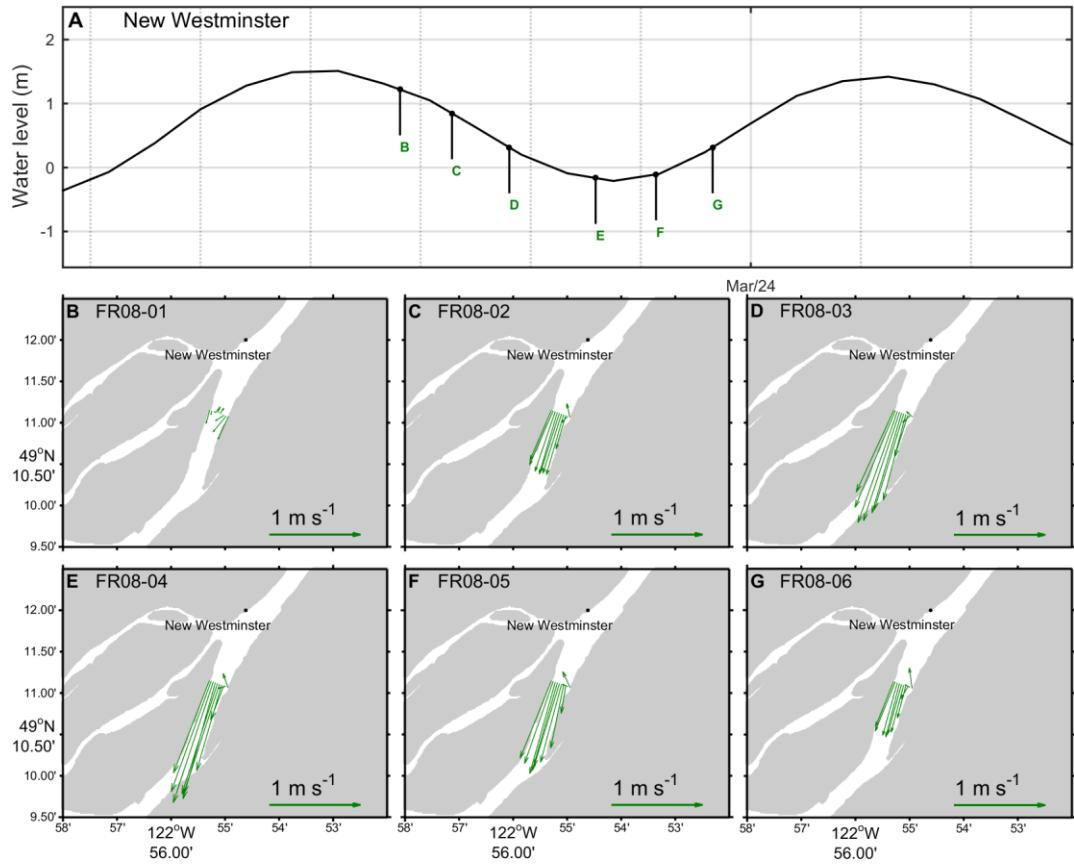


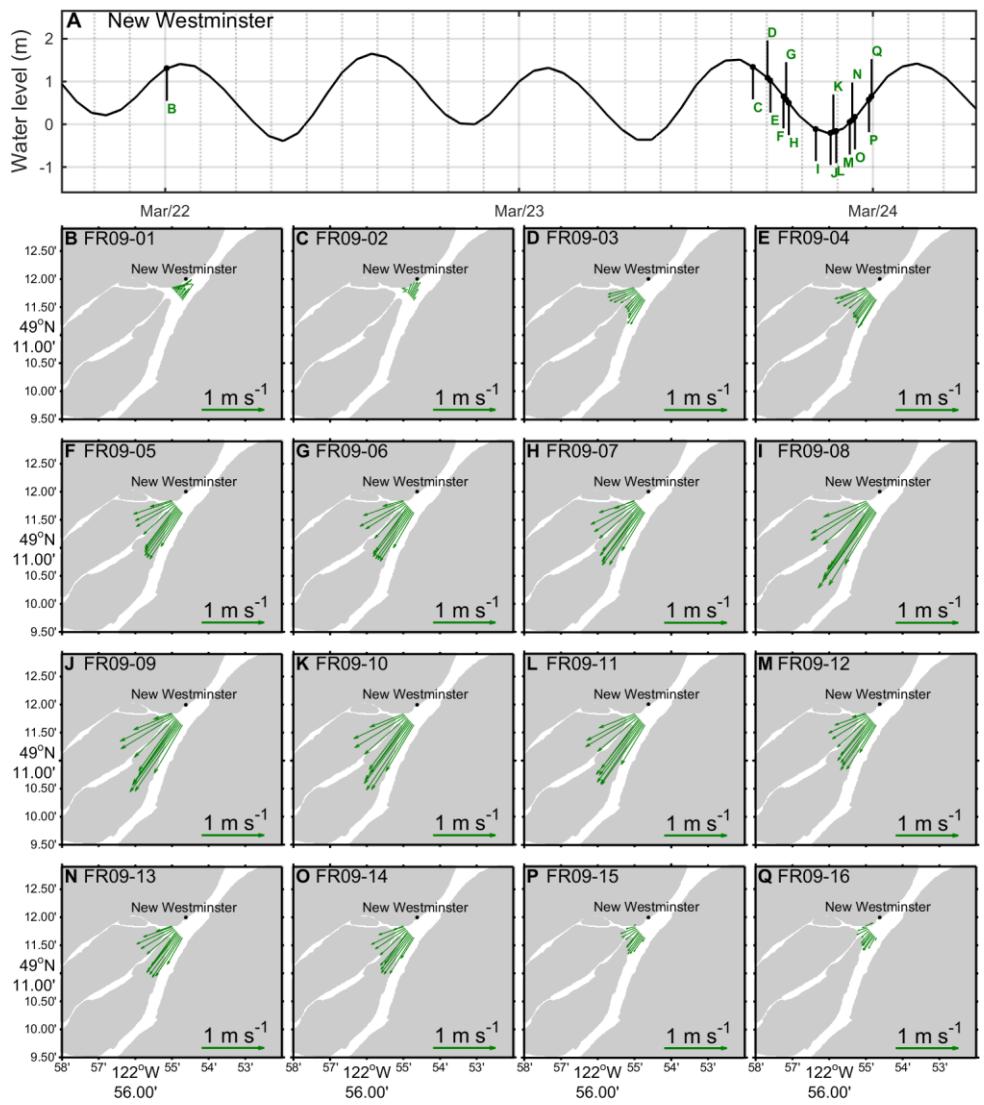


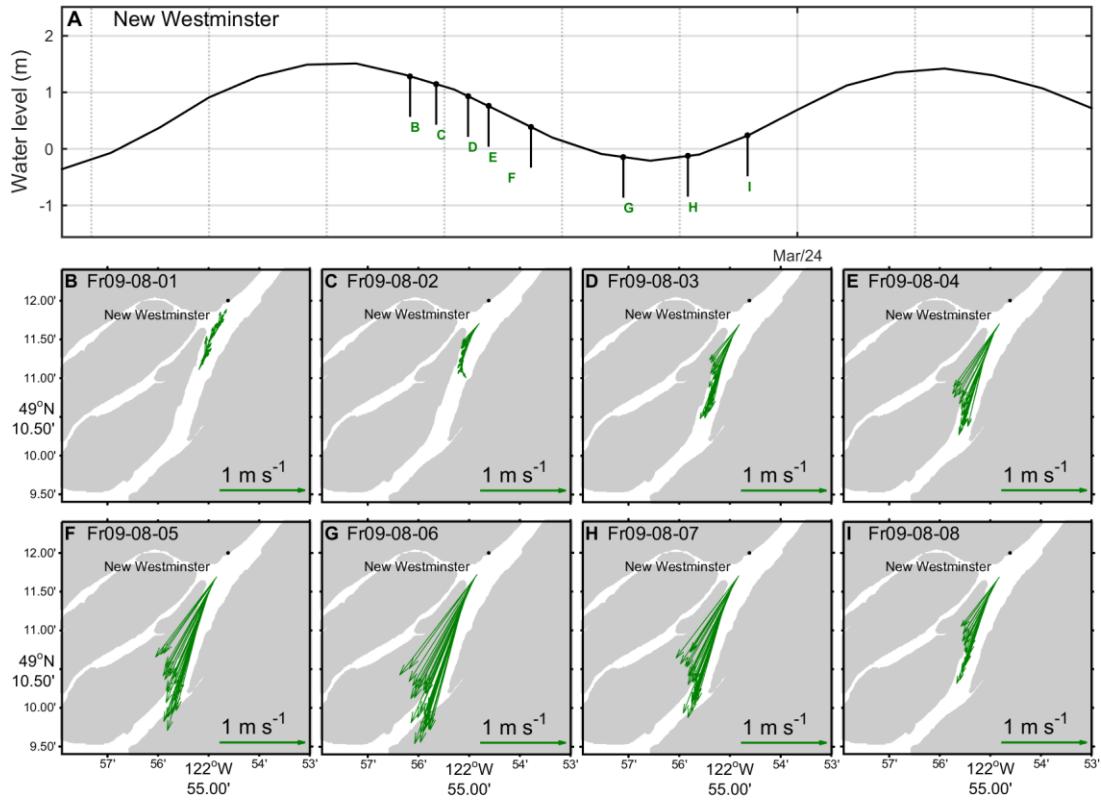


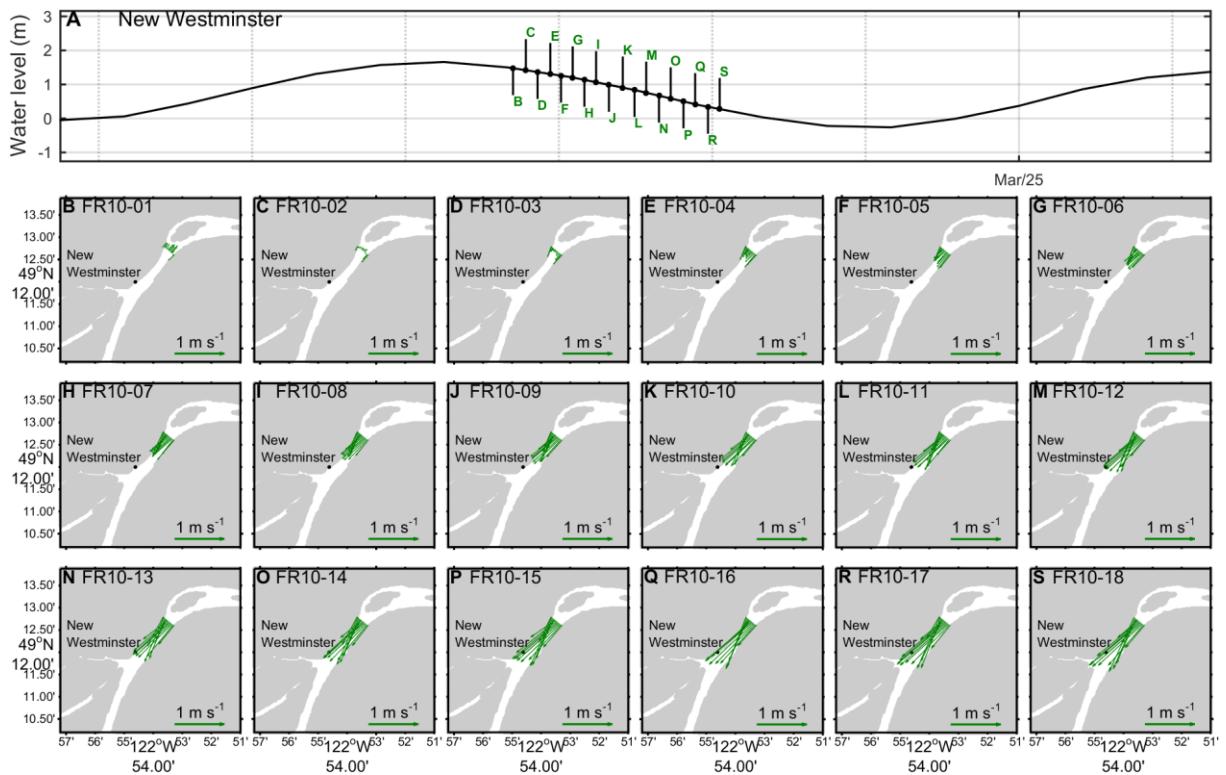


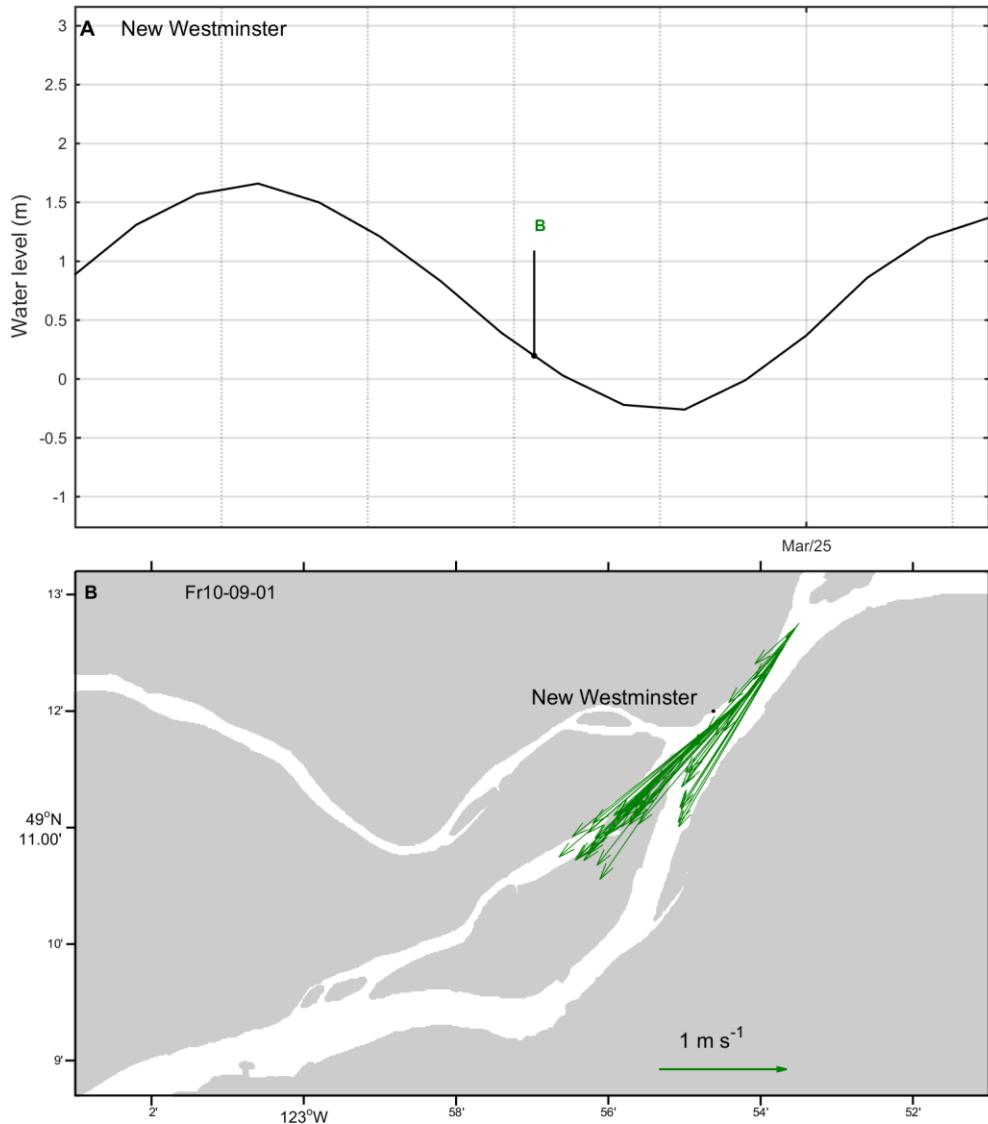












7.2 OCTOBER

The following table lists the metadata for the vessel-mounted ADCP lines measured in October 2016.

Table 6 October 2016 vessel-mounted ADCP metadata

Line #	Start Time LineA (UTC)	Start Time LineB (UTC)	ADCP October			
			Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR01	10/18/2016 0:34	10/18/2016 0:44	49.0989	-123.2983	1.47	25.95
	10/18/2016 1:04	10/18/2016 1:04	49.0989	-123.2988	1.47	23.91
	10/18/2016 18:03	10/18/2016 18:20	49.0988	-123.2991	1.47	25.95
FR02	10/18/2016 17:22	10/18/2016 17:27	49.1228	-123.2475	1.47	17.79

Line #	ADCP October						Minimum Depth (m)	Maximum Depth (m)
	Start Time LineA (UTC)	Start Time LineB (UTC)	Start Latitude (°N)	Start Longitude (°W)				
FR02	10/18/2016 19:54	10/18/2016 19:59	49.1229	-123.2472		1.47	16.77	
	10/18/2016 21:49	10/18/2016 21:55	49.1229	-123.2476		1.47	16.77	
	10/19/2016 0:45	10/19/2016 0:50	49.1228	-123.2474		1.47	17.79	
FR03	10/18/2016 16:42	10/18/2016 16:47	49.1218	-123.2085		1.47	12.69	
	10/18/2016 19:11	10/18/2016 19:18	49.1217	-123.2083		1.47	11.67	
	10/18/2016 20:59	10/18/2016 21:06	49.1215	-123.2084		1.47	11.67	
	not available	not available	49.1215	-123.2082		1.47	12.69	
	10/21/2016 18:05	10/21/2016 18:10	49.1214	-123.2085		1.47	12.69	
FR03b	not available	not available	49.1125	-123.1819		1.47	12.69	
	10/19/2016 16:50	10/19/2016 16:56	49.1123	-123.1826		1.47	13.71	
	10/19/2016 22:17	10/19/2016 22:25	49.1123	-123.1823		1.47	12.69	
	10/21/2016 17:33	10/21/2016 17:40	49.1122	-123.1829		1.47	13.71	
not available	not available	10/18/2016 22:56	49.1143	-123.1808		1.47	12.69	
not available	10/18/2016 19:29	10/18/2016 19:29	49.1243	-123.2069		1.47	14.73	
not available	10/18/2016 21:17	10/18/2016 21:17	49.1241	-123.2061		1.47	13.71	
not available	10/19/2016 0:22	10/19/2016 0:22	49.1277	-123.2159		1.47	13.71	
FR04	10/19/2016 17:23	10/19/2016 17:28	49.1066	-123.1431		1.47	16.77	
	10/19/2016 21:37	10/19/2016 21:42	49.1066	-123.1433		1.47	15.75	
	10/20/2016 0:35	not available	49.1066	-123.1433		1.47	15.75	
	10/20/2016 19:03	10/20/2016 19:08	49.1066	-123.1432		1.47	16.77	
	10/21/2016 16:56	10/21/2016 17:01	49.1065	-123.1430		1.47	15.75	
not available	10/19/2016 21:55	not available	49.1066	-123.1441		1.47	14.73	
not available	10/21/2016 17:08	10/21/2016 17:08	49.1069	-123.1431		1.47	16.77	
FR05	10/19/2016 17:53	10/19/2016 17:59	49.1153	-123.0823		1.47	15.75	
	not available	10/19/2016 20:07	49.1154	-123.0823		1.47	14.73	
	not available	not available	49.1153	-123.0823		1.47	15.75	
	not available	not available	49.1153	-123.0823		1.47	15.75	
	10/20/2016 17:28	10/20/2016 17:28	49.1155	-123.0823		1.47	16.77	
	10/20/2016 18:17	10/20/2016 18:17	49.1155	-123.0822		1.47	16.77	
	10/20/2016 20:26	10/20/2016 20:26	49.1153	-123.0822		1.47	15.75	
	10/20/2016 20:52	10/20/2016 20:52	49.1154	-123.0822		1.47	15.75	

Line #	Start Time LineA (UTC)	Start Time LineB (UTC)	ADCP October			
			Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR05	10/20/2016 22:36	10/20/2016 22:44	49.1154	-123.0822	1.47	14.73
	10/20/2016 23:45	10/20/2016 23:52	49.1153	-123.0822	1.47	15.75
	10/21/2016 0:52	10/21/2016 0:59	49.1153	-123.0823	1.47	15.75
not available	10/19/2016 21:16	10/19/2016 21:16	49.1150	-123.0899	1.47	17.79
not available	10/20/2016 18:27	10/20/2016 18:27	49.1186	-123.0848	1.47	14.73
FR06	10/19/2016 19:18	10/19/2016 19:25	49.1379	-123.0473	1.47	14.73
	not available	not available	49.1384	-123.0474	1.47	14.73
	10/20/2016 16:41	10/20/2016 16:46	49.1384	-123.0475	1.47	15.75
	10/20/2016 19:38	10/20/2016 19:51	49.1383	-123.0476	1.47	15.75
	10/20/2016 21:49	10/20/2016 22:00	49.1383	-123.0476	1.47	14.73
	10/20/2016 23:10	10/20/2016 23:16	49.1382	-123.0473	1.47	14.73
	10/21/2016 0:17	10/21/2016 0:28	49.1383	-123.0472	1.47	14.73
	10/24/2016 19:31	10/24/2016 19:38	49.1385	-123.0473	1.47	15.75
	10/24/2016 22:57	10/24/2016 23:03	49.1383	-123.0474	1.47	15.75
not available	10/19/2016 18:15	10/19/2016 18:15	49.1289	-123.0637	1.47	19.83
not available	10/19/2016 18:34	10/19/2016 18:34	49.1397	-123.0489	1.47	11.67
not available	10/19/2016 19:34	10/19/2016 19:34	49.1395	-123.0501	1.47	17.79
not available	10/20/2016 16:53	10/20/2016 16:53	49.1398	-123.0497	1.47	17.79
not available	10/20/2016 19:59	10/20/2016 19:59	49.1395	-123.0498	1.47	16.77
FR07	10/24/2016 18:49	10/24/2016 18:53	49.1551	-122.9680	1.47	14.73
	10/24/2016 20:09	not available	49.1551	-122.9679	1.47	15.75
	10/24/2016 21:16	10/24/2016 21:20	49.1552	-122.9677	1.47	15.75
	10/24/2016 22:23	10/24/2016 22:29	49.1552	-122.9678	1.47	15.75
	10/24/2016 23:36	10/24/2016 23:40	49.1552	-122.9679	1.47	15.75
	10/25/2016 0:25	10/25/2016 0:29	49.1553	-122.9682	1.47	14.73
	10/25/2016 16:57	10/25/2016 17:02	49.1552	-122.9679	1.47	13.71
	10/27/2016 17:08	10/27/2016 17:11	49.1552	-122.9680	1.47	13.71
	10/27/2016 17:18	10/27/2016 17:22	49.1552	-122.9679	1.47	13.71
	10/27/2016 19:16	10/27/2016 19:20	49.1552	-122.9680	1.47	13.71

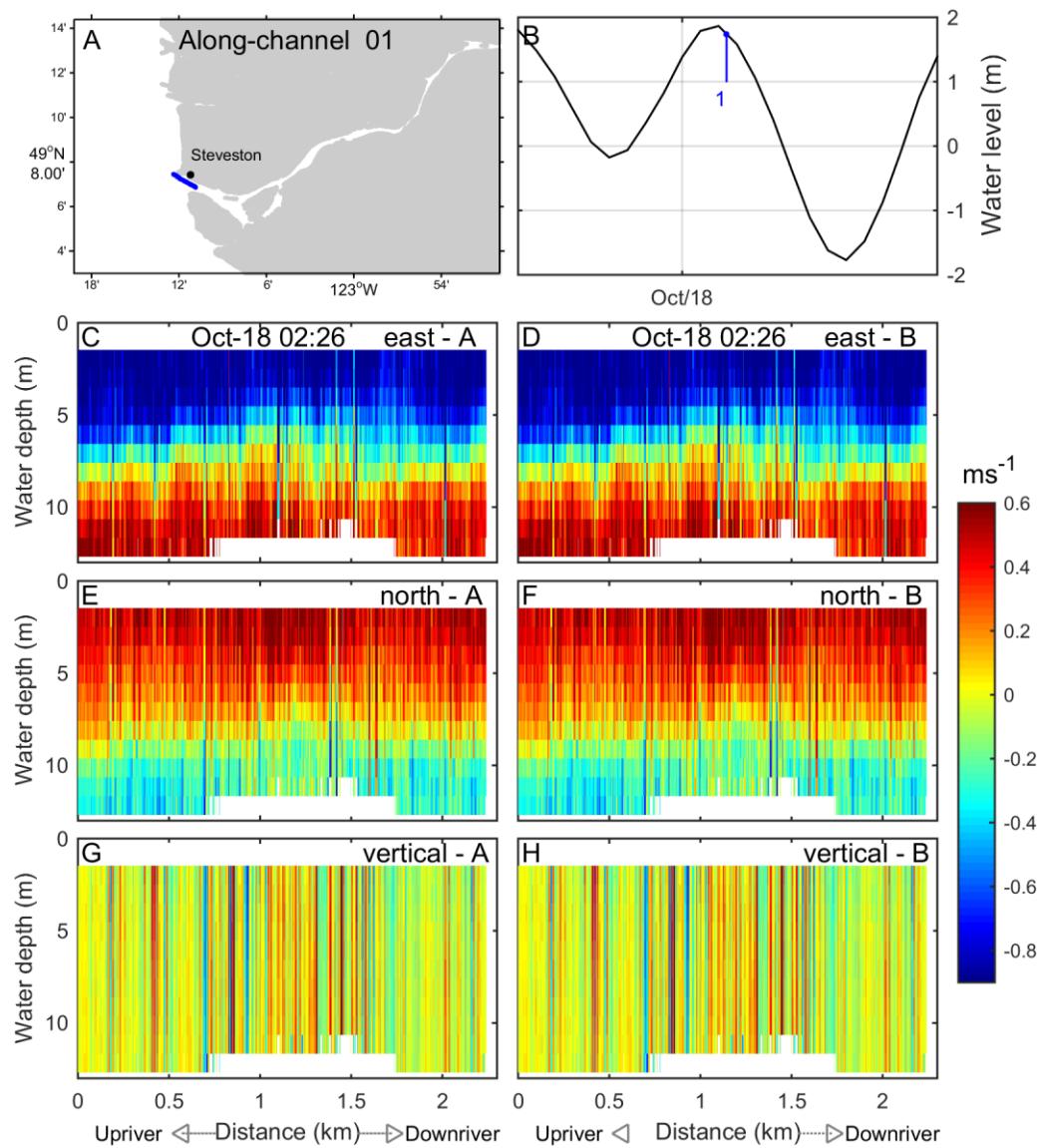
Line #	Start Time LineA (UTC)	Start Time LineB (UTC)	ADCP October			
			Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR07	10/27/2016 20:52	10/27/2016 20:56	49.1552	-122.9680	1.47	14.73
	10/27/2016 21:18	10/27/2016 21:22	49.1552	-122.9680	1.47	14.73
	10/27/2016 21:41	10/27/2016 21:46	49.1552	-122.9680	1.47	14.73
FR07a	10/24/2016 18:22	10/24/2016 18:28	49.1559	-122.9450	1.47	19.83
	10/24/2016 20:41	10/24/2016 20:48	49.1563	-122.9452	1.47	25.95
	10/24/2016 21:42	10/24/2016 21:48	49.1562	-122.9452	1.47	27.99
	10/25/2016 0:02	10/25/2016 0:07	49.1564	-122.9450	1.47	25.95
	10/25/2016 16:29	10/25/2016 16:35	49.1562	-122.9452	1.47	25.95
	10/25/2016 19:11	10/25/2016 19:15	49.1563	-122.9448	1.47	25.95
	10/25/2016 21:02	10/25/2016 21:07	49.1563	-122.9449	1.47	25.95
	10/25/2016 22:59	10/25/2016 23:04	49.1563	-122.9451	1.47	27.99
	10/27/2016 16:43	10/27/2016 16:47	49.1558	-122.9456	1.47	23.91
	10/27/2016 17:43	10/27/2016 17:48	49.1559	-122.9454	1.47	25.95
	10/27/2016 18:46	10/27/2016 18:51	49.1559	-122.9453	1.47	25.95
	10/27/2016 22:07	10/27/2016 22:12	49.1559	-122.9453	1.47	27.99
not available	10/24/2016 18:35	10/24/2016 18:35	49.1564	-122.9454	1.47	14.73
not available	10/24/2016 20:20	10/24/2016 20:20	49.1566	-122.9454	1.47	15.75
not available	10/24/2016 20:55	10/24/2016 20:55	49.1566	-122.9455	1.47	16.77
not available	10/24/2016 21:32	10/24/2016 21:32	49.1560	-122.9454	1.47	16.77
not available	10/24/2016 22:02	10/24/2016 22:02	49.1565	-122.9453	1.47	16.77
not available	10/24/2016 23:44	10/24/2016 23:44	49.1567	-122.9452	1.47	15.75
not available	10/25/2016 16:43	10/25/2016 16:43	49.1576	-122.9457	1.47	23.91
not available	10/27/2016 16:55	10/27/2016 16:55	49.1575	-122.9457	1.47	25.95
FR08	10/25/2016 17:32	10/25/2016 17:37	49.1850	-122.9151	1.47	15.75
	10/25/2016 18:38	10/25/2016 18:43	49.1851	-122.9150	1.47	15.75
	10/25/2016 19:39	10/25/2016 19:46	49.1852	-122.9151	1.47	16.77
	10/25/2016 20:29	10/25/2016 20:34	49.1850	-122.9150	1.47	15.75
	10/25/2016 21:40	10/25/2016 21:44	49.1851	-122.9150	1.47	17.79
	10/25/2016 22:32	10/25/2016 22:36	49.1851	-122.9151	1.47	16.77

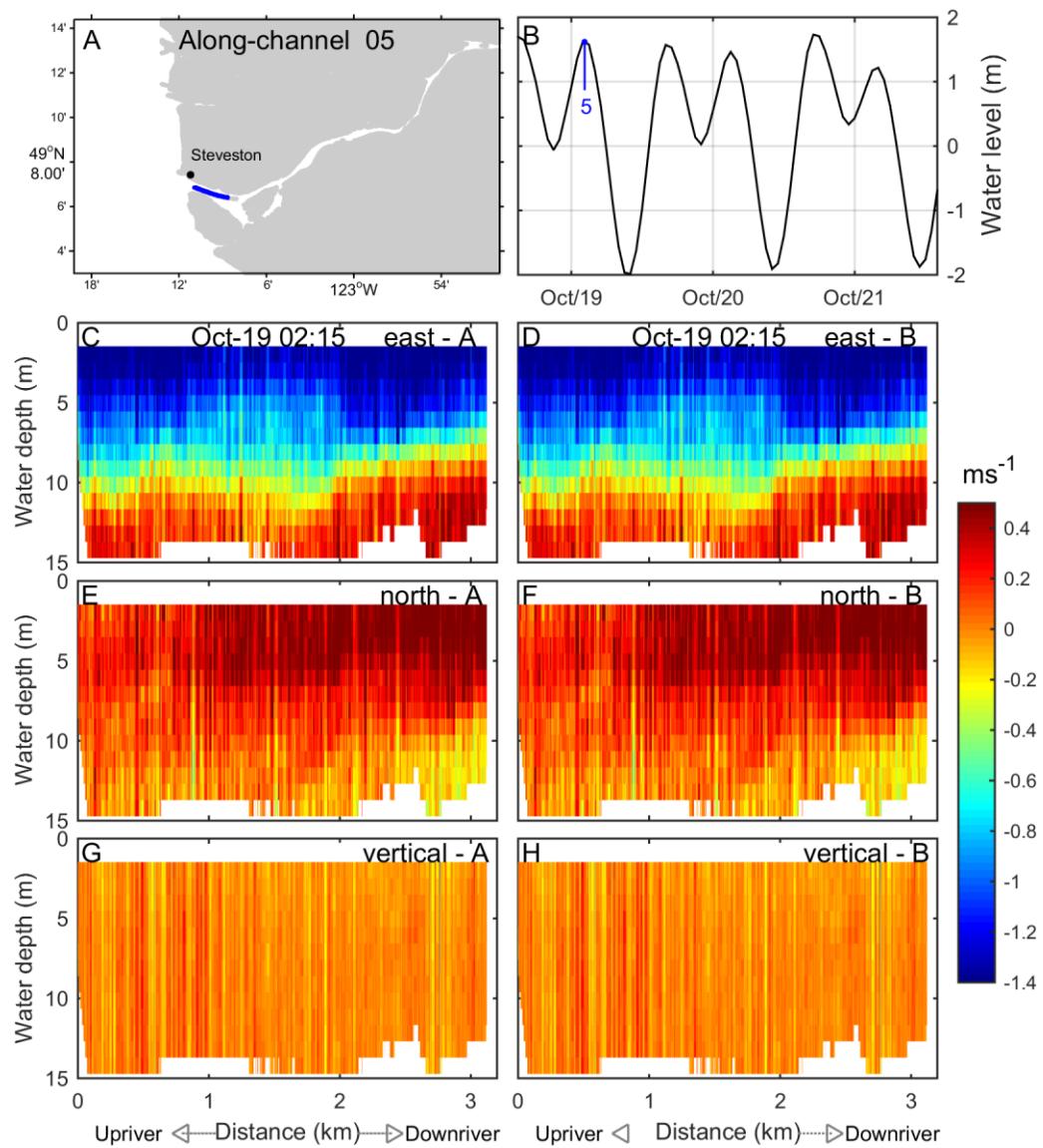
Line #	Start Time LineA (UTC)	Start Time LineB (UTC)	ADCP October			
			Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR08	10/26/2016 0:27	10/26/2016 0:32	49.1851	-122.9149	1.47	16.77
	10/26/2016 16:38	10/26/2016 16:43	49.1849	-122.9151	1.47	14.73
	10/26/2016 18:09	10/26/2016 18:14	49.1852	-122.9149	1.47	15.75
	10/26/2016 23:46	10/26/2016 23:52	49.1851	-122.9150	1.47	16.77
	10/27/2016 18:11	10/27/2016 18:15	49.1861	-122.9143	1.47	15.75
	10/27/2016 22:48	10/27/2016 23:00	49.1858	-122.9158	1.47	15.75
	10/28/2016 16:49	10/28/2016 16:54	49.1846	-122.9158	1.47	15.75
not available	10/27/2016 22:19	10/27/2016 22:19	49.1863	-122.9197	1.47	15.75
FR09	10/25/2016 17:57	10/25/2016 18:04	49.1936	-122.9118	1.47	12.69
	10/25/2016 20:01	10/25/2016 20:07	49.1936	-122.9117	1.47	13.71
	10/25/2016 21:58	10/25/2016 22:03	49.1937	-122.9118	1.47	14.73
	10/26/2016 17:47	10/26/2016 17:53	49.1937	-122.9118	1.47	12.69
	10/26/2016 19:28	10/26/2016 19:33	49.1937	-122.9119	1.47	12.69
	10/26/2016 20:45	10/26/2016 20:50	49.1938	-122.9117	1.47	13.71
	10/26/2016 22:22	10/26/2016 22:27	49.1937	-122.9118	1.47	13.71
	10/27/2016 0:14	10/27/2016 0:18	49.1936	-122.9117	1.47	14.73
	10/28/2016 16:30	10/28/2016 16:36	49.1937	-122.9117	1.47	13.71
	10/28/2016 18:08	10/28/2016 18:13	49.1938	-122.9117	1.47	12.69
not available	10/25/2016 17:46	10/25/2016 17:46	49.1940	-122.9122	1.47	11.67
not available	10/25/2016 19:52	10/25/2016 19:52	49.1941	-122.9121	1.47	12.69
not available	10/25/2016 20:18	10/25/2016 20:18	49.1945	-122.9124	1.47	13.71
not available	10/25/2016 21:51	10/25/2016 21:51	49.1941	-122.9124	1.47	13.71
not available	10/26/2016 17:59	10/26/2016 17:59	49.1940	-122.9125	1.47	11.67
not available	10/26/2016 23:58	10/26/2016 23:58	49.1940	-122.9123	1.47	13.71
not available	10/28/2016 16:41	10/28/2016 16:41	49.1939	-122.9126	1.47	12.69
FR10	10/26/2016 17:14	10/26/2016 17:20	49.2098	-122.8884	1.47	13.71
	10/26/2016 18:53	10/26/2016 18:58	49.2102	-122.8883	1.47	13.71
	10/26/2016 19:57	10/26/2016 20:04	49.2100	-122.8885	1.47	14.73
	10/26/2016 21:21	10/26/2016 21:26	49.2100	-122.8883	1.47	14.73

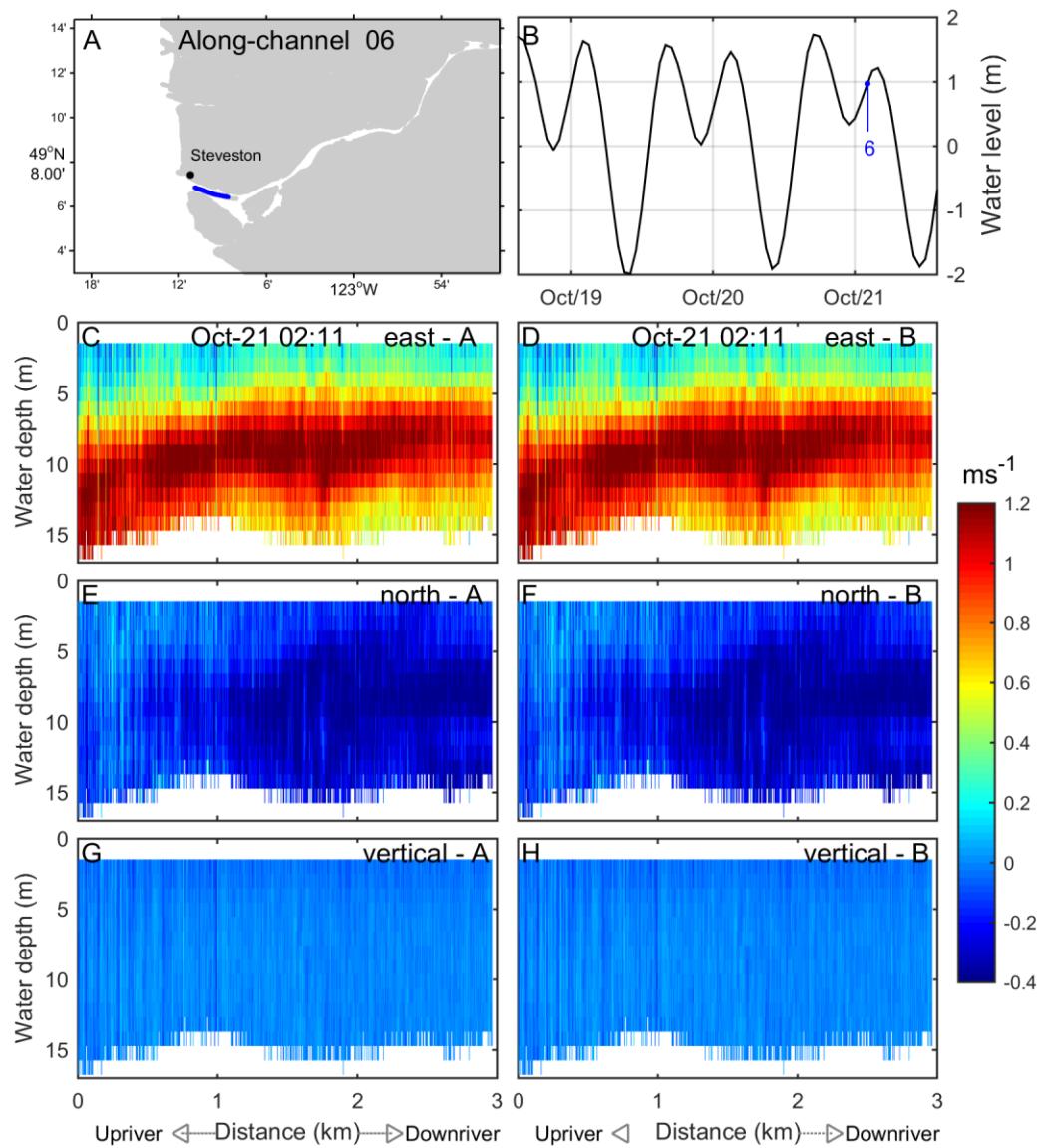
Line #	Start Time LineA (UTC)	Start Time LineB (UTC)	ADCP October			
			Start Latitude (°N)	Start Longitude (°W)	Minimum Depth (m)	Maximum Depth (m)
FR10	10/26/2016 21:46	10/26/2016 21:52	49.2102	-122.8883	1.47	14.73
	10/26/2016 22:50	not available	49.2103	-122.8883	1.47	14.73
	10/26/2016 23:14	10/26/2016 23:20	49.2103	-122.8881	1.47	14.73
	10/27/2016 20:04	10/27/2016 20:10	49.2100	-122.8883	1.47	13.71
	10/28/2016 16:05	10/28/2016 16:10	49.2099	-122.8883	1.47	13.71
	10/28/2016 17:20	10/28/2016 17:25	49.2102	-122.8883	1.47	13.71
	10/28/2016 17:42	10/28/2016 17:47	49.2100	-122.8884	1.47	13.71
	not available	10/26/2016 17:30	49.2112	-122.8892	1.47	16.77
not available	10/26/2016 19:06	10/26/2016 19:06	49.2119	-122.8884	1.47	16.77
not available	10/26/2016 20:57	10/26/2016 20:57	49.2116	-122.8890	1.47	17.79

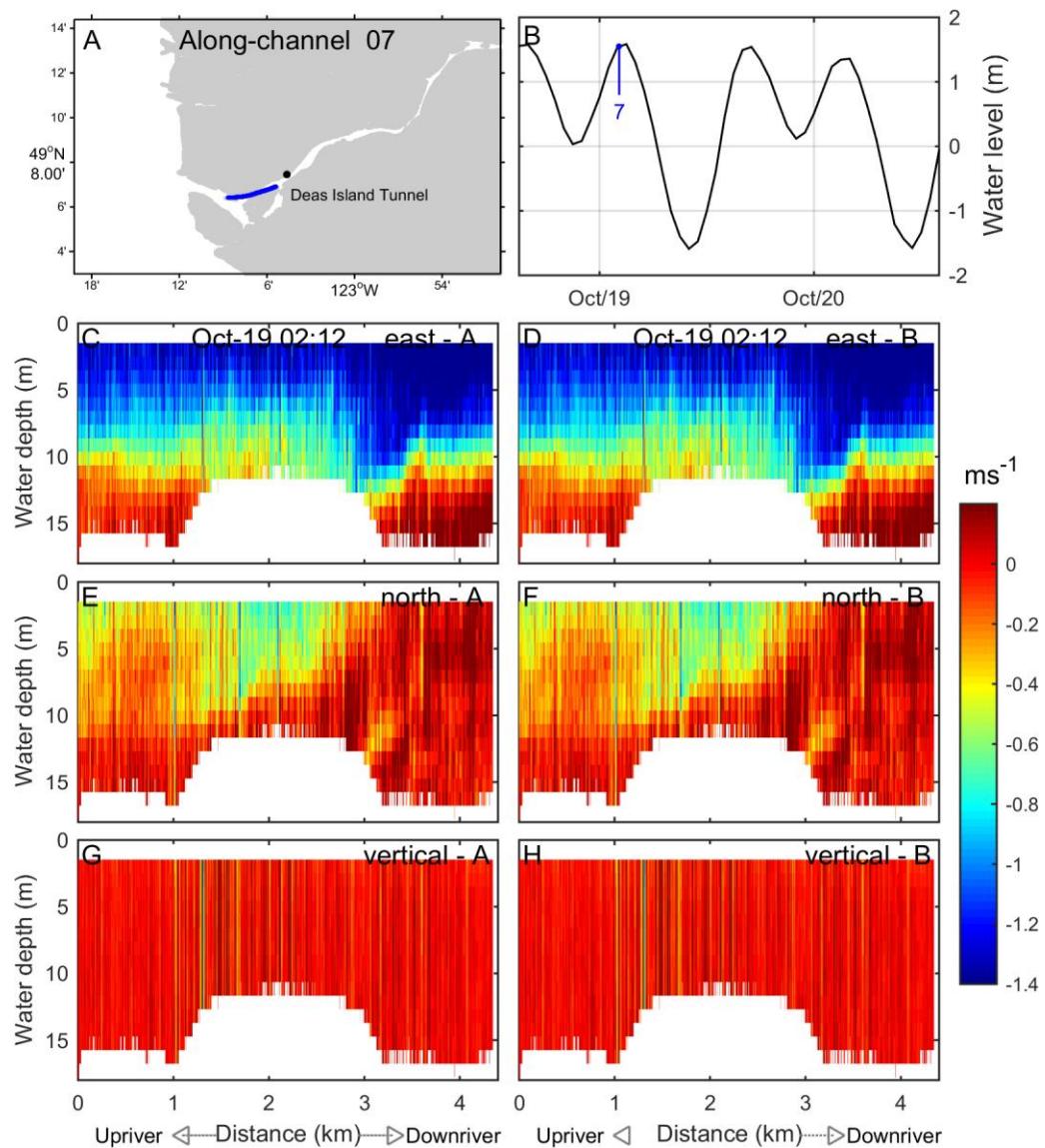
7.2.1 October Velocity Data for A and B Lines: Vertical Sections

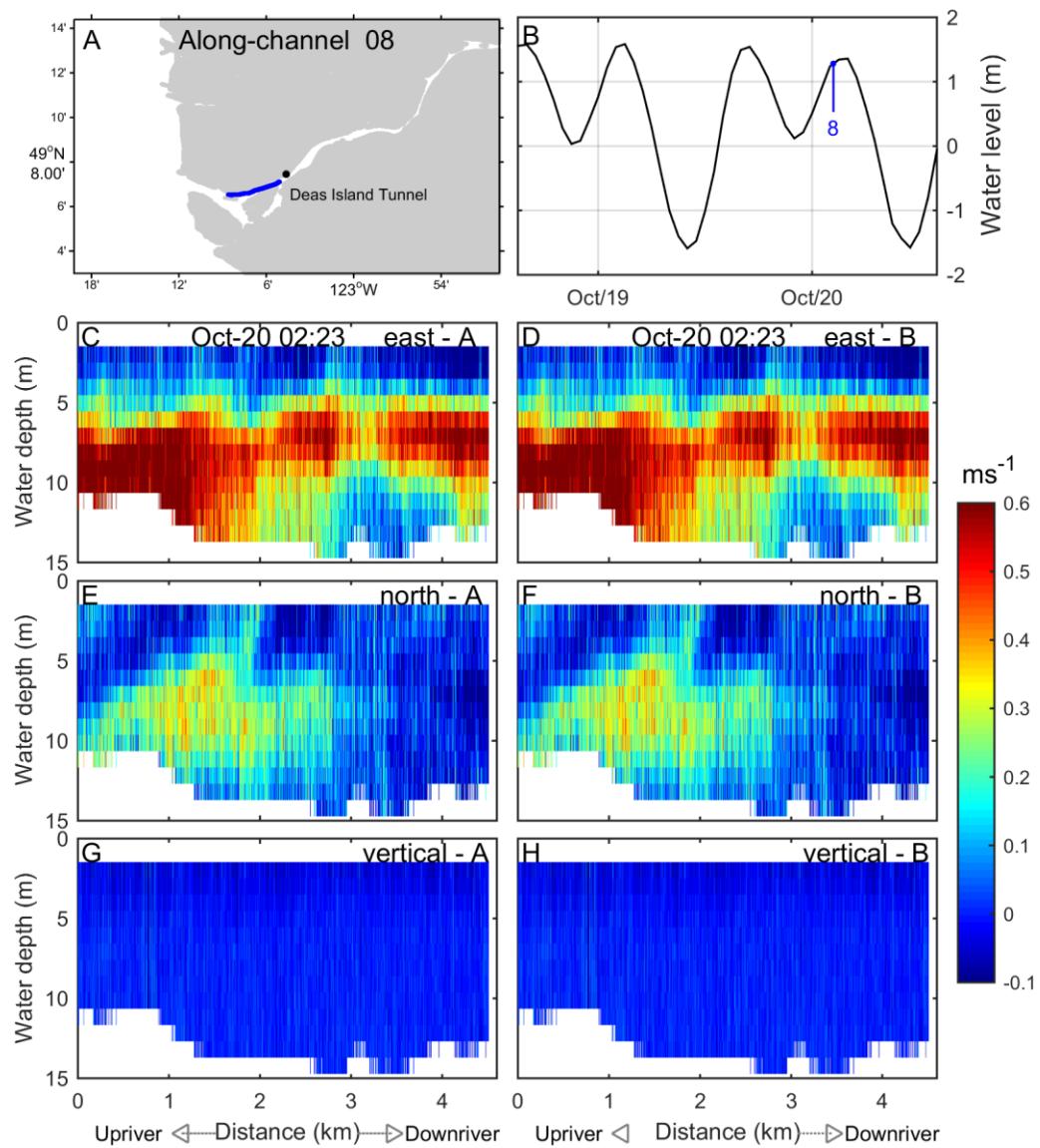
The following figures show October vertical sections of the east and north (u and v) horizontal velocity components and the vertical component for the A (left column) and B (right column) lines. The top row of each figure shows the position of the transect (A) and the time during the tidal cycle that the transect was sampled (B). The second row presents the east components (C and D), the third row presents the north components (E and F), and the bottom row presents the vertical components (G and H). The units are in ms^{-1} .

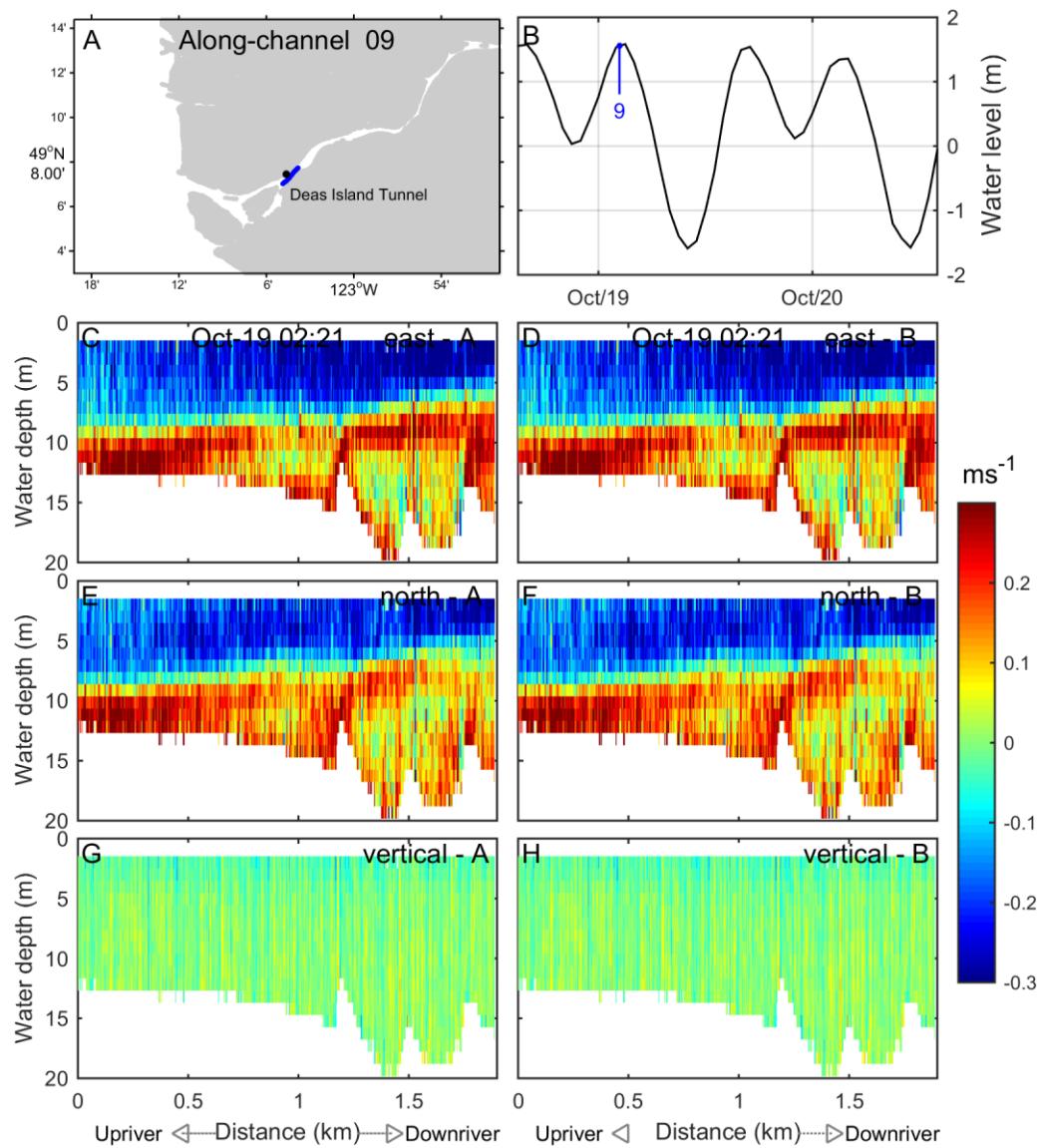


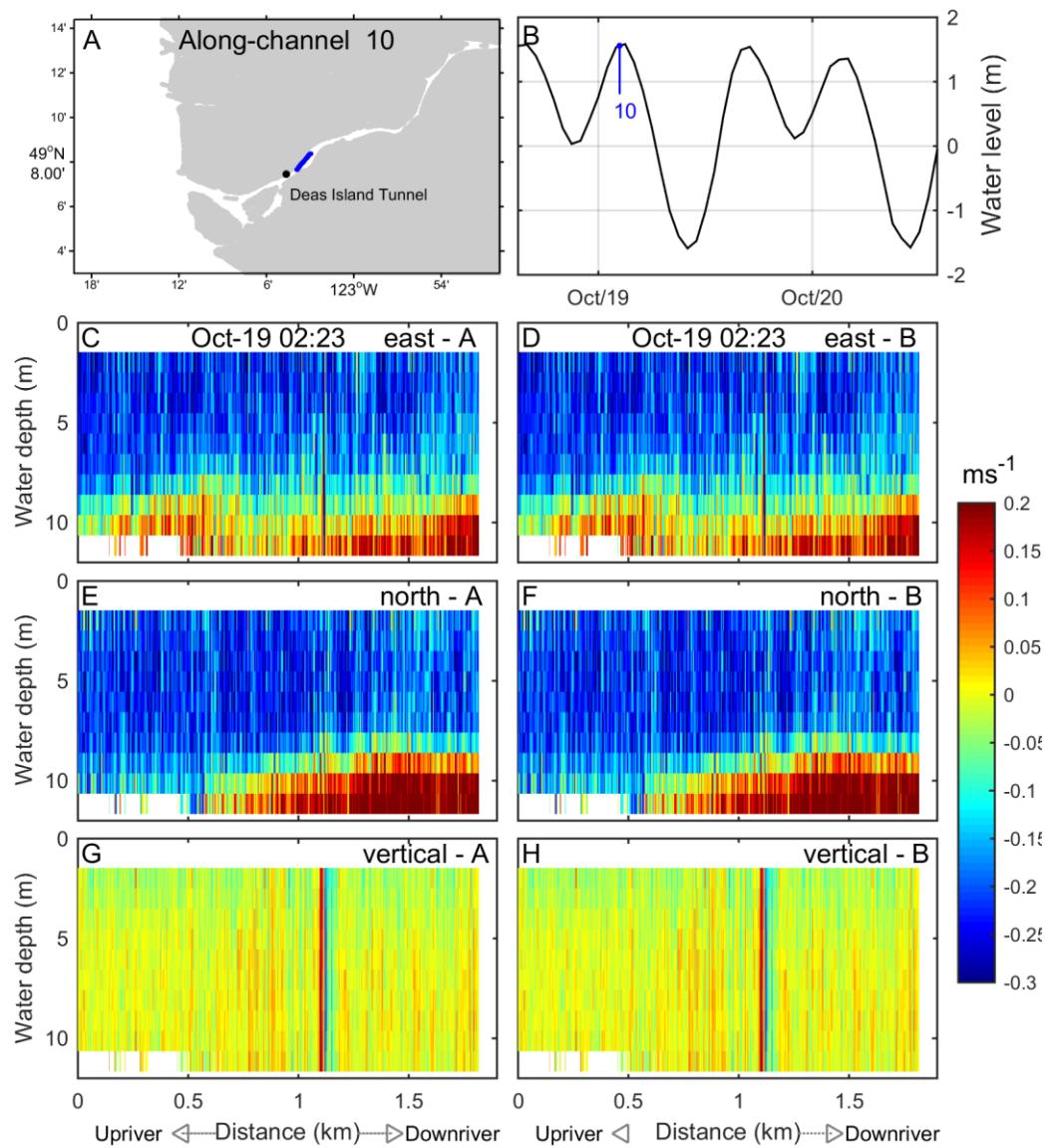


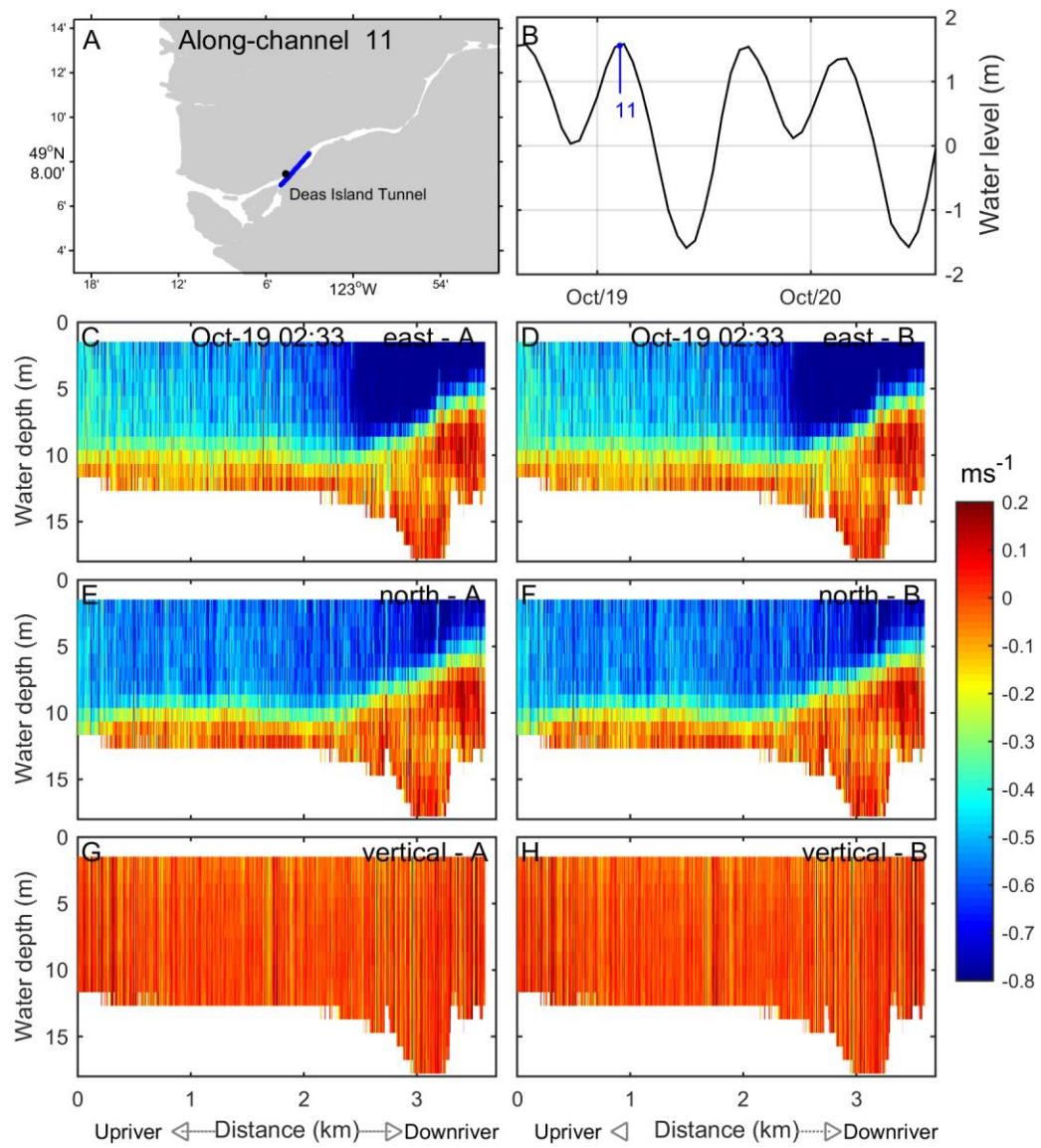


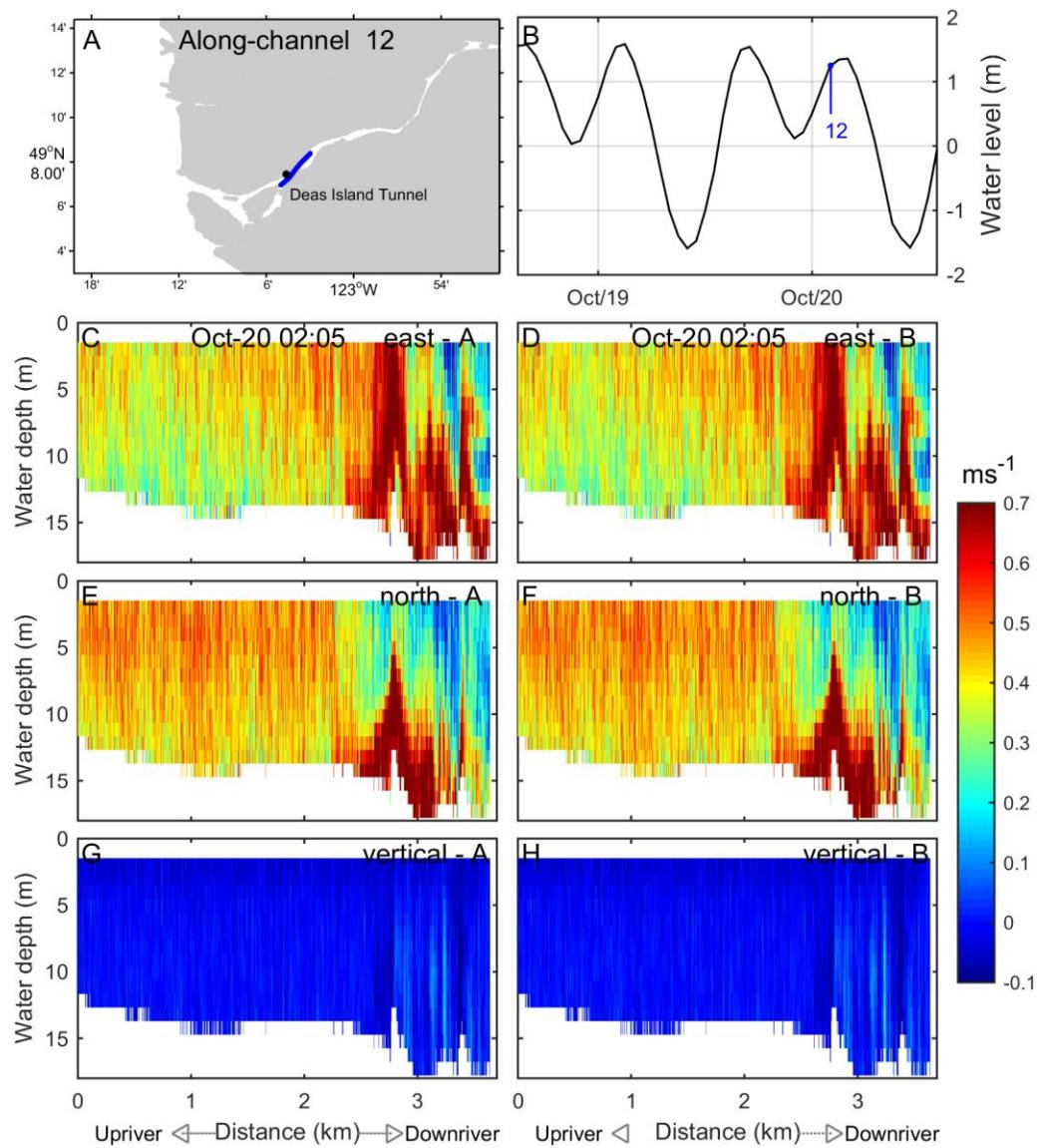


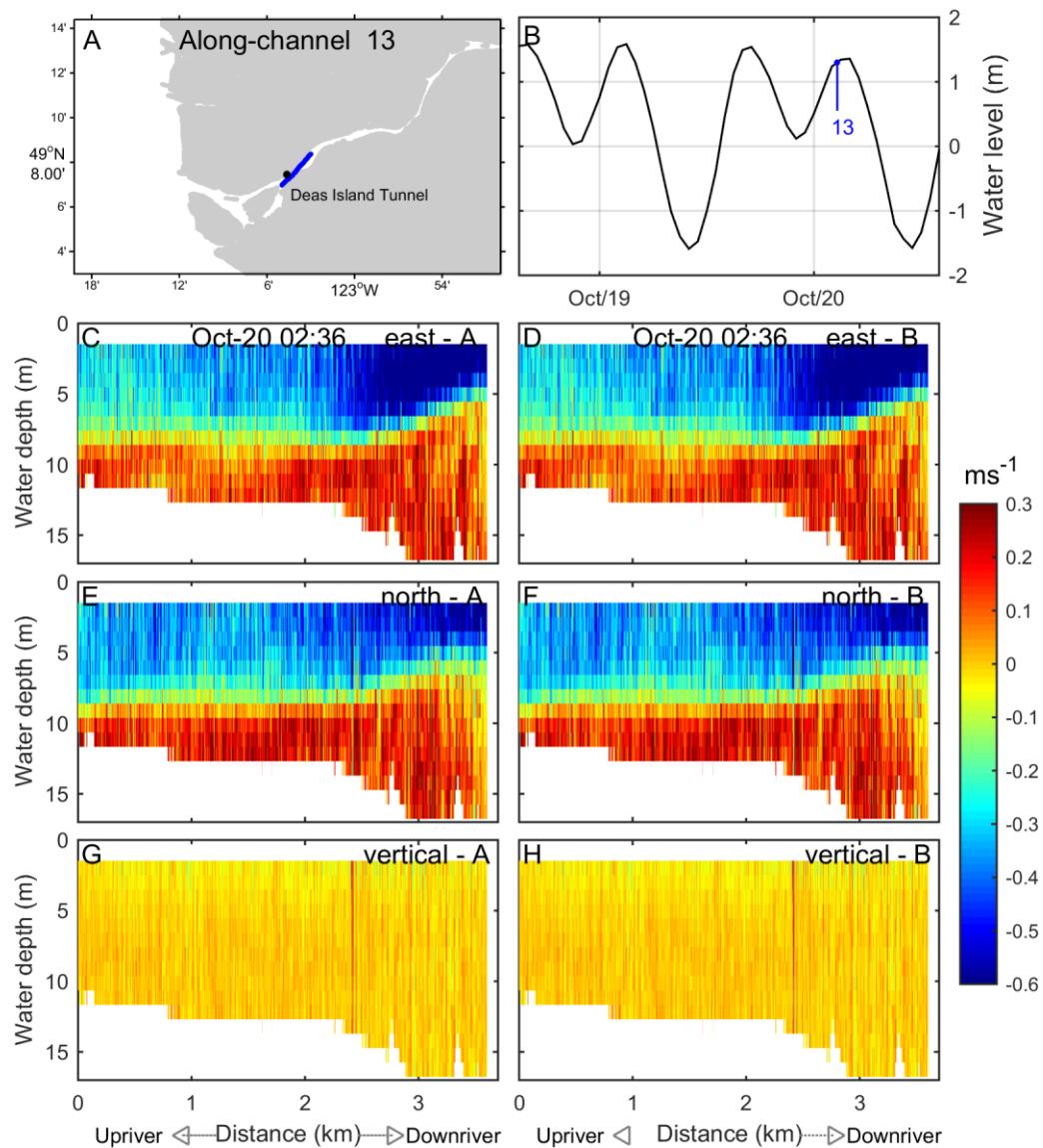


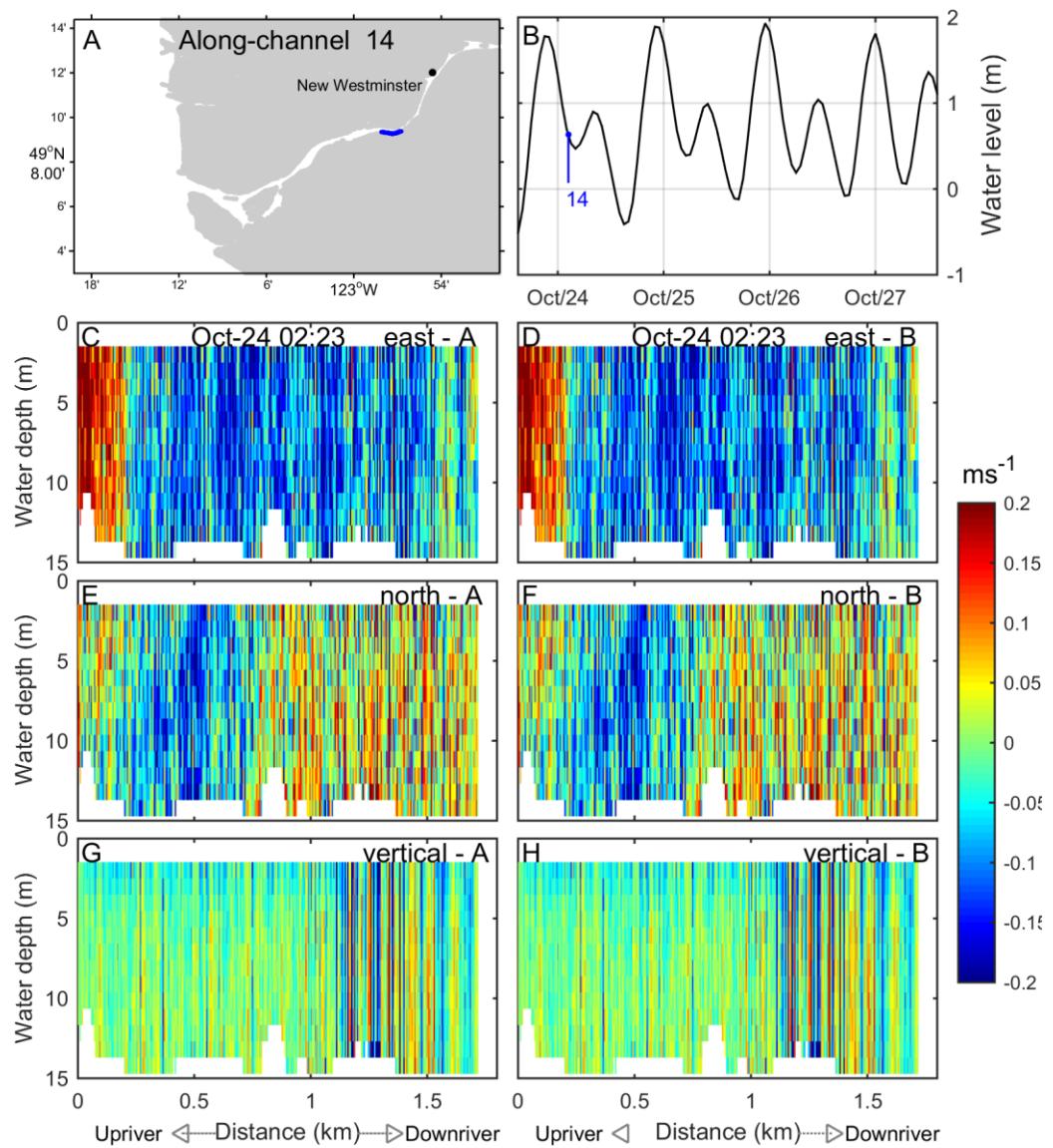


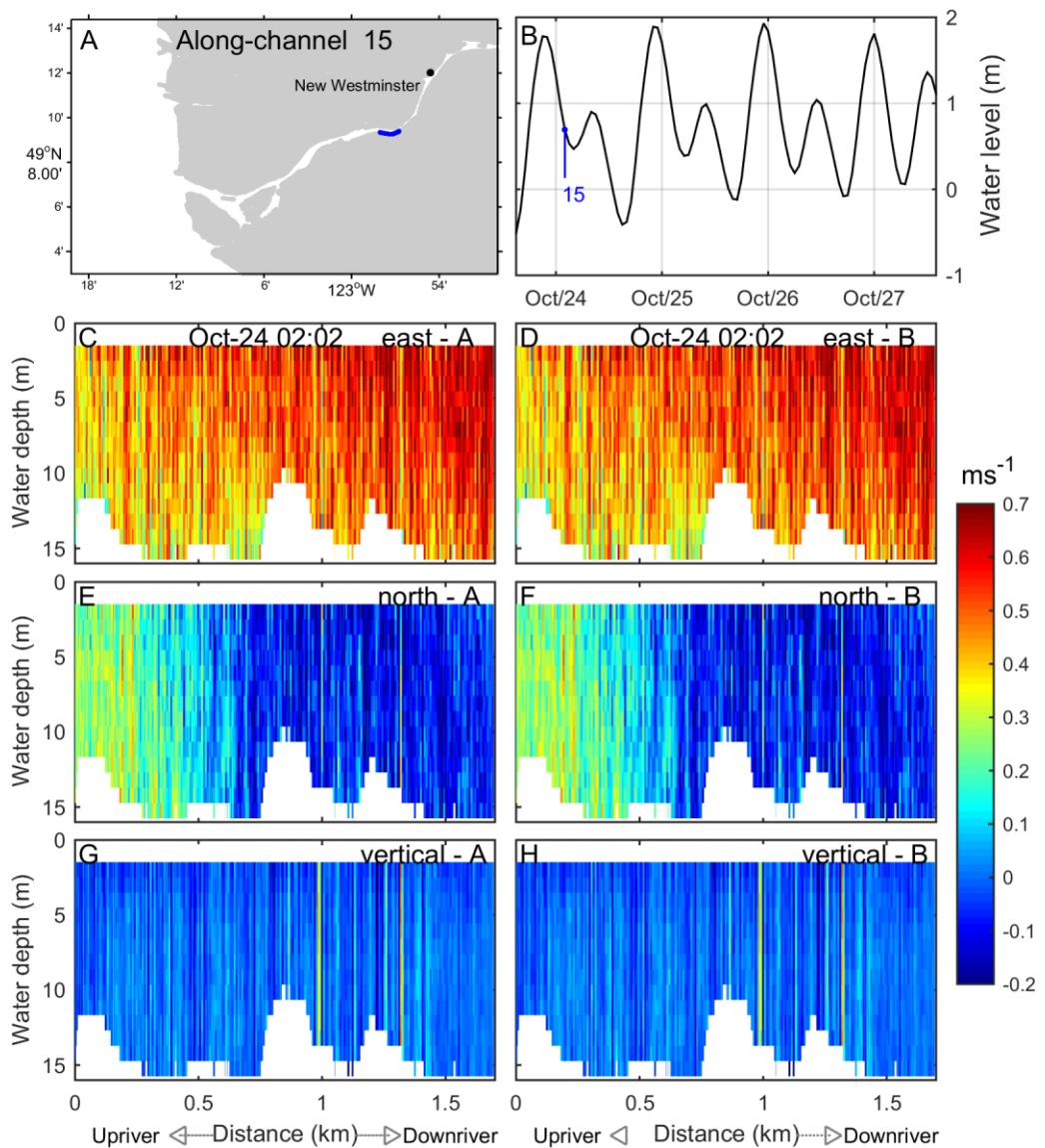


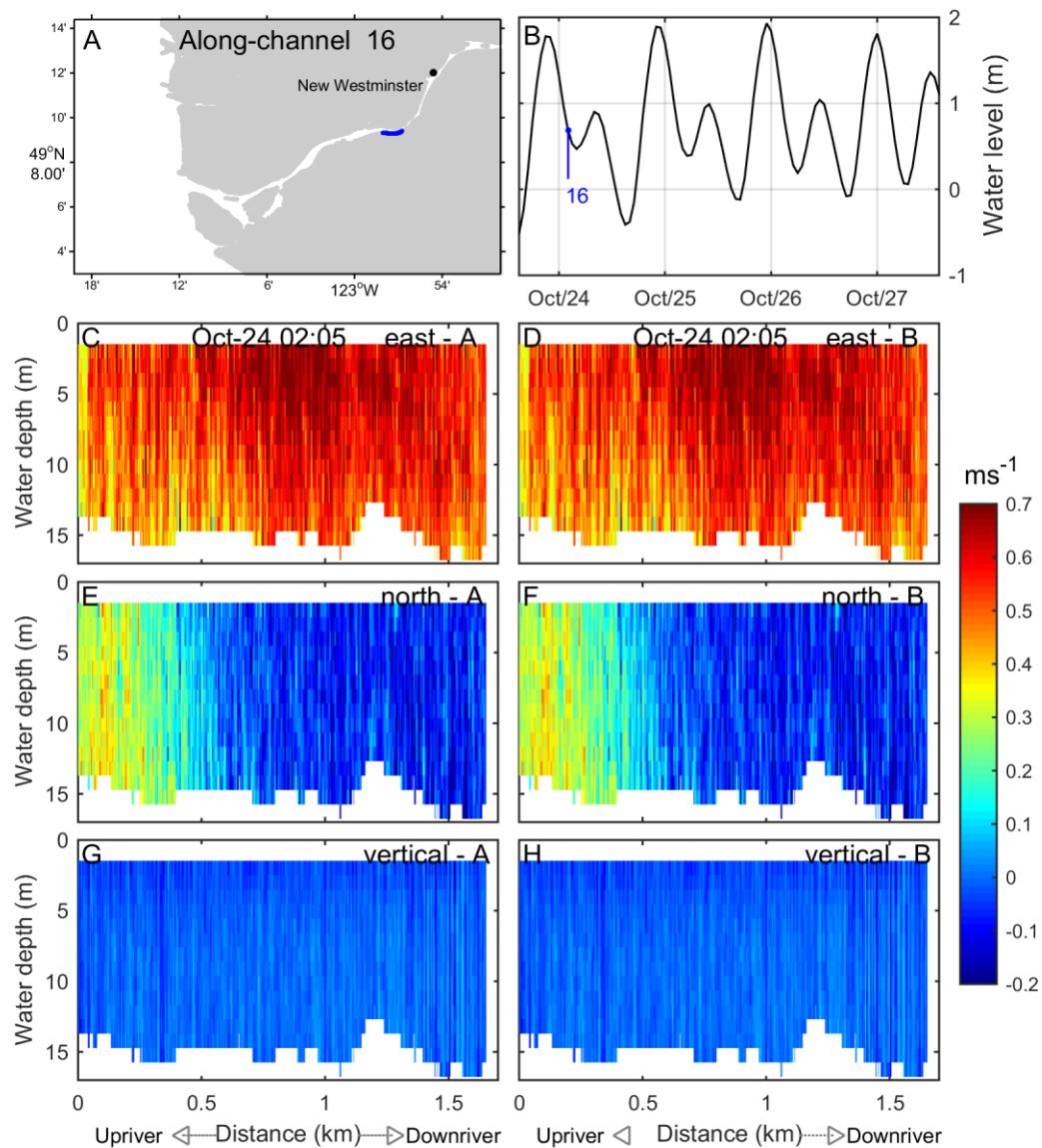


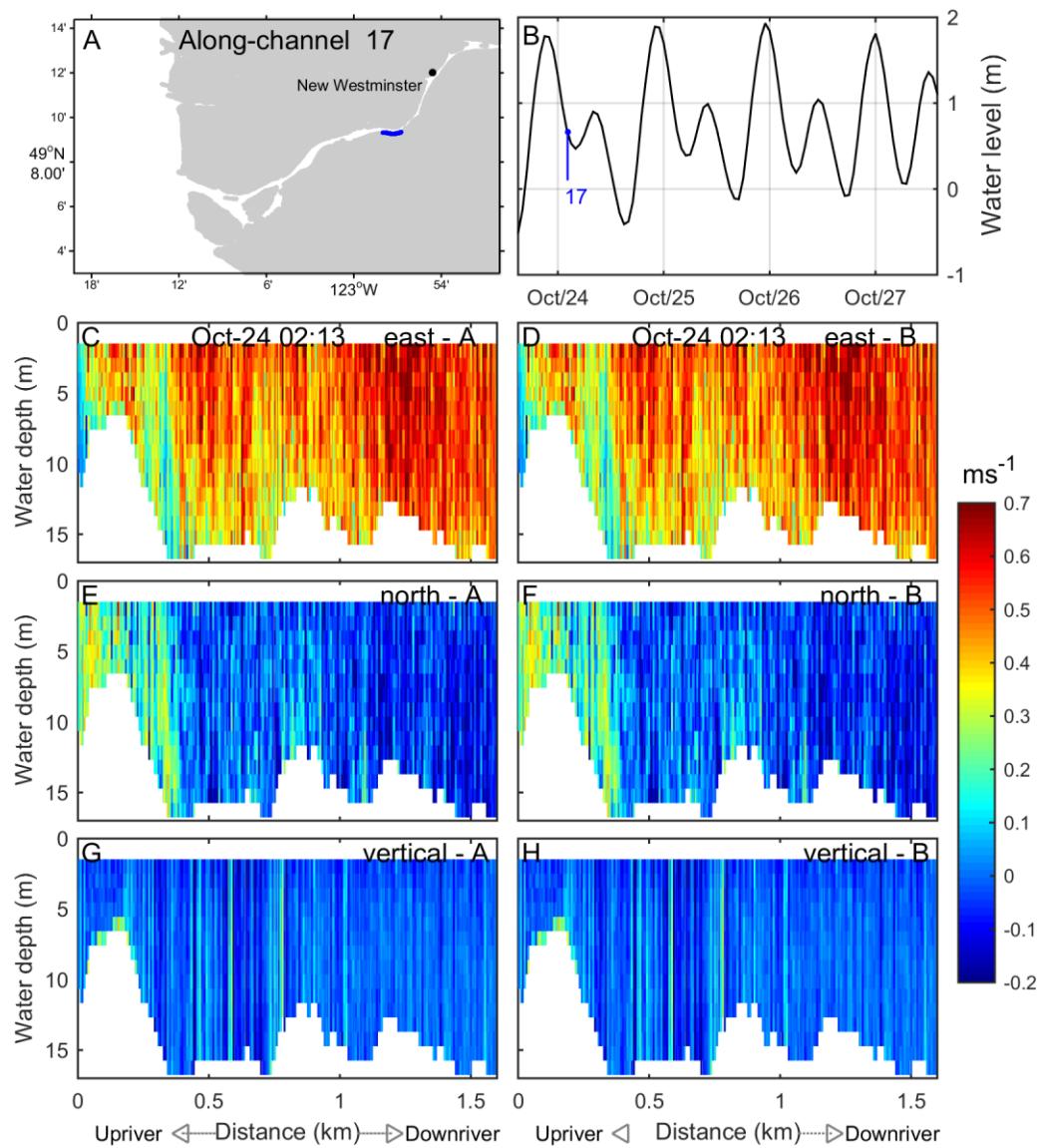


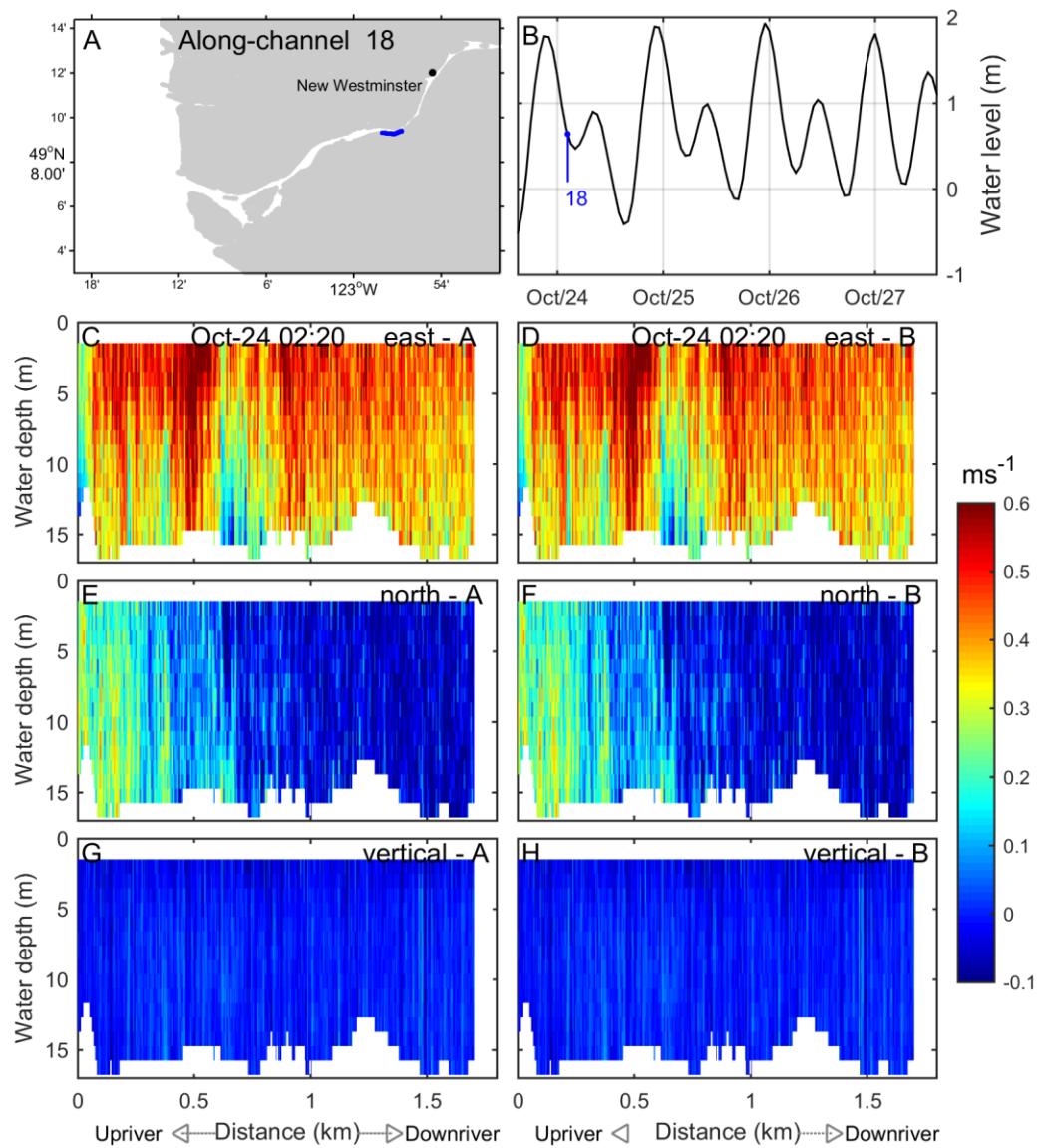


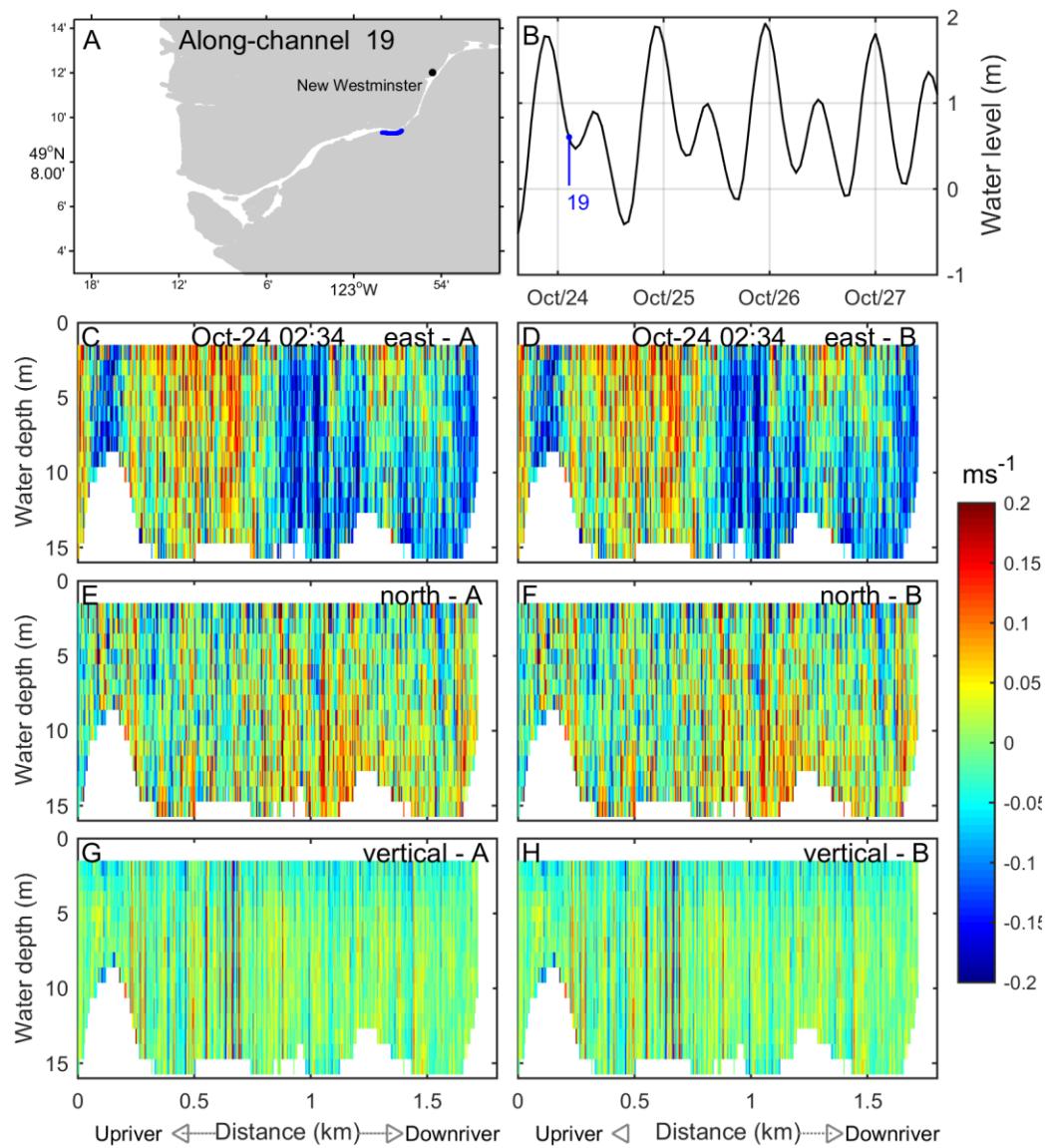


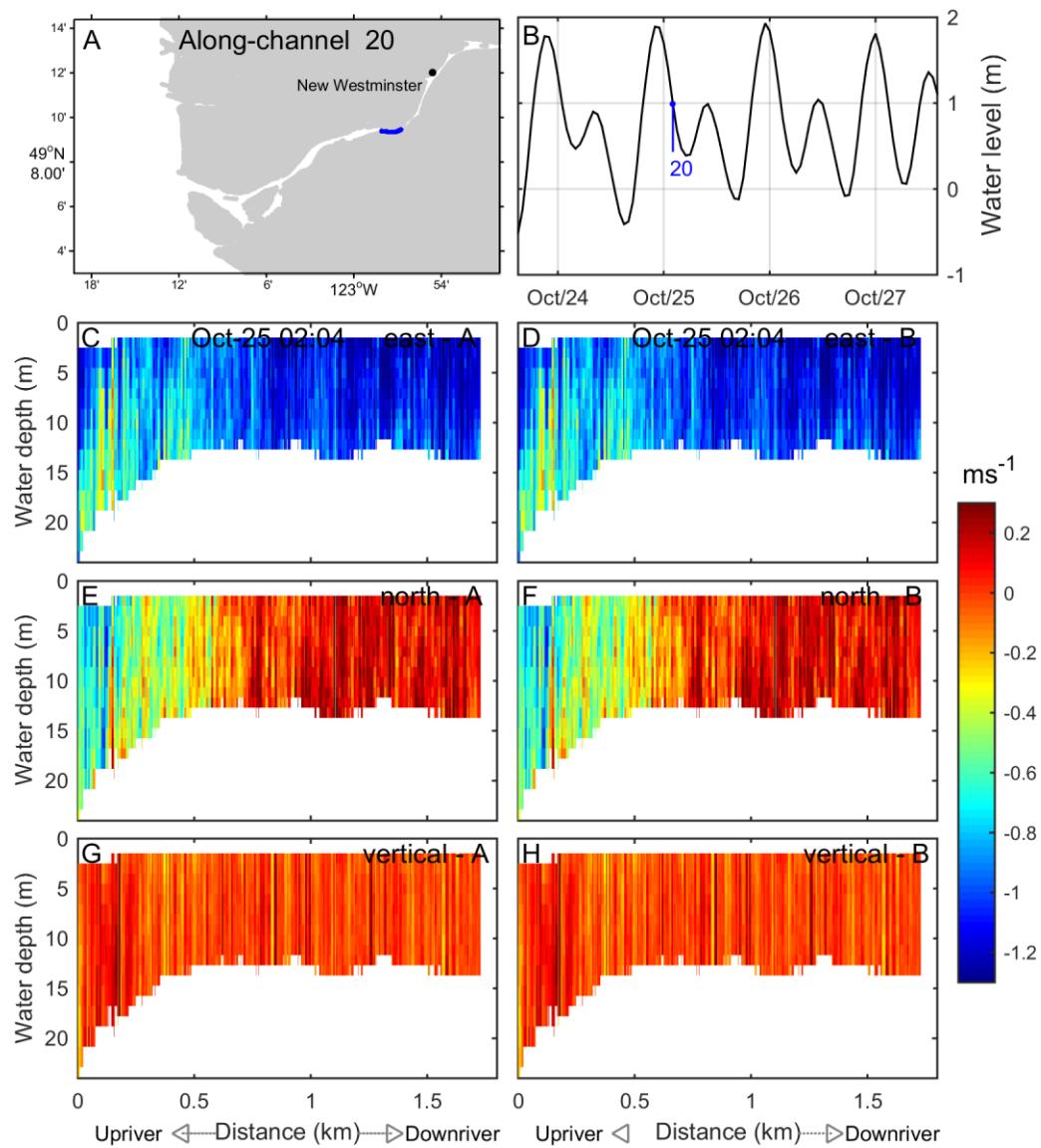


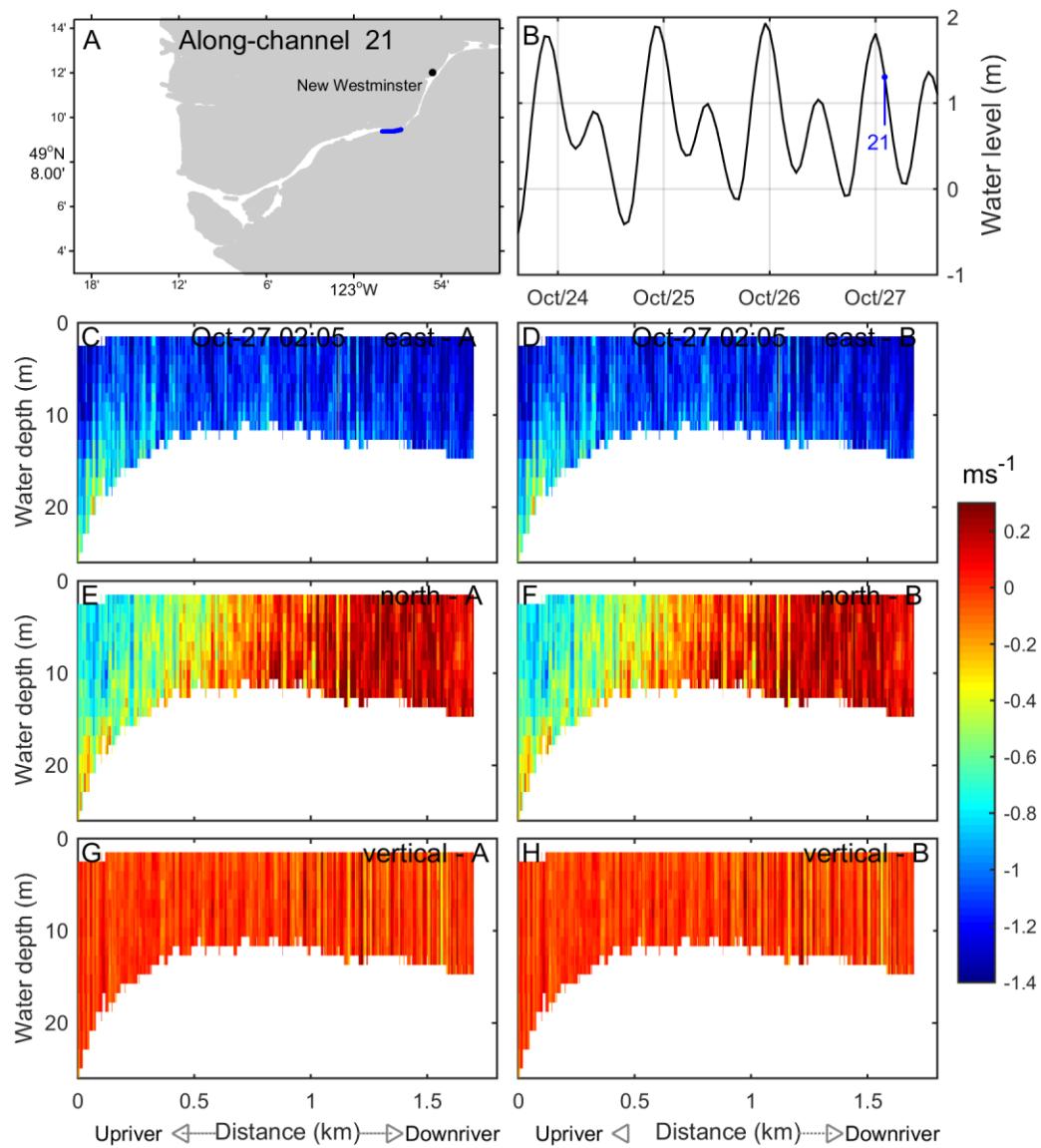


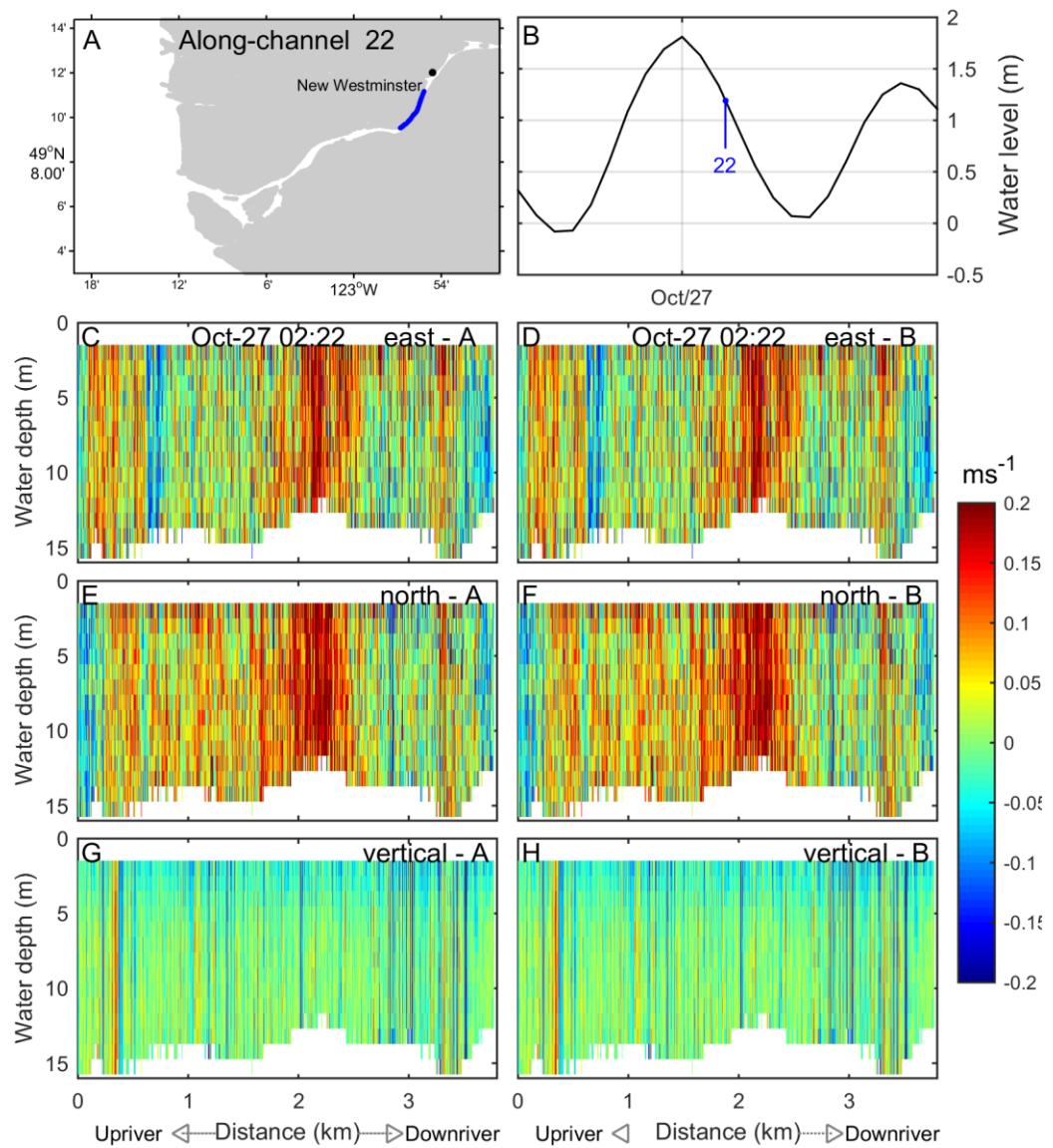


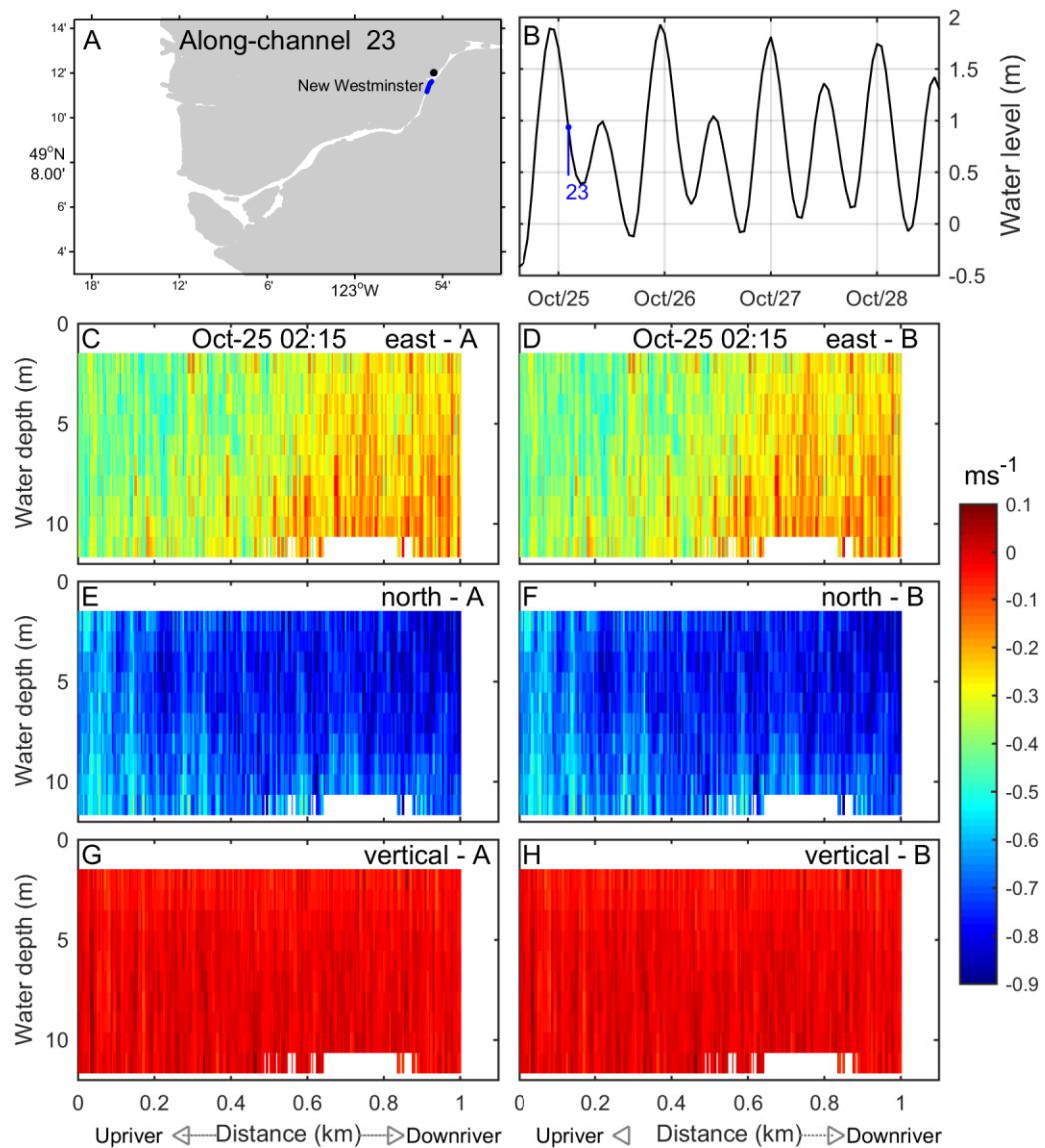


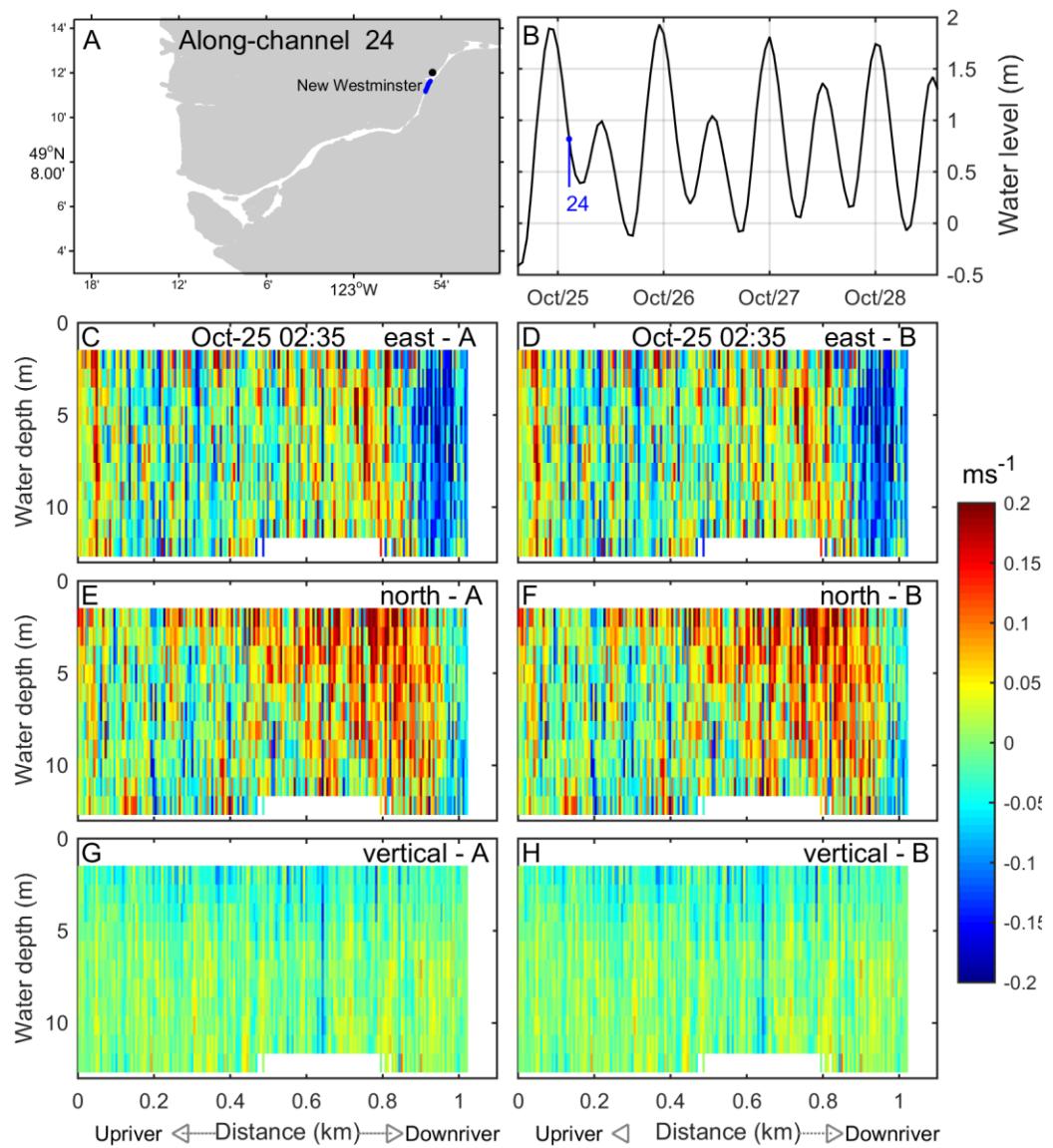


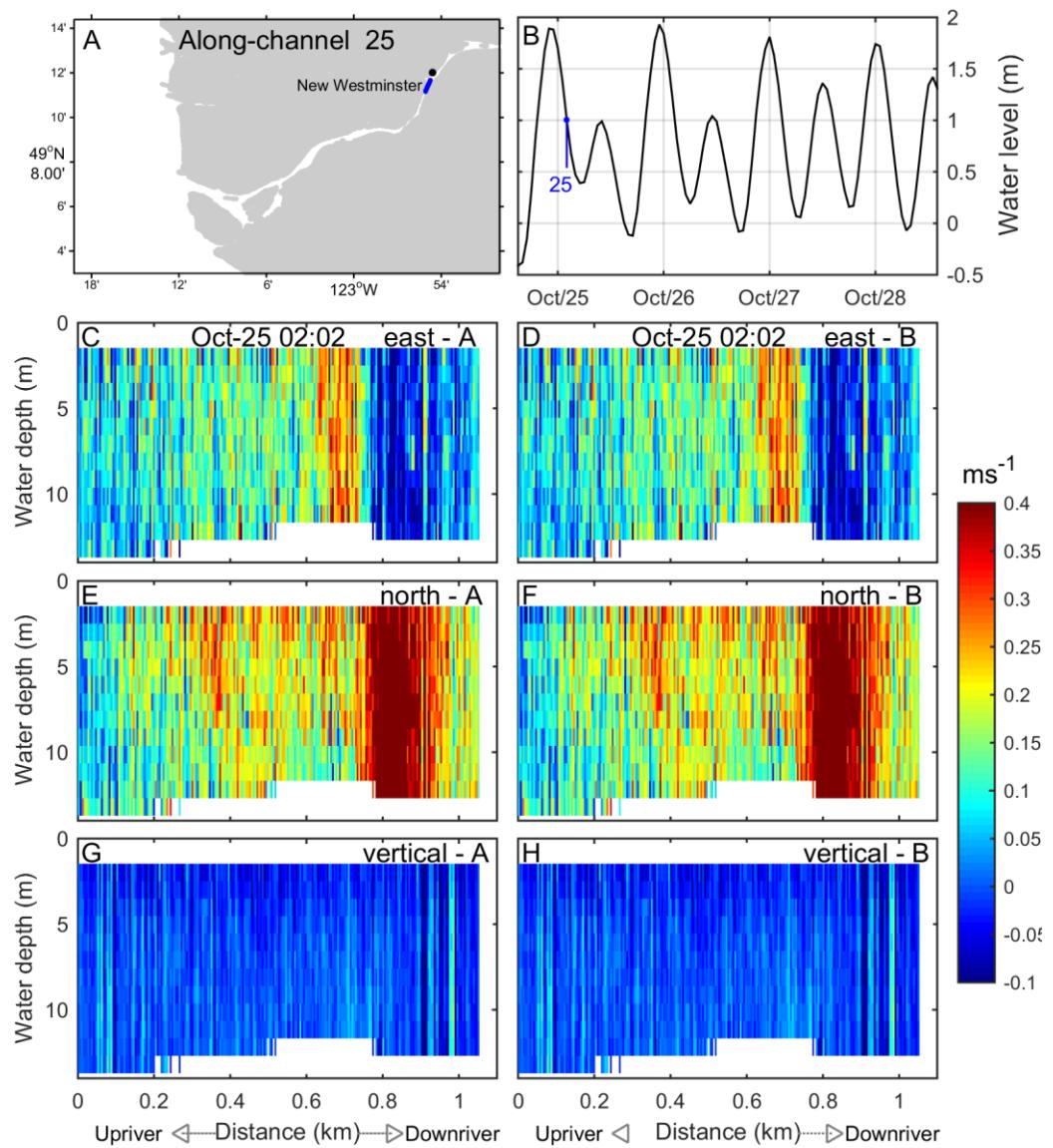


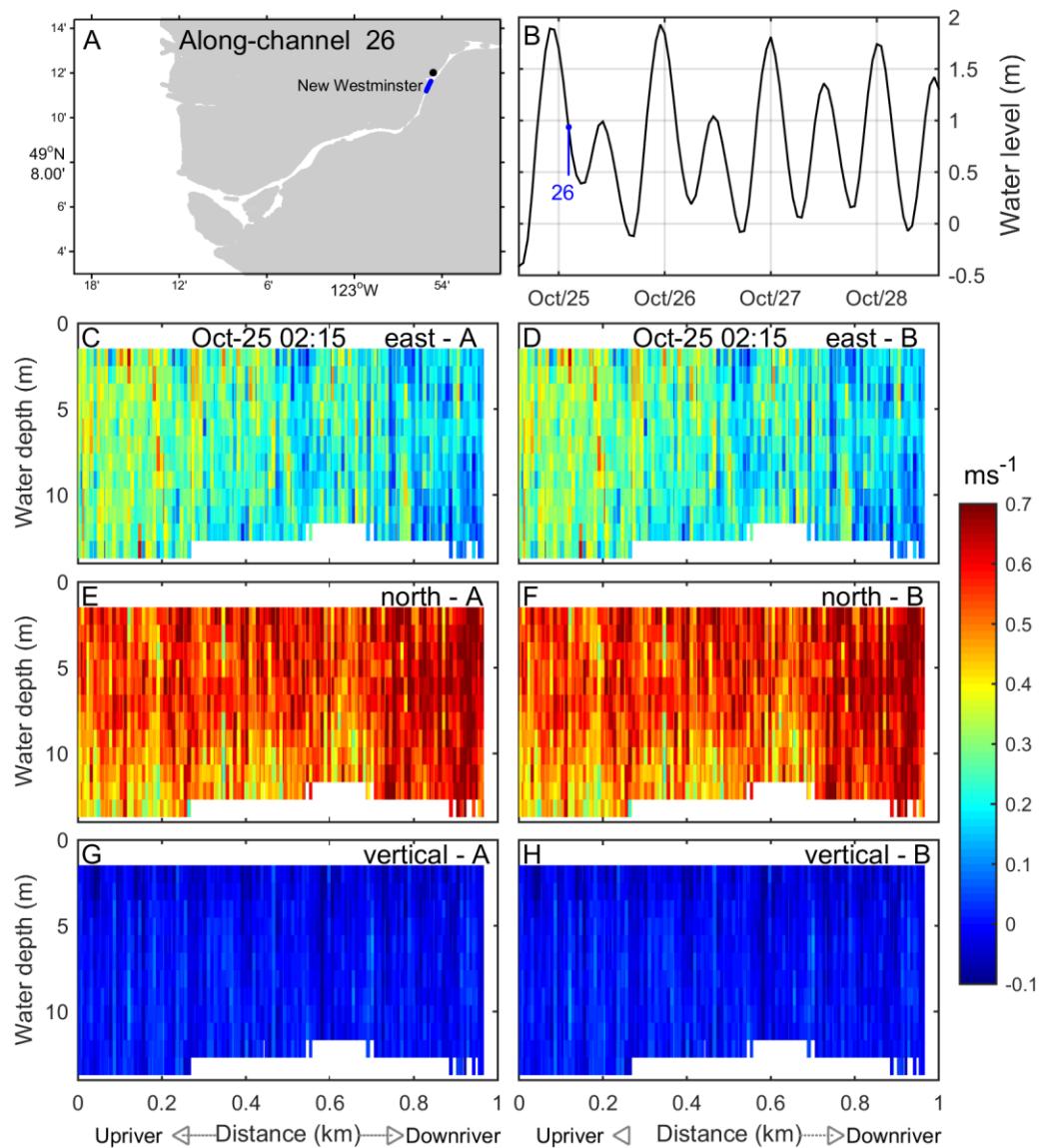


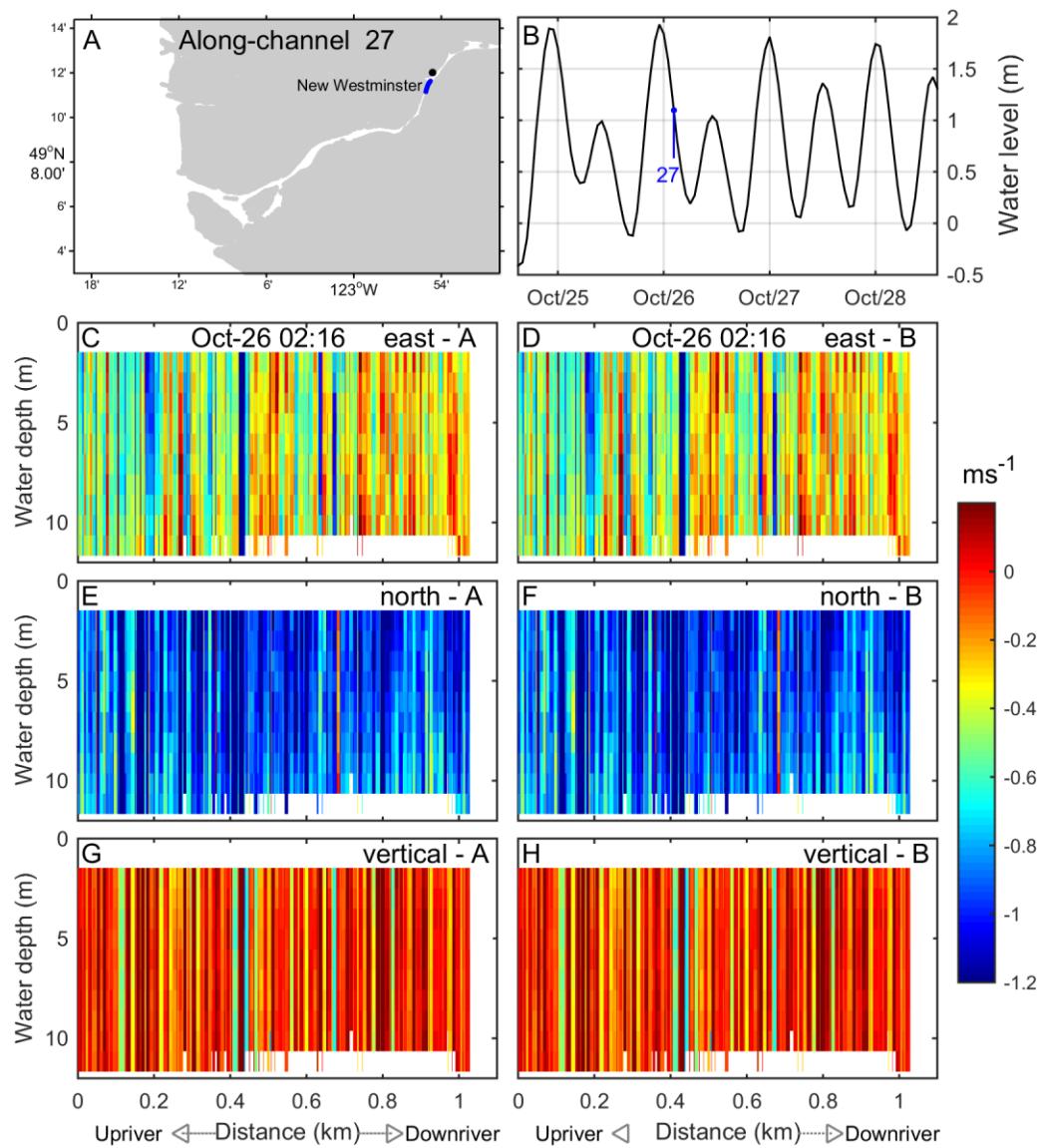


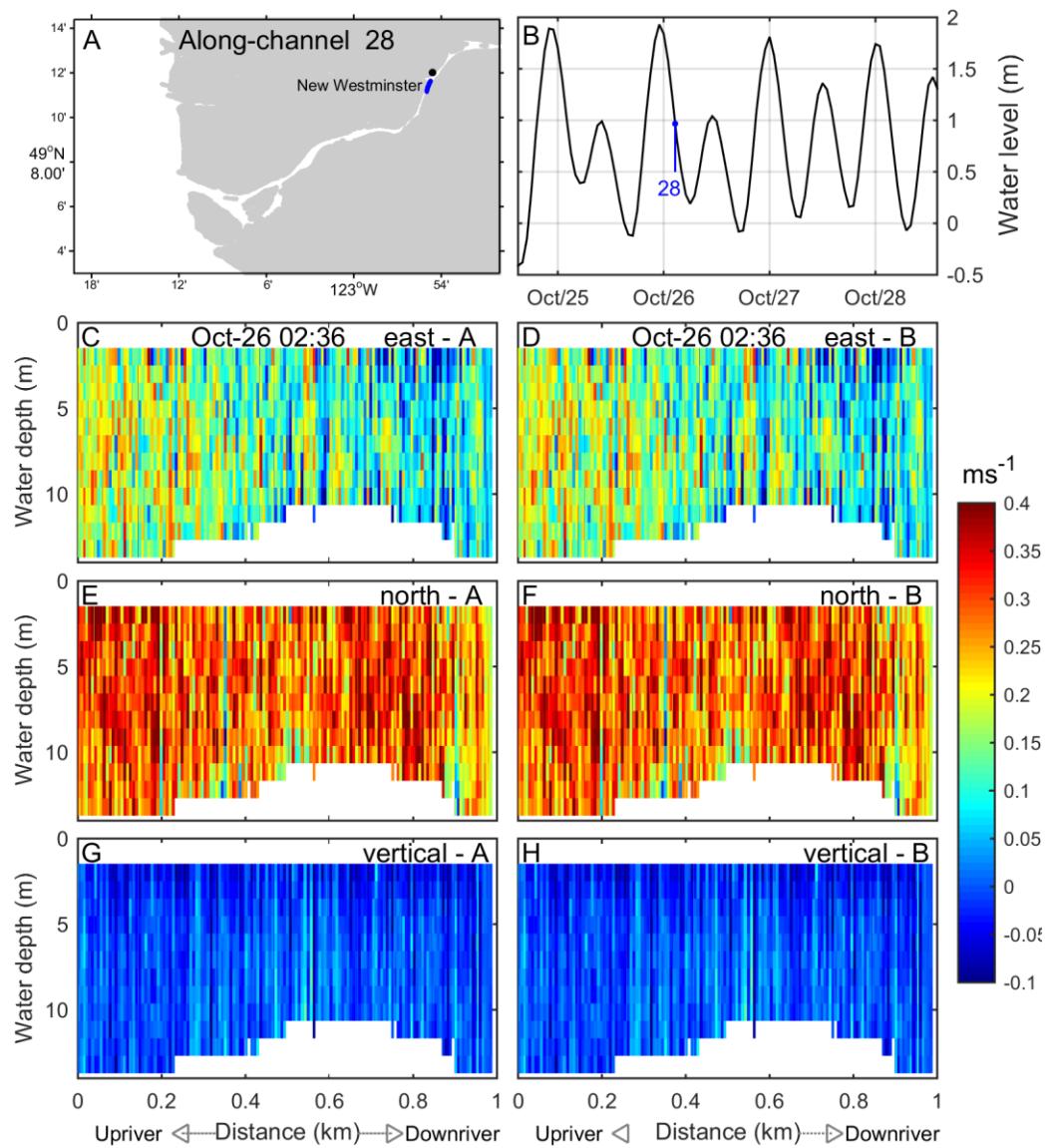


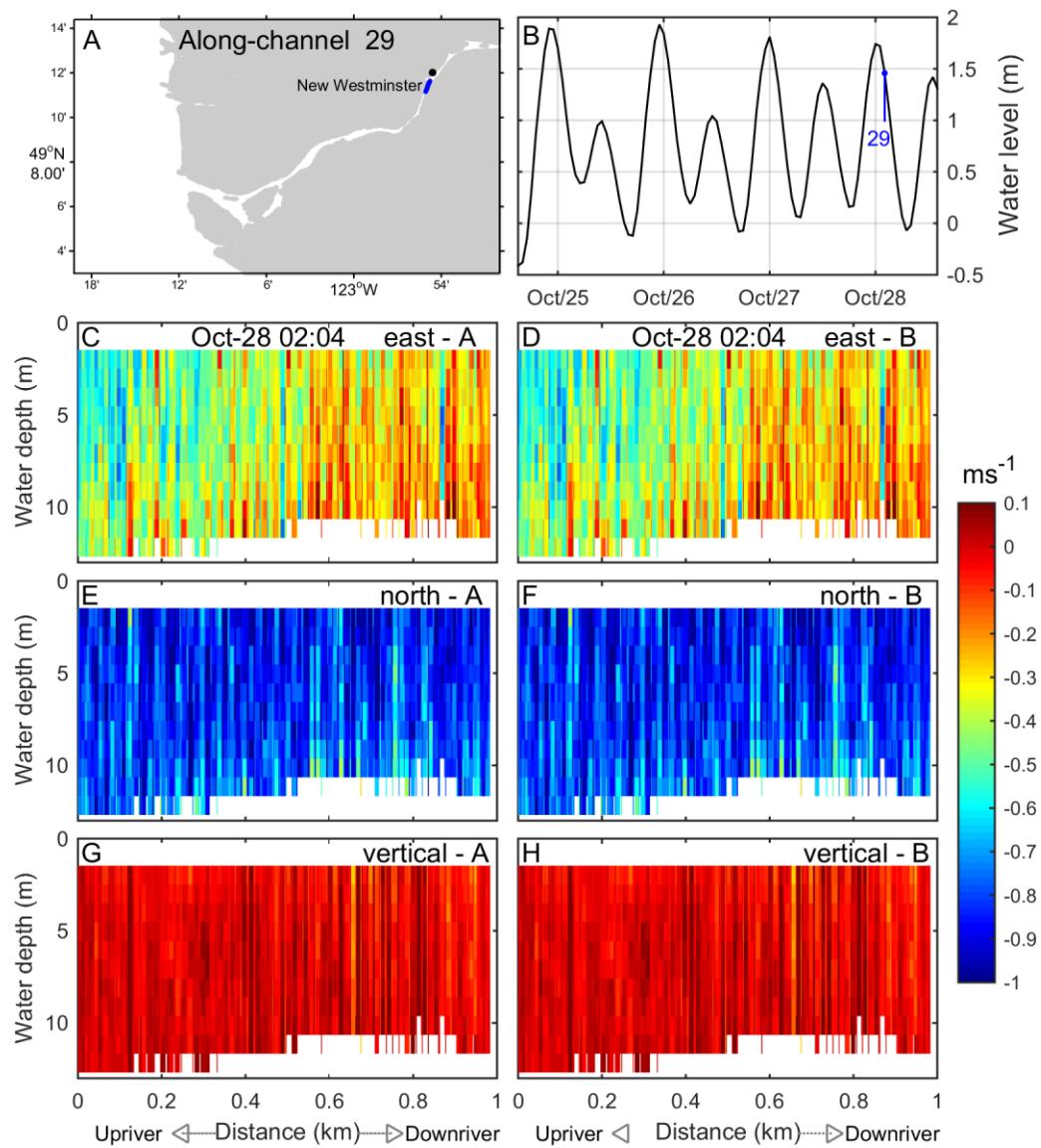


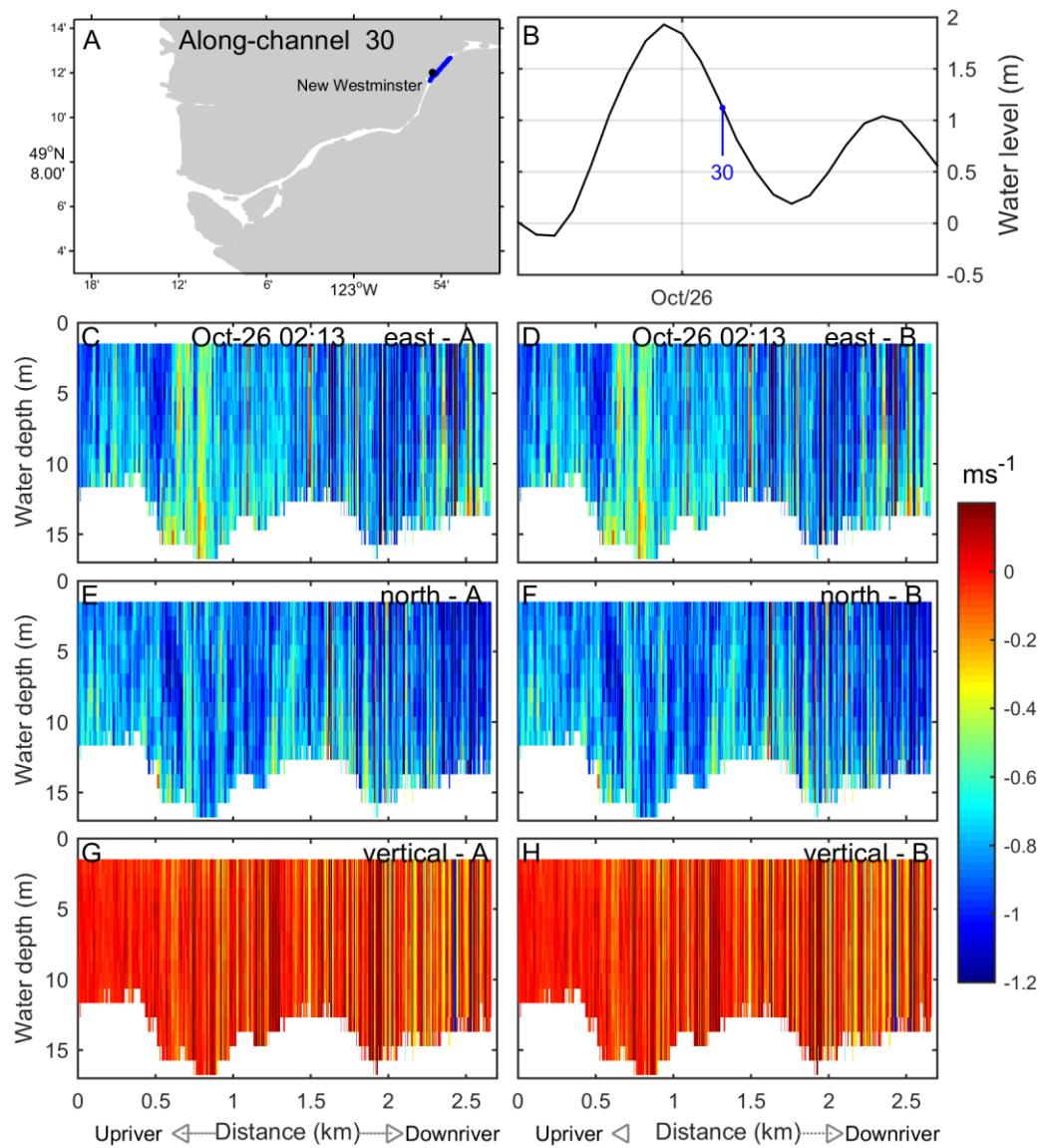


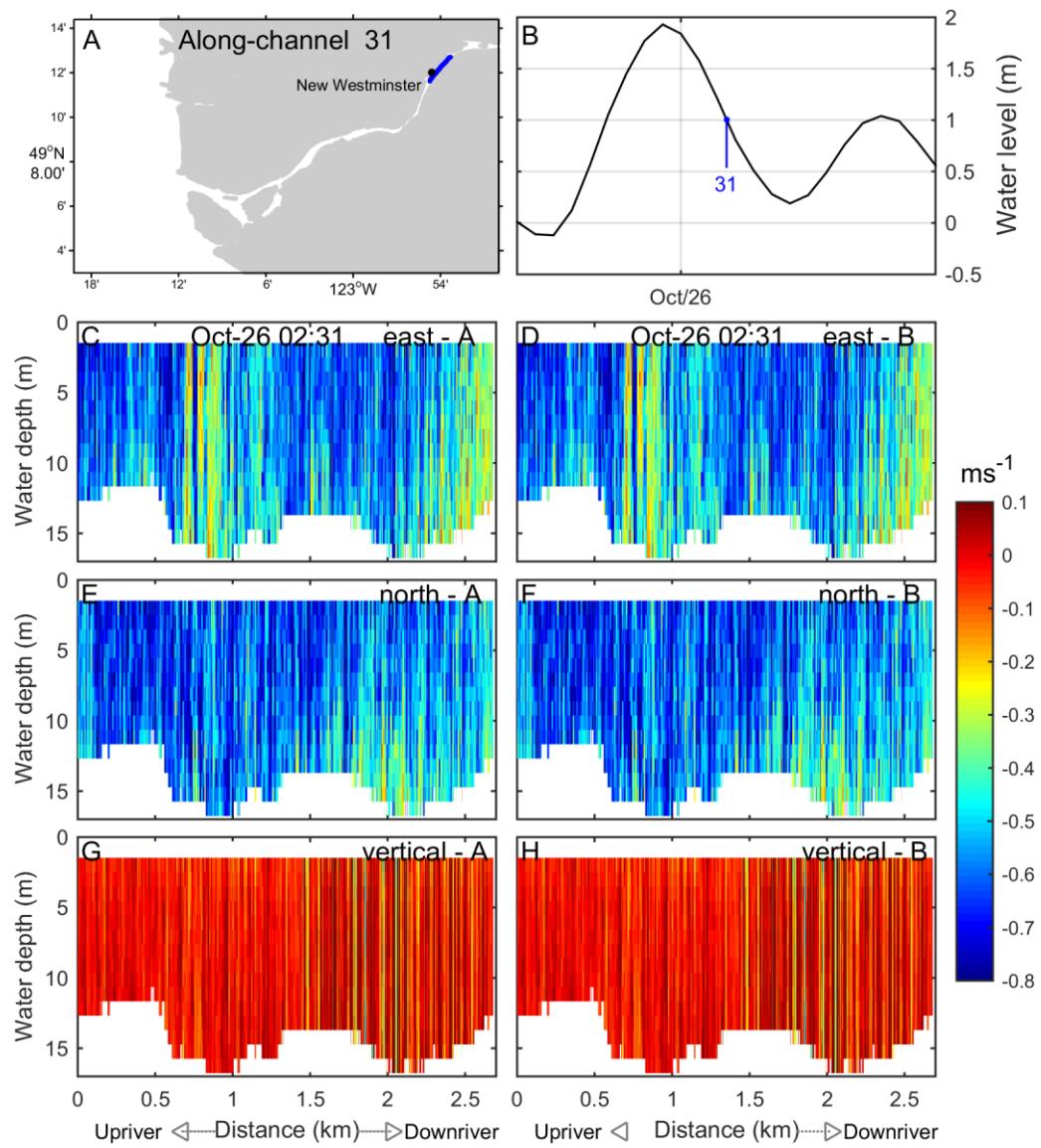


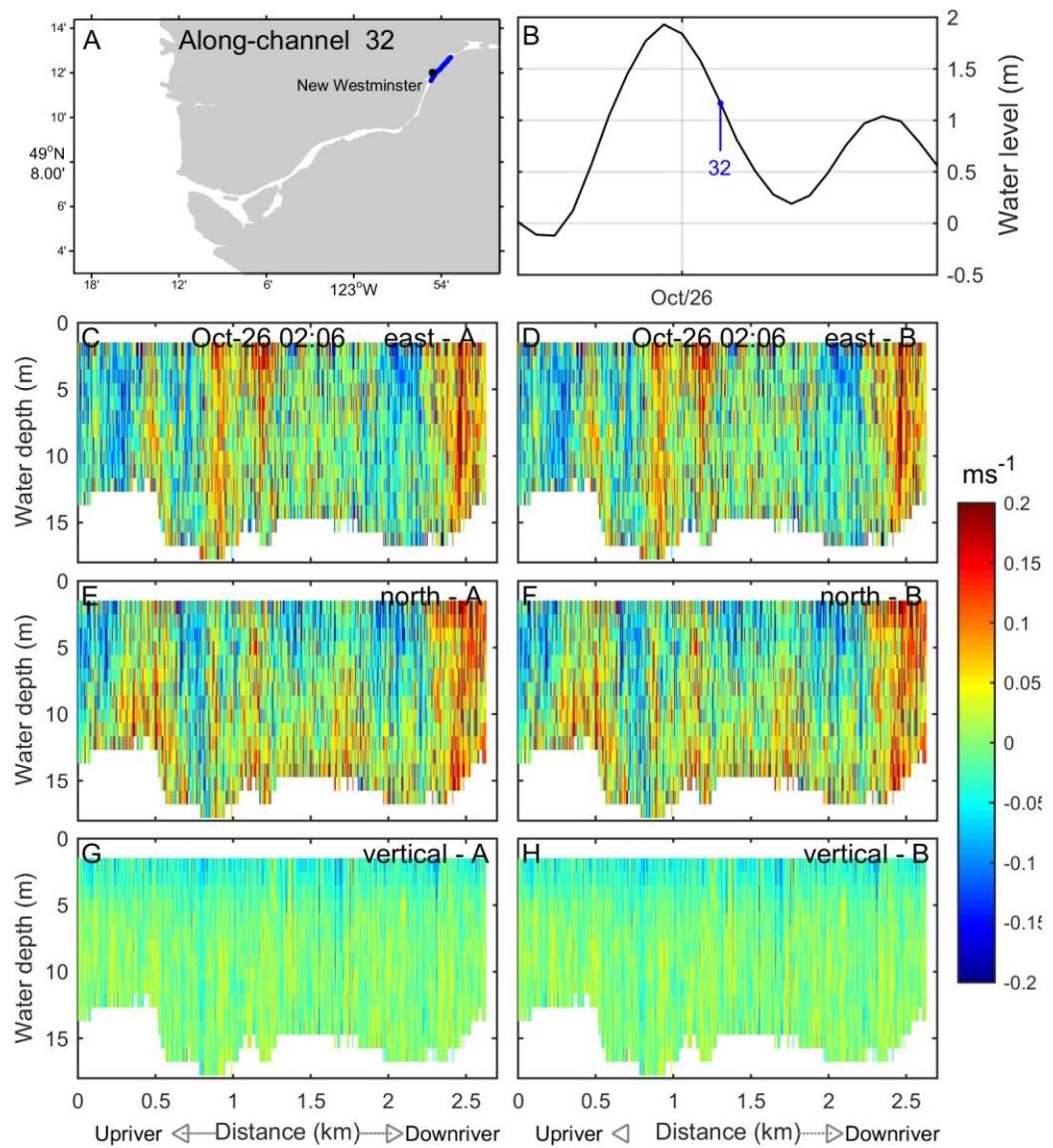


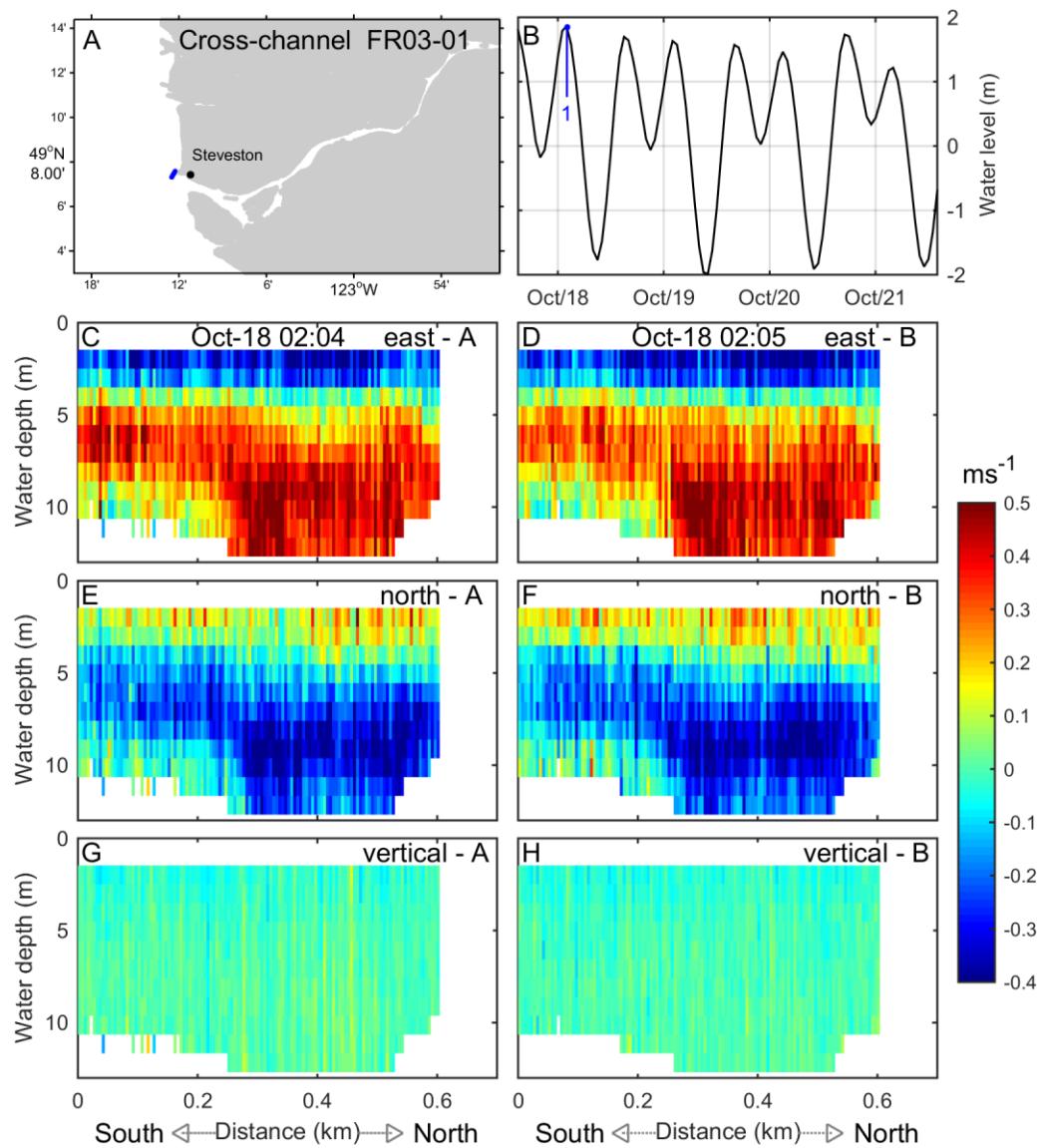


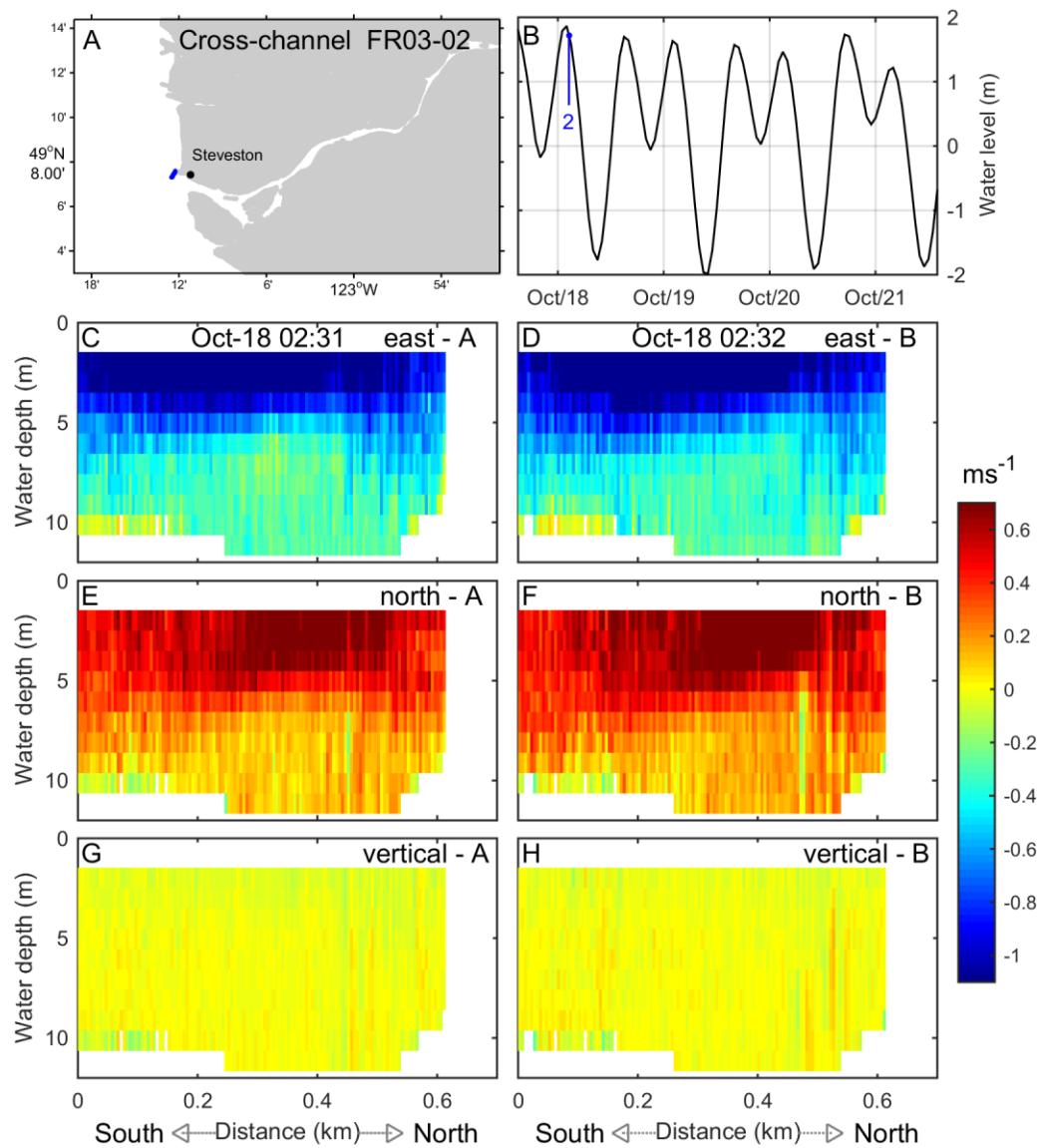


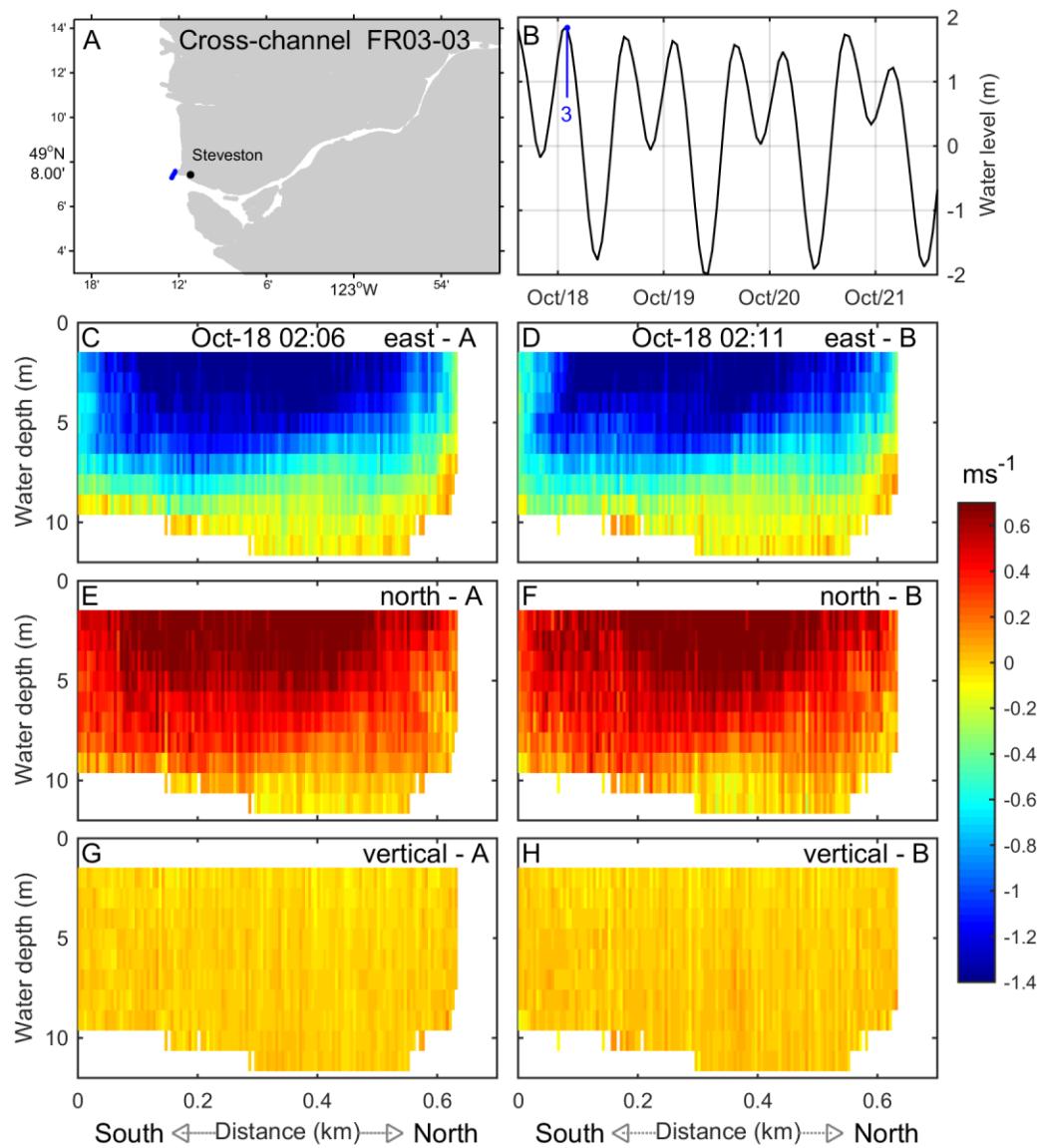


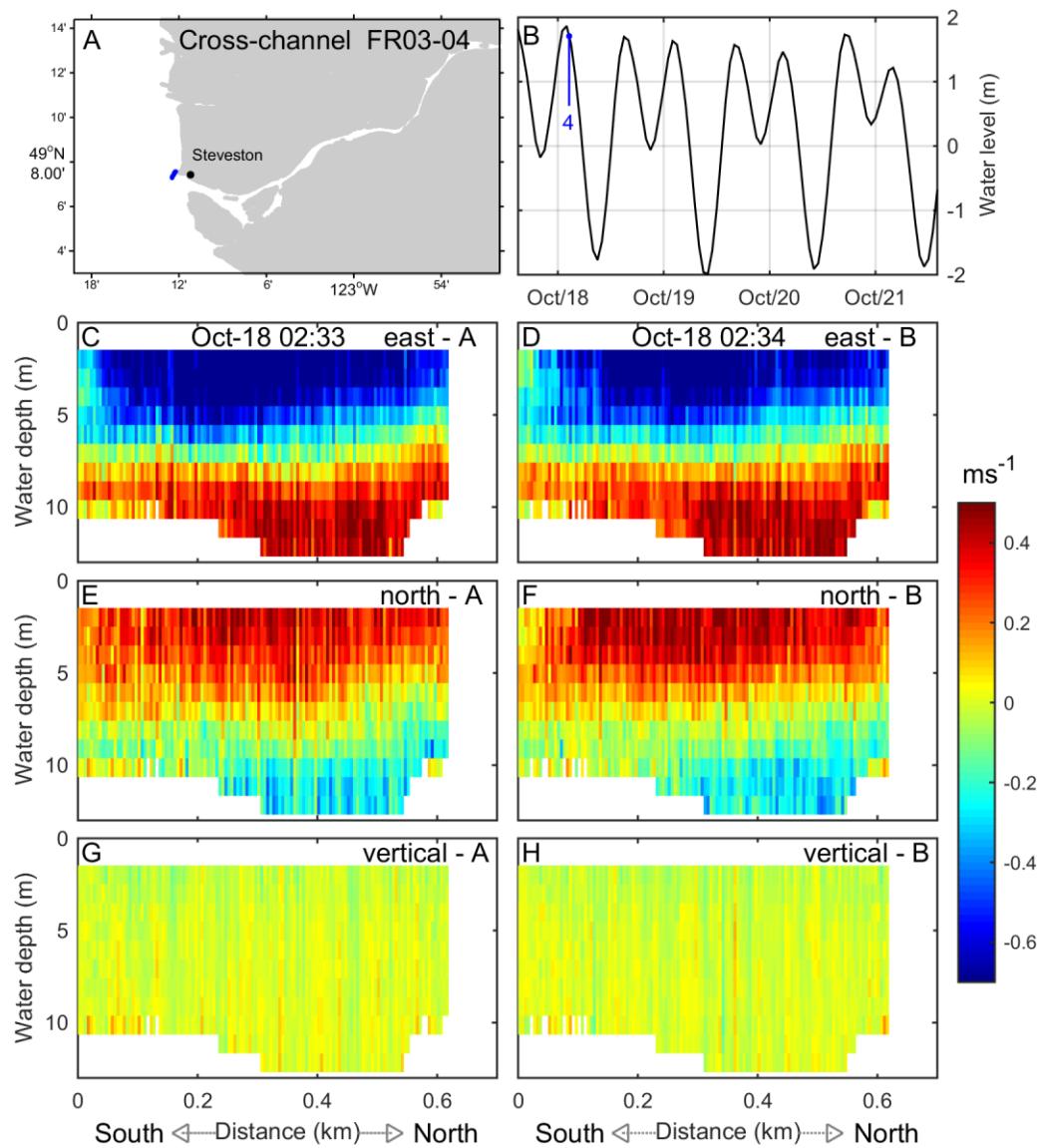


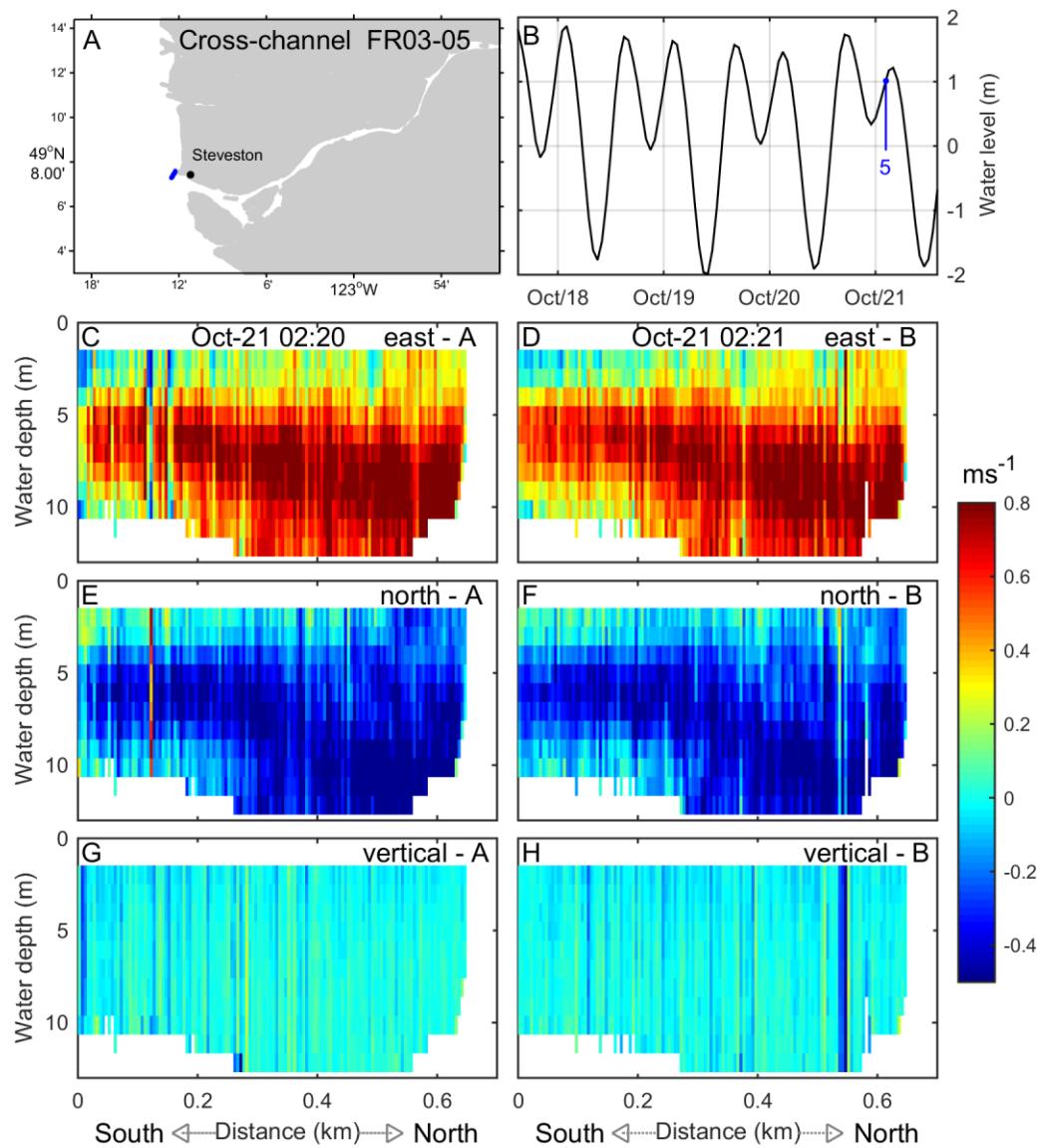


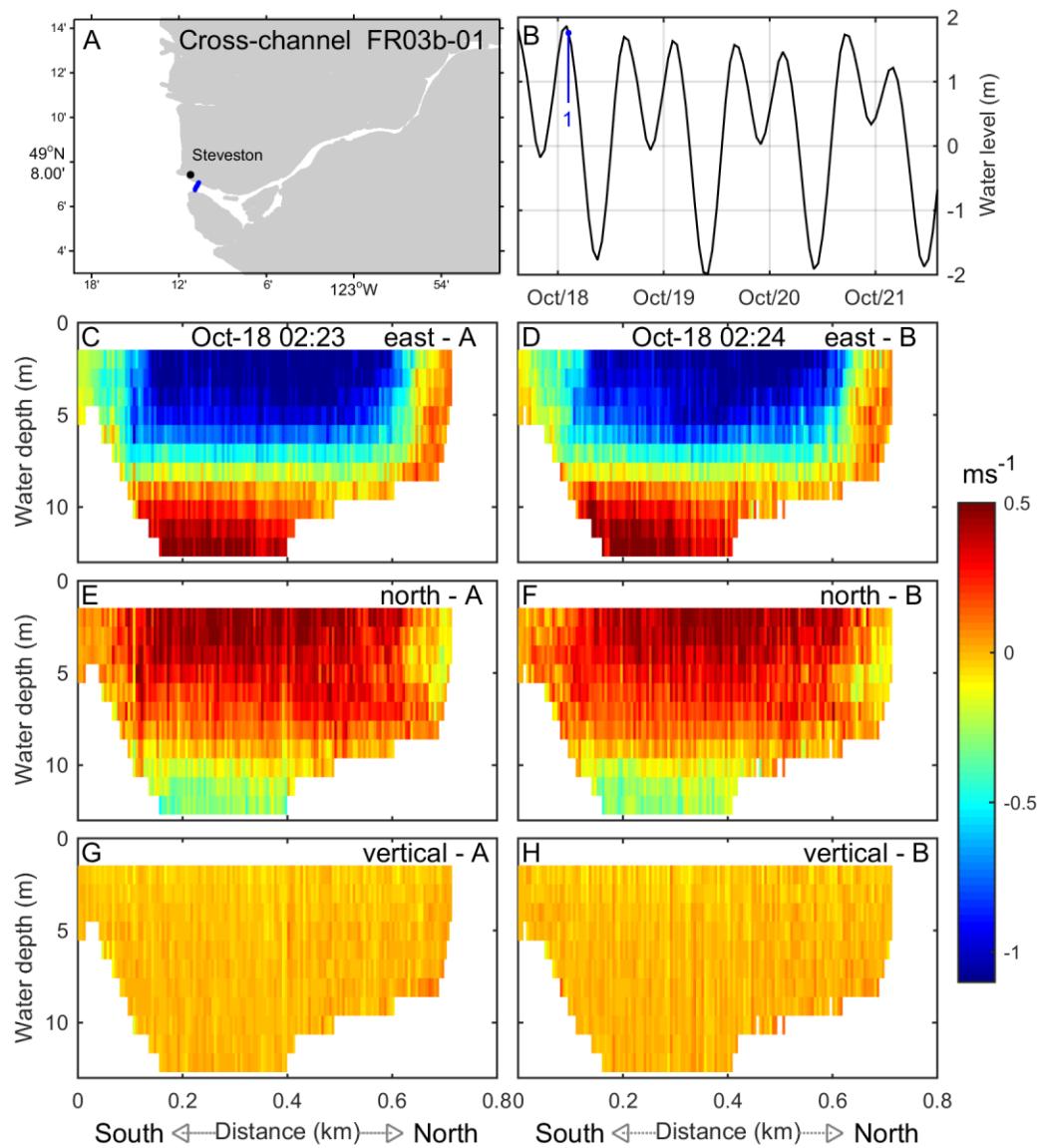


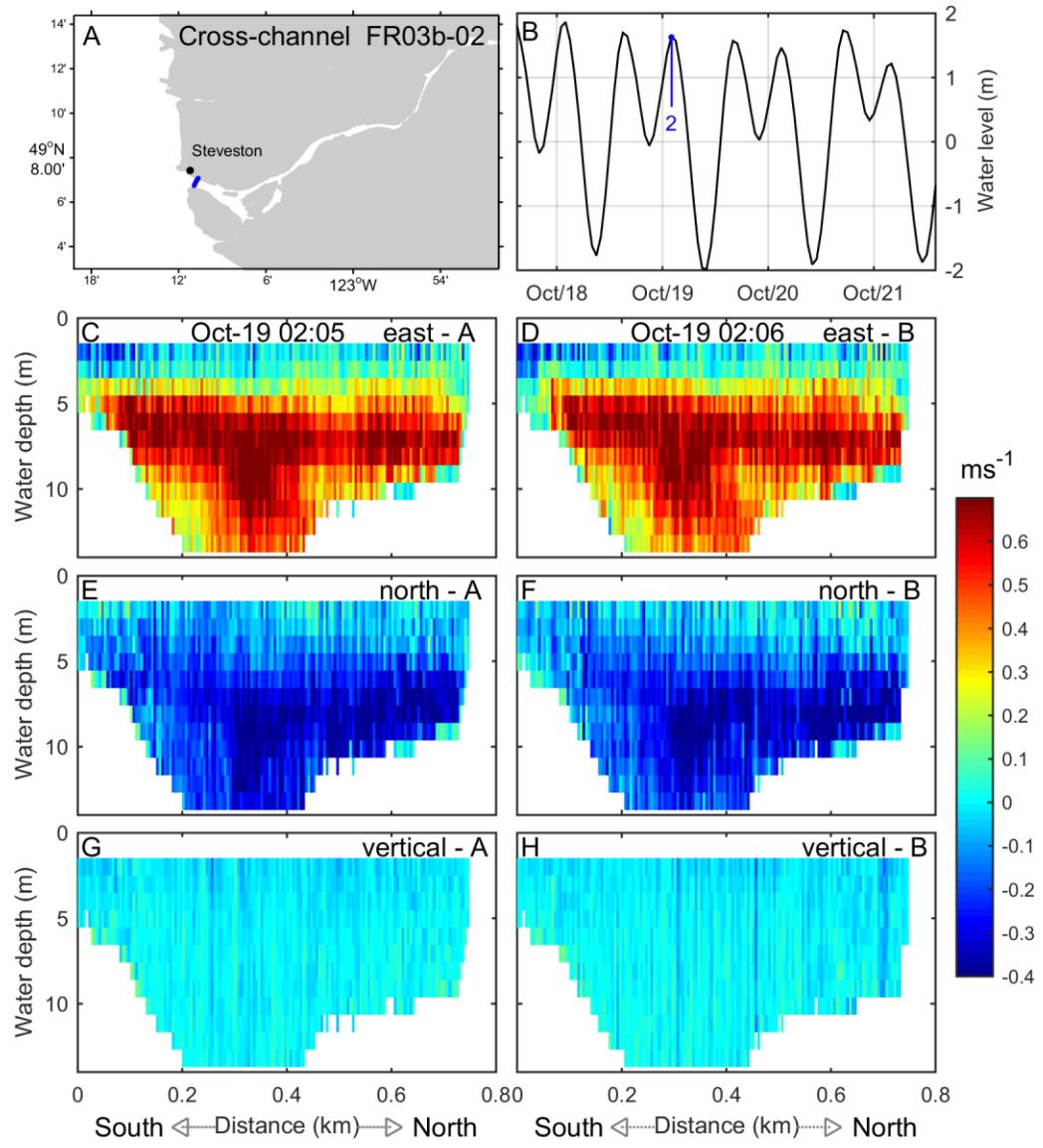


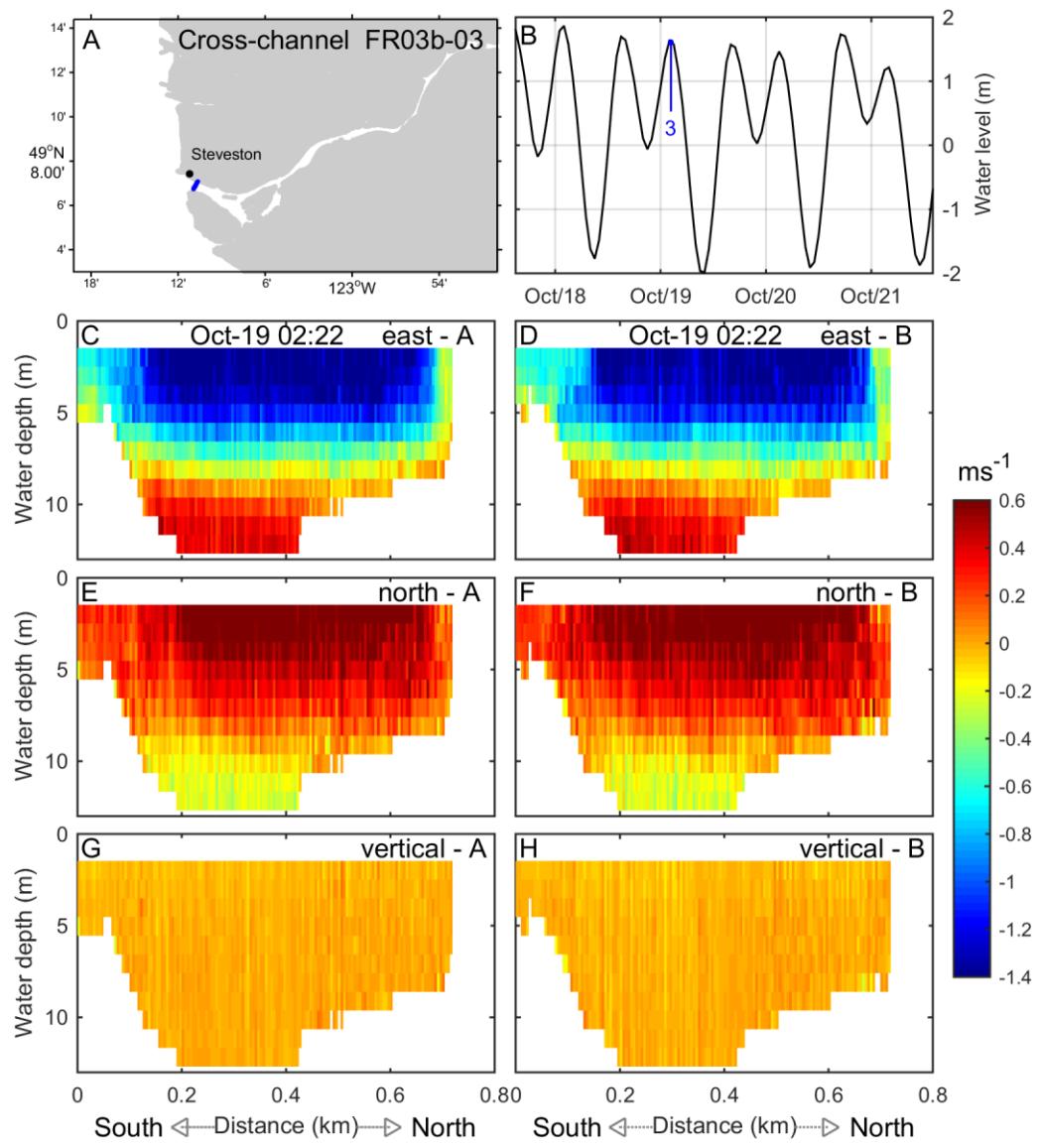


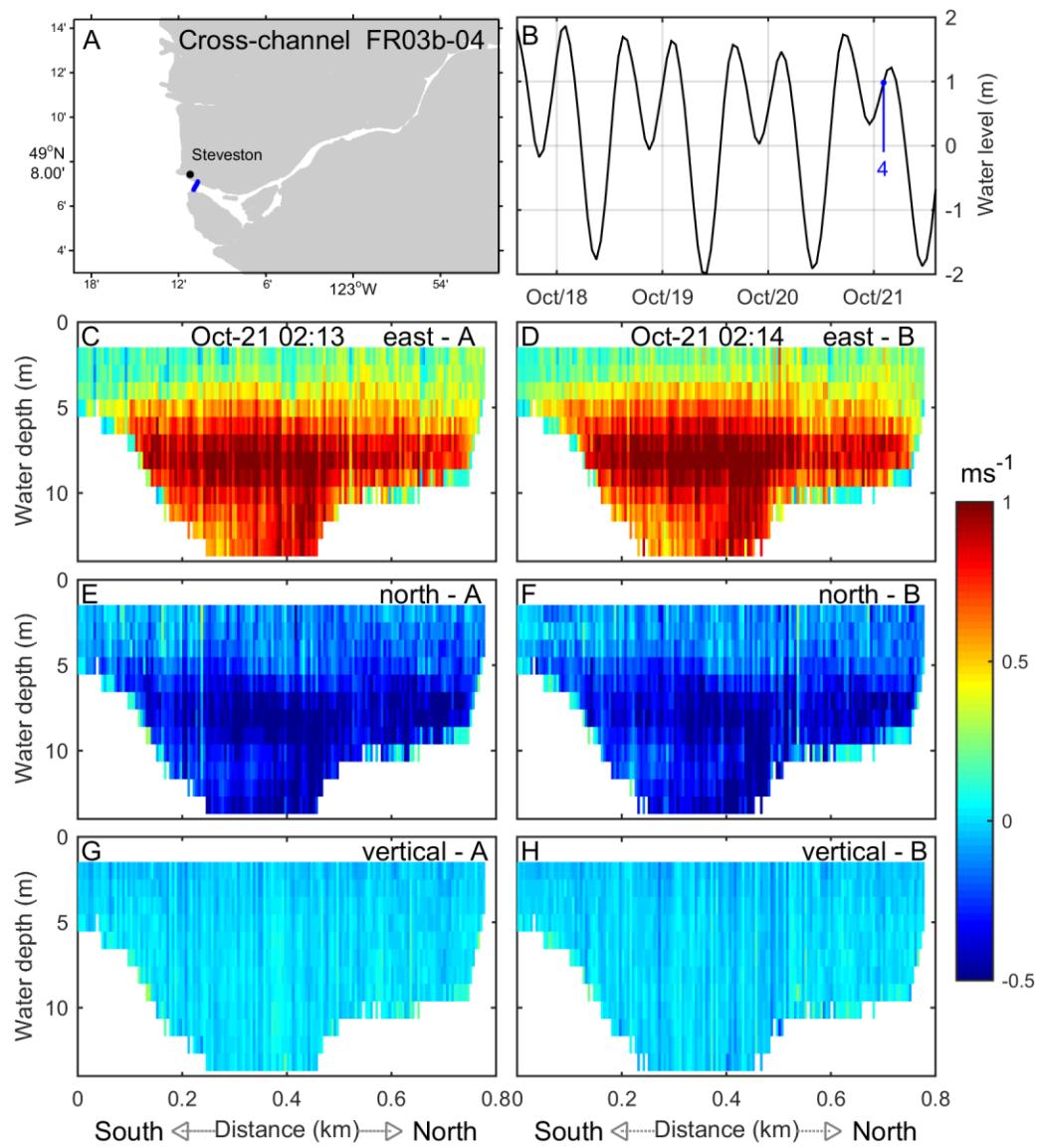


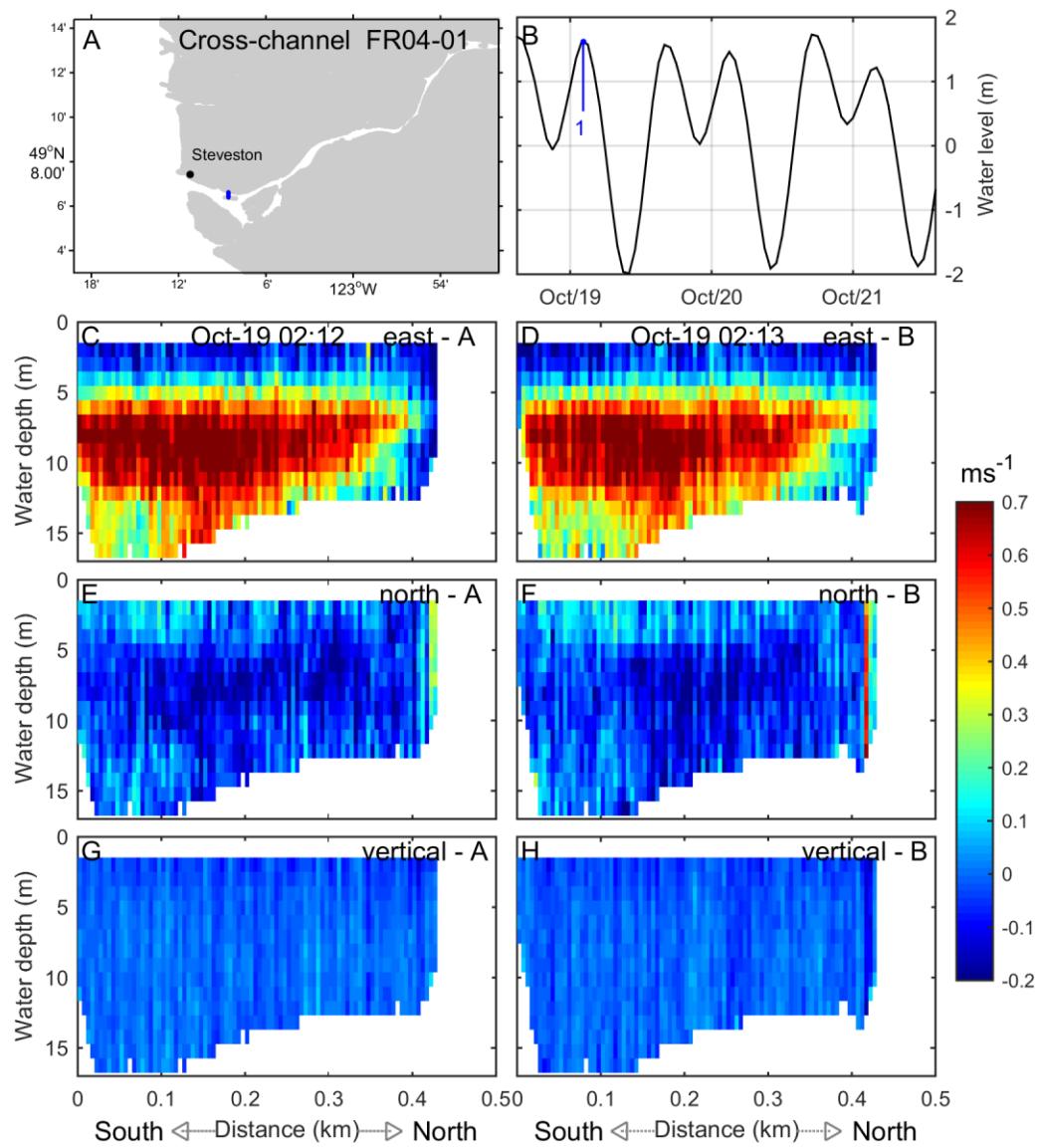


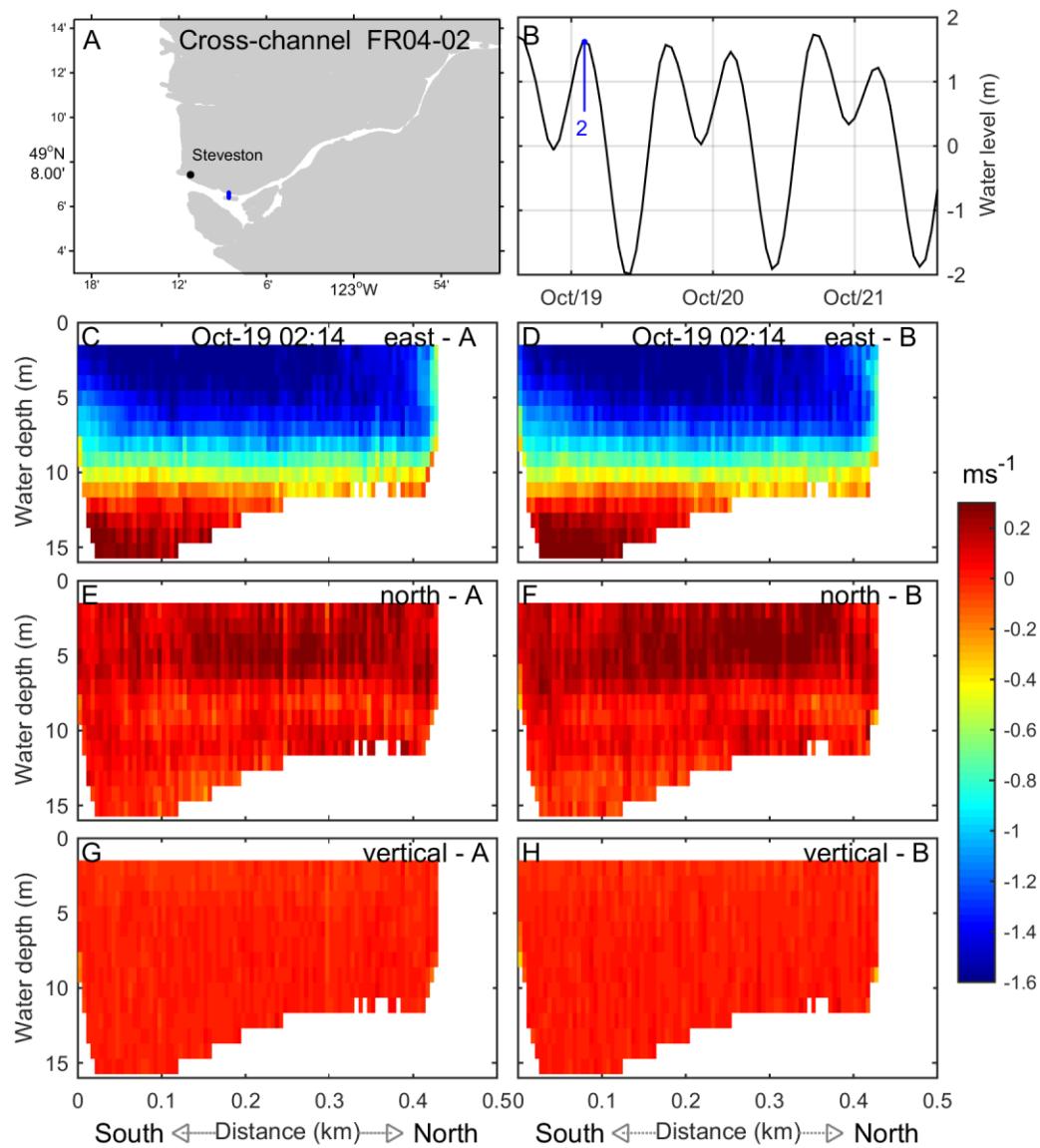


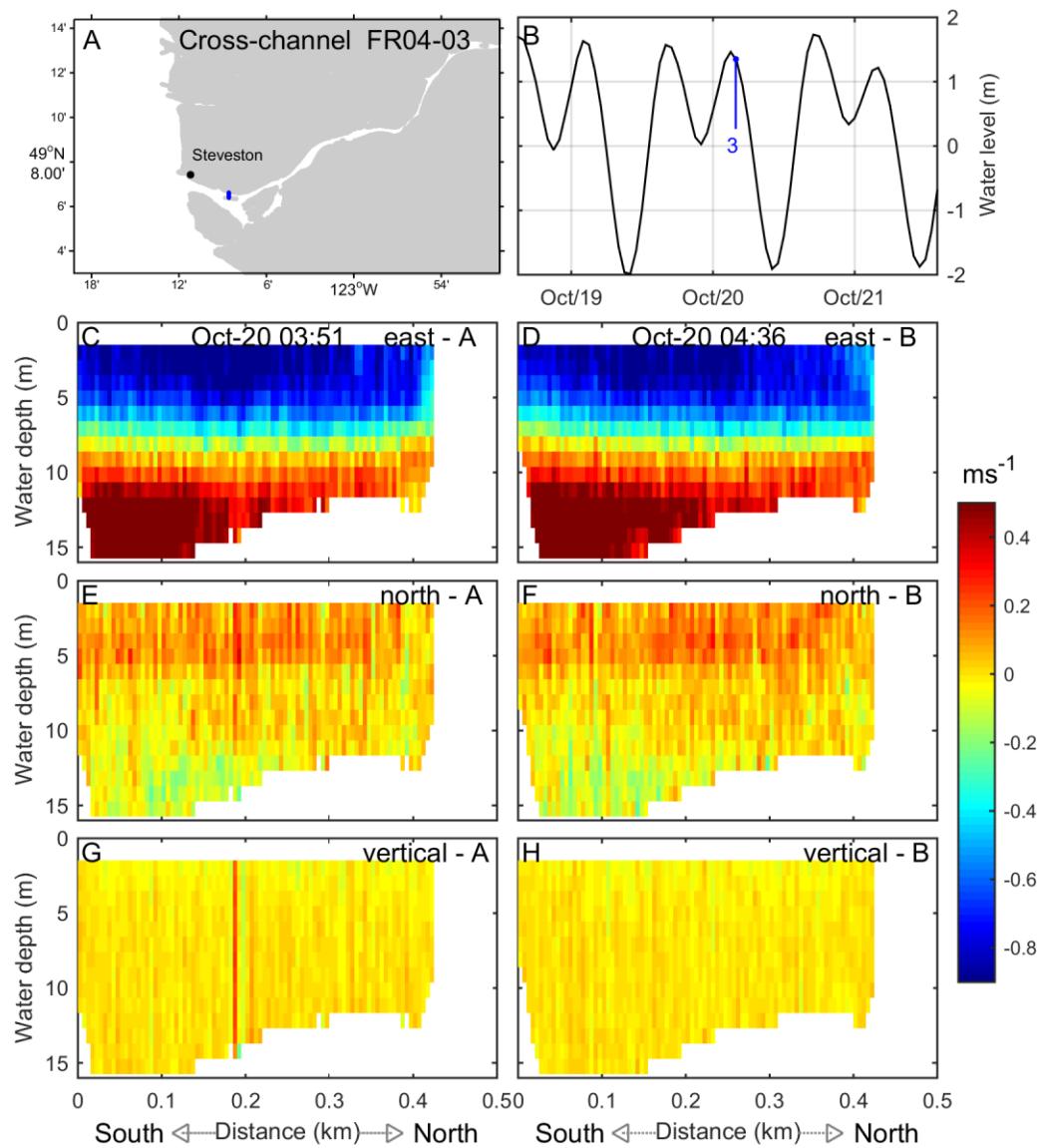


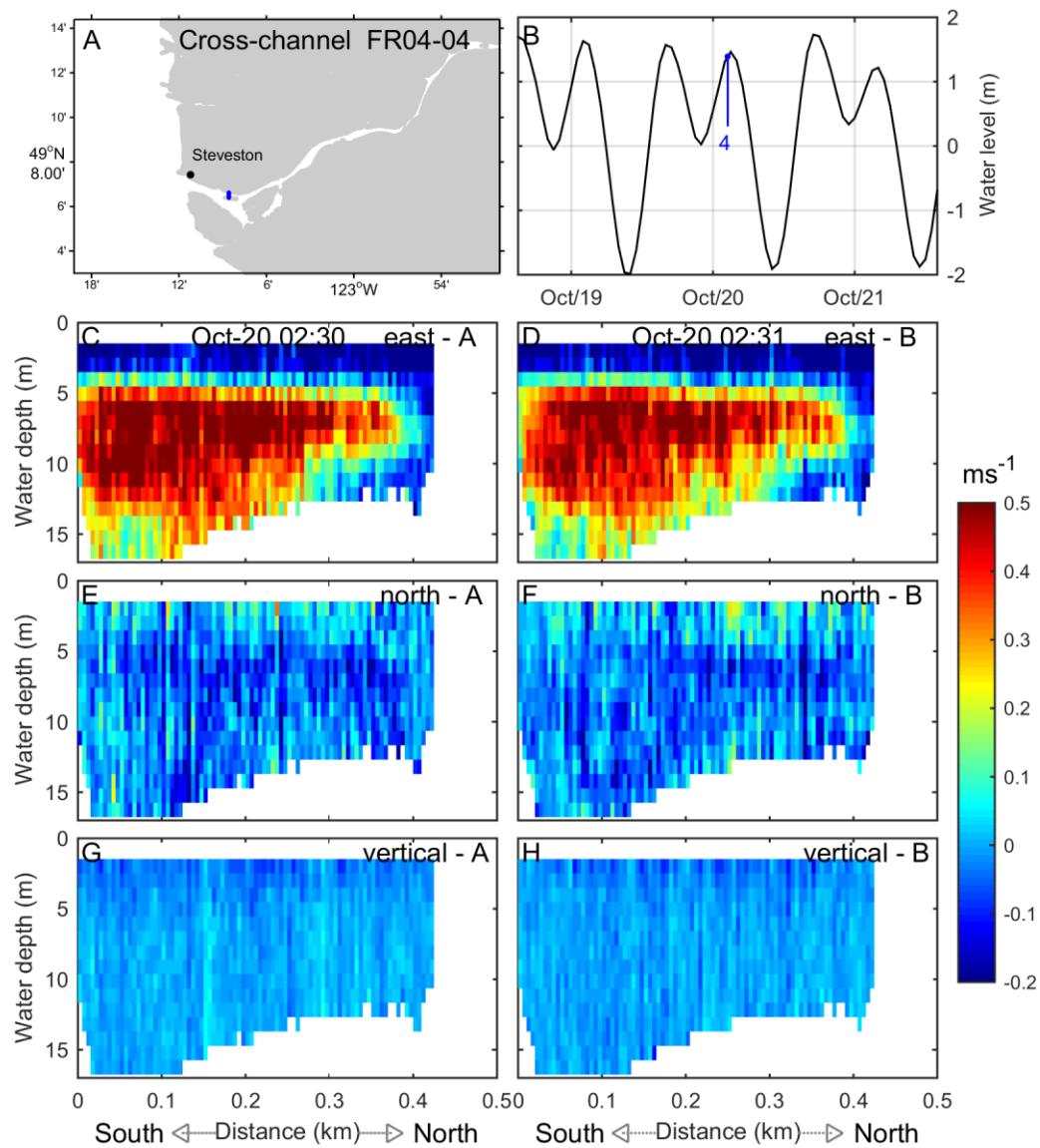


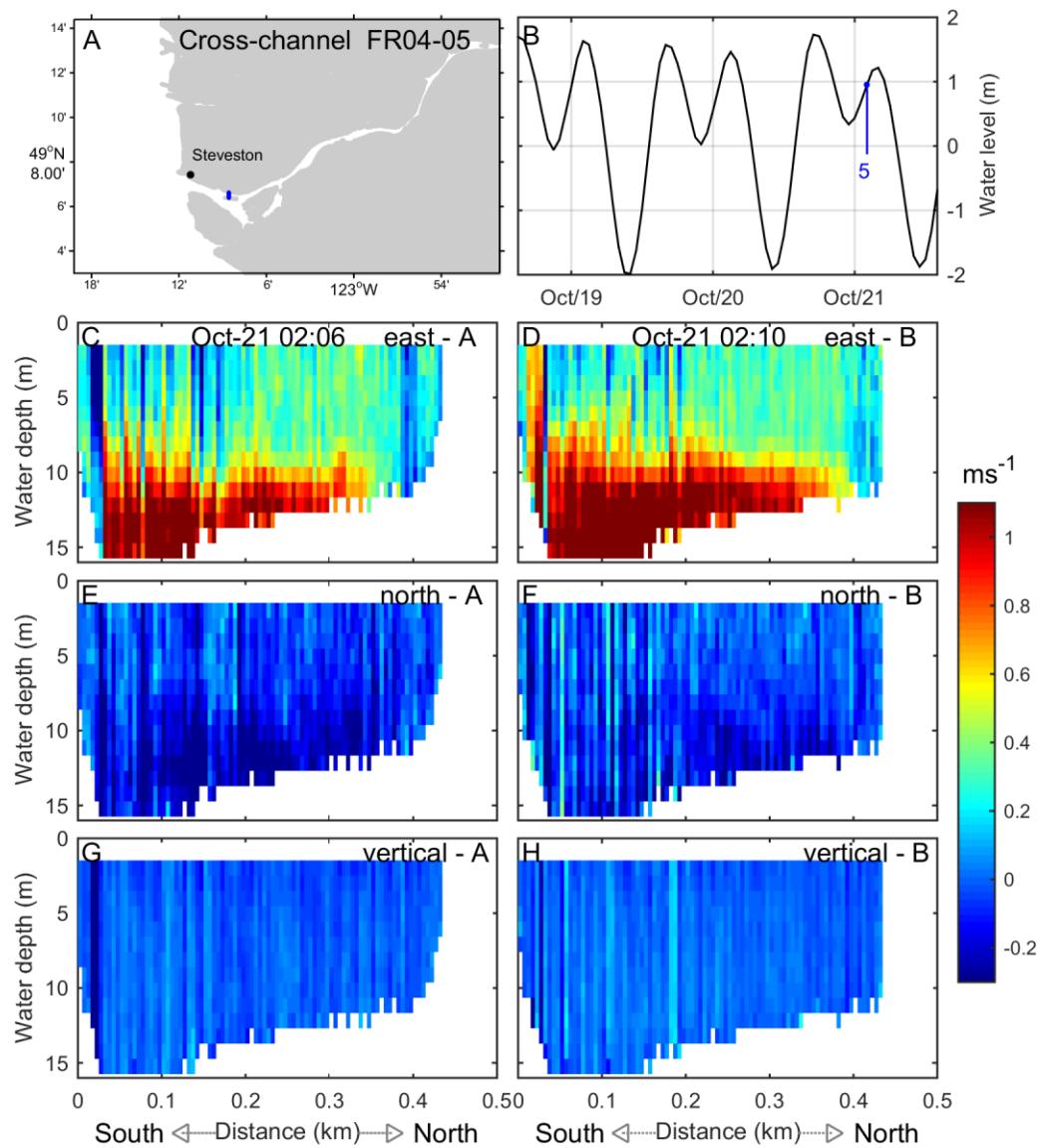


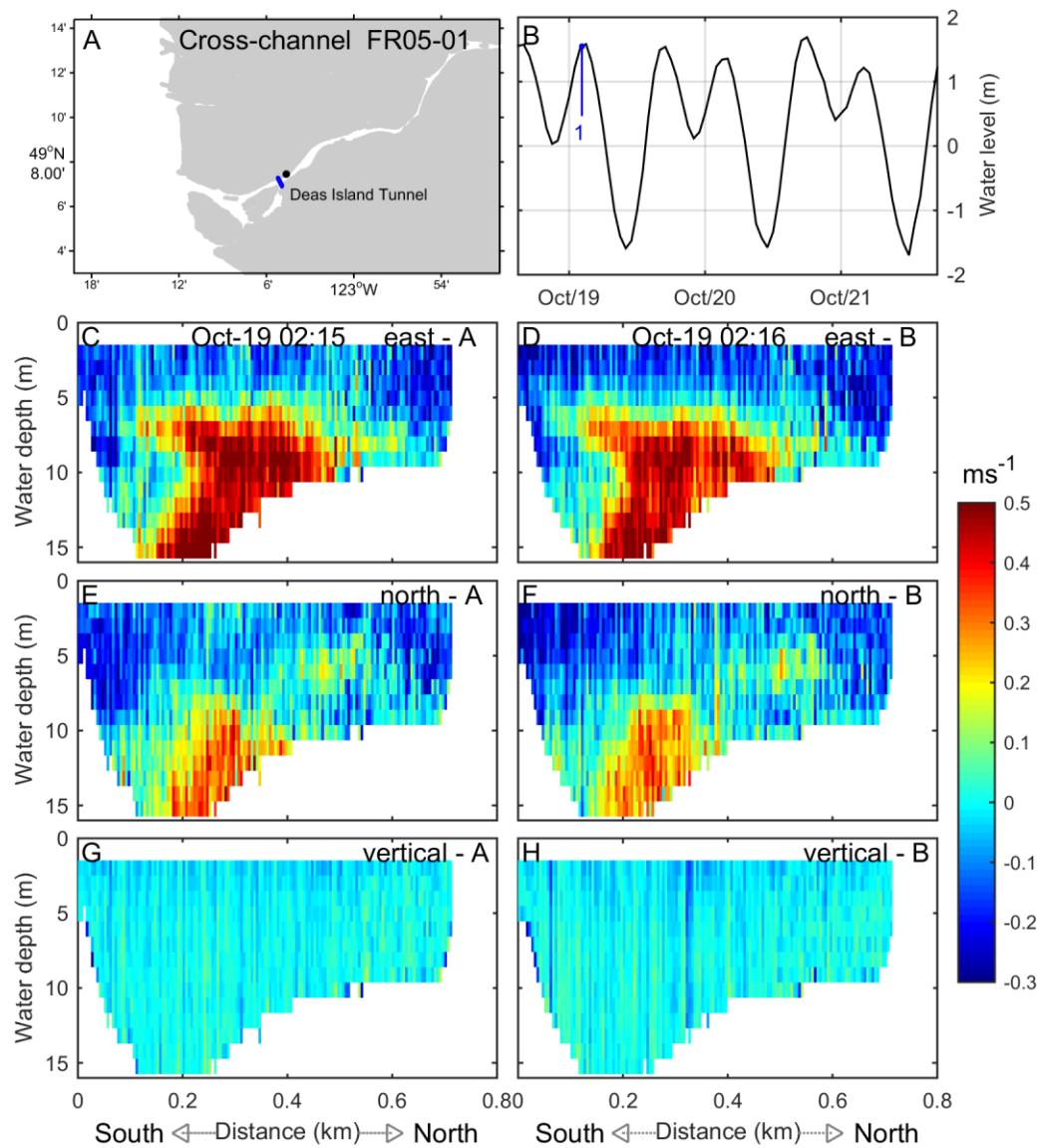


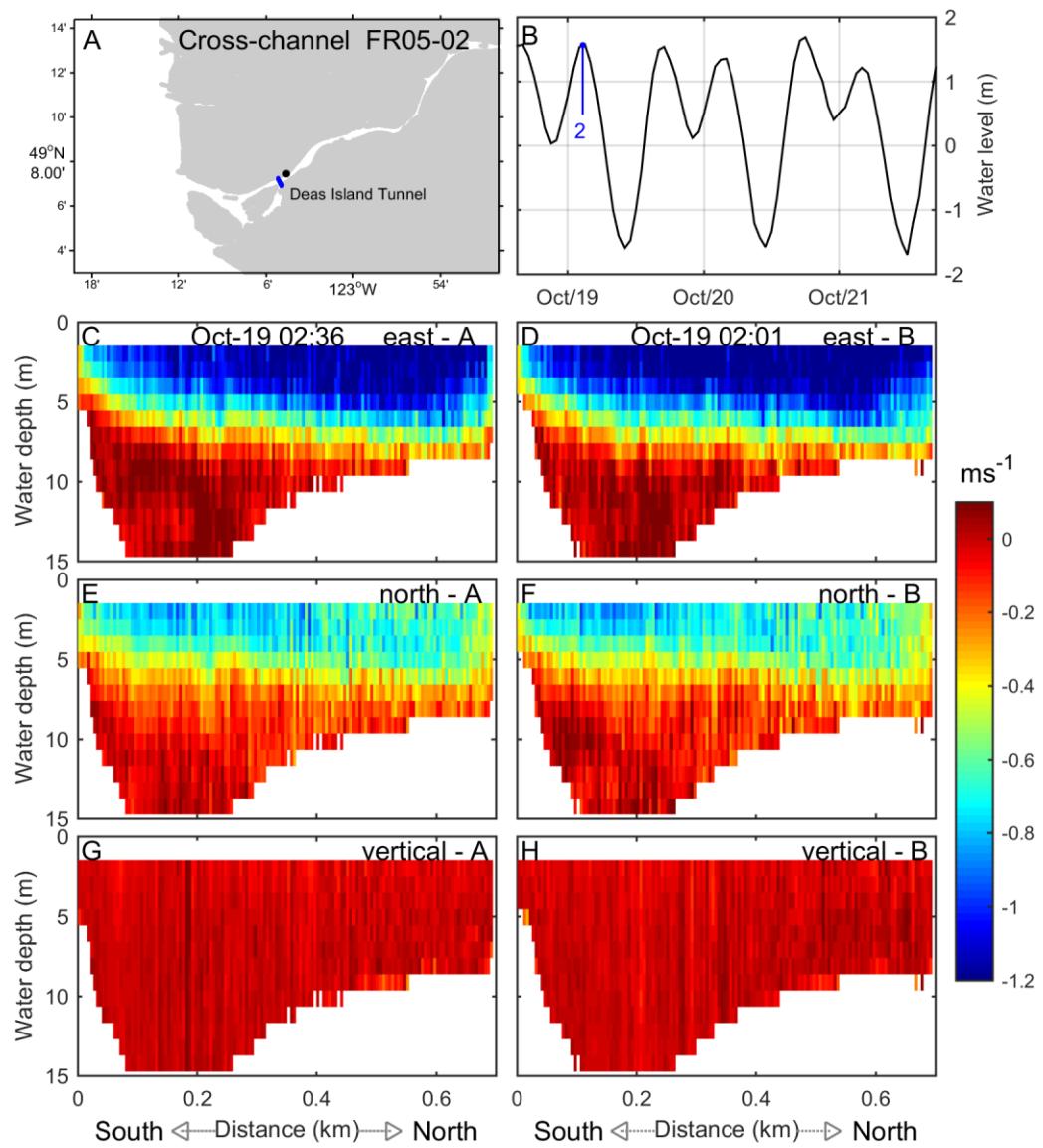


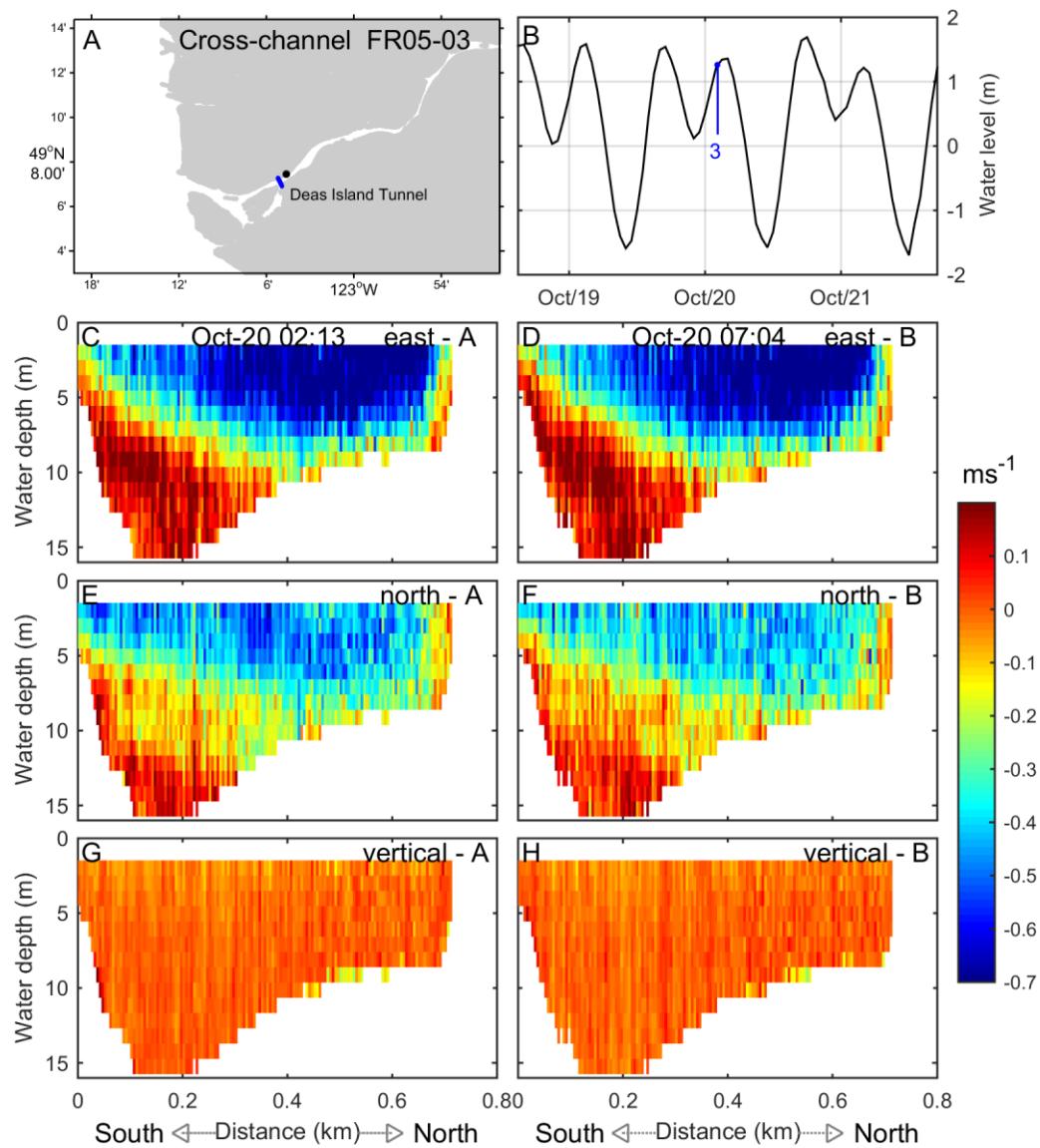


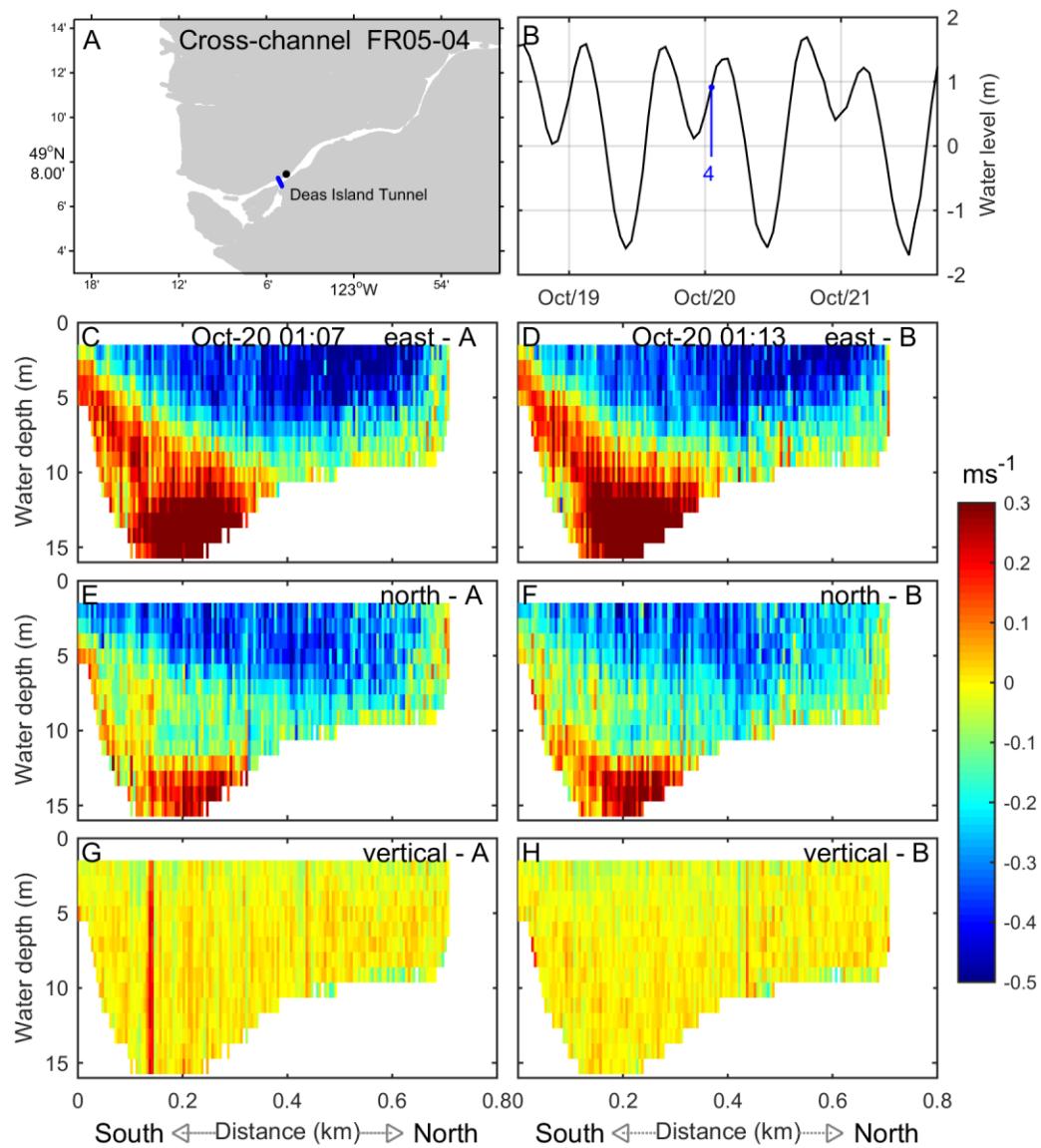


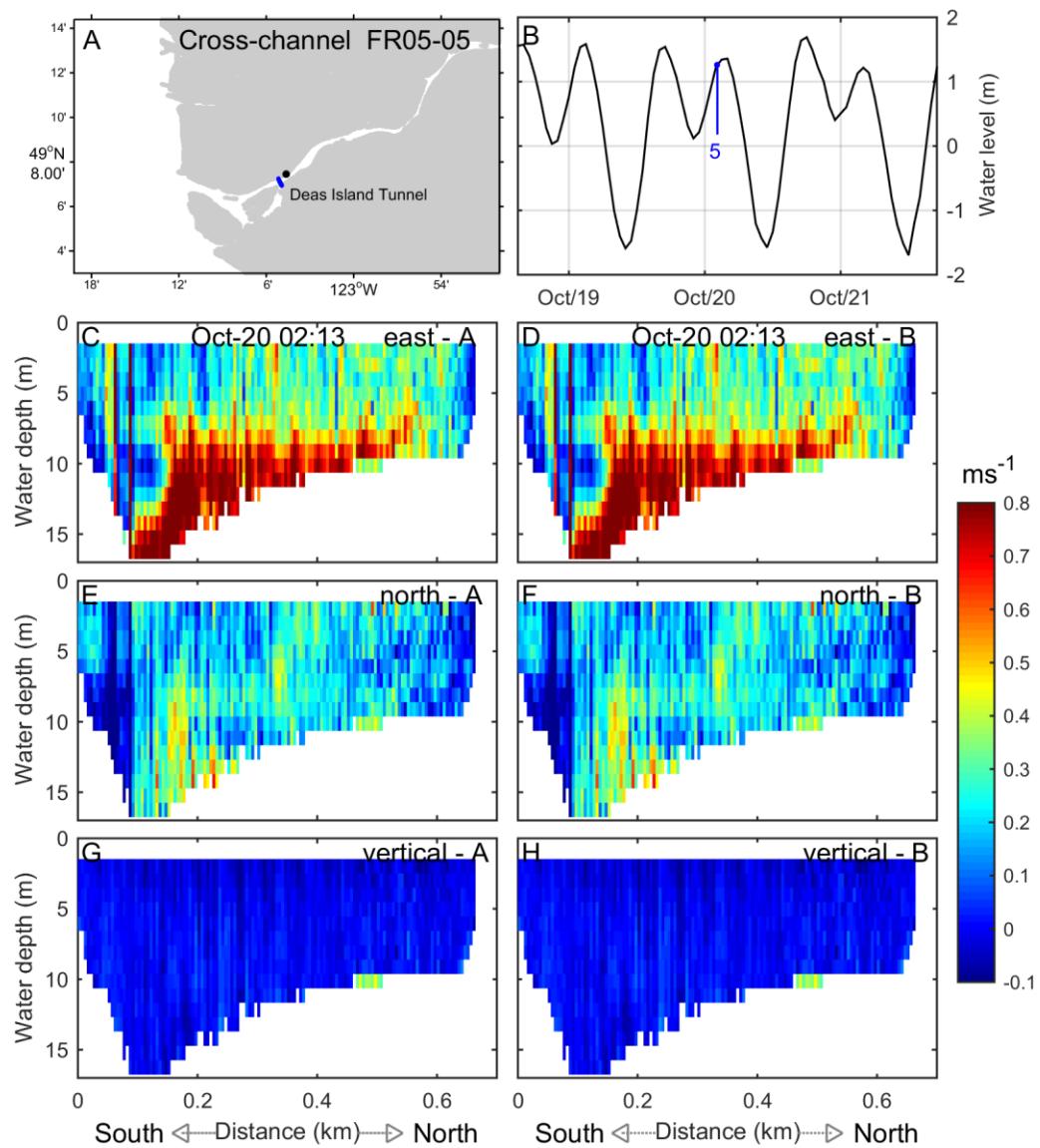


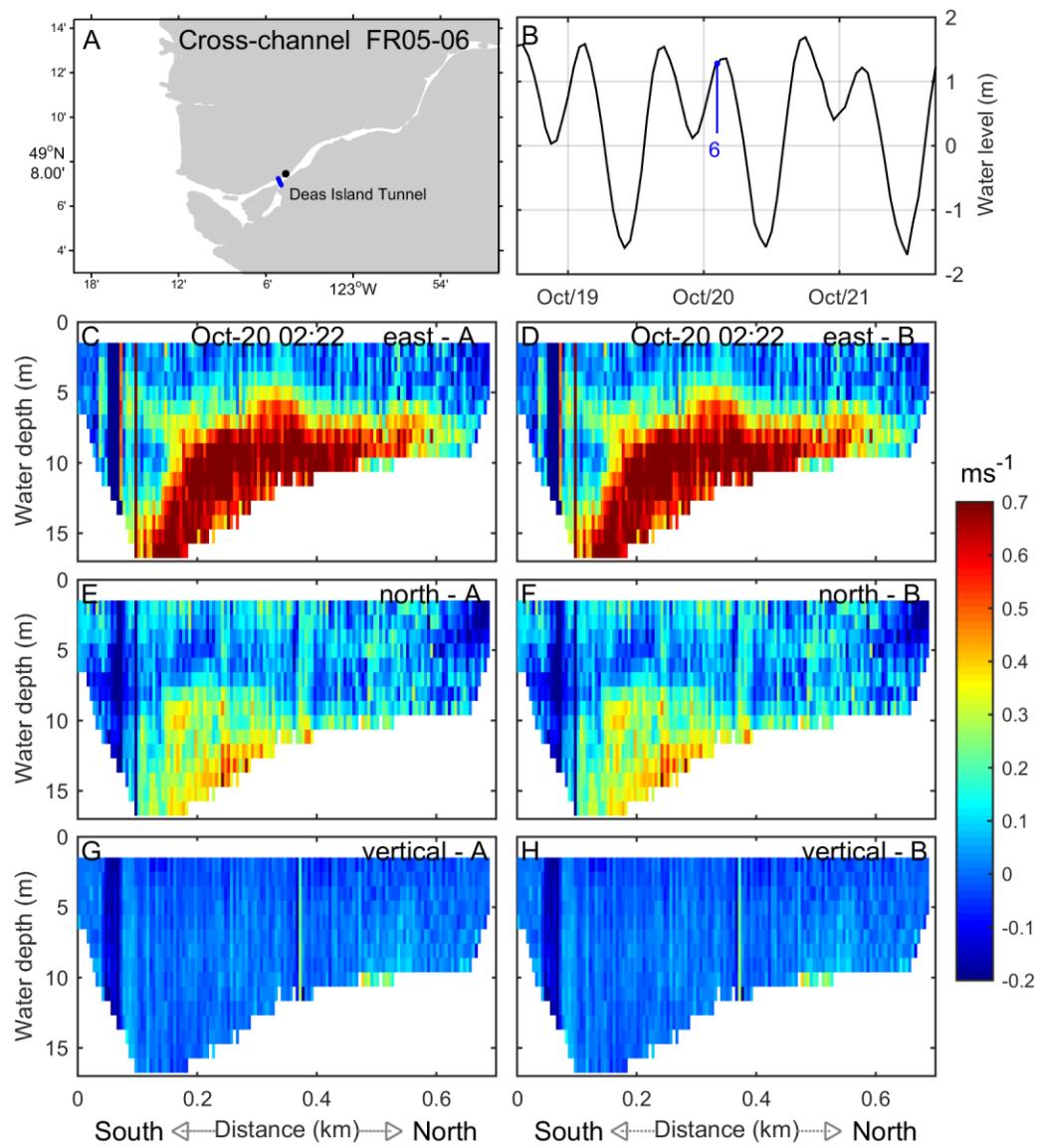


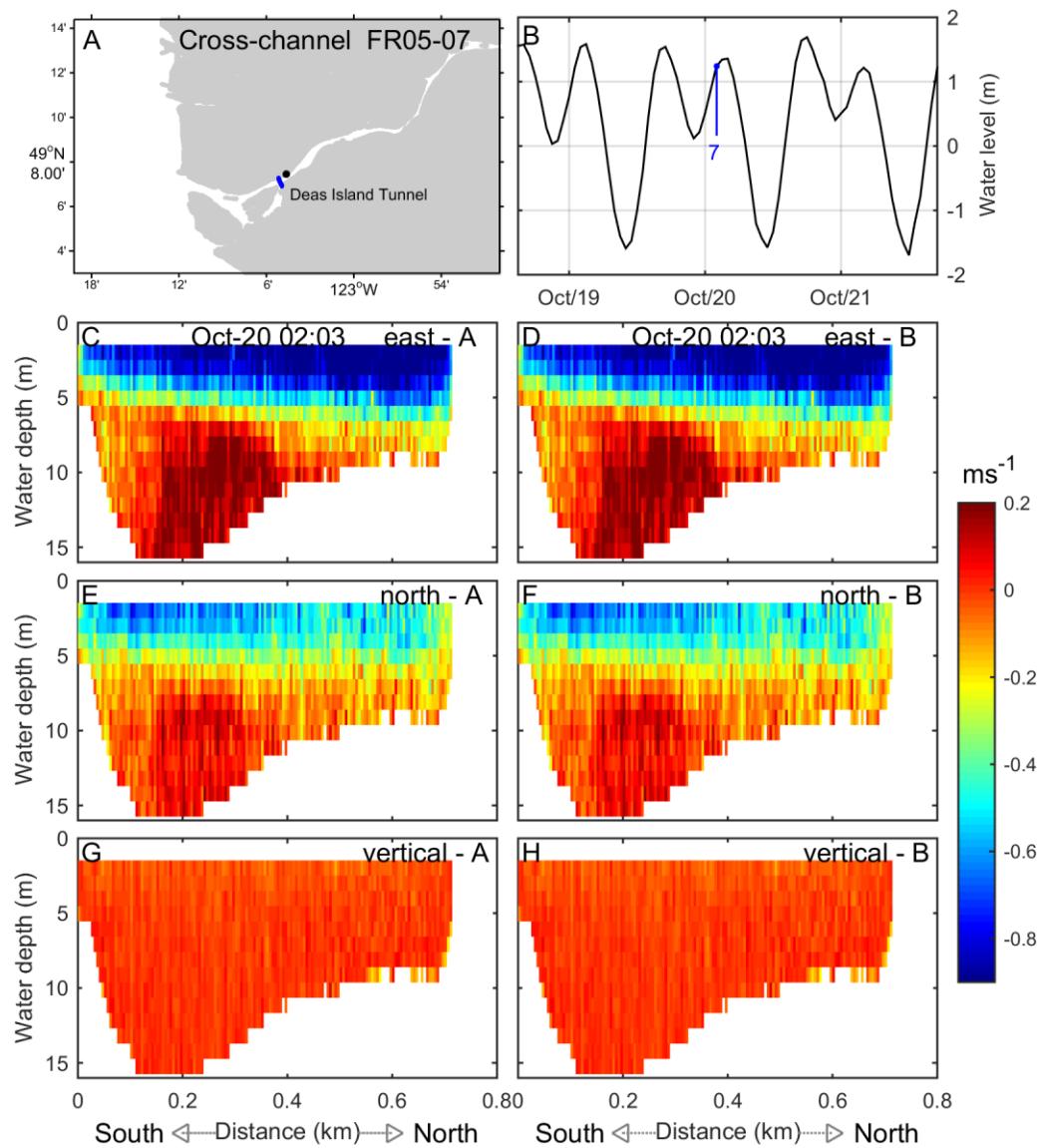


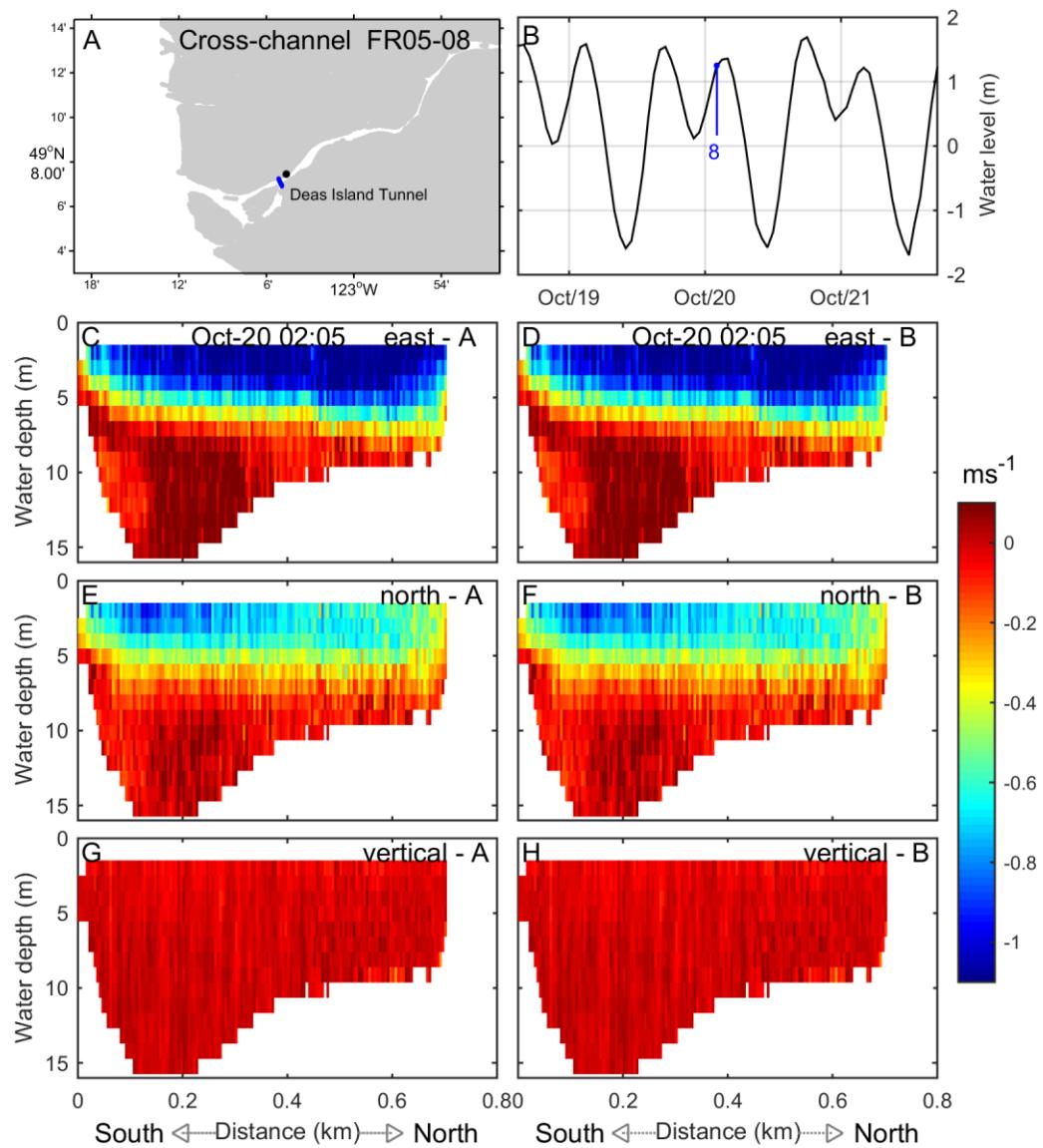


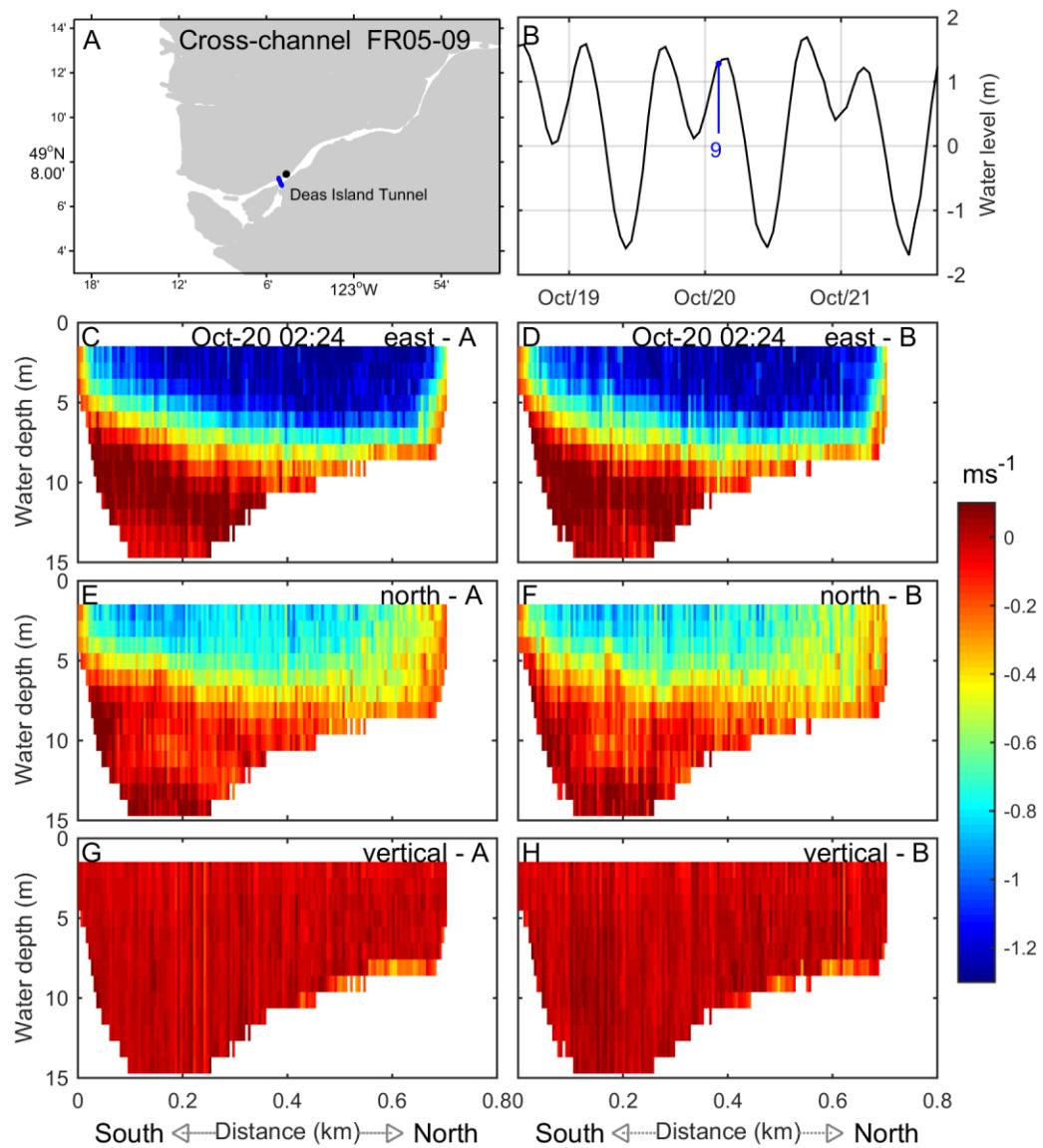


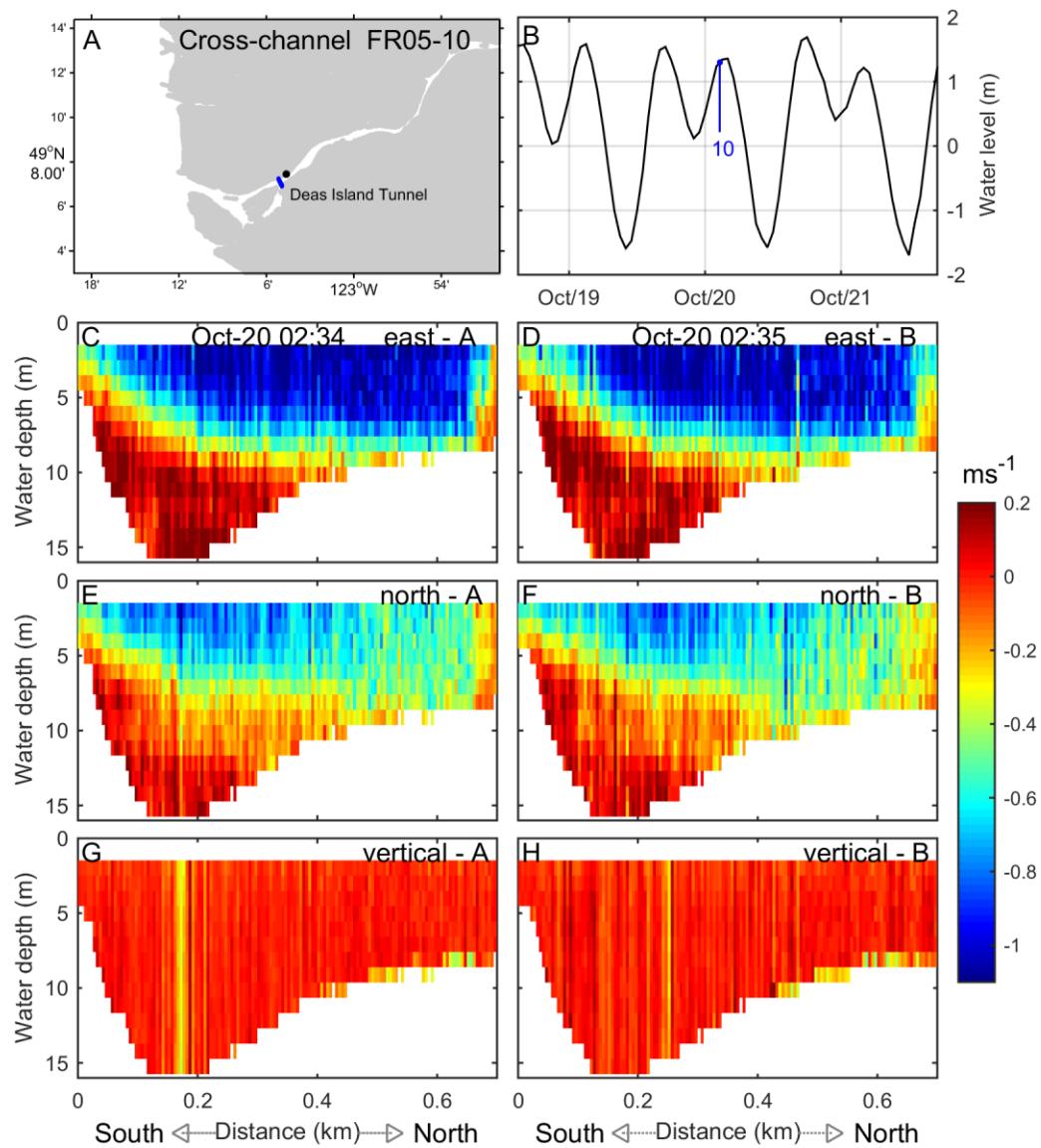


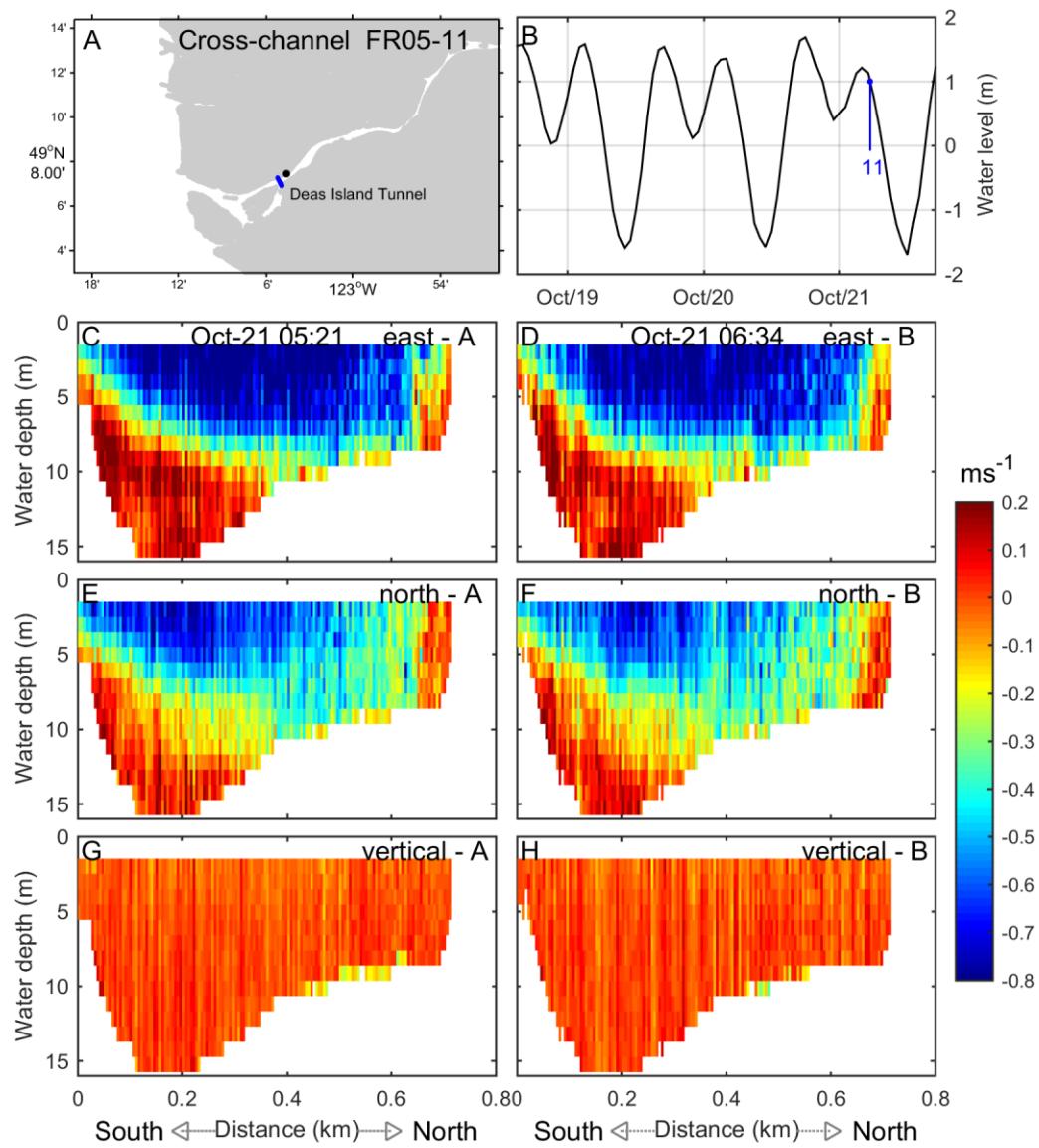


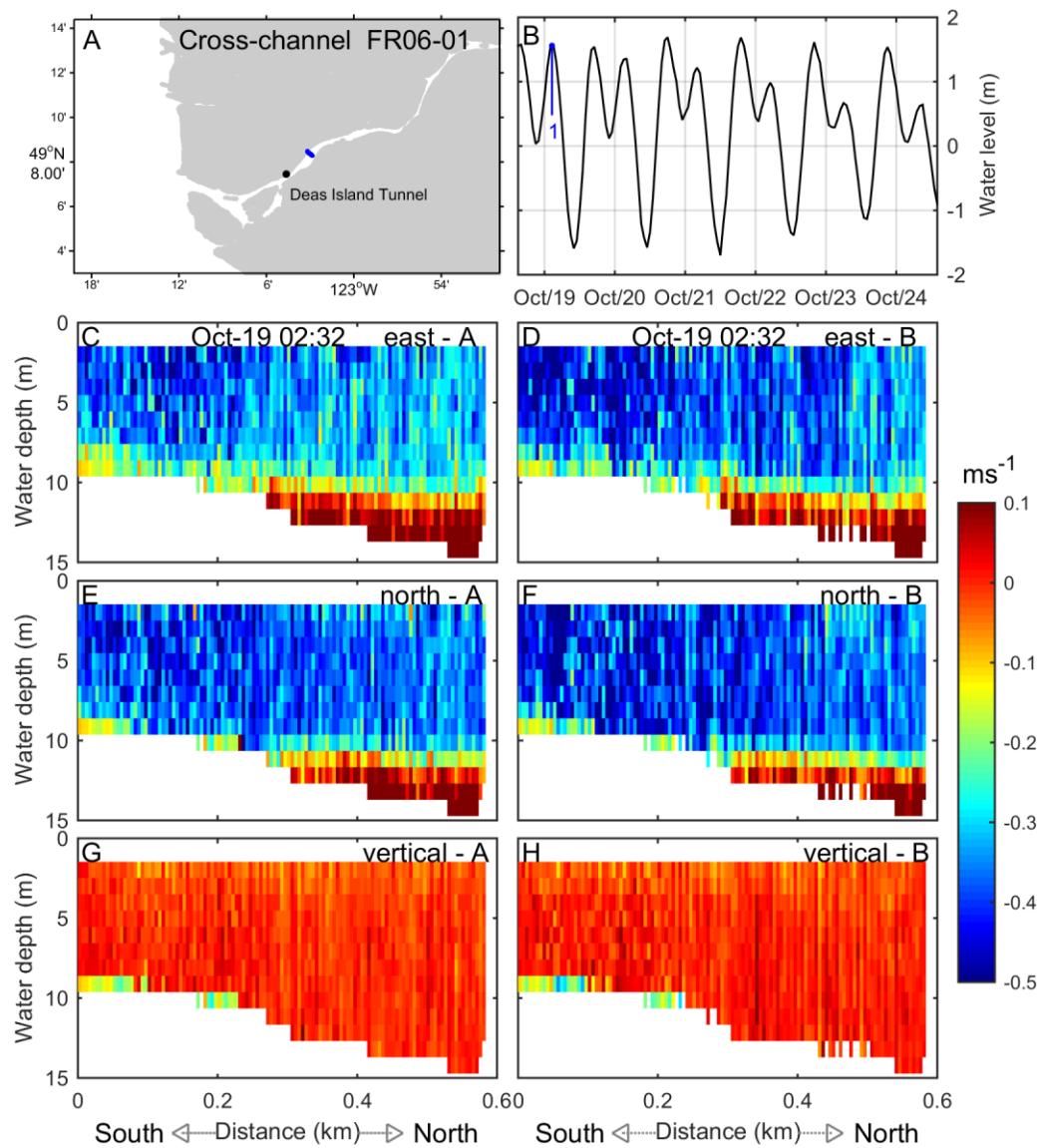


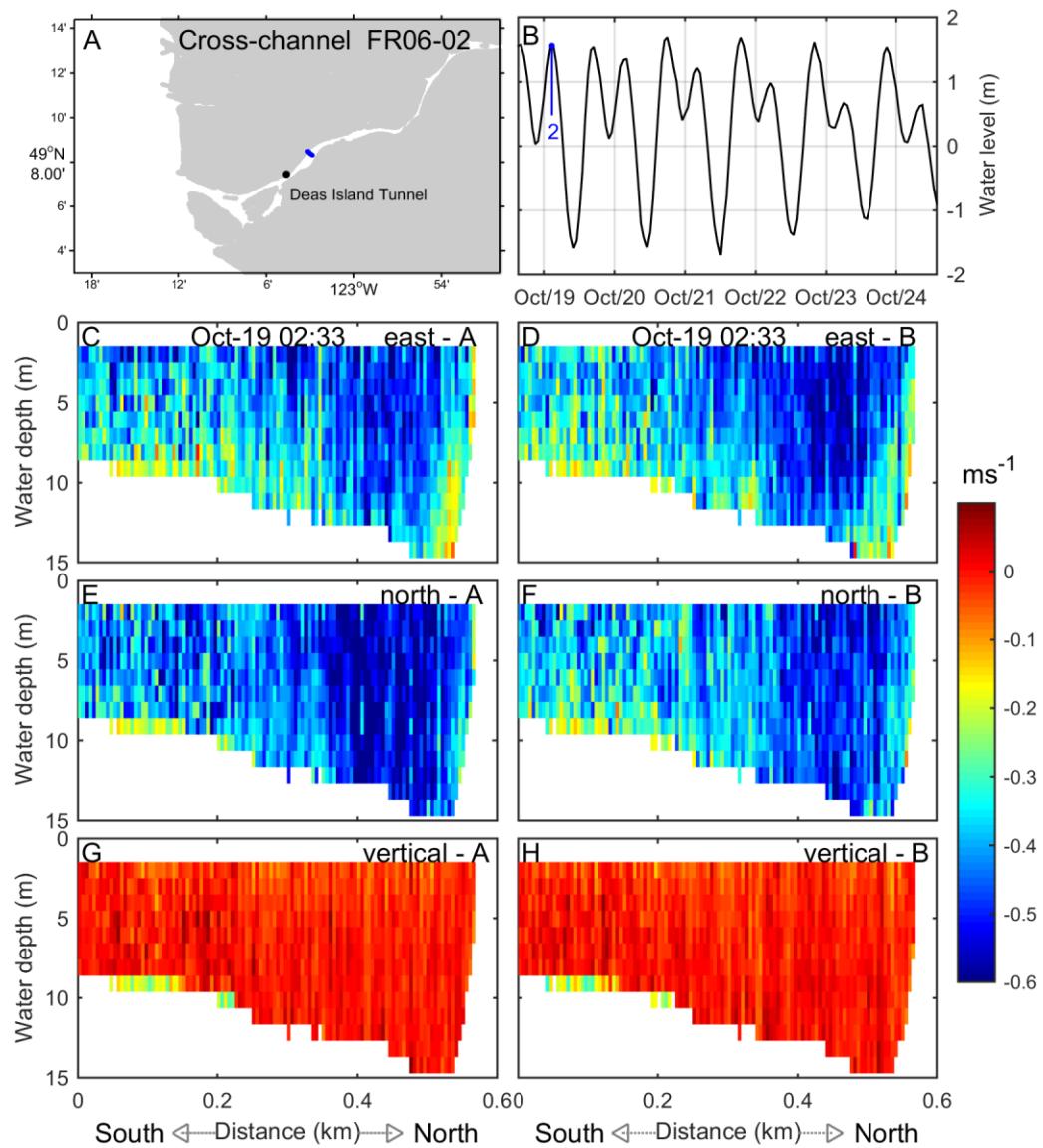


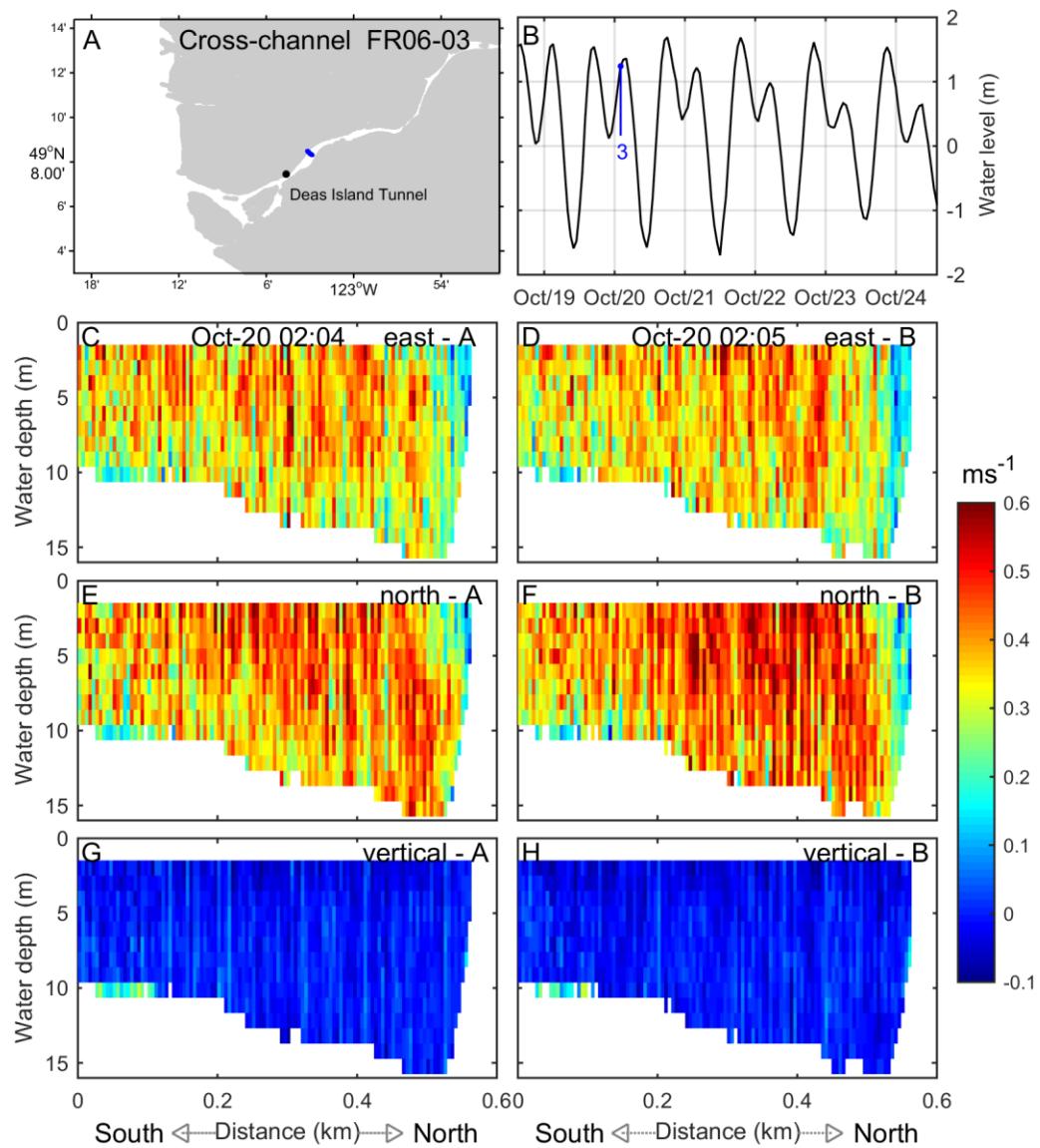


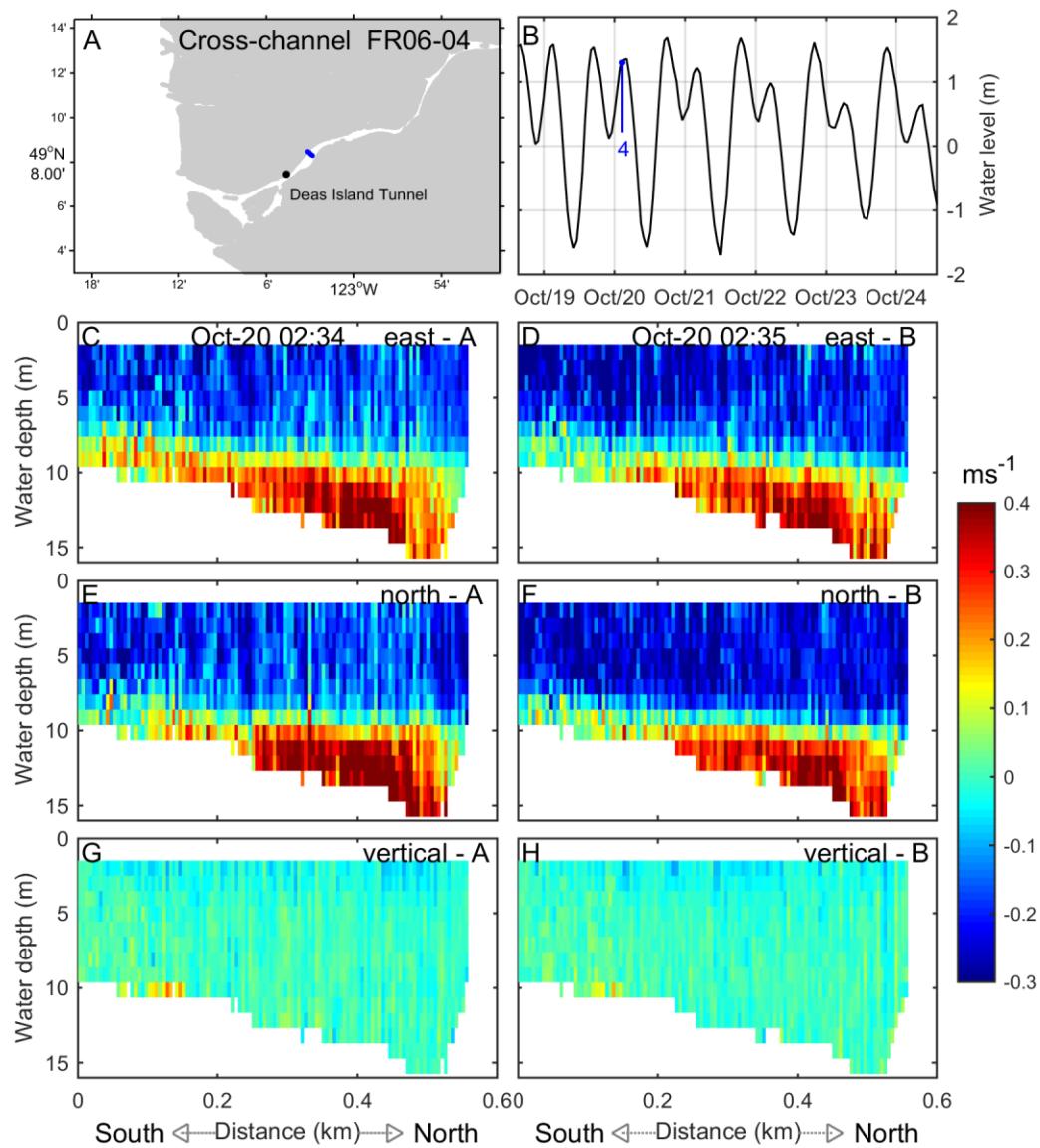


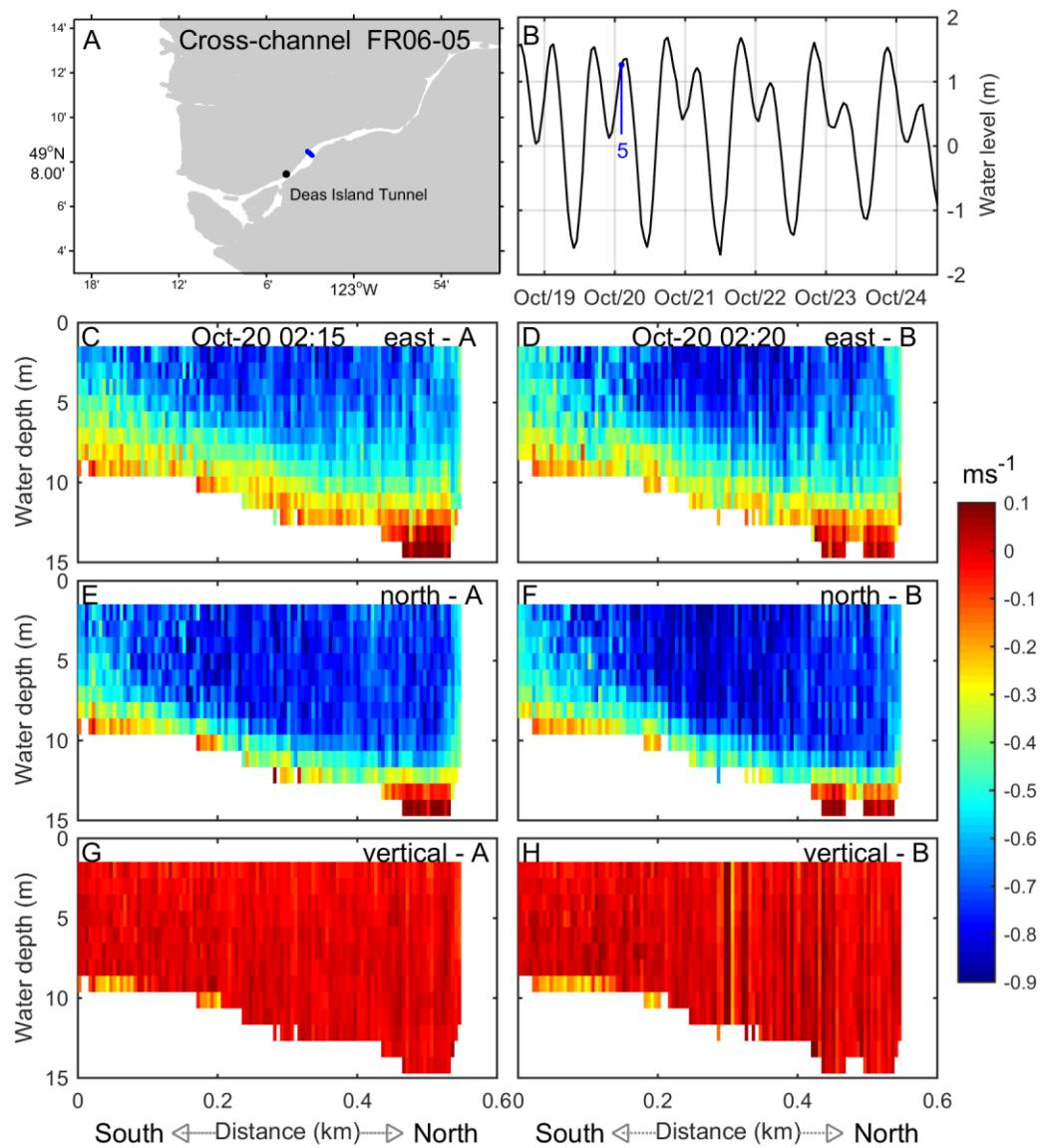


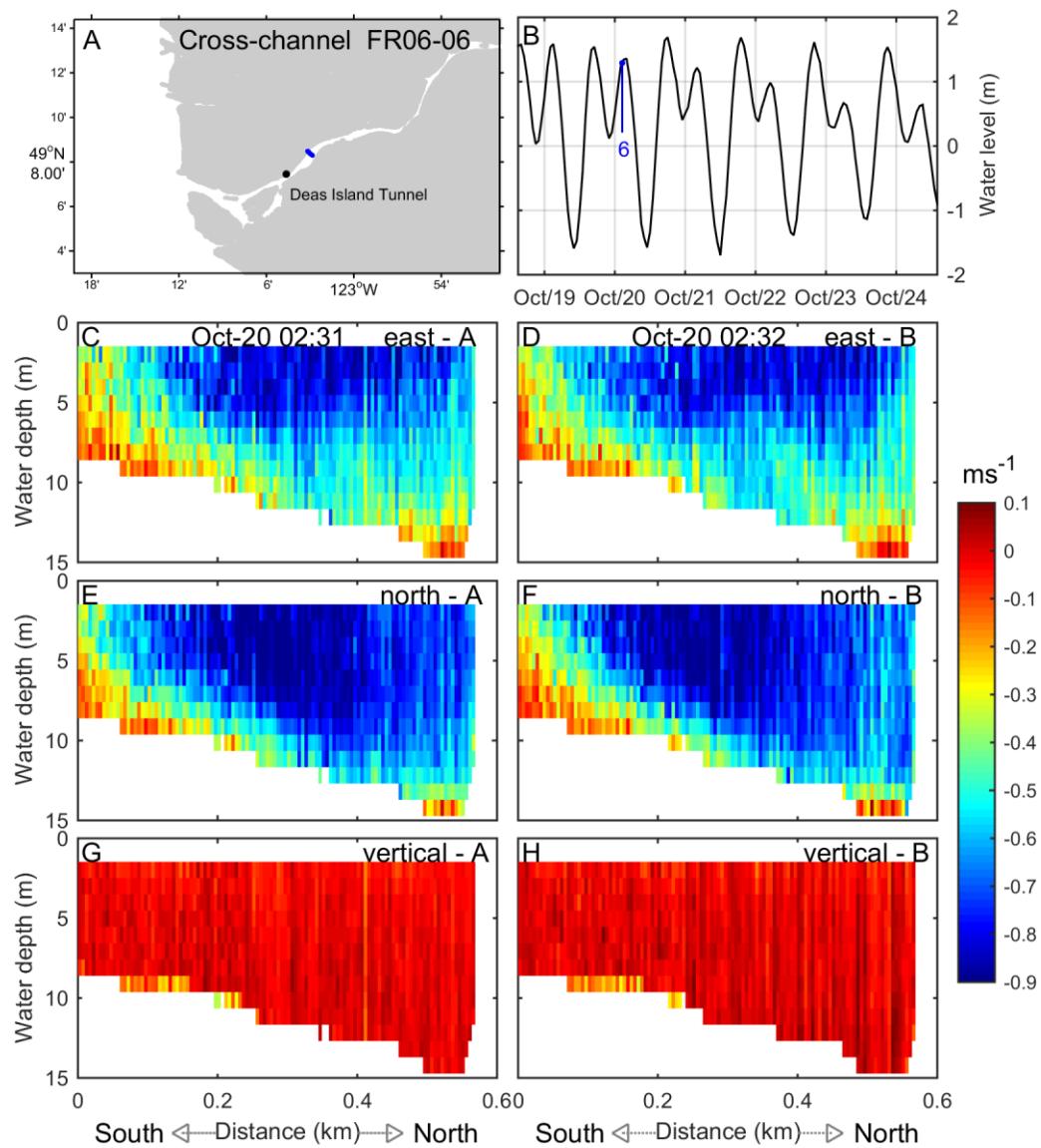


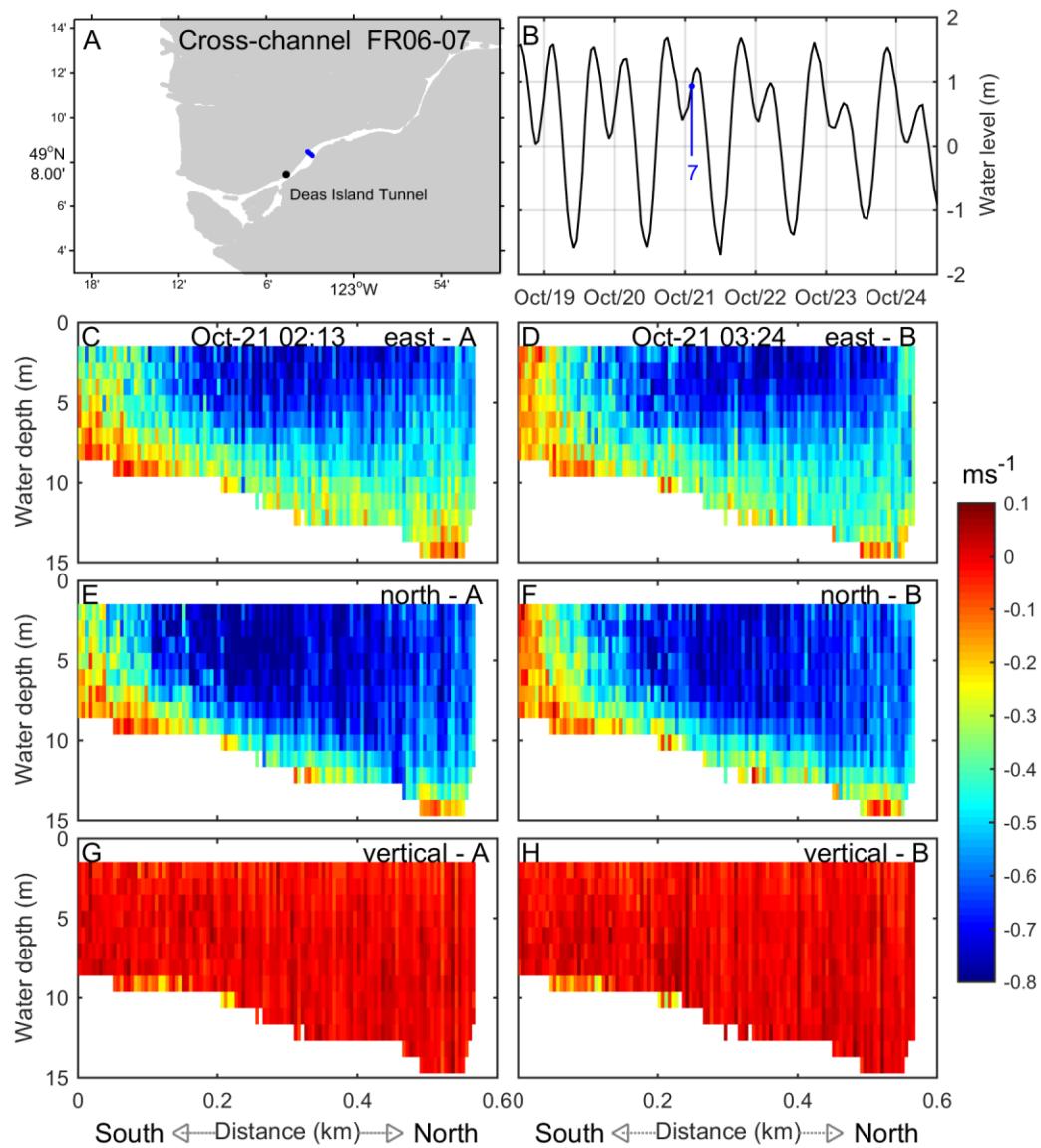


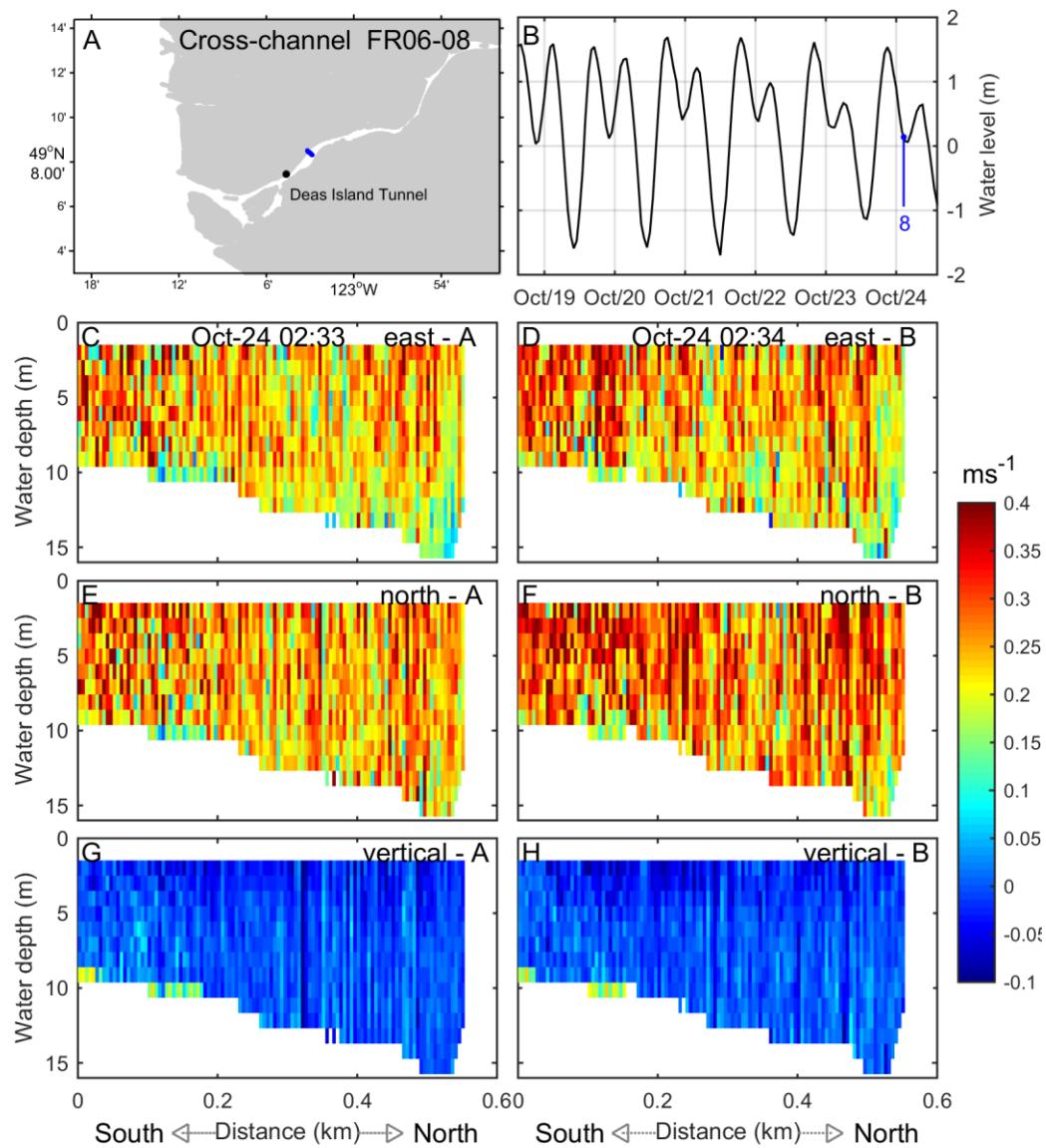


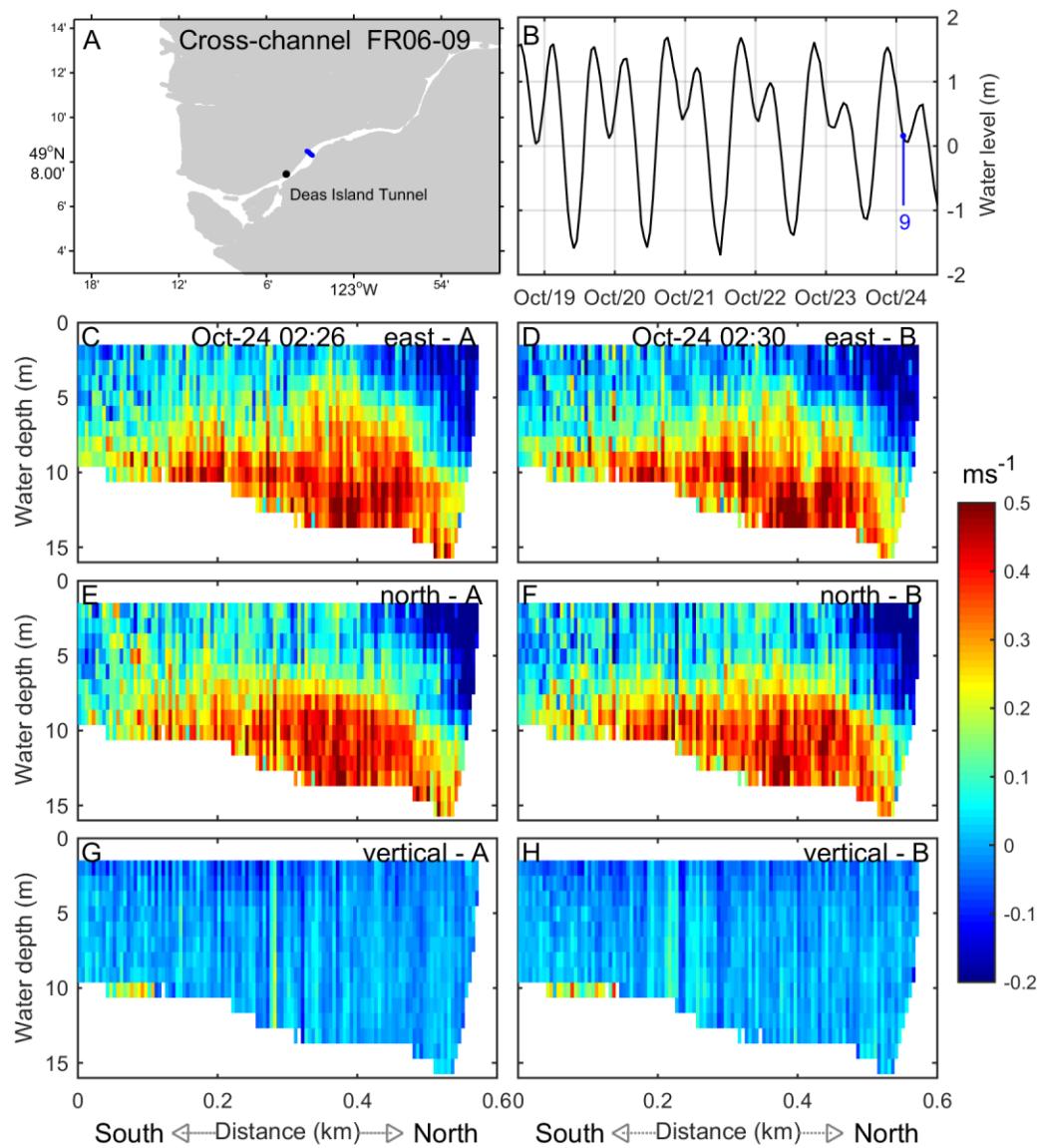


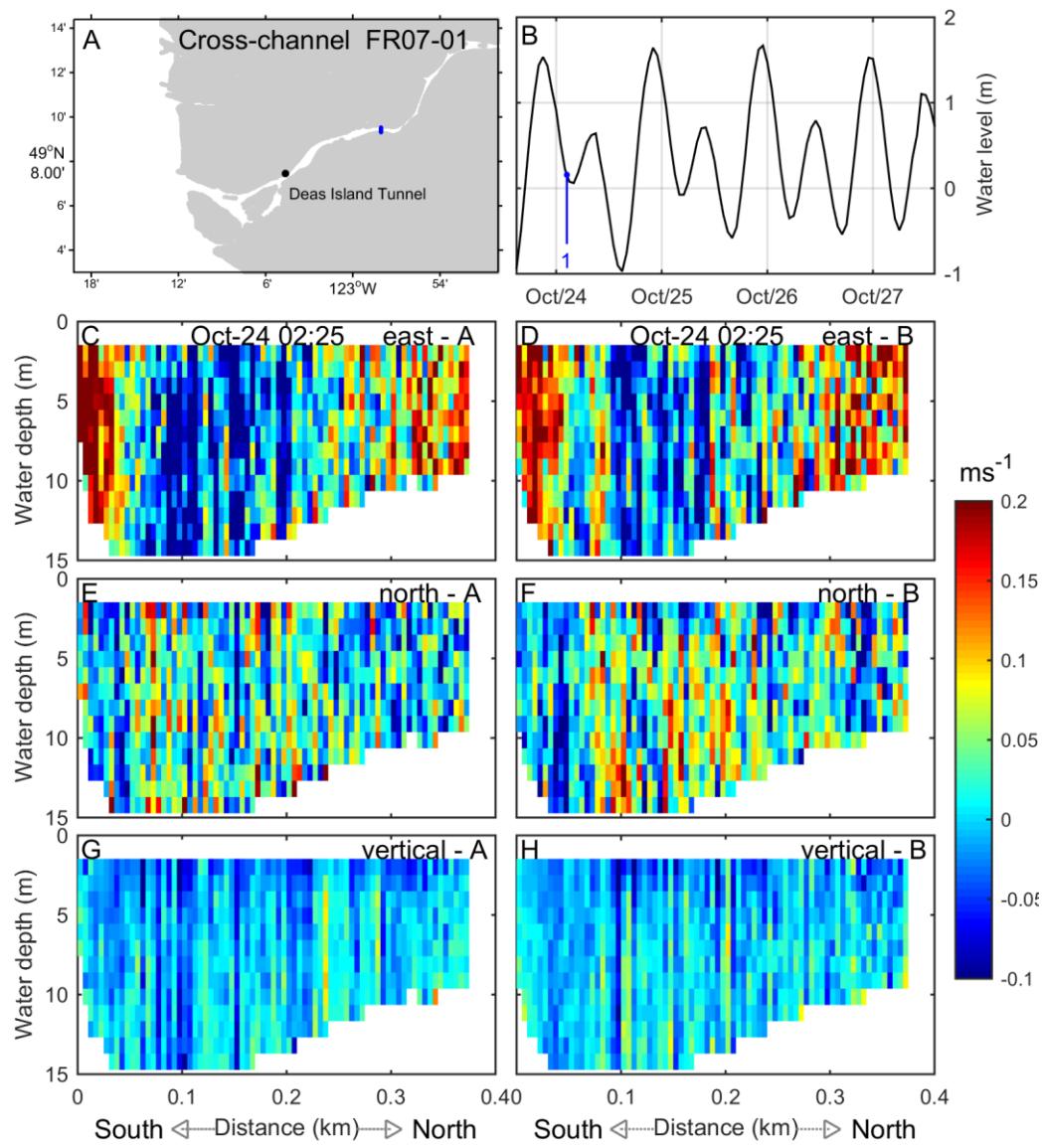


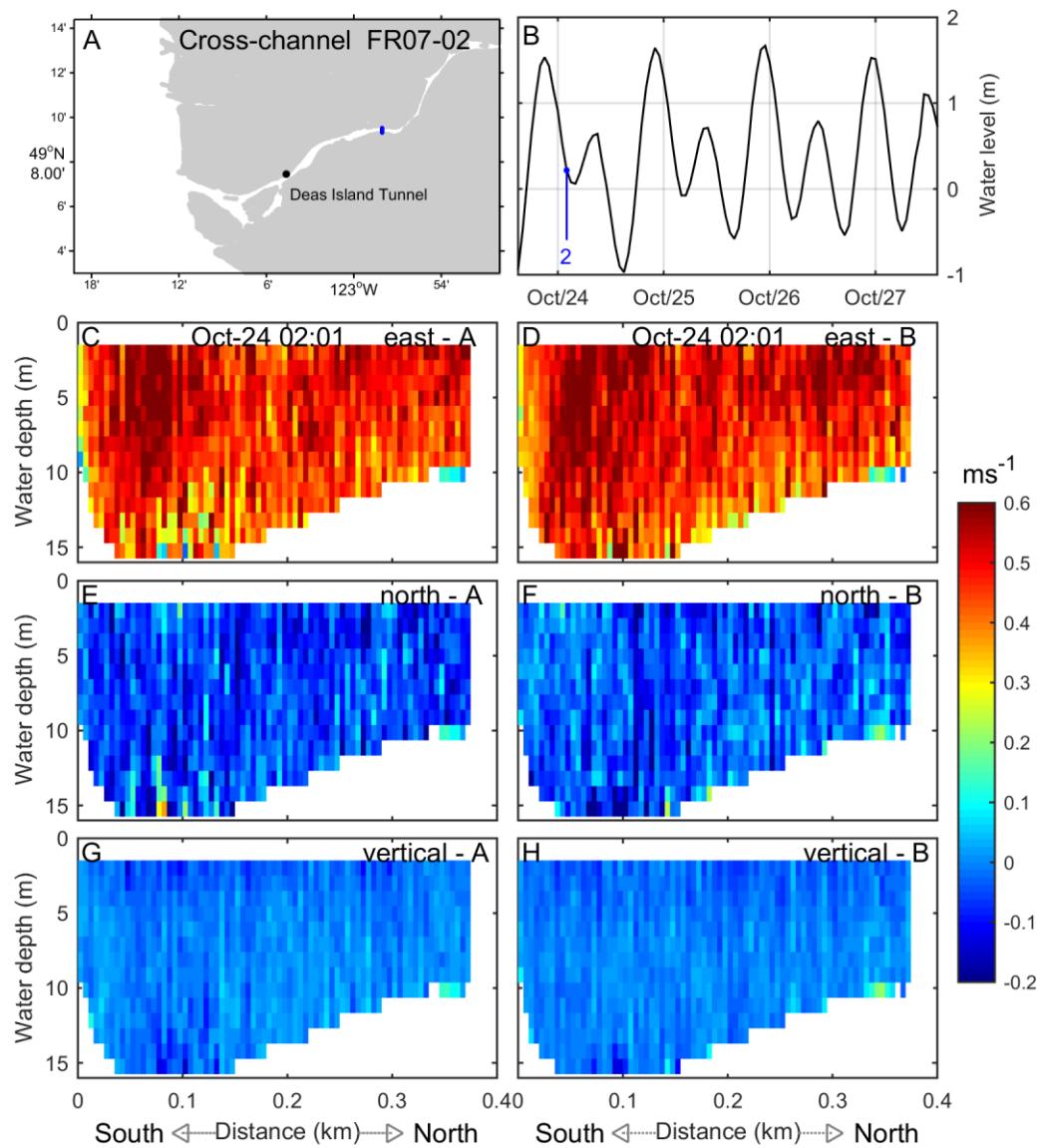


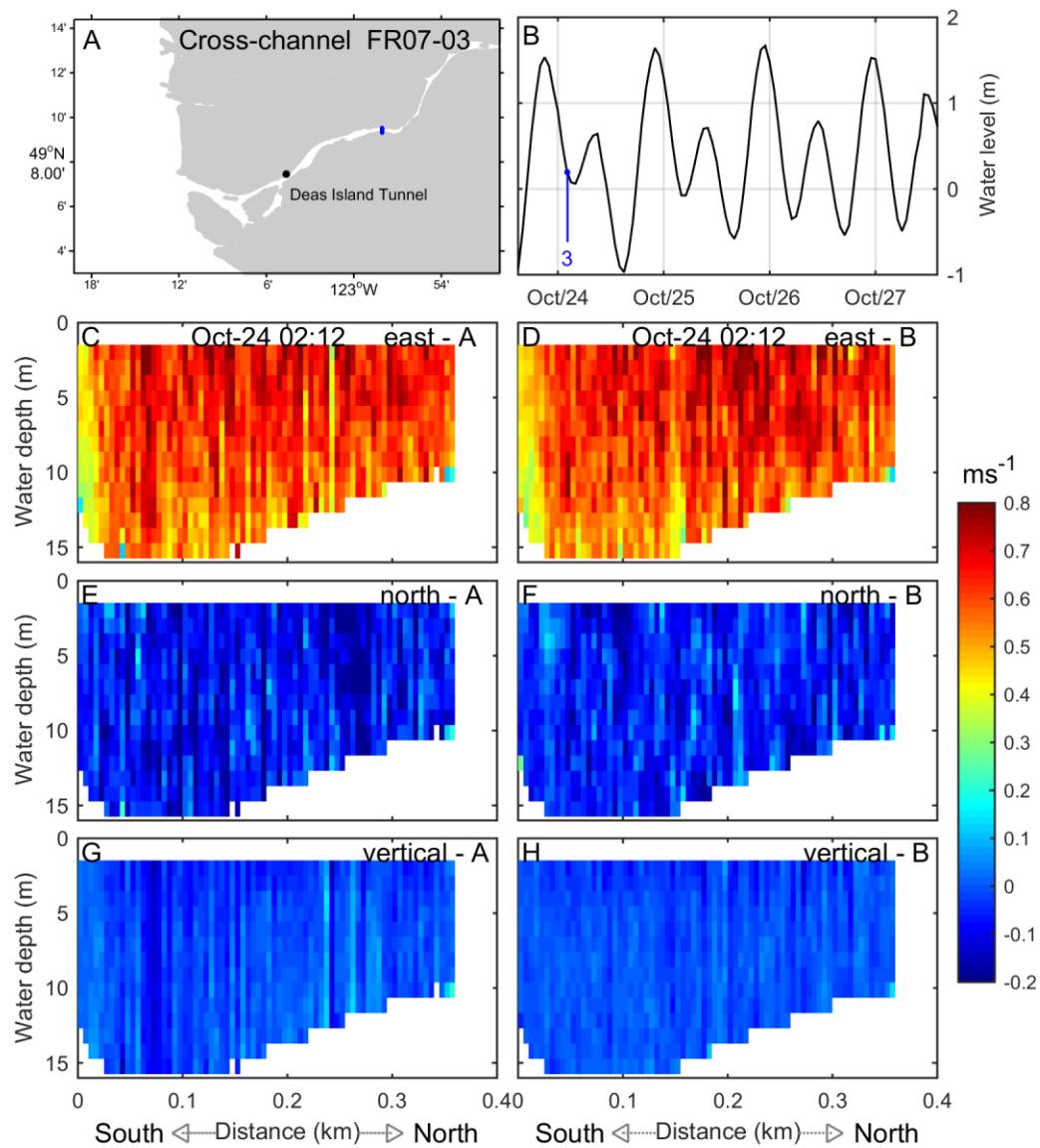


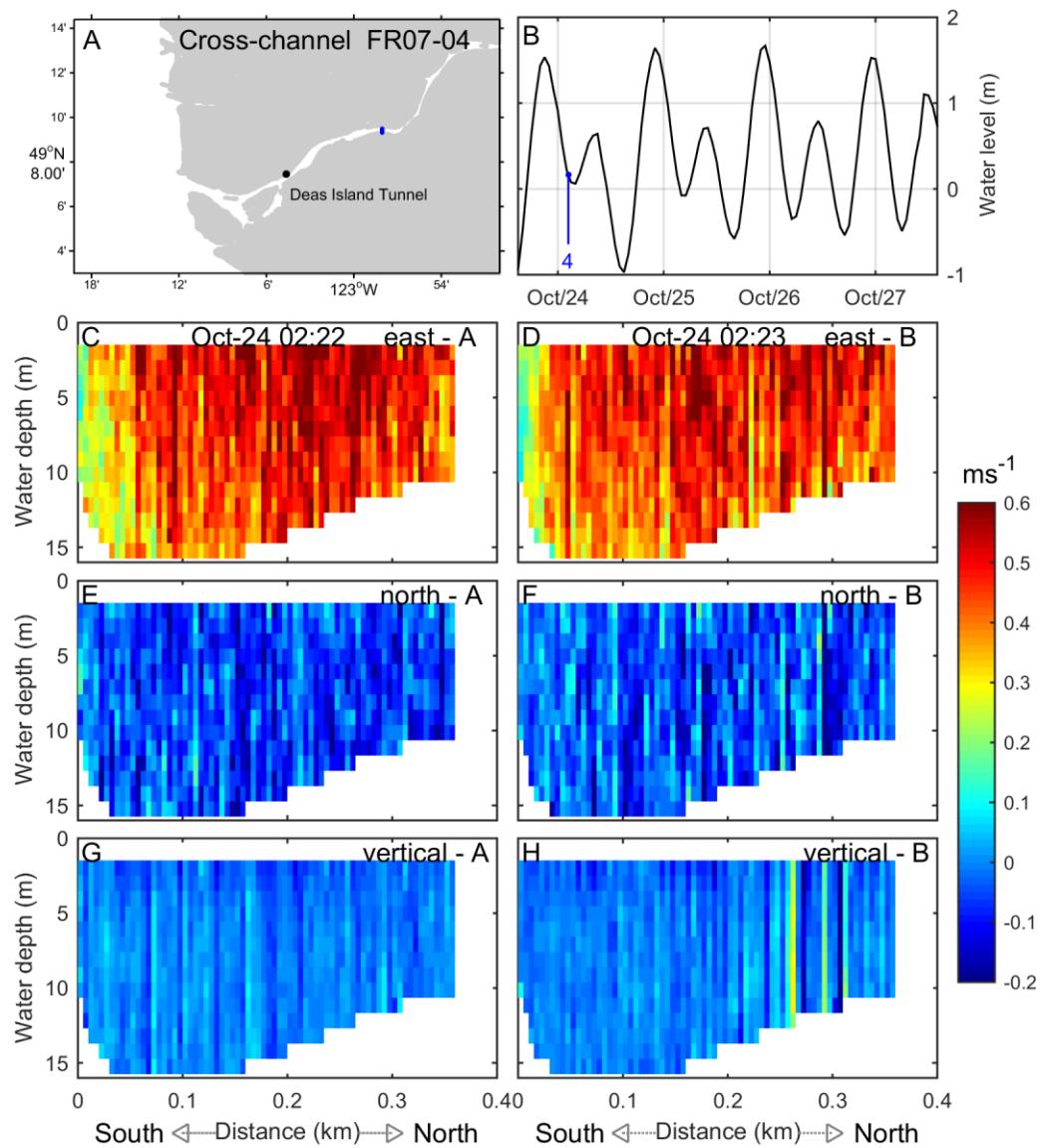


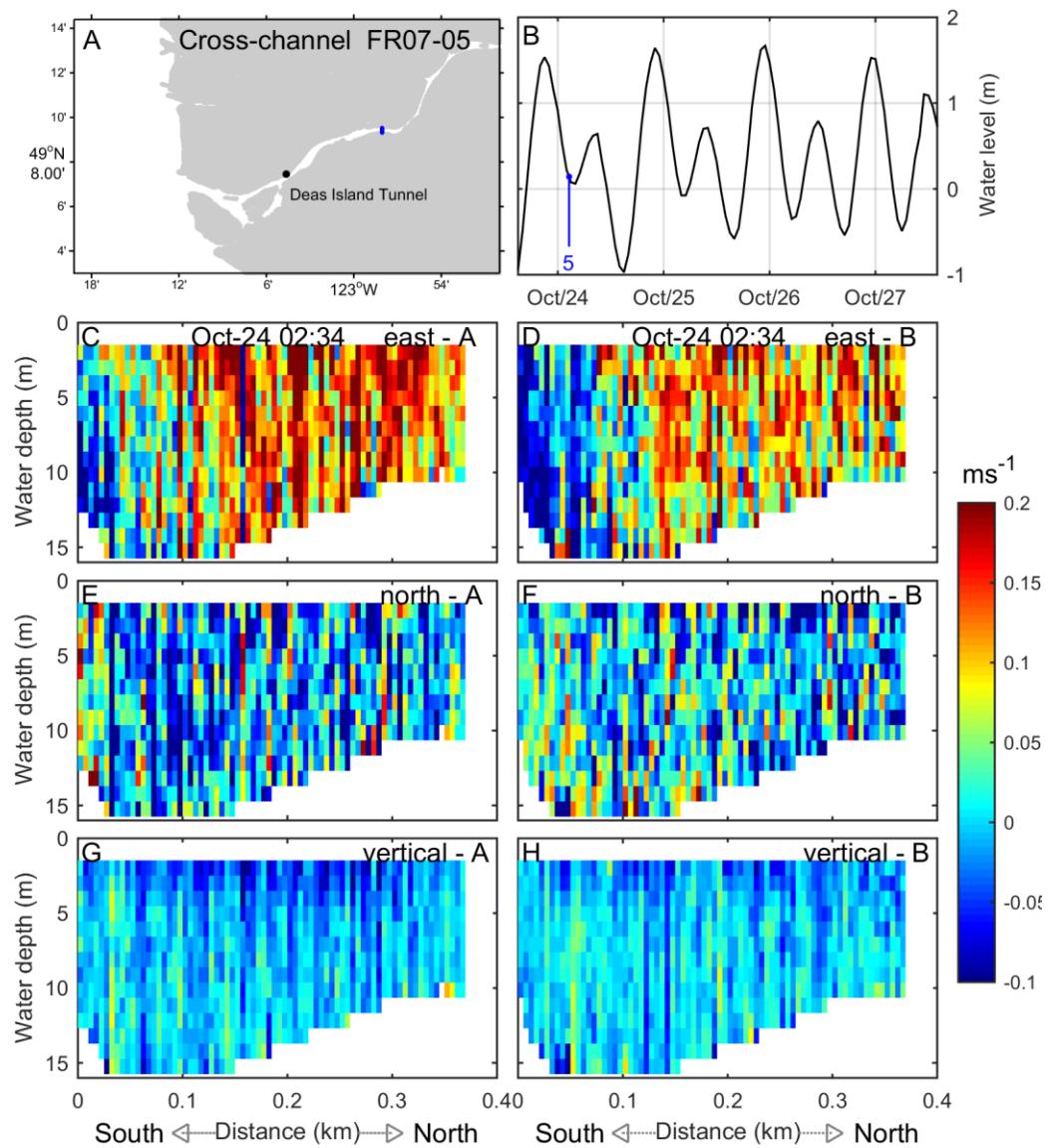


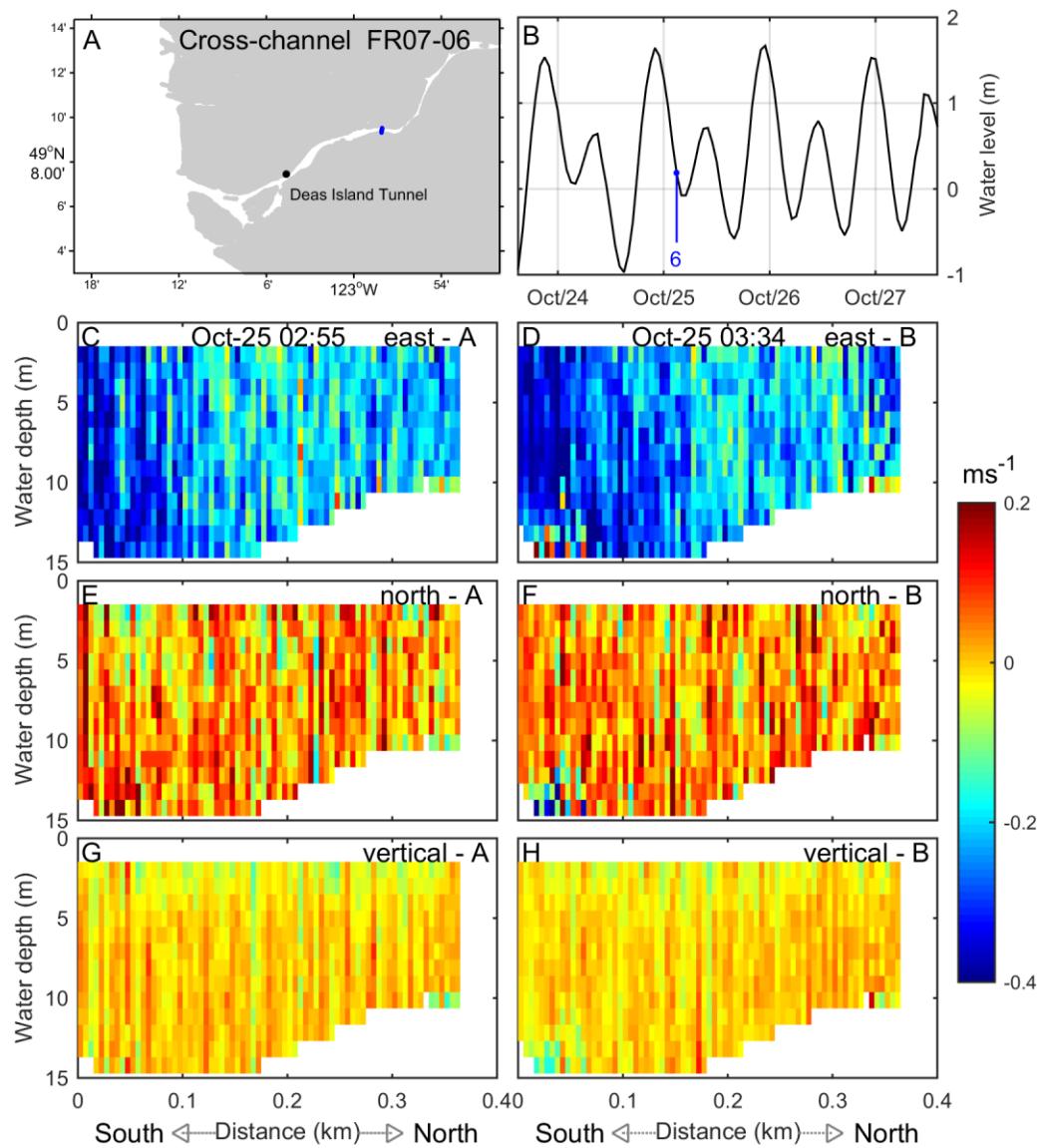


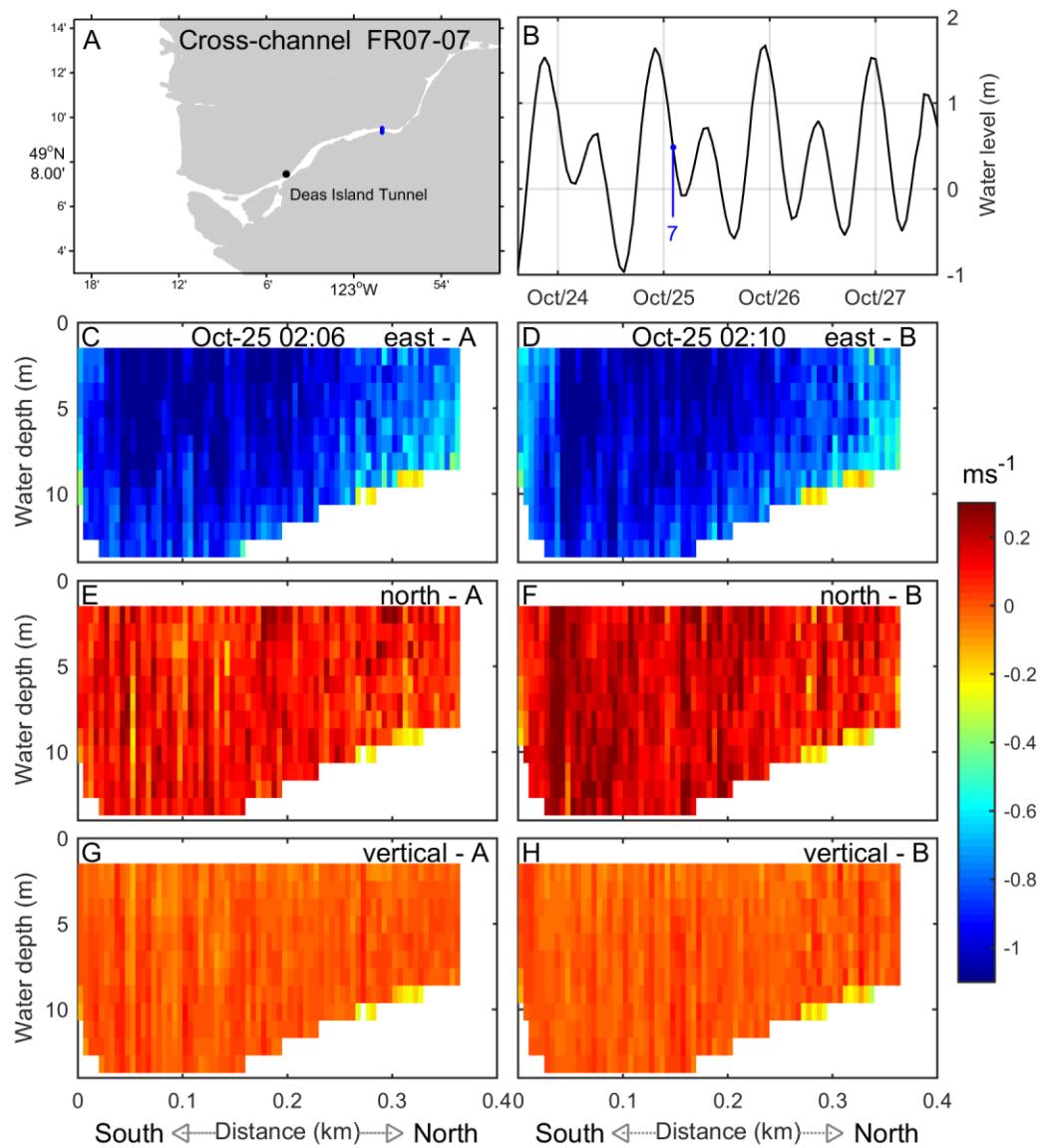


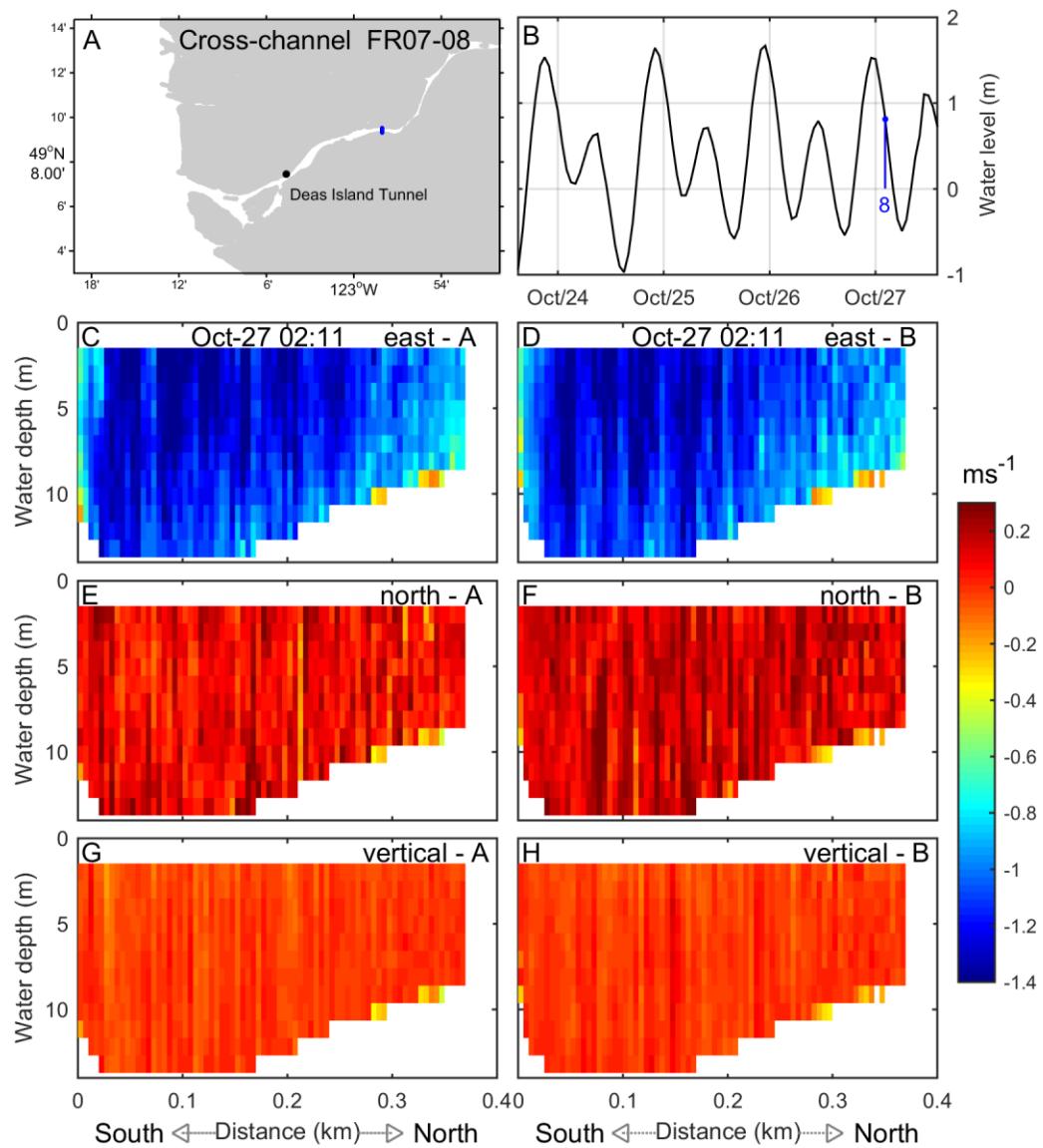


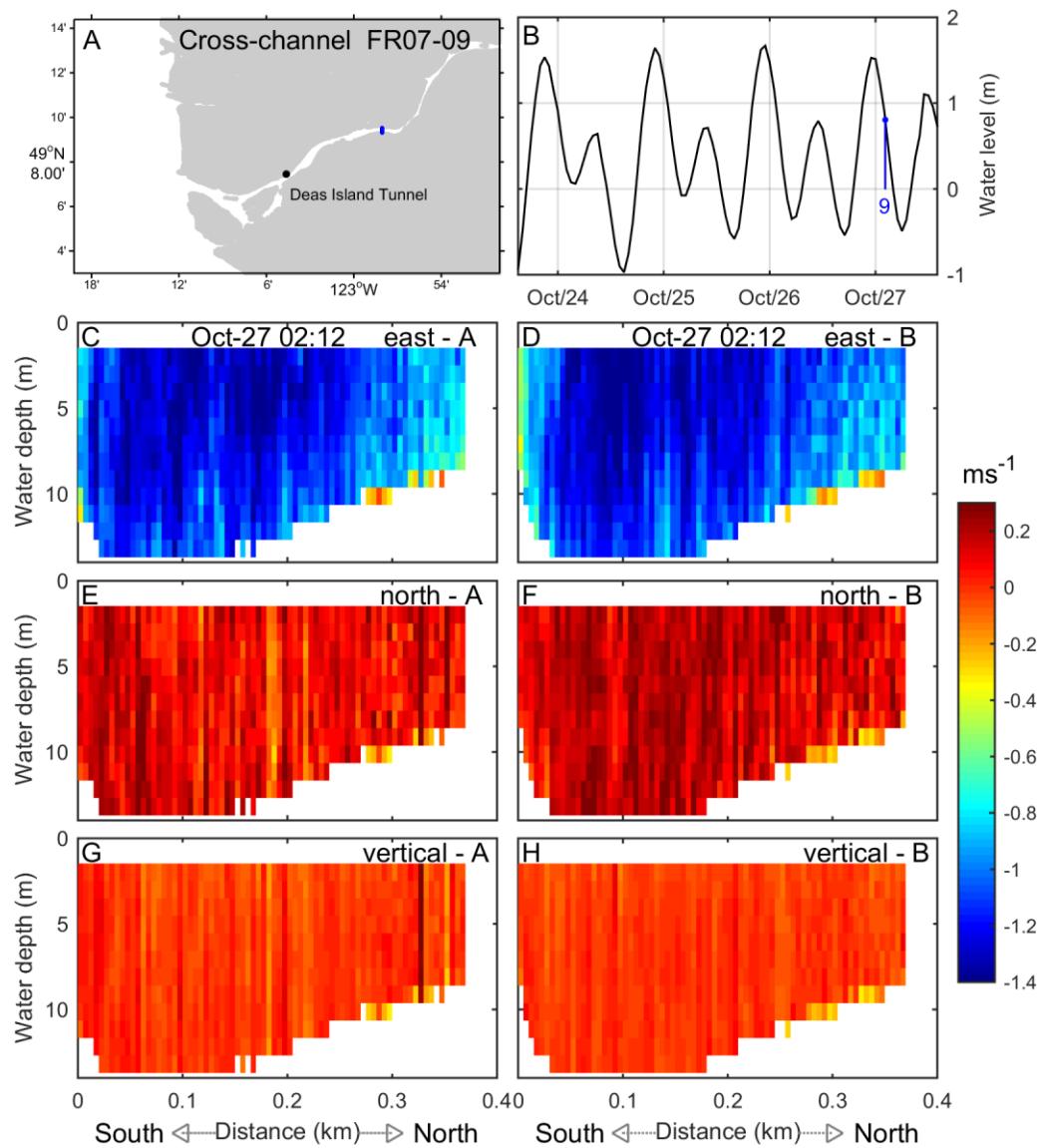


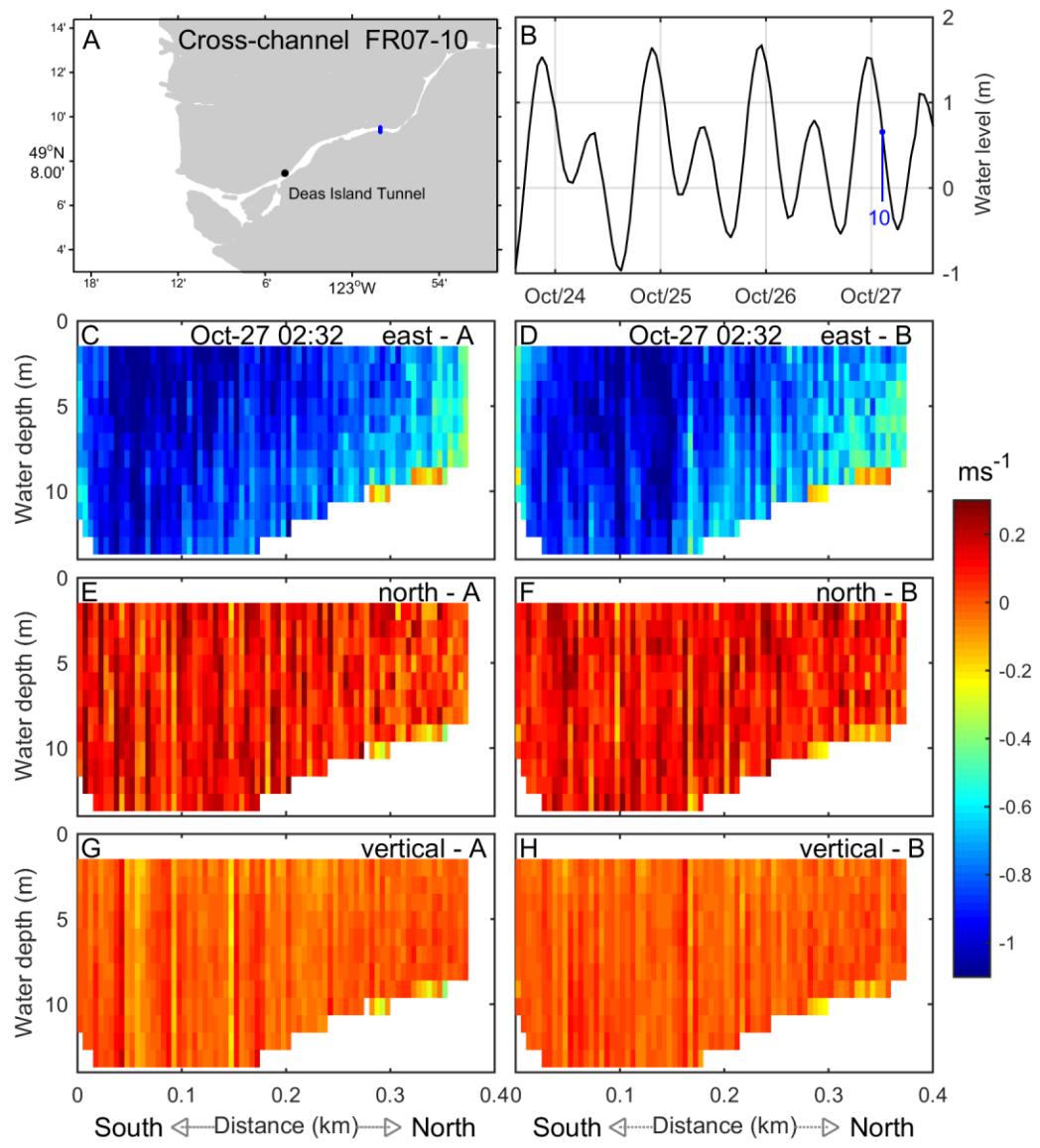


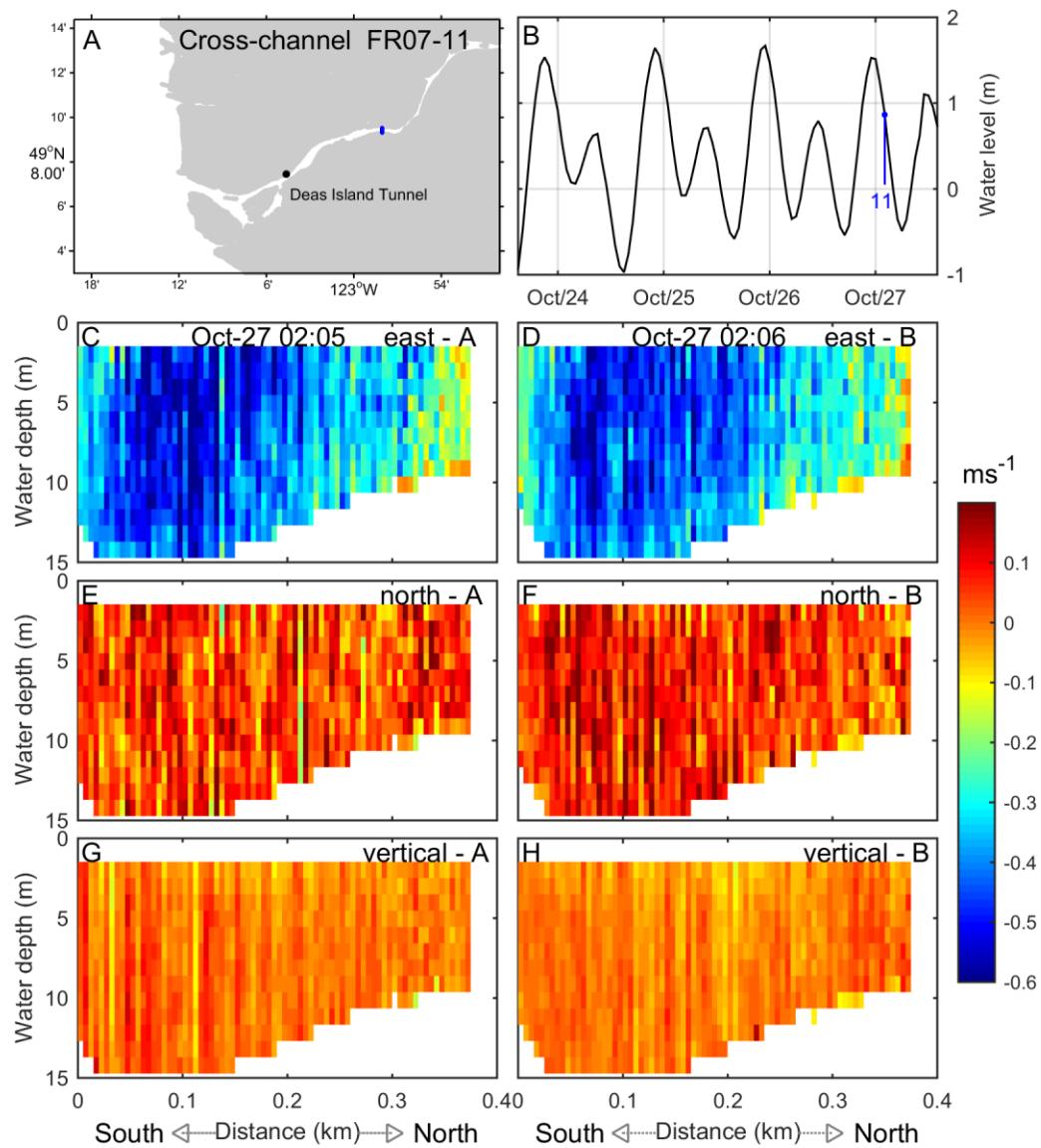


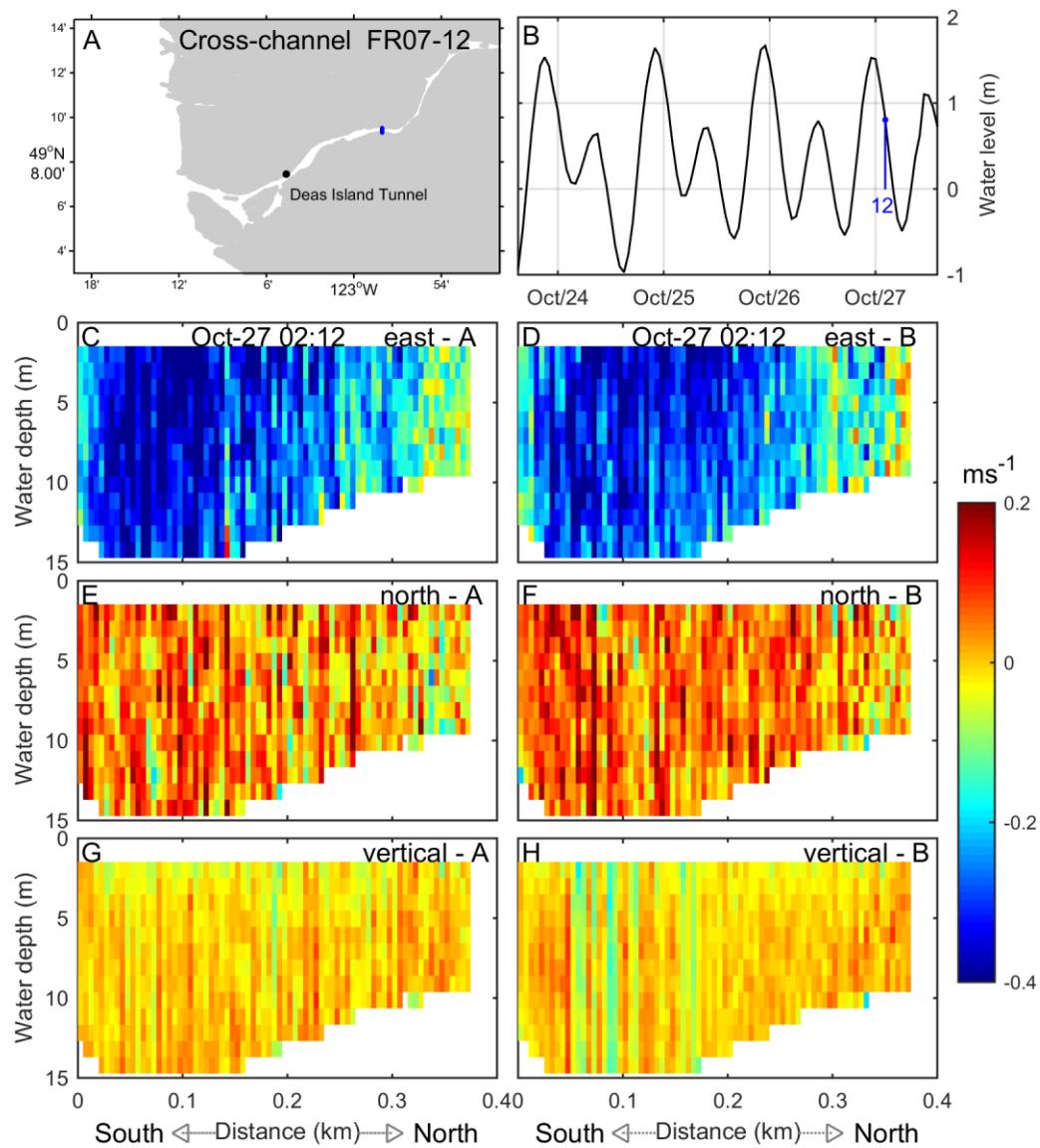


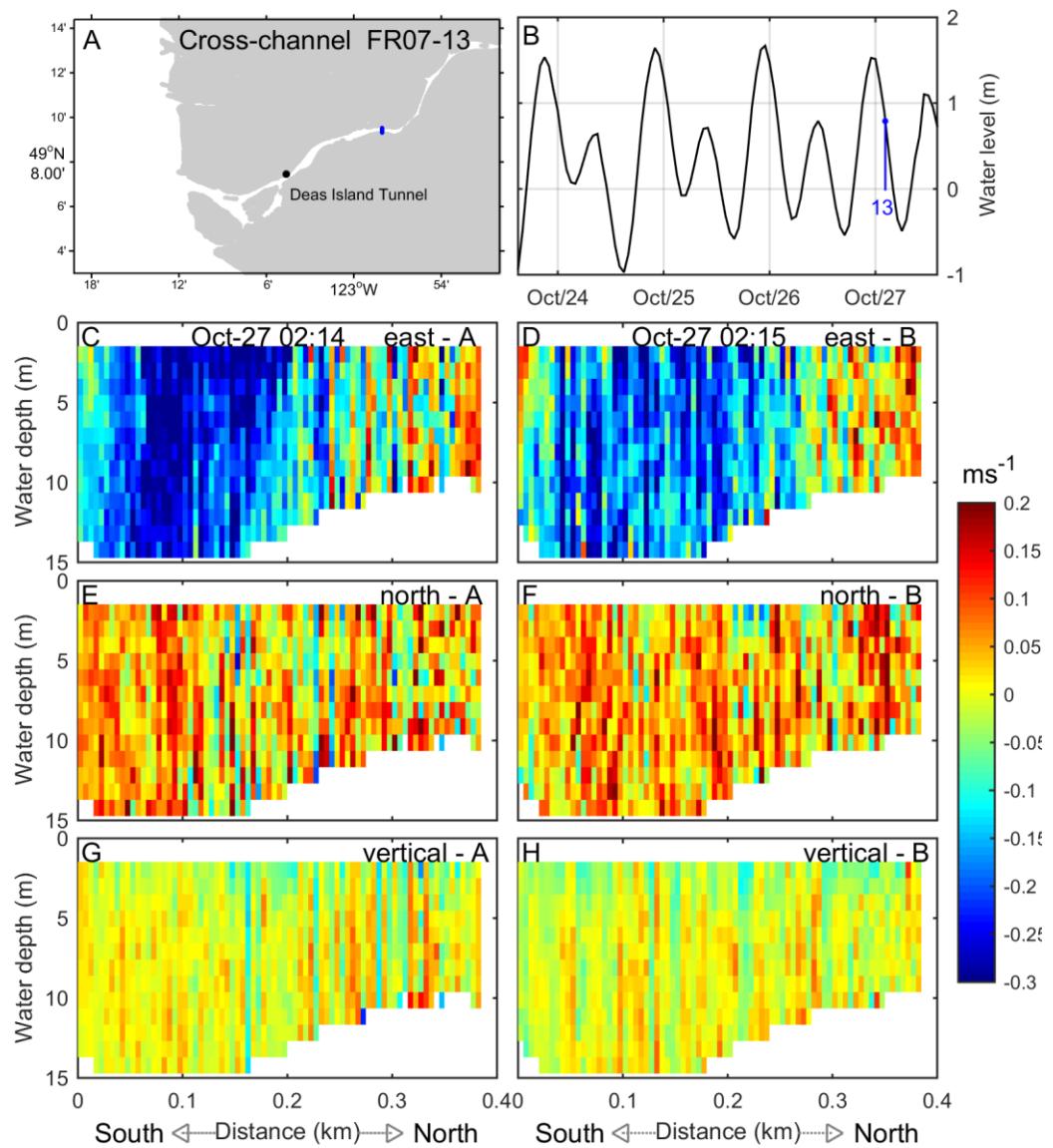


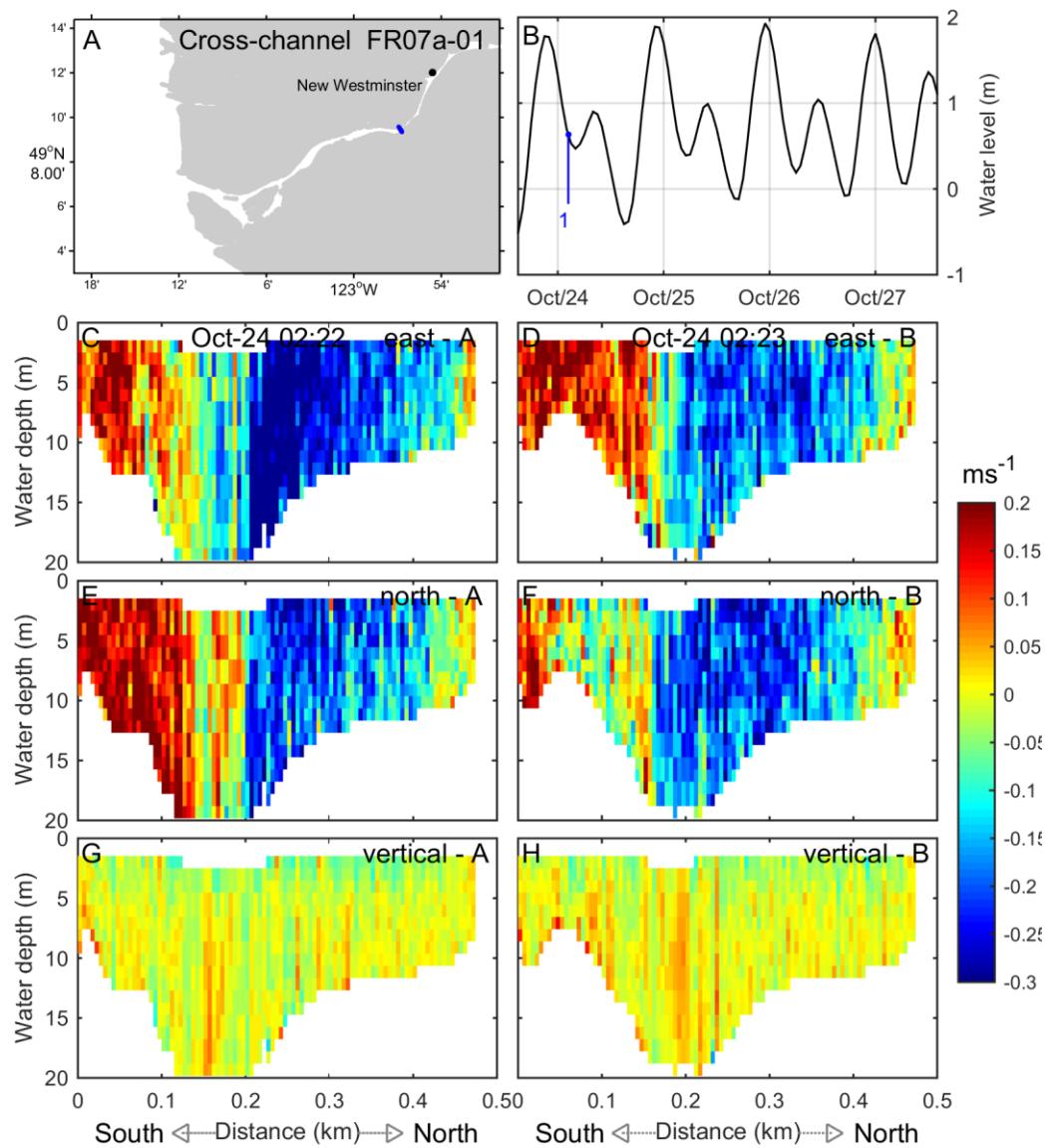


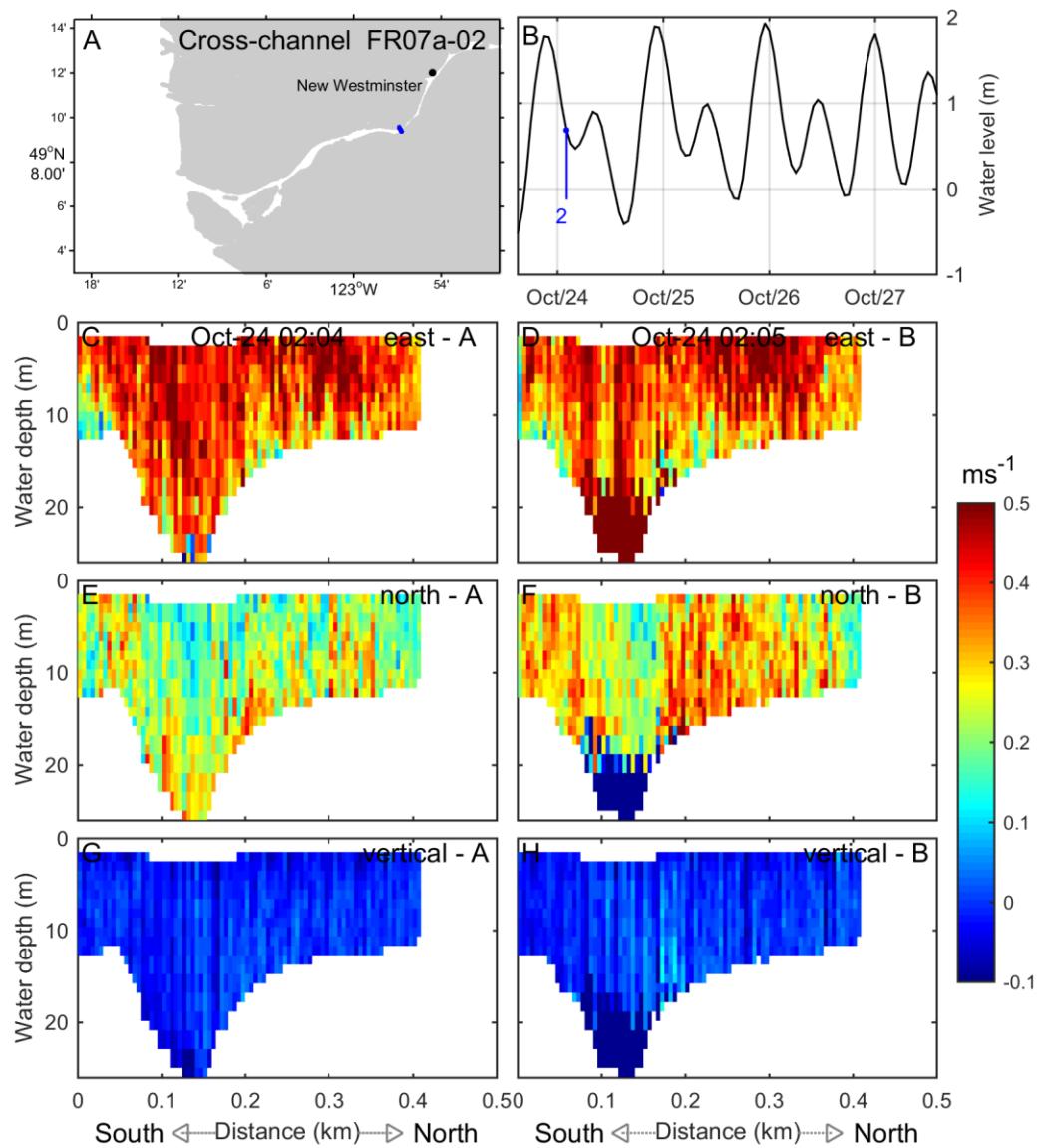


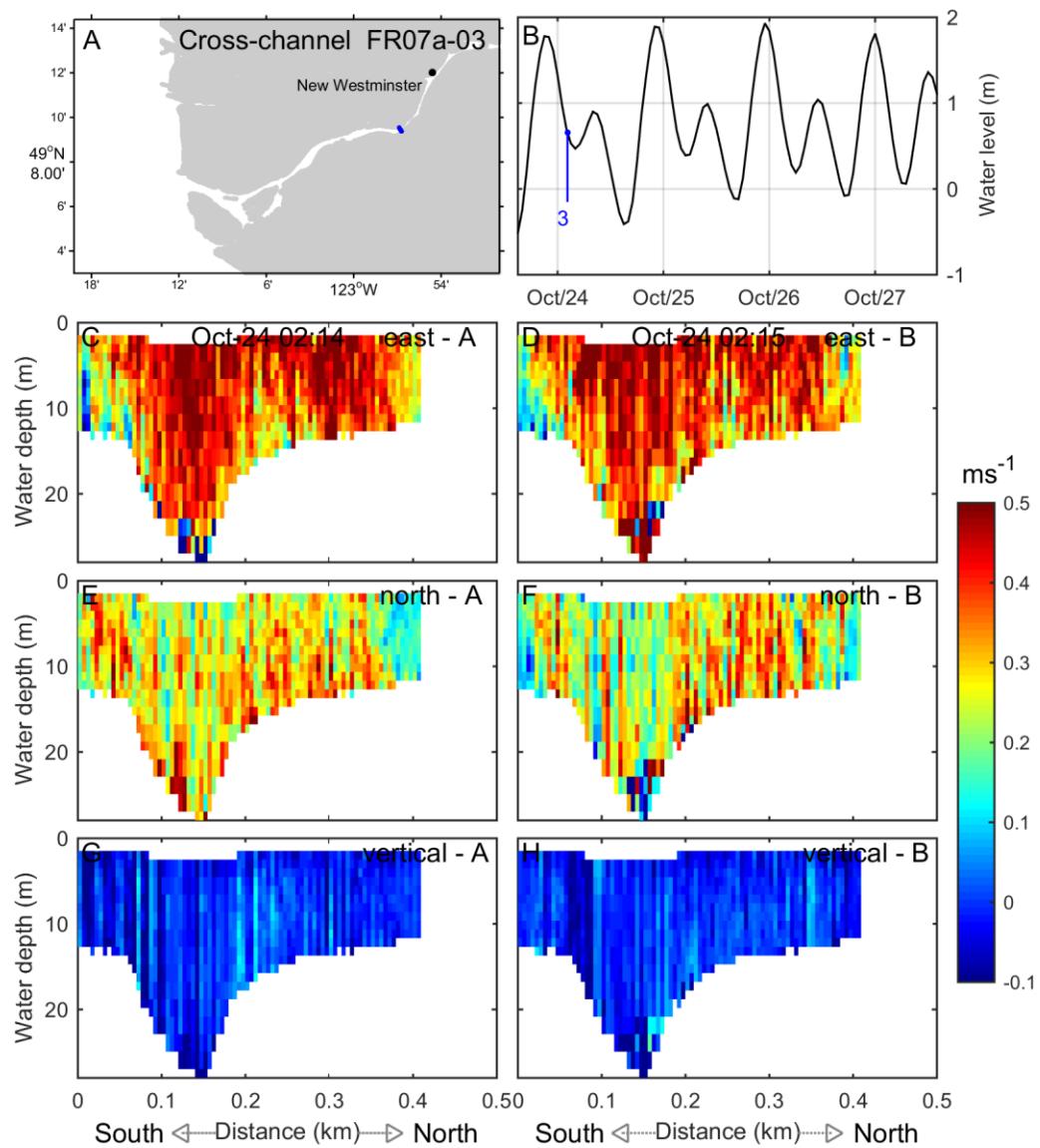


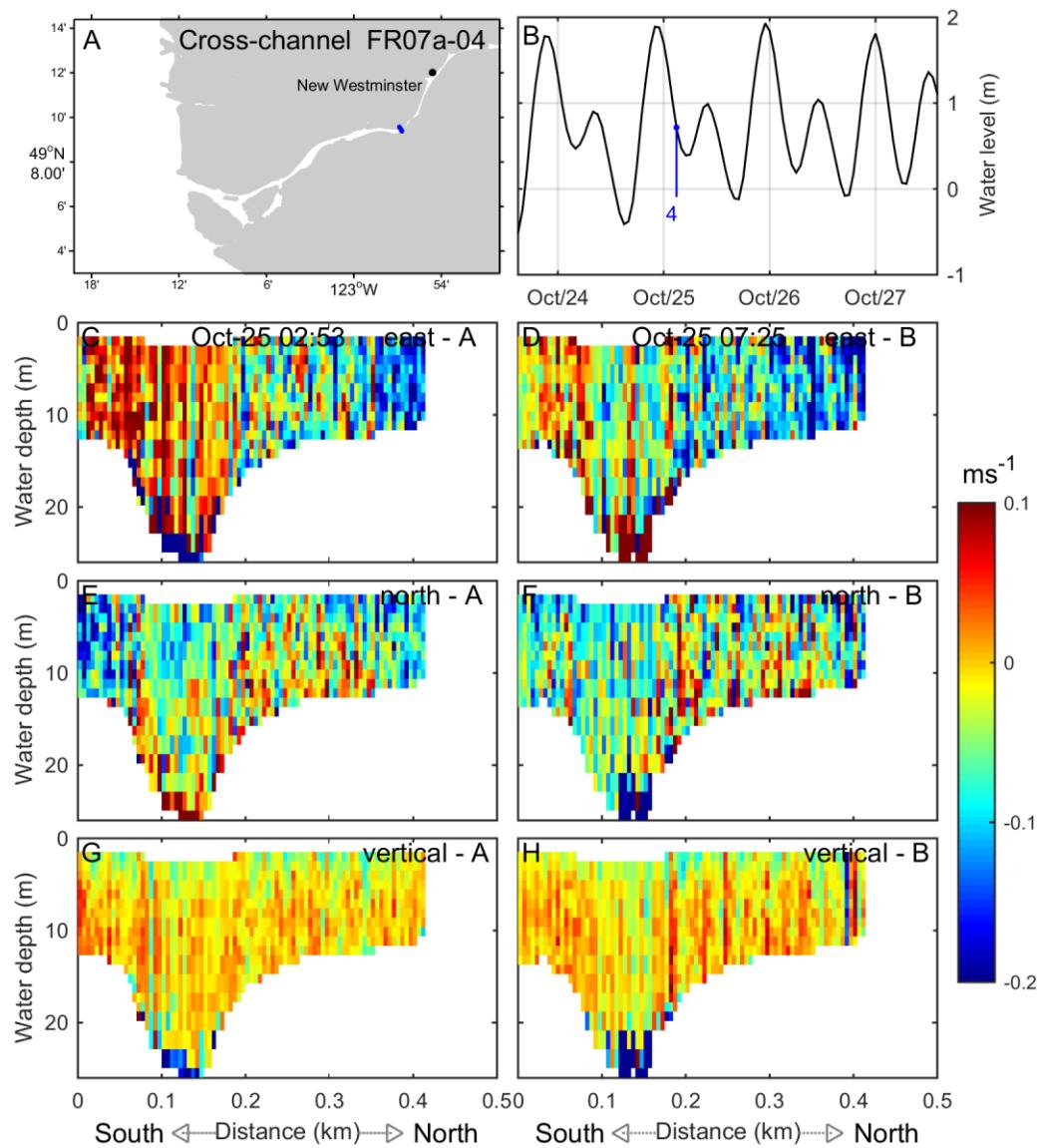


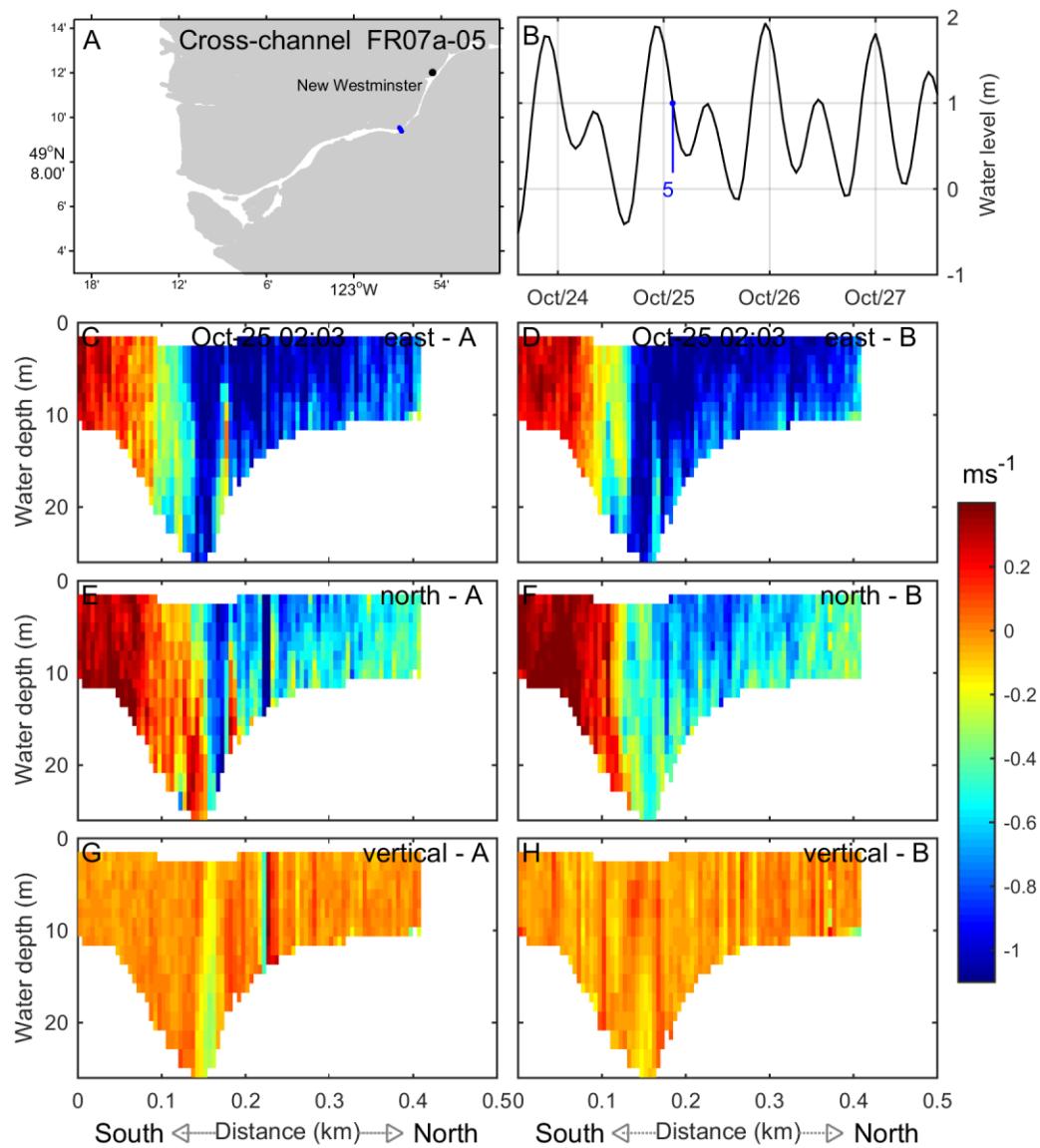


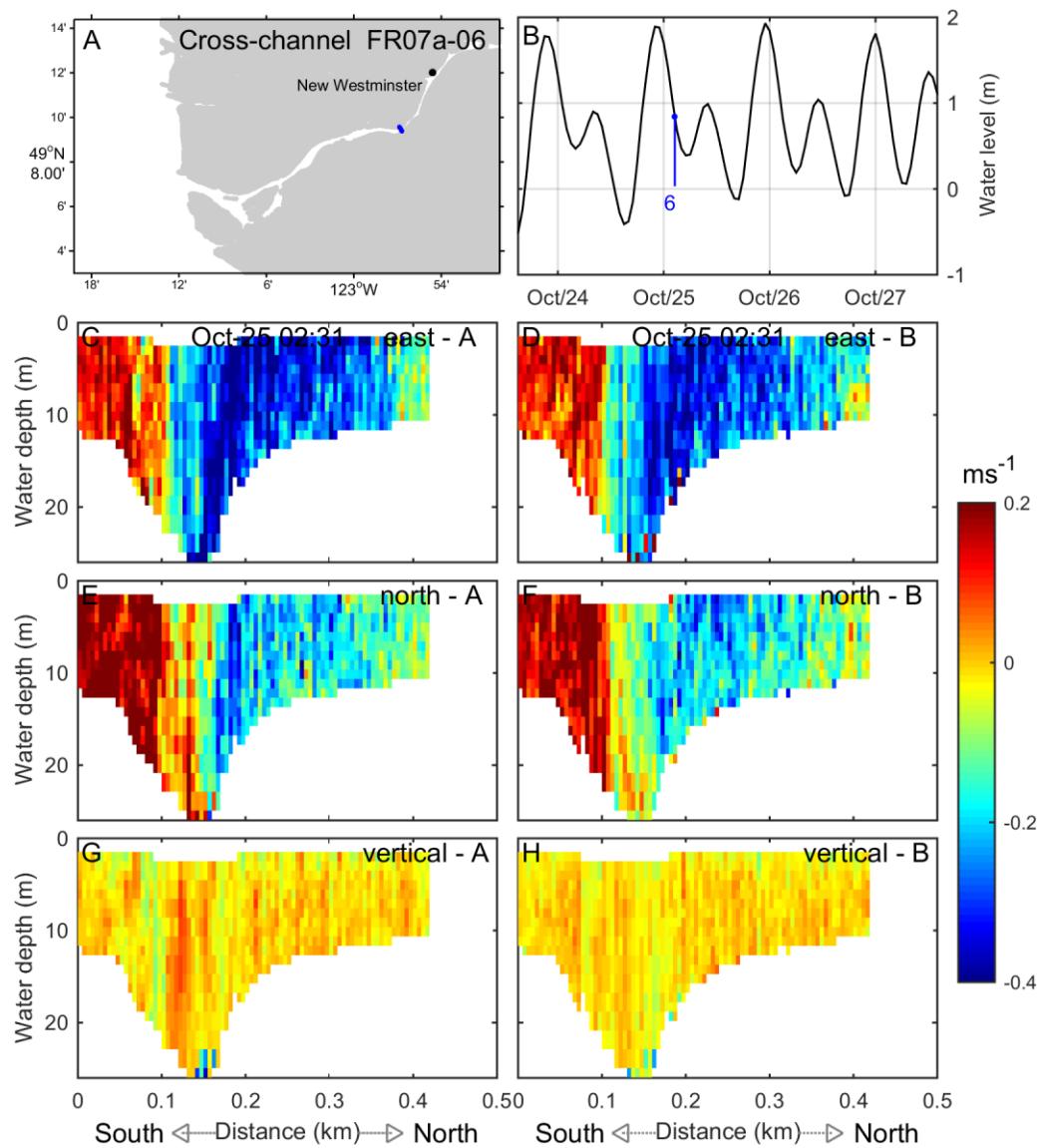


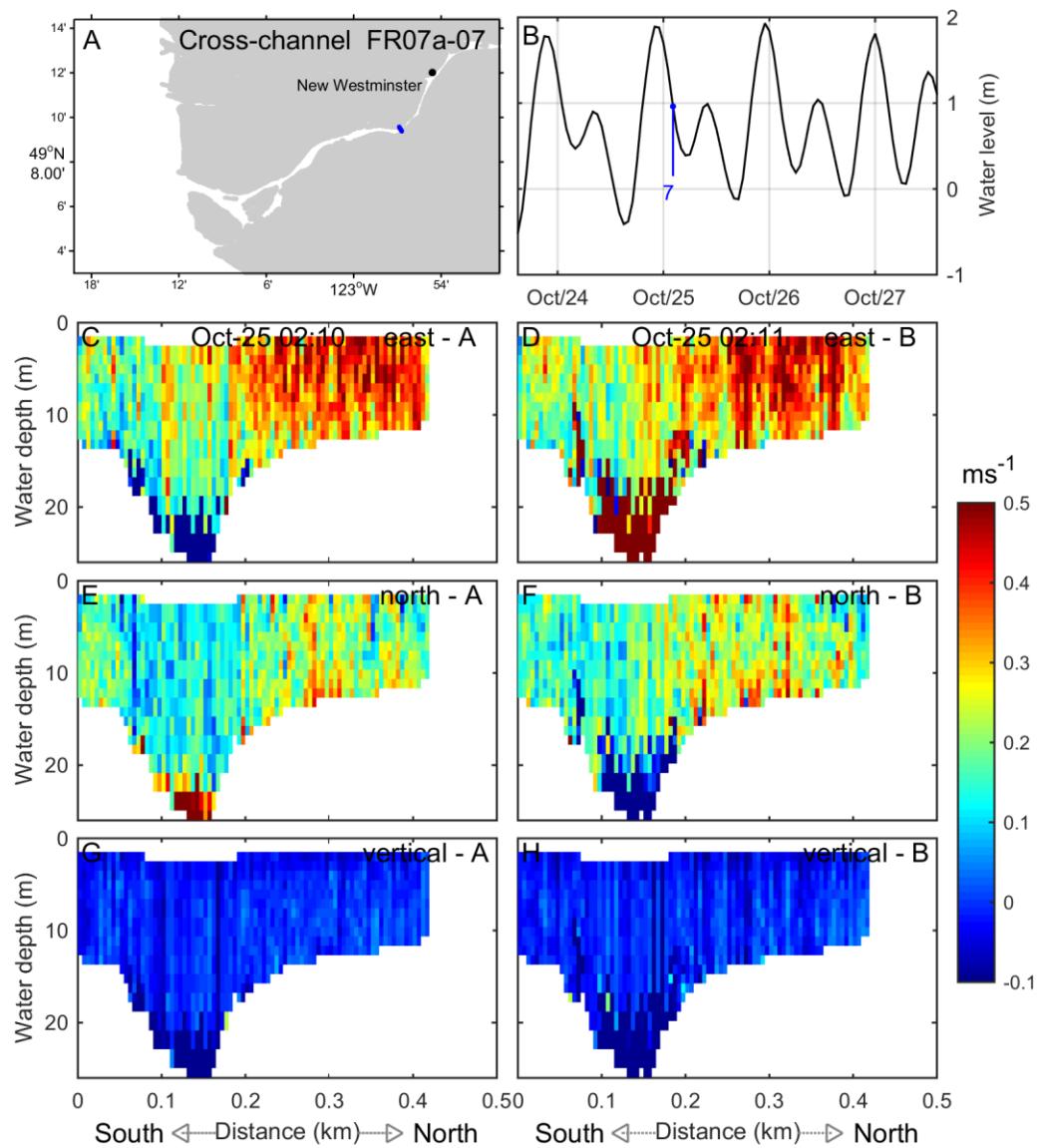


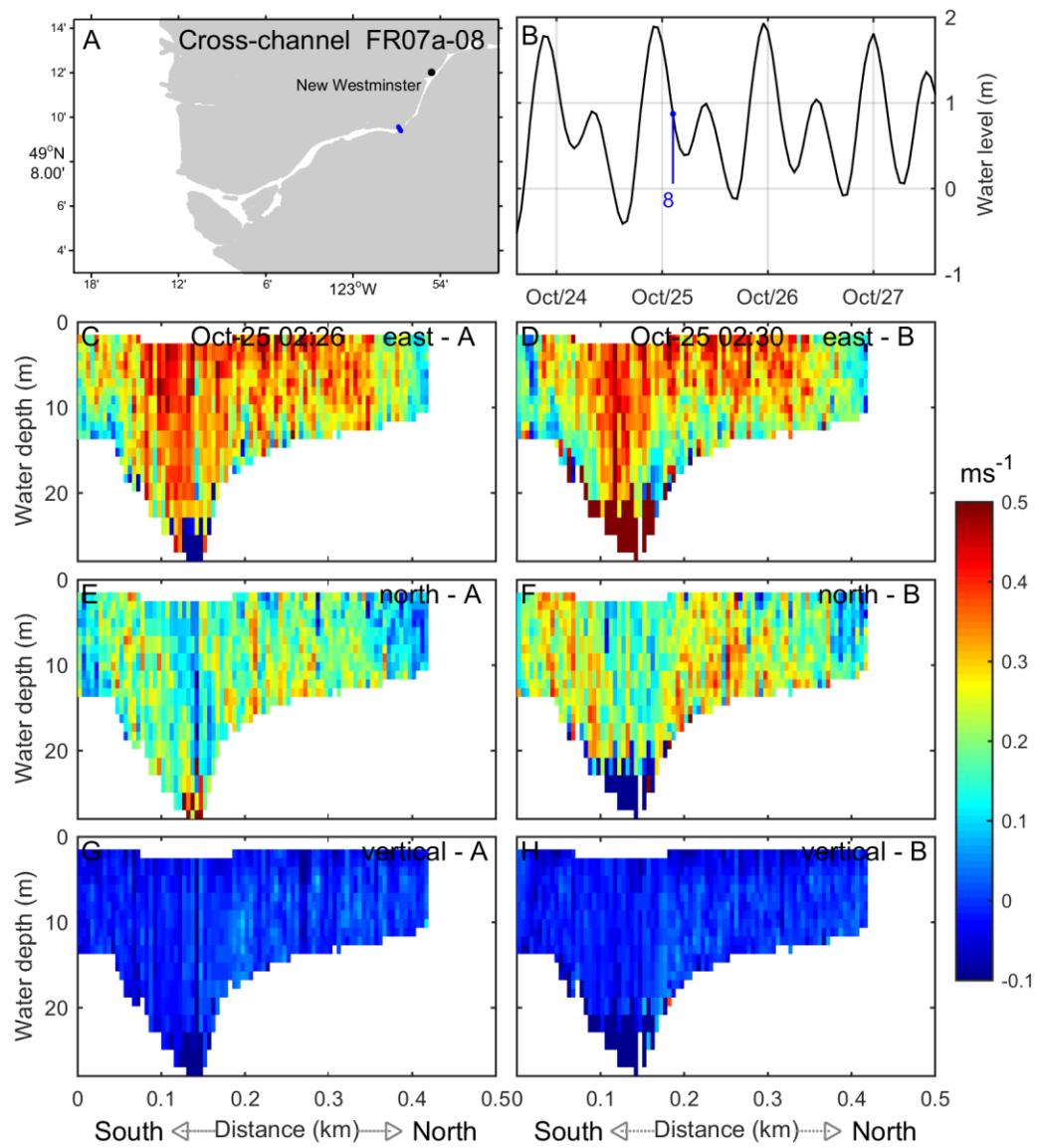


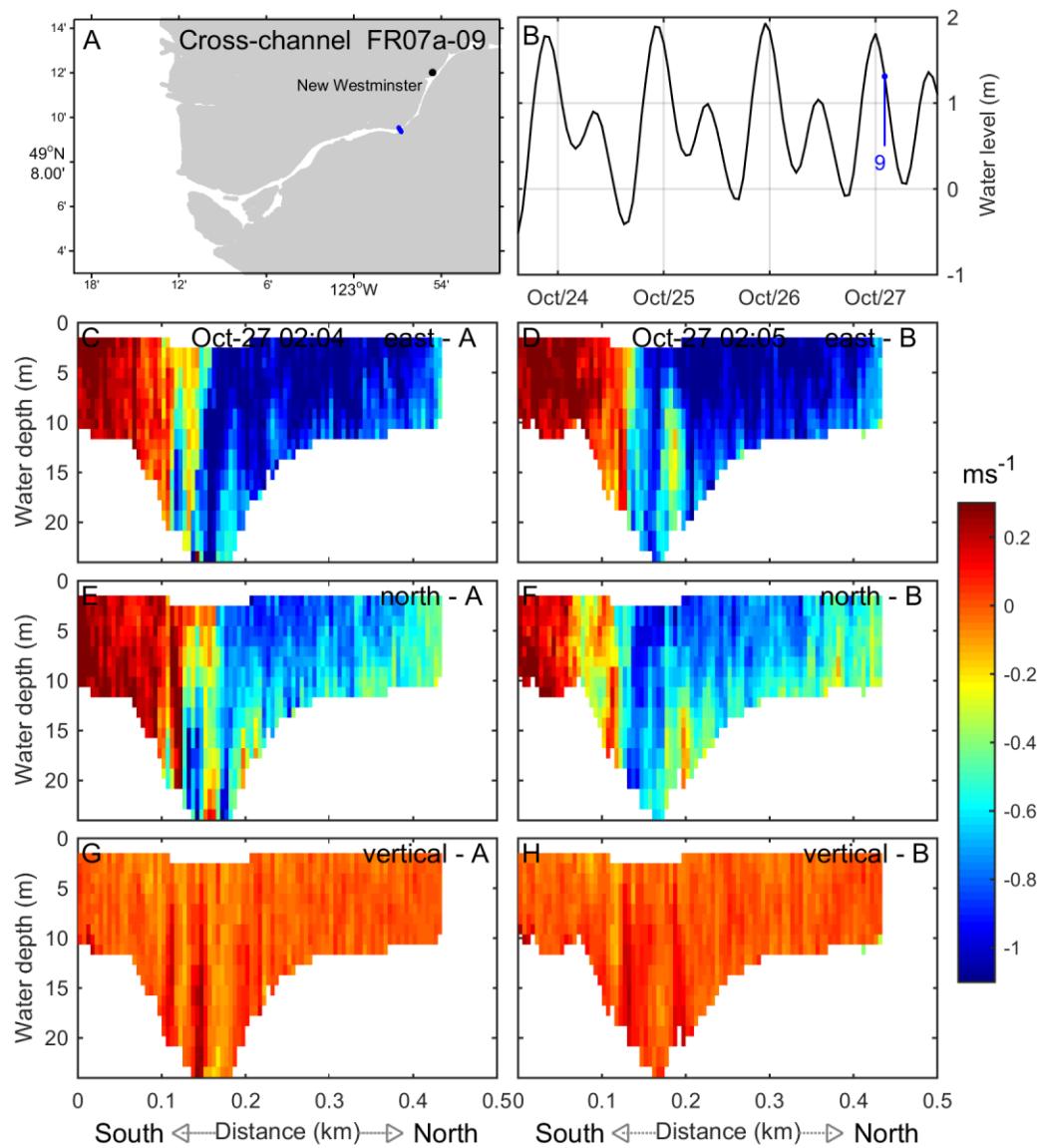


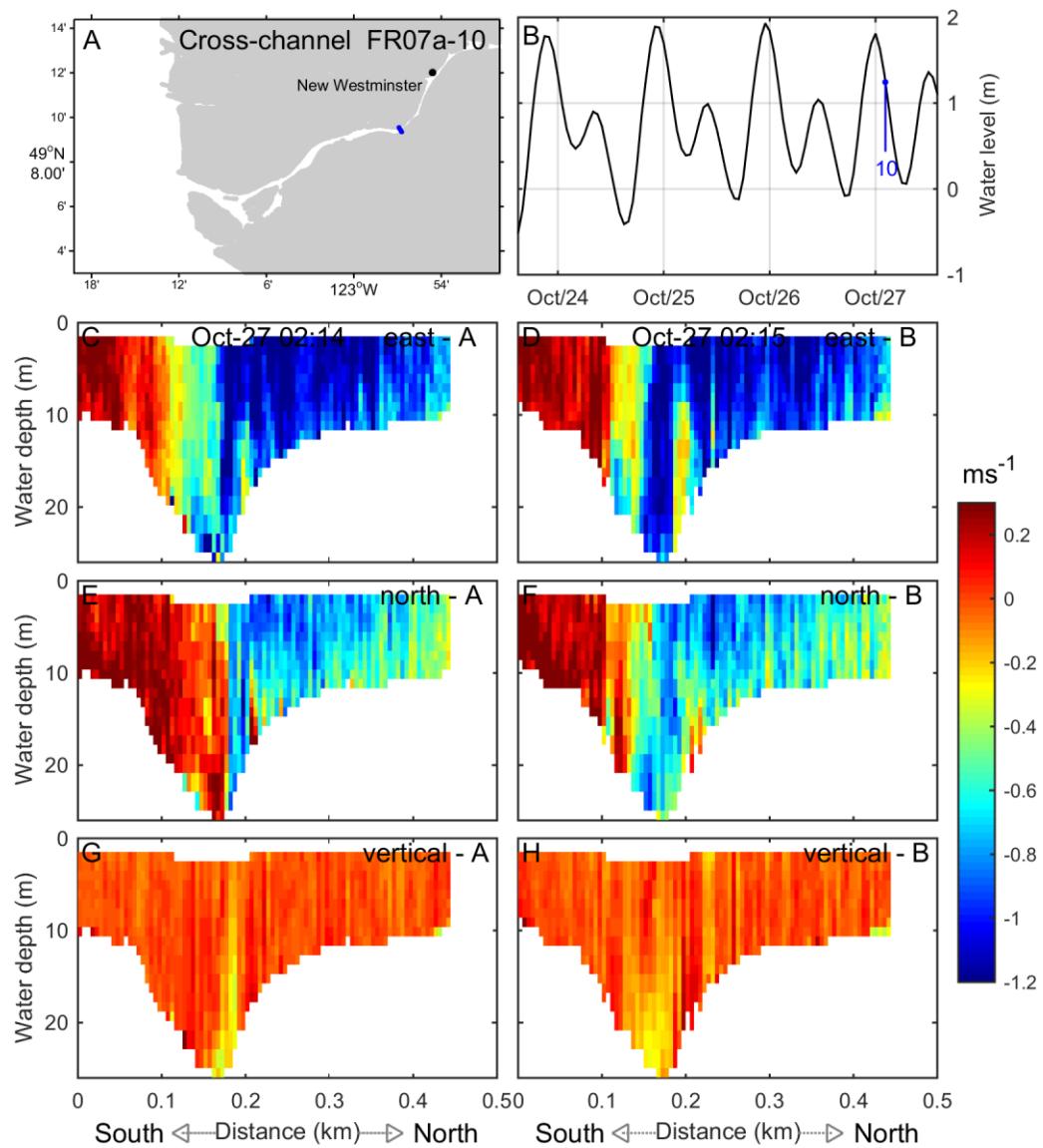


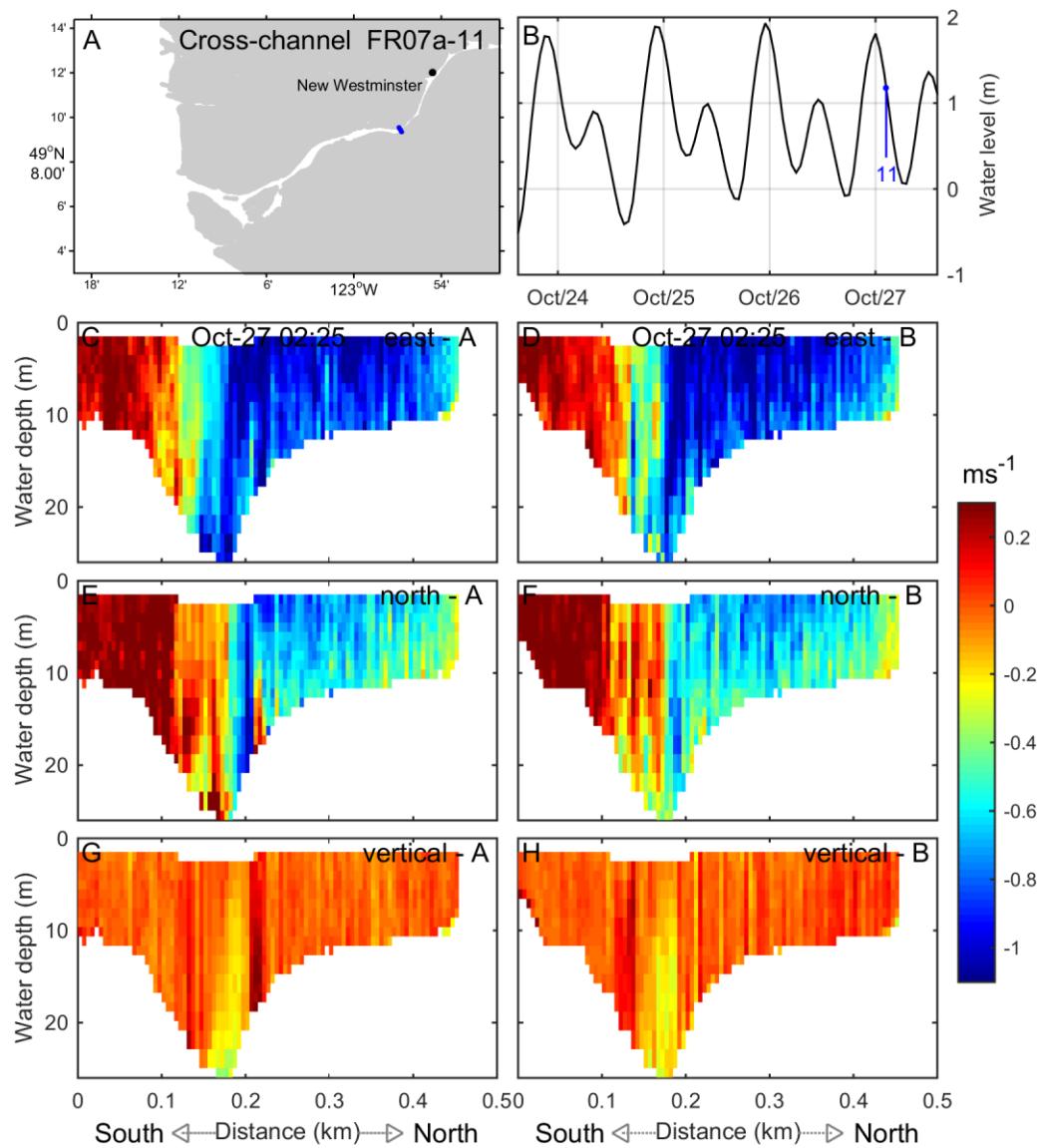


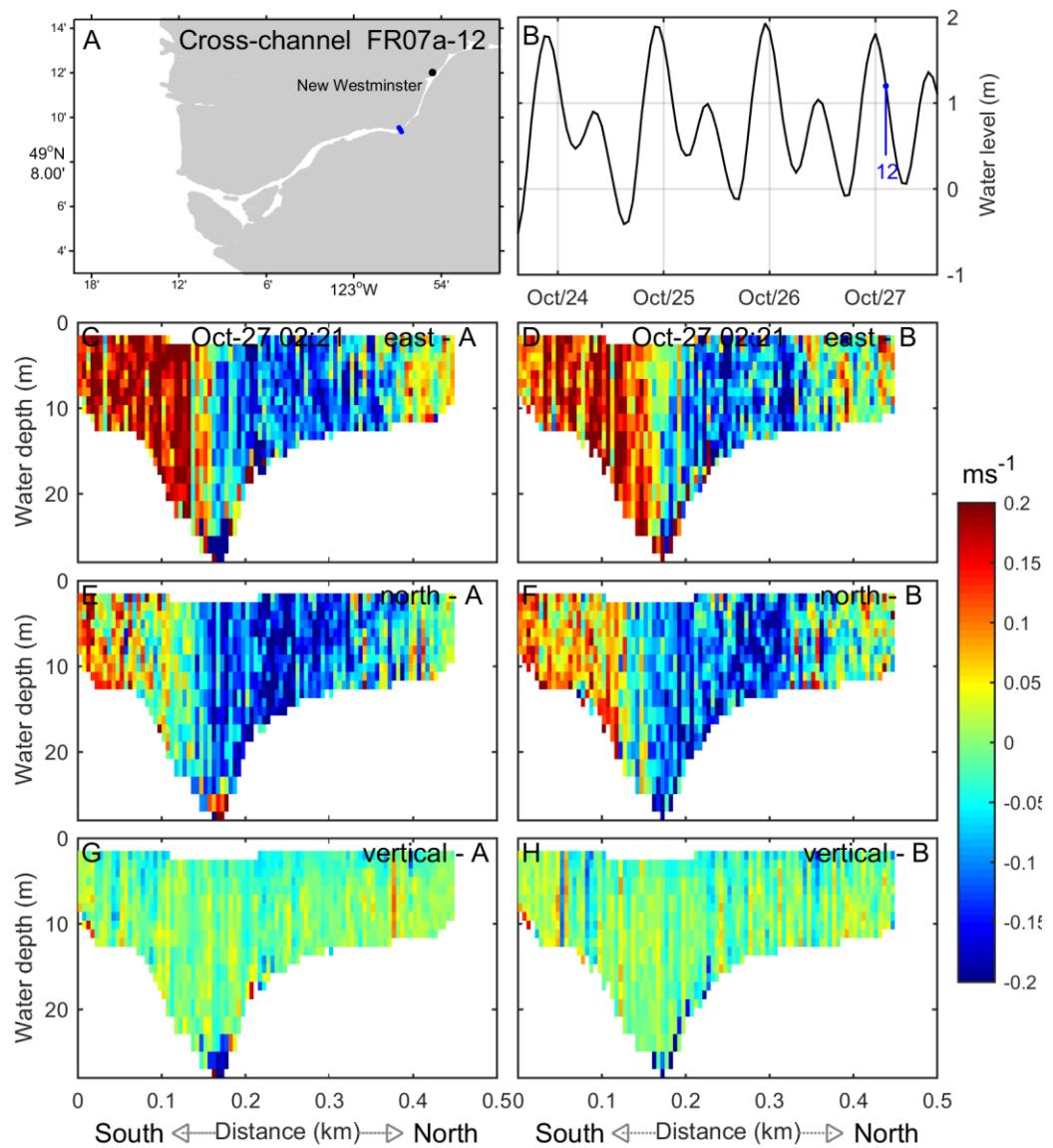


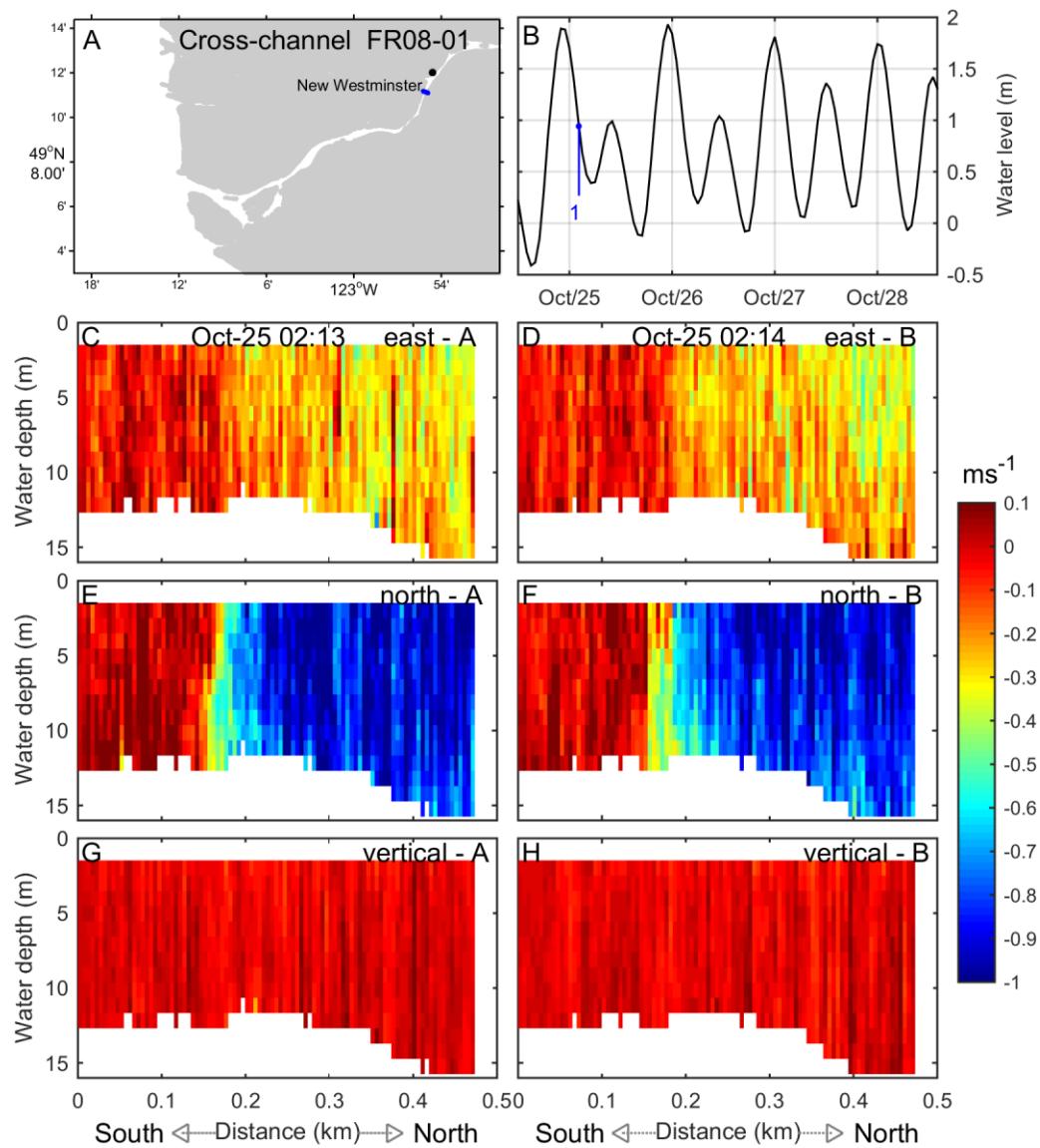


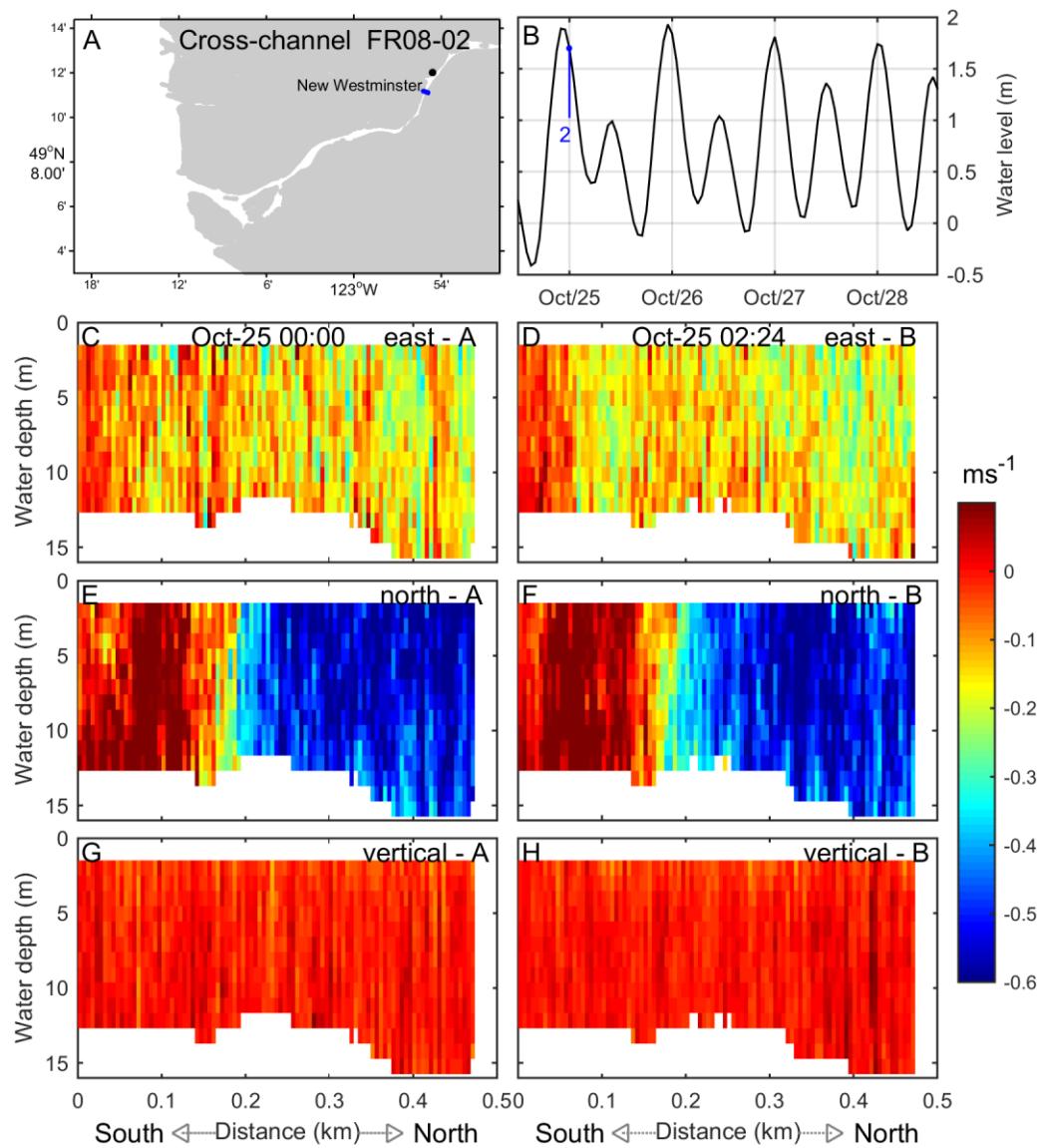


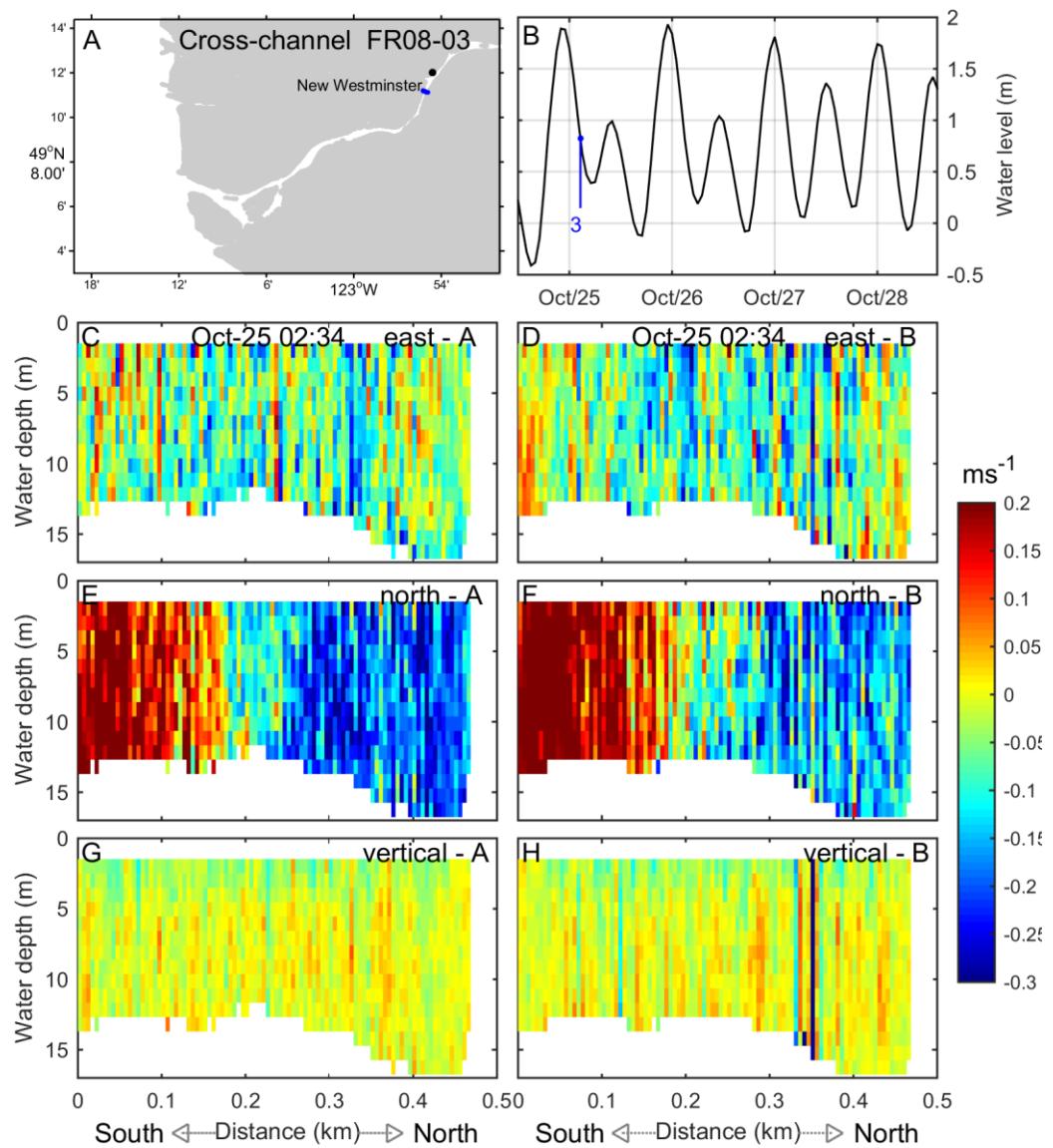


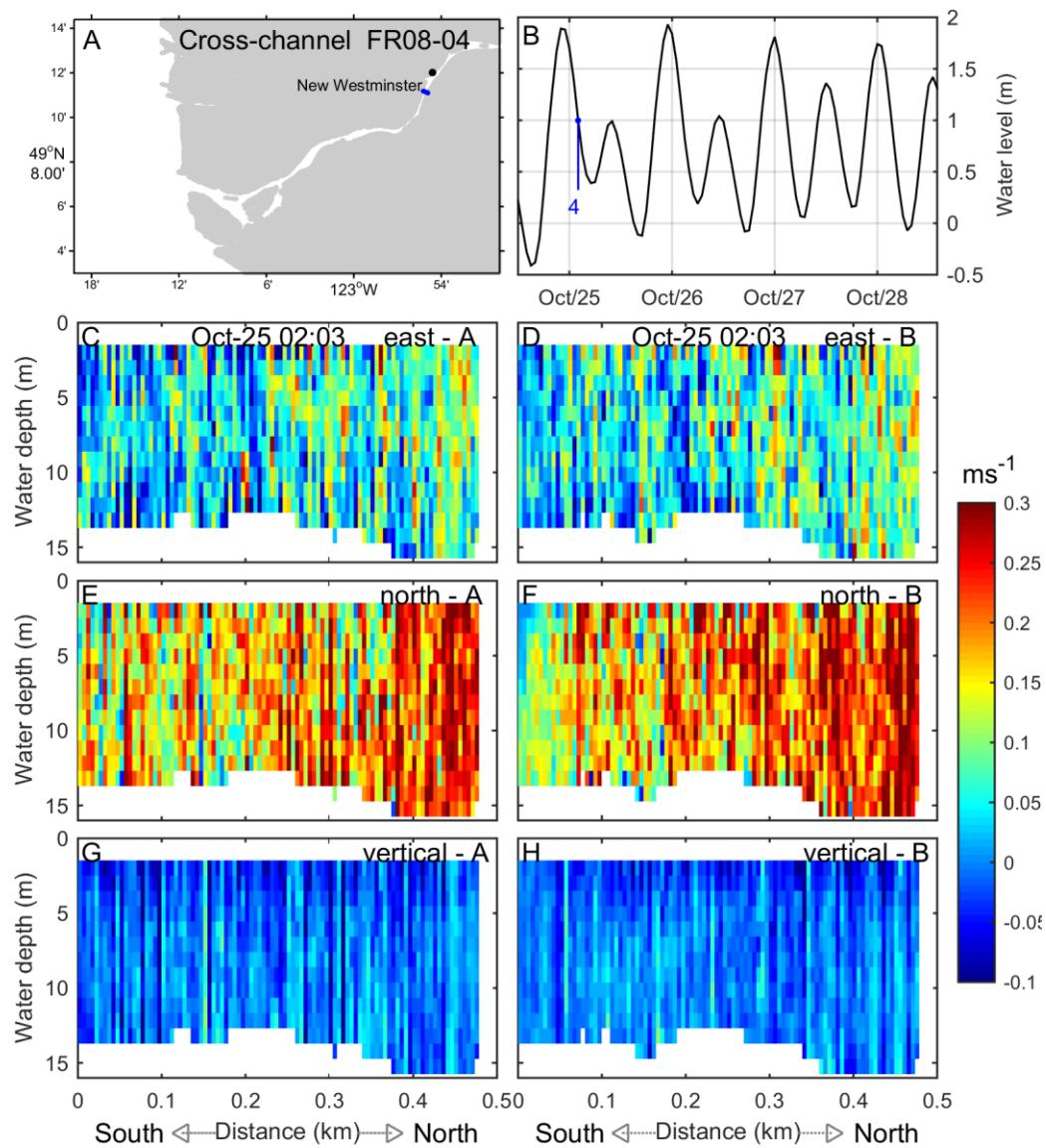


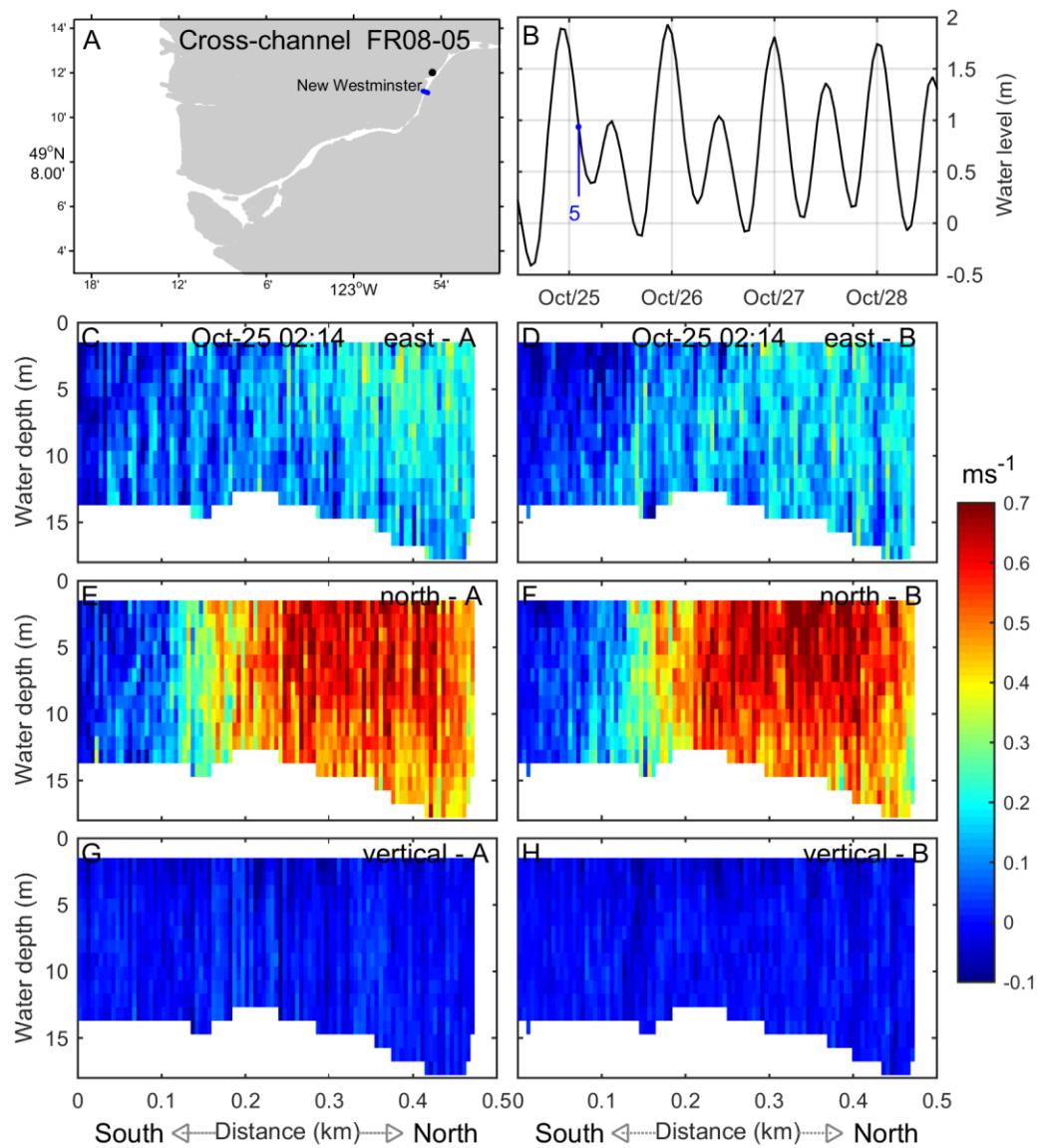


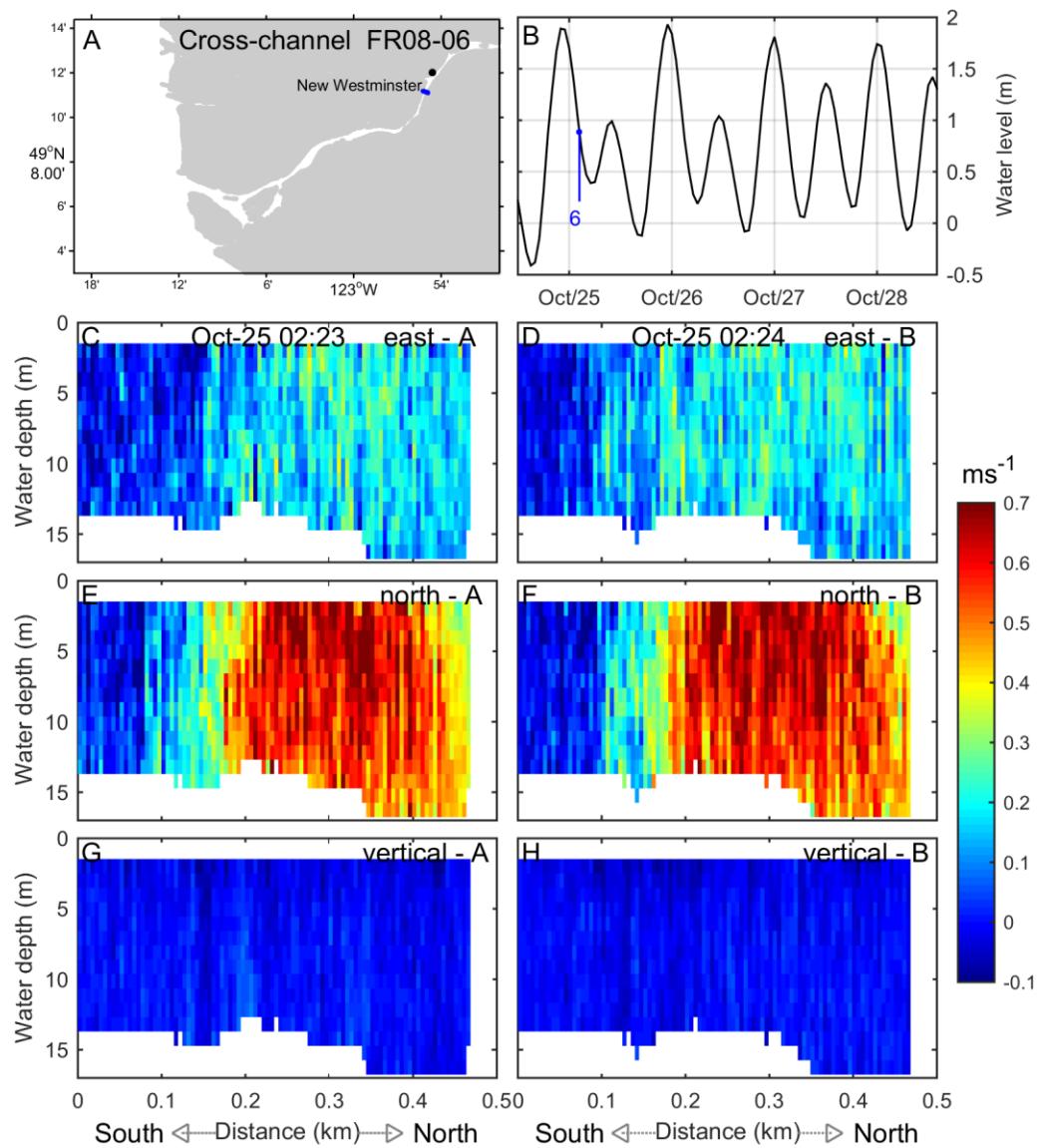


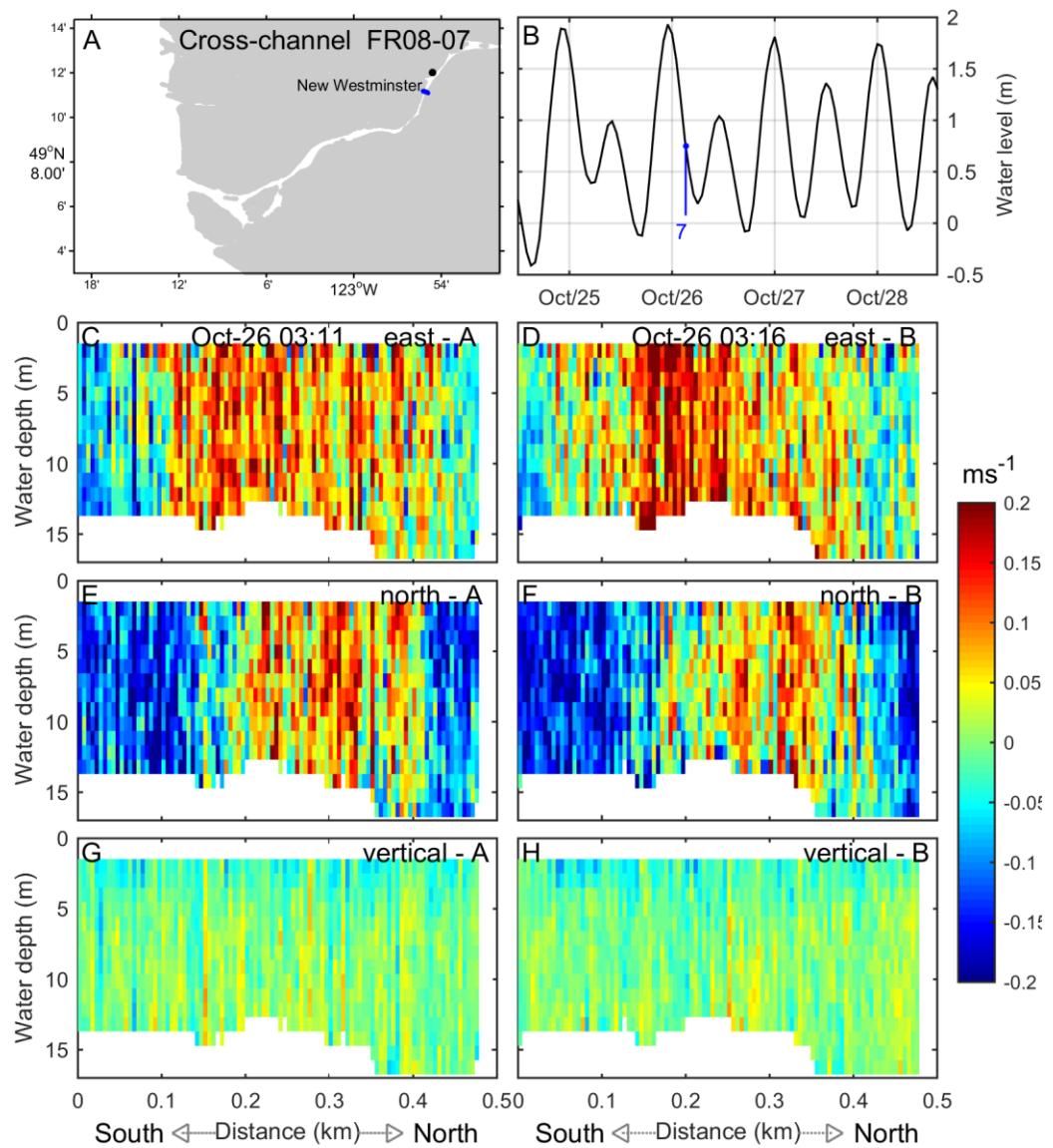


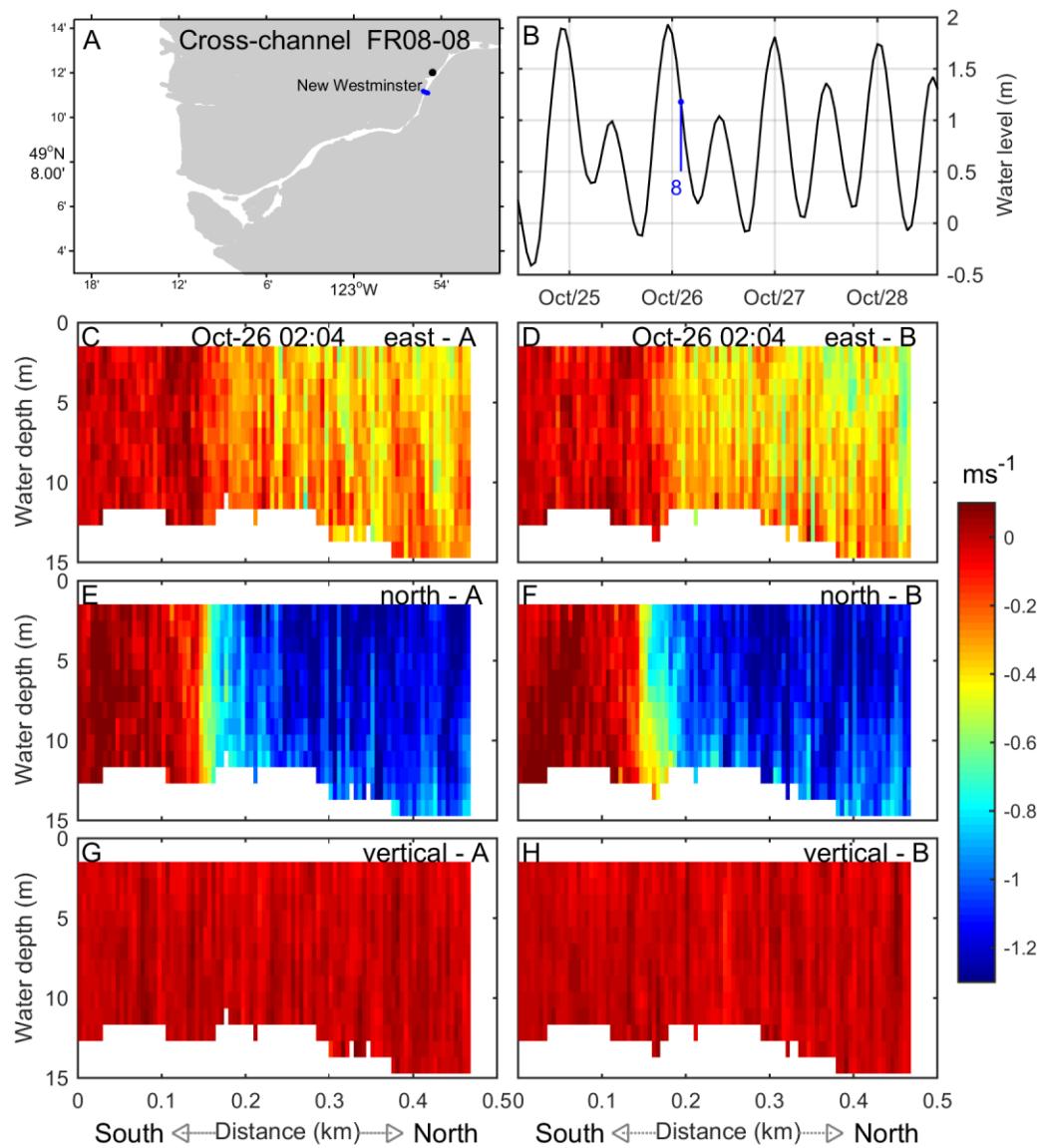


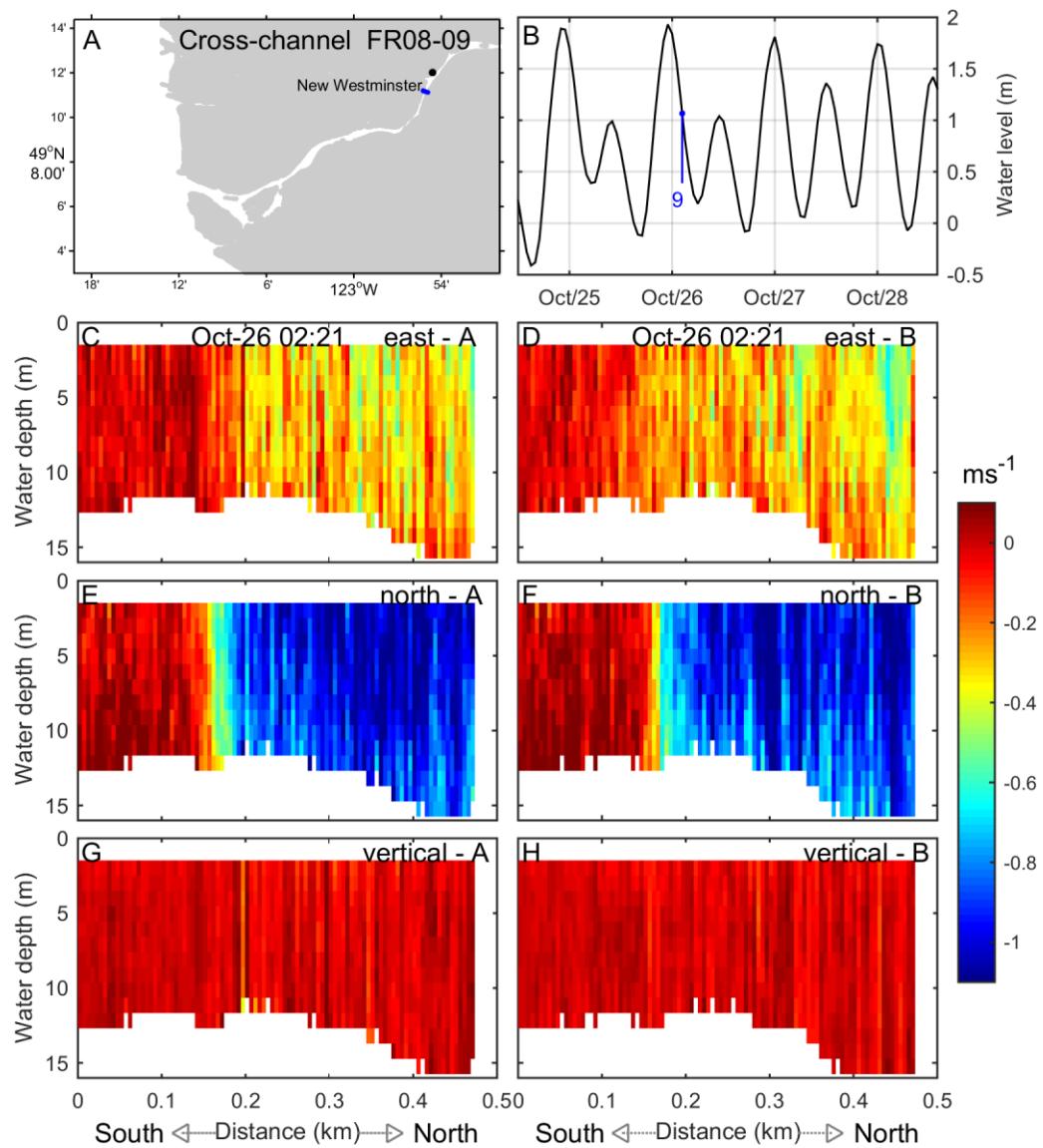


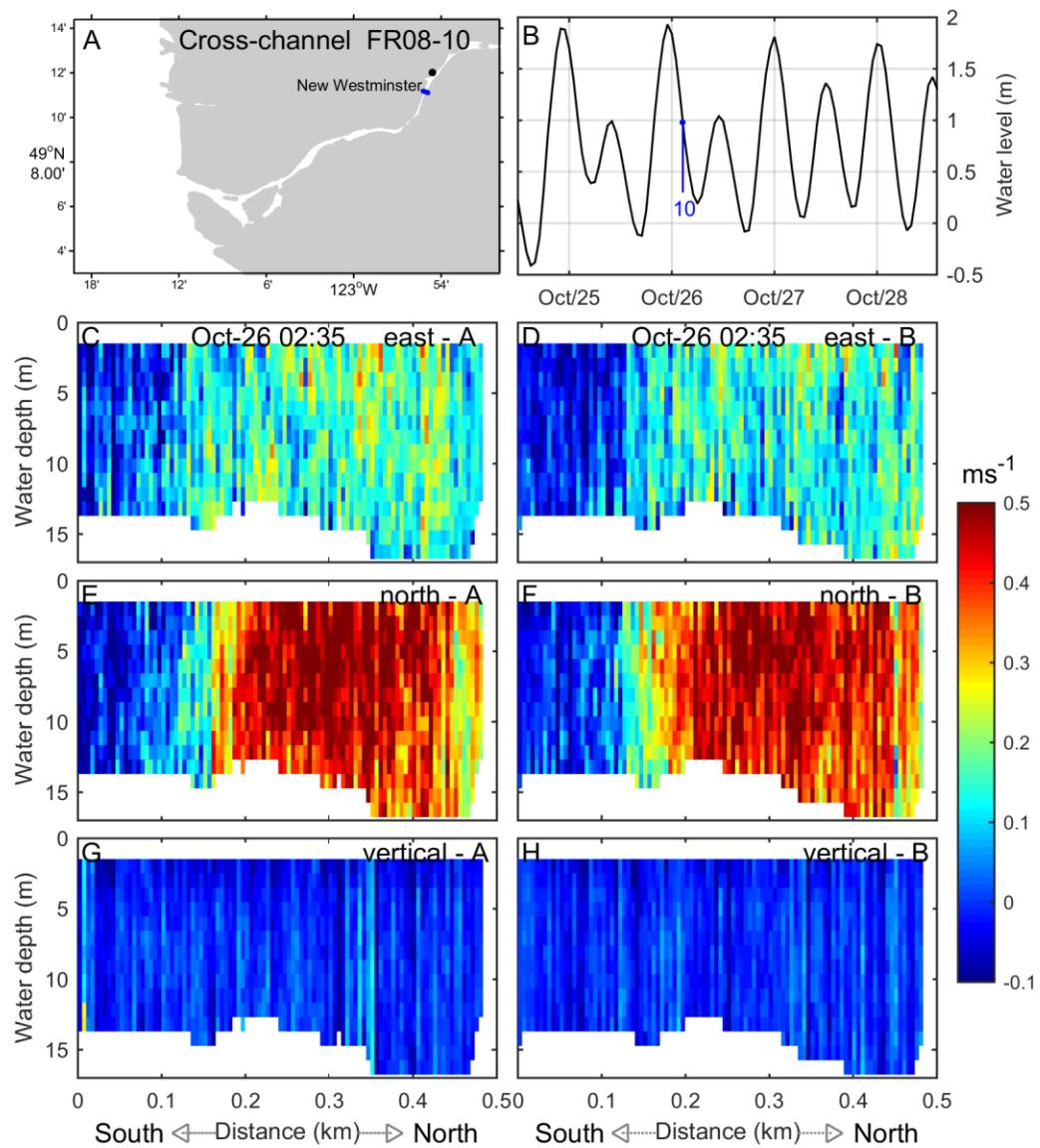


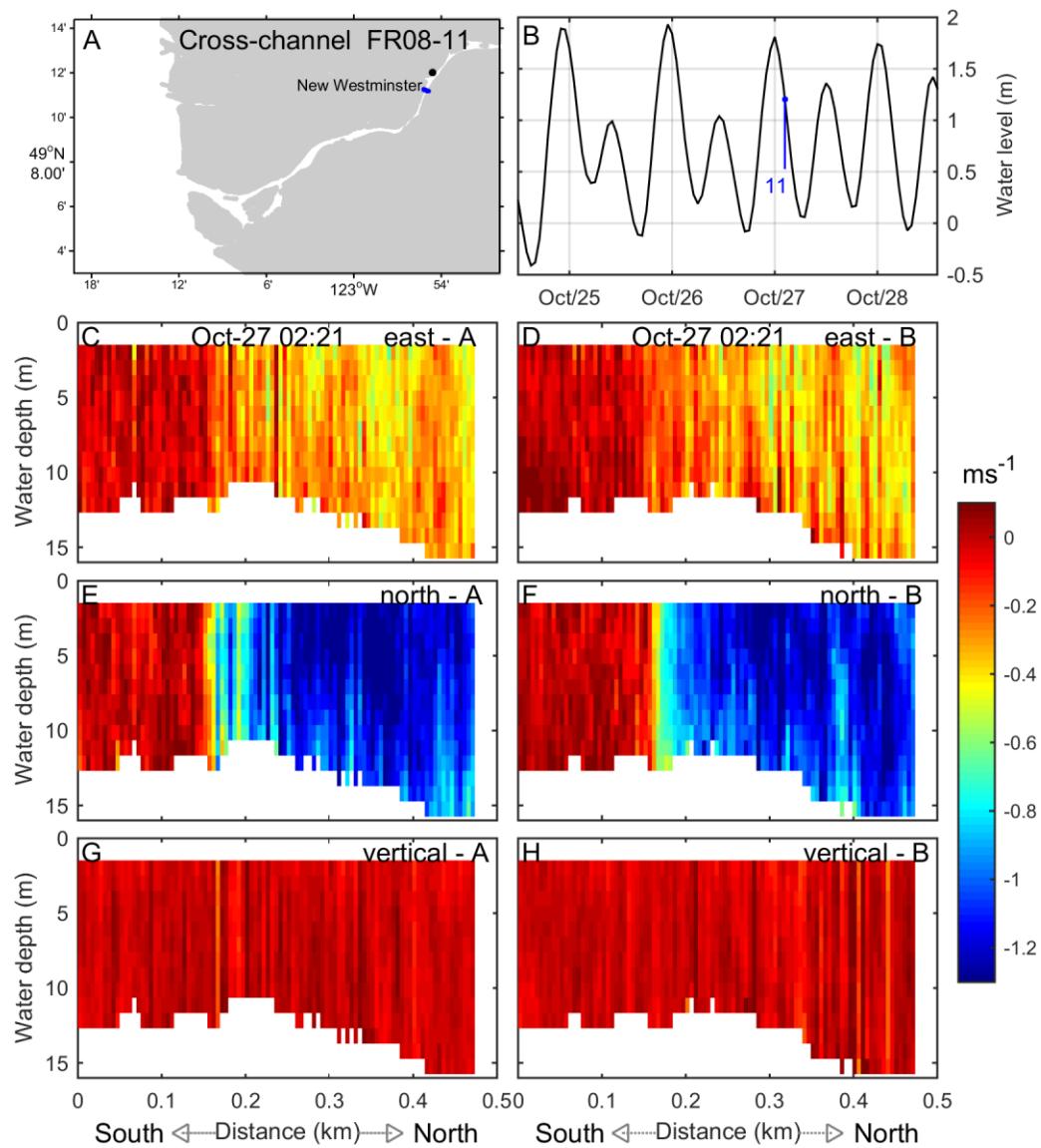


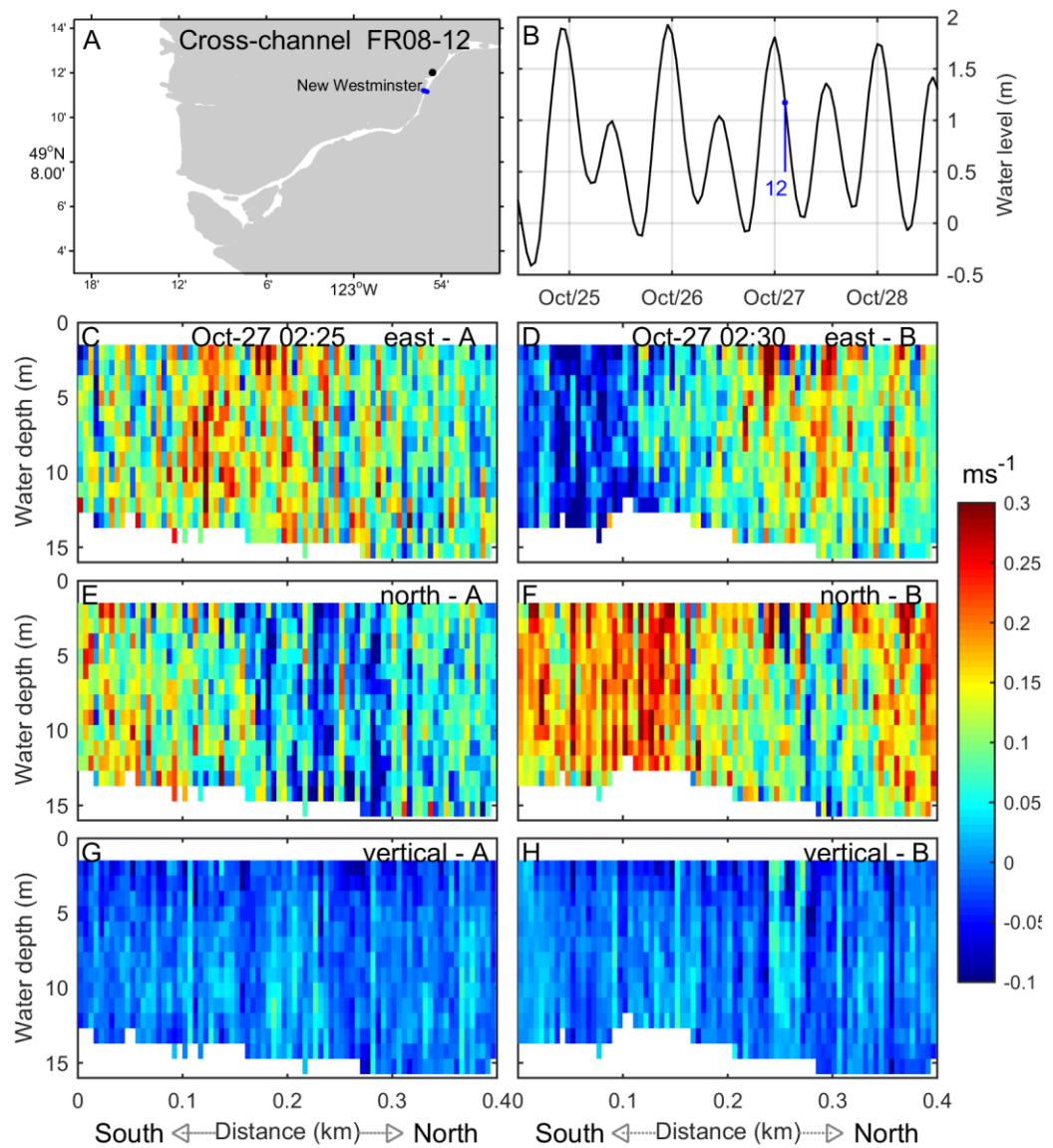


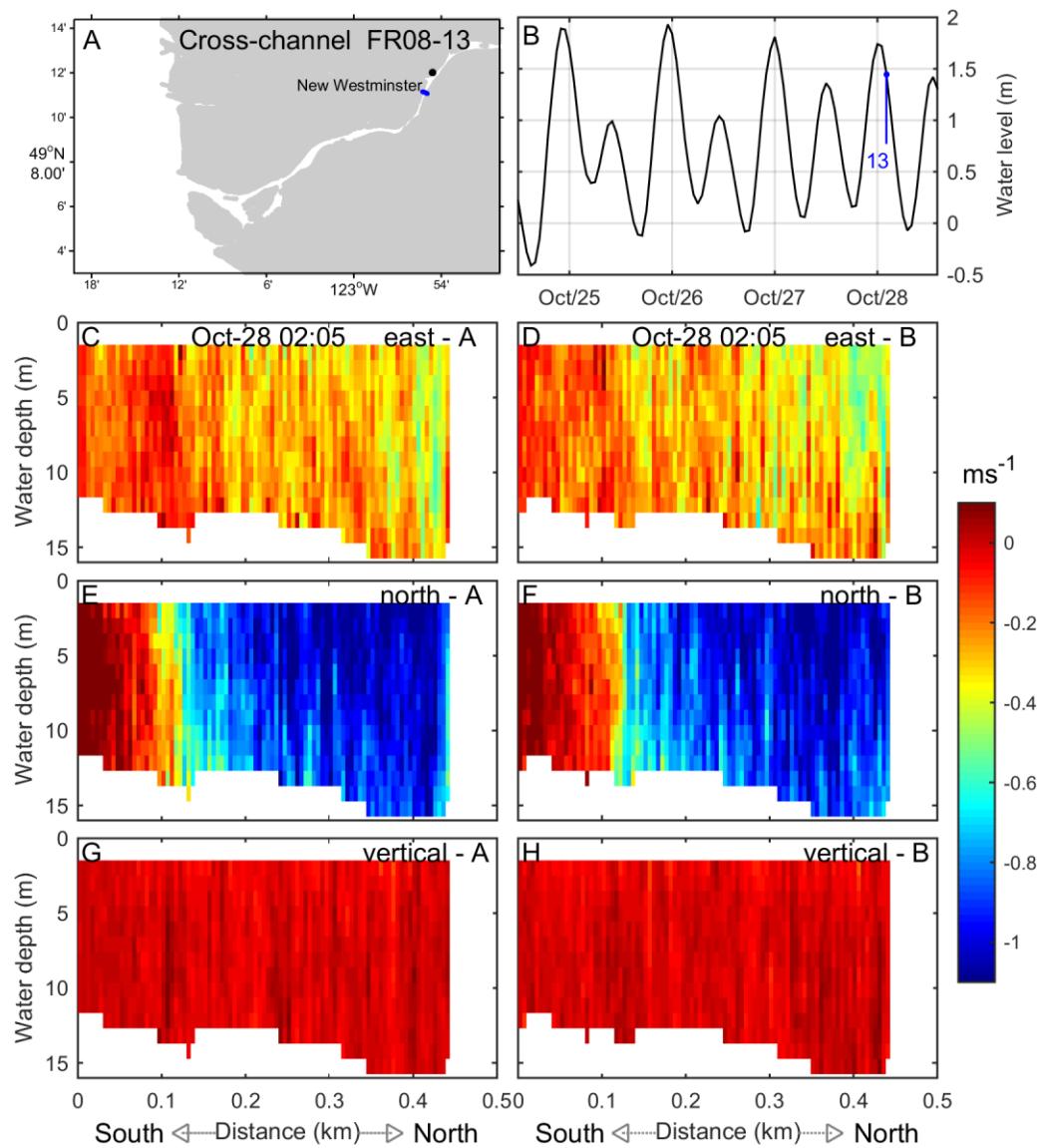


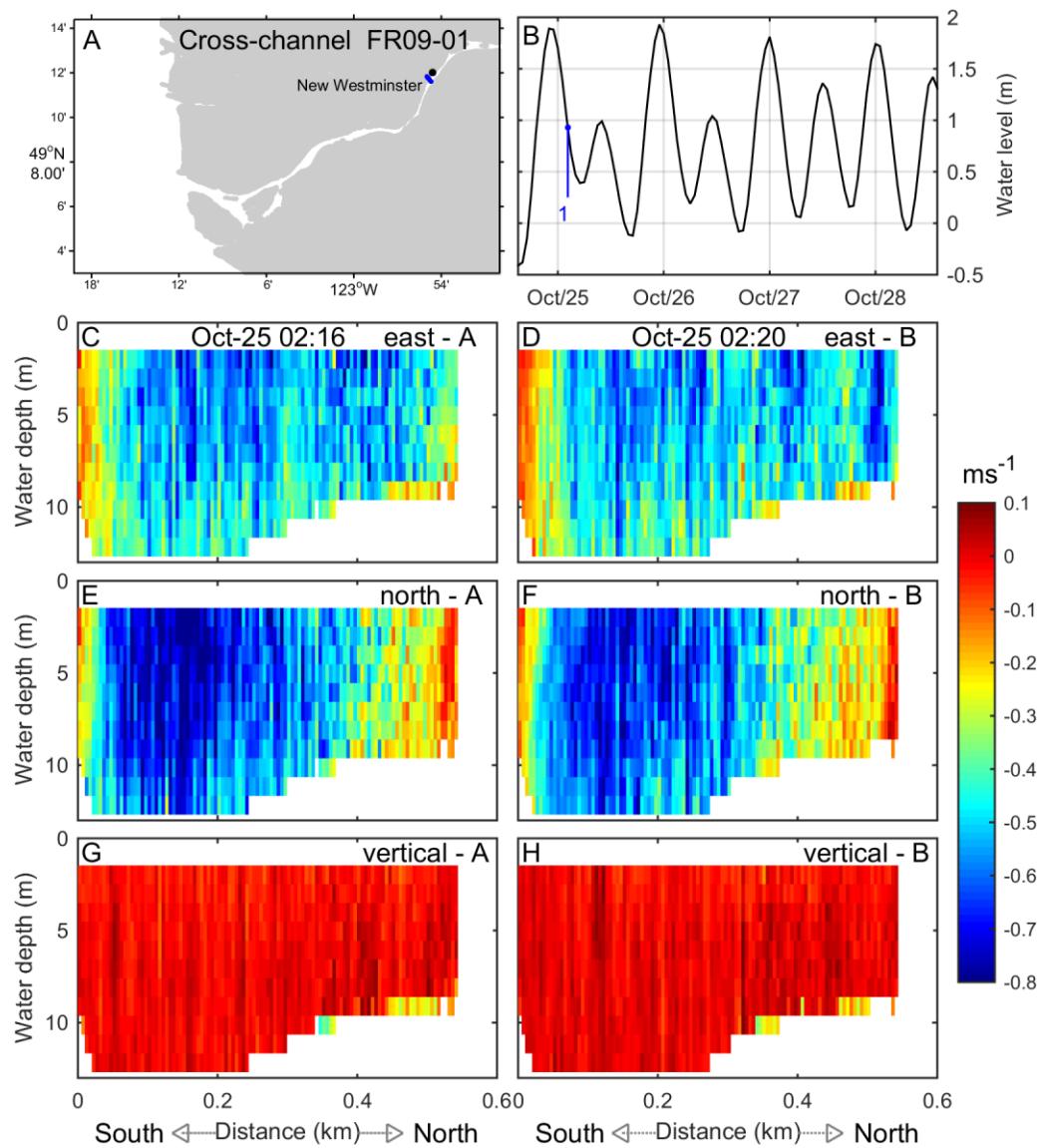


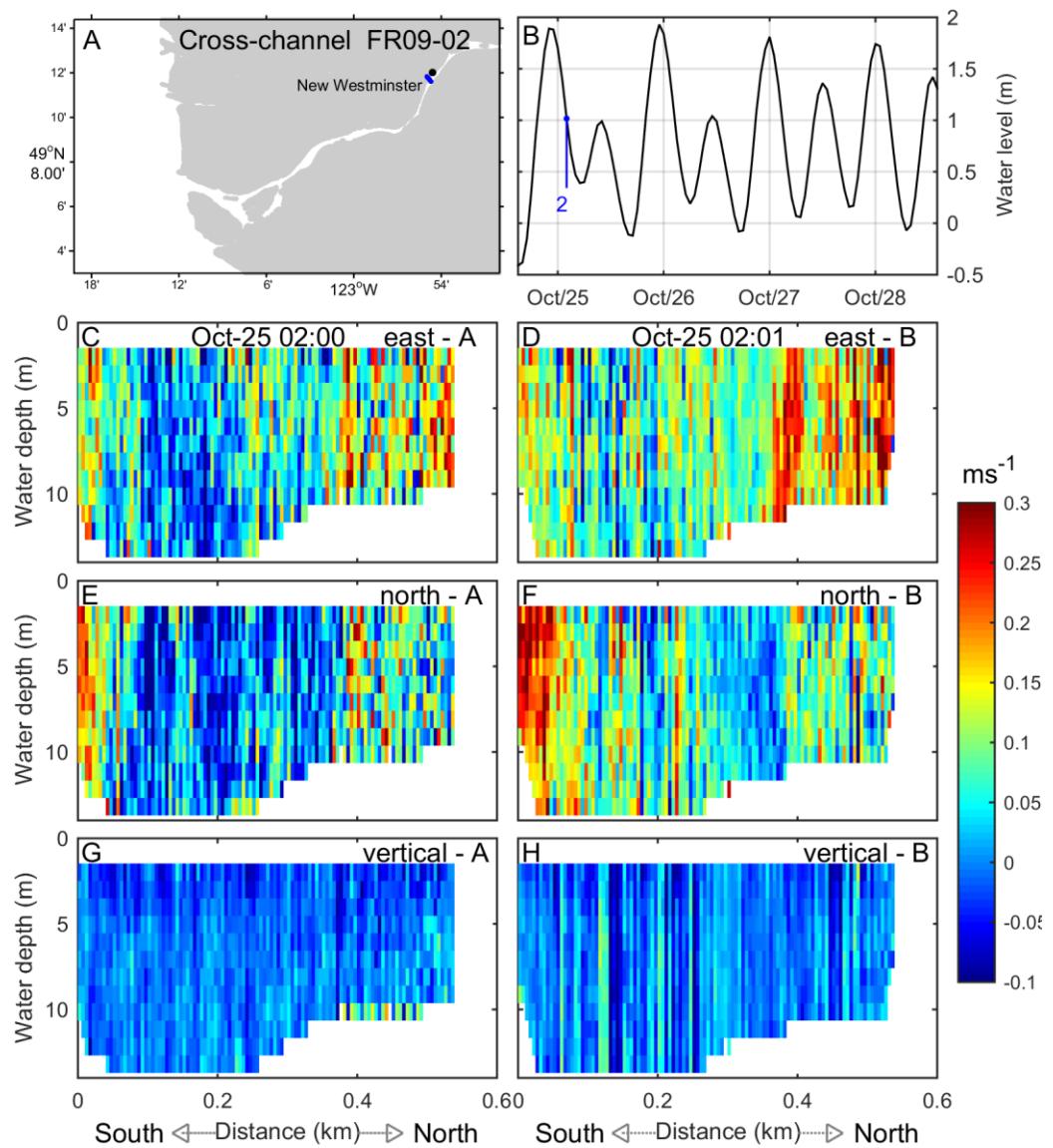


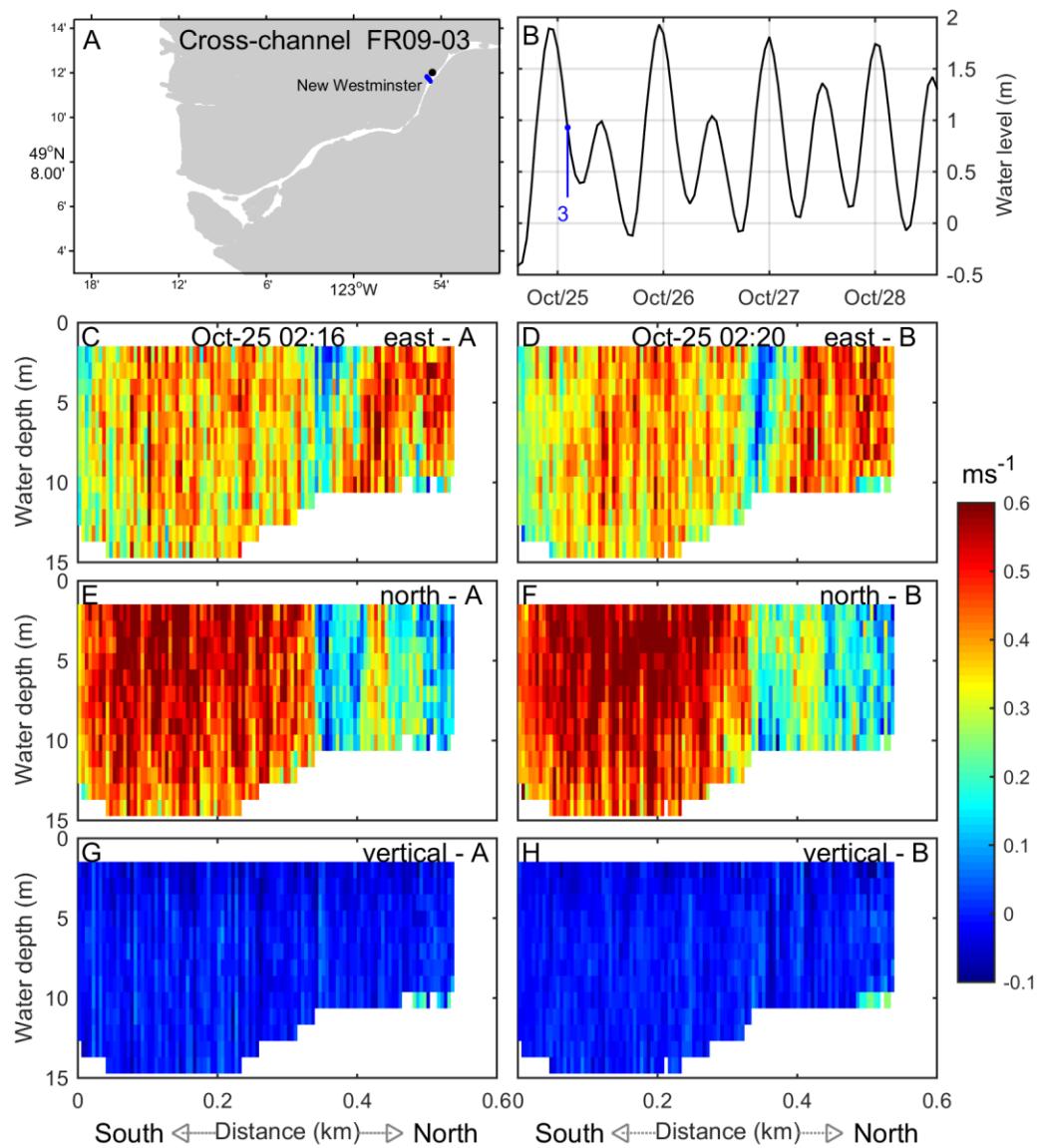


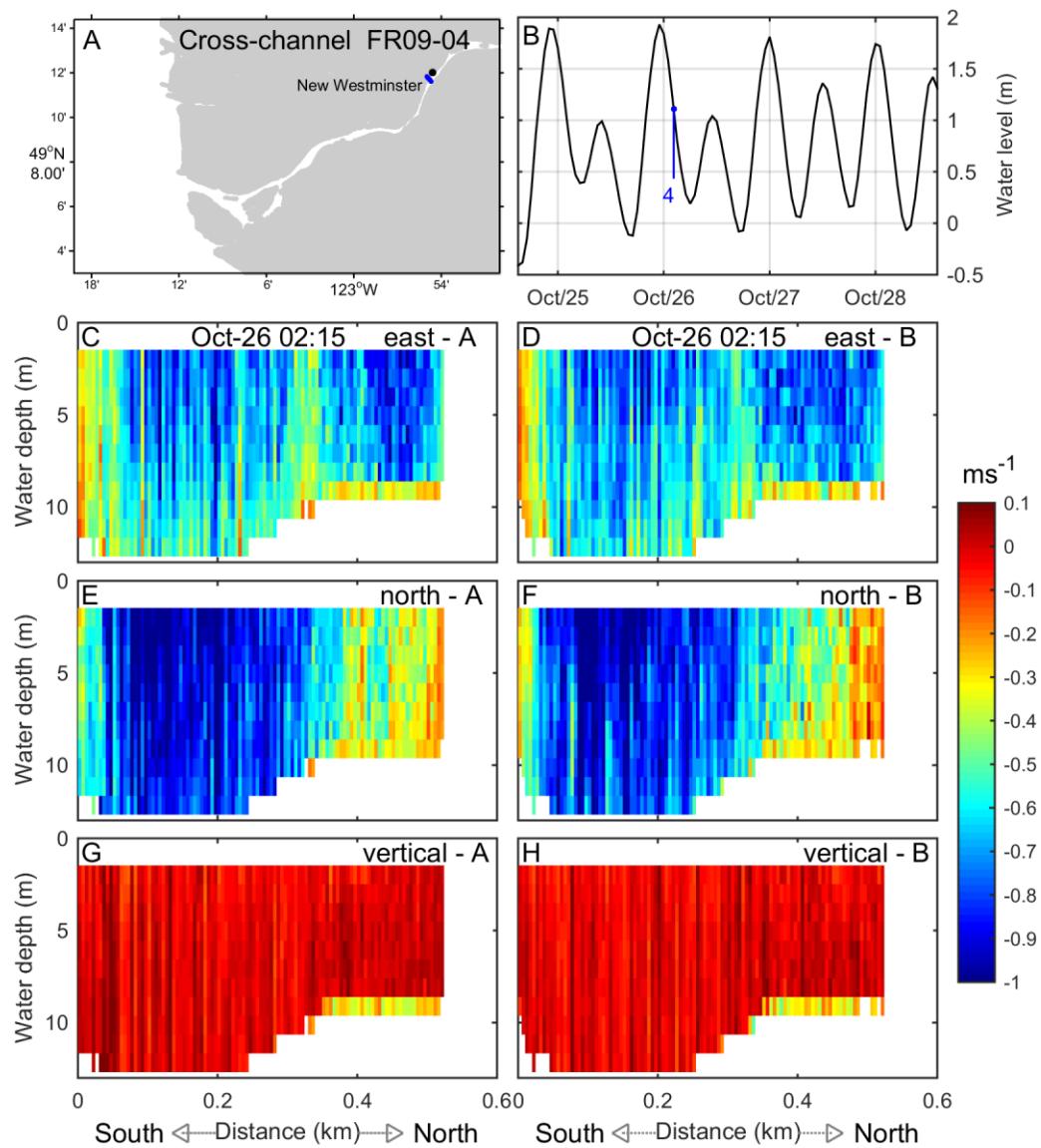


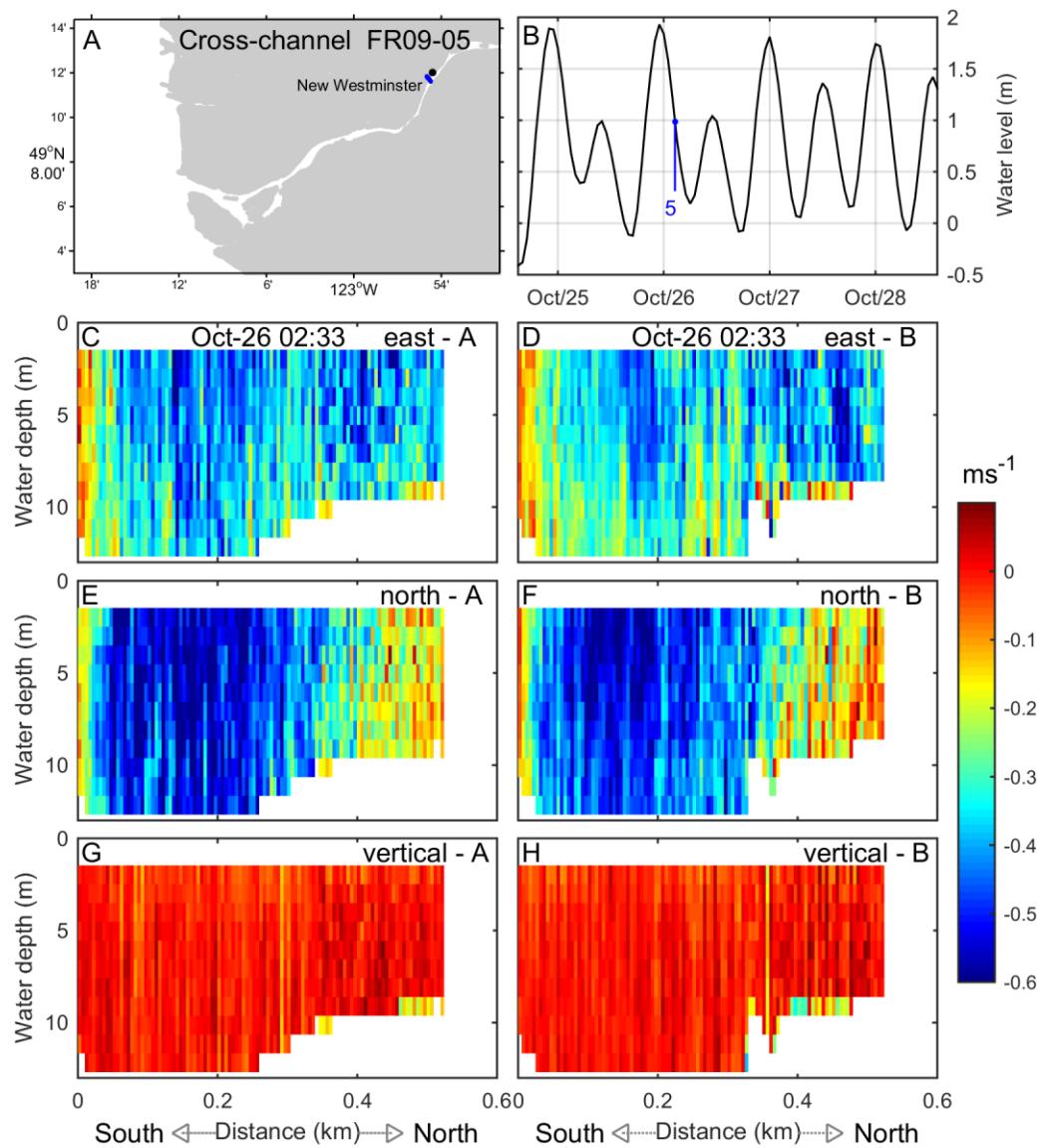


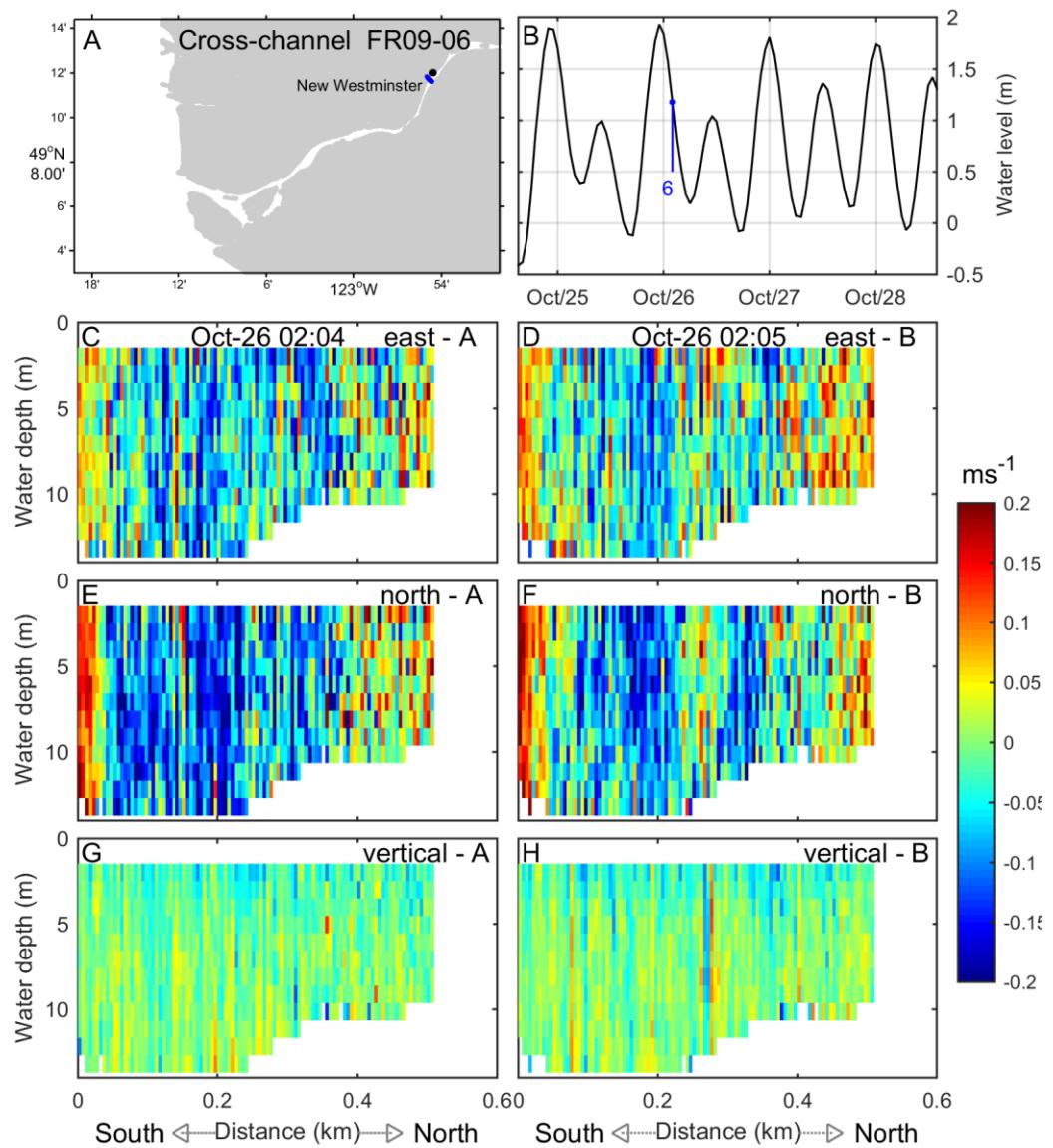


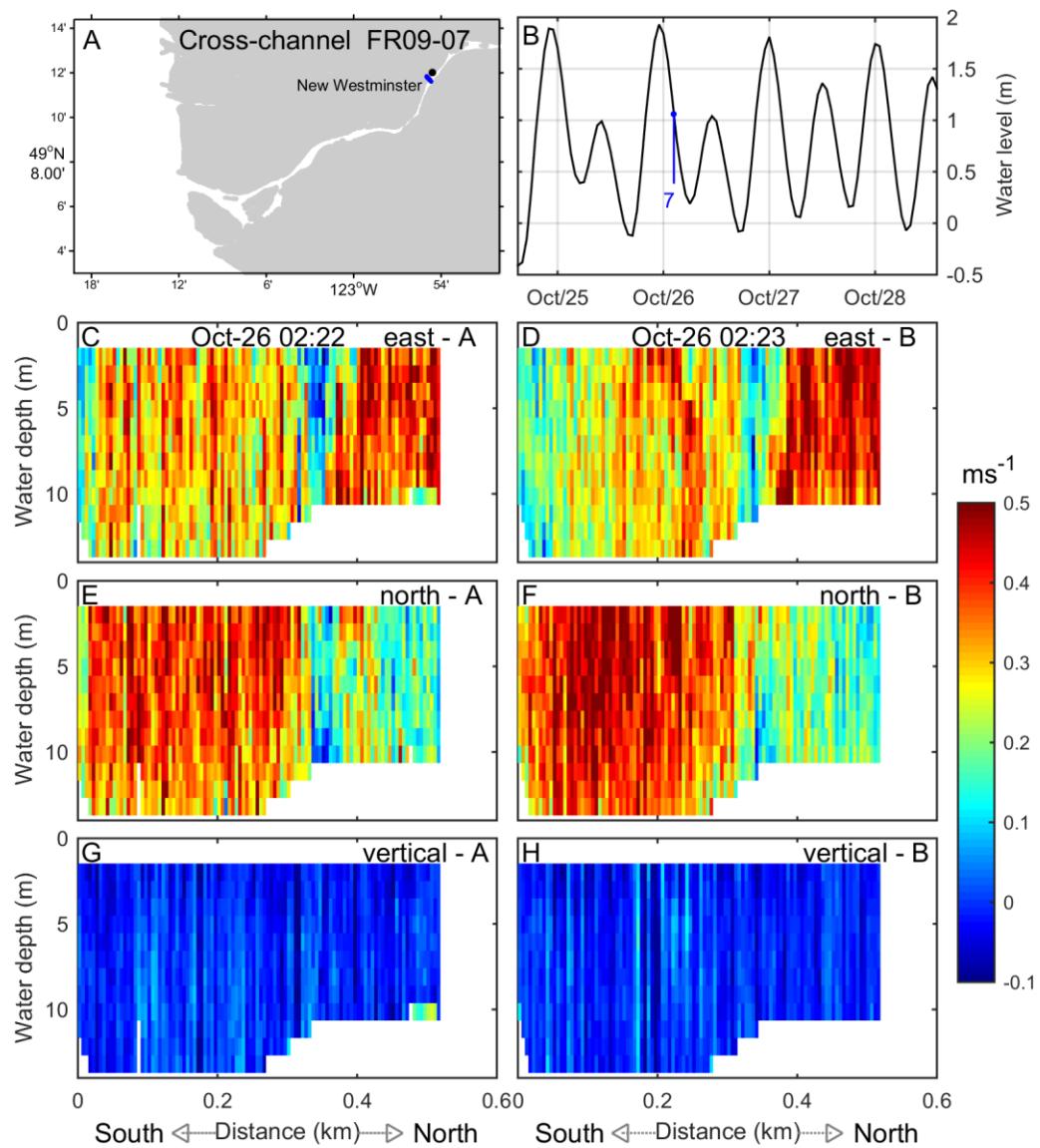


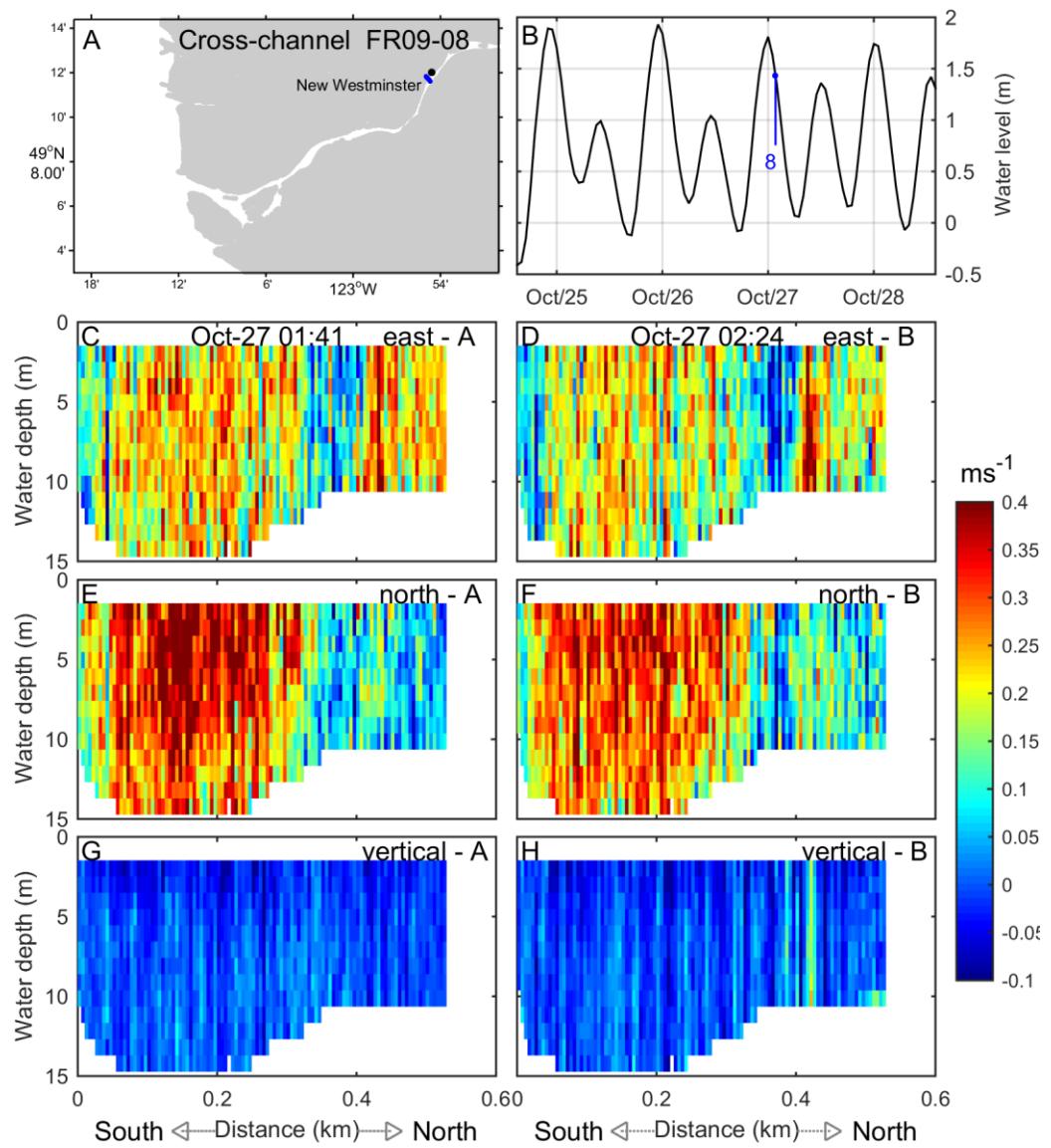


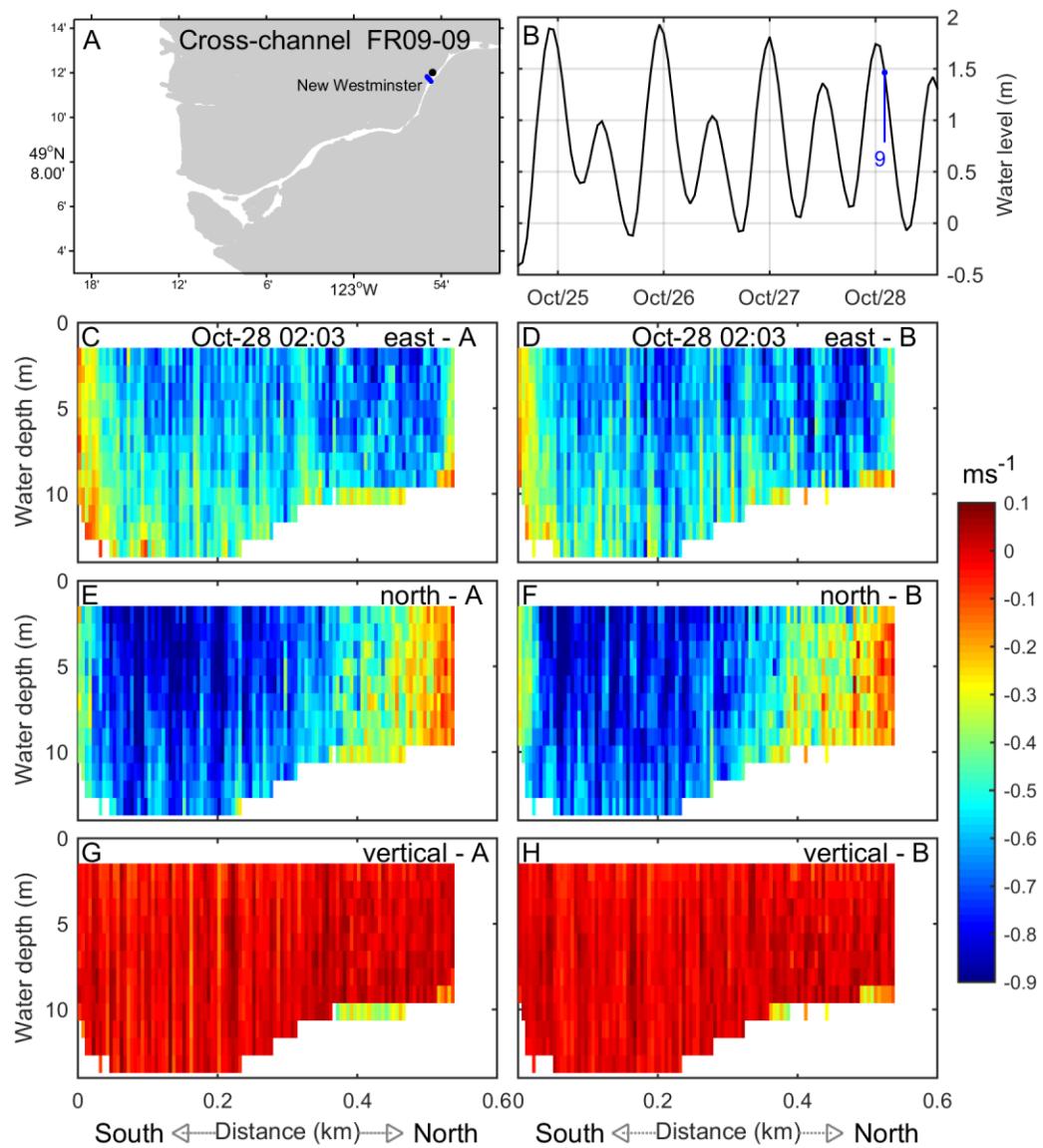


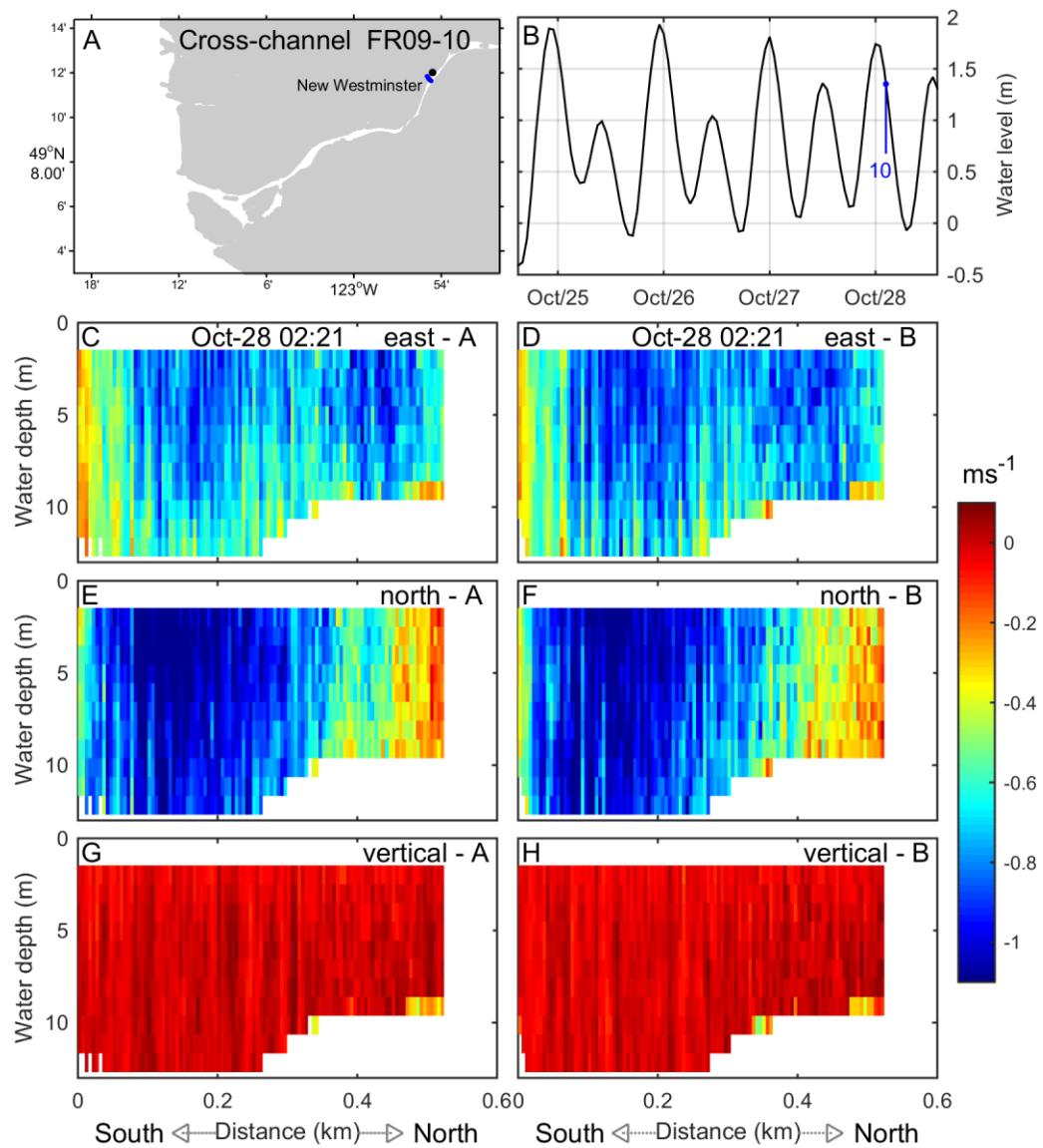


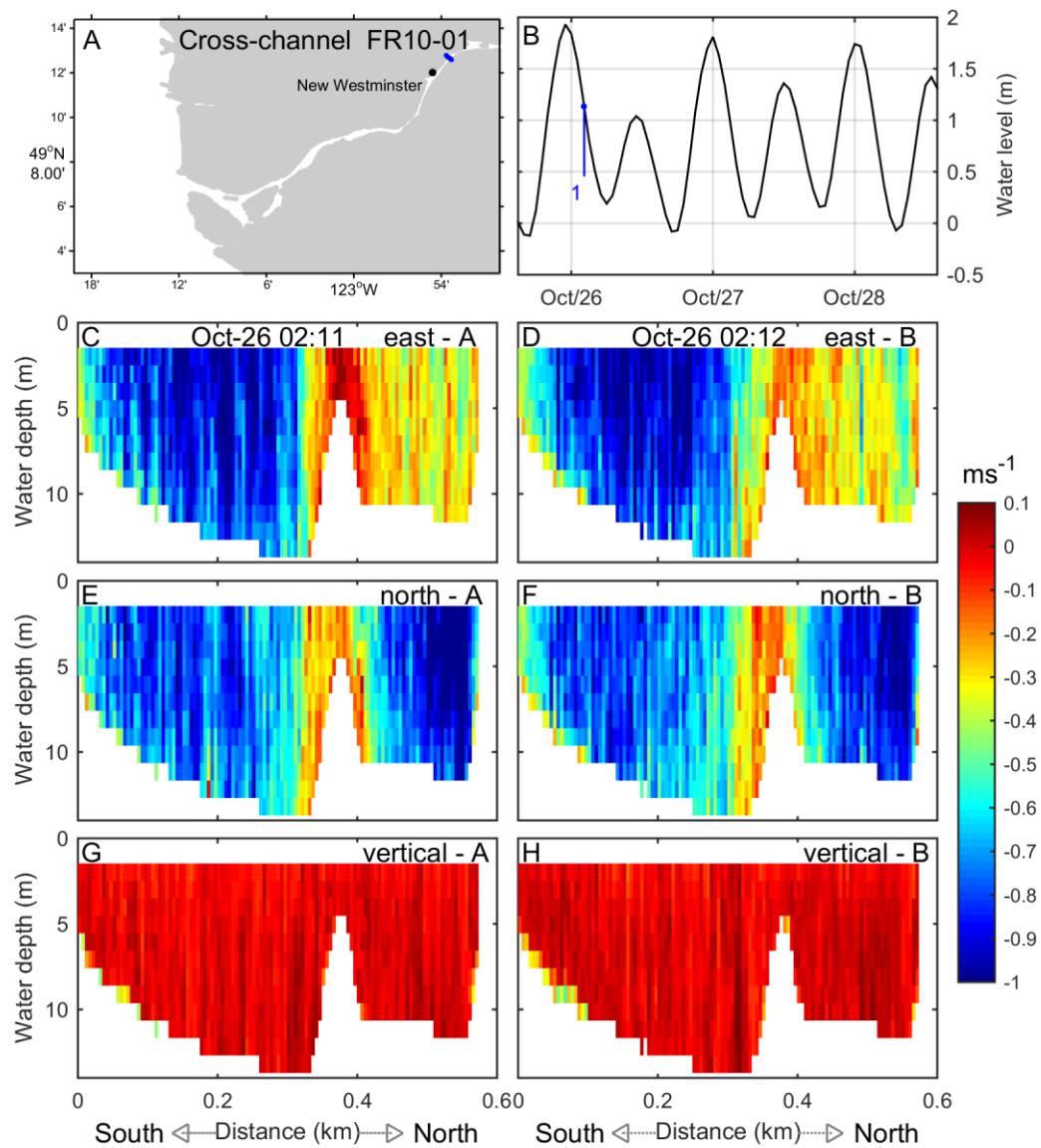


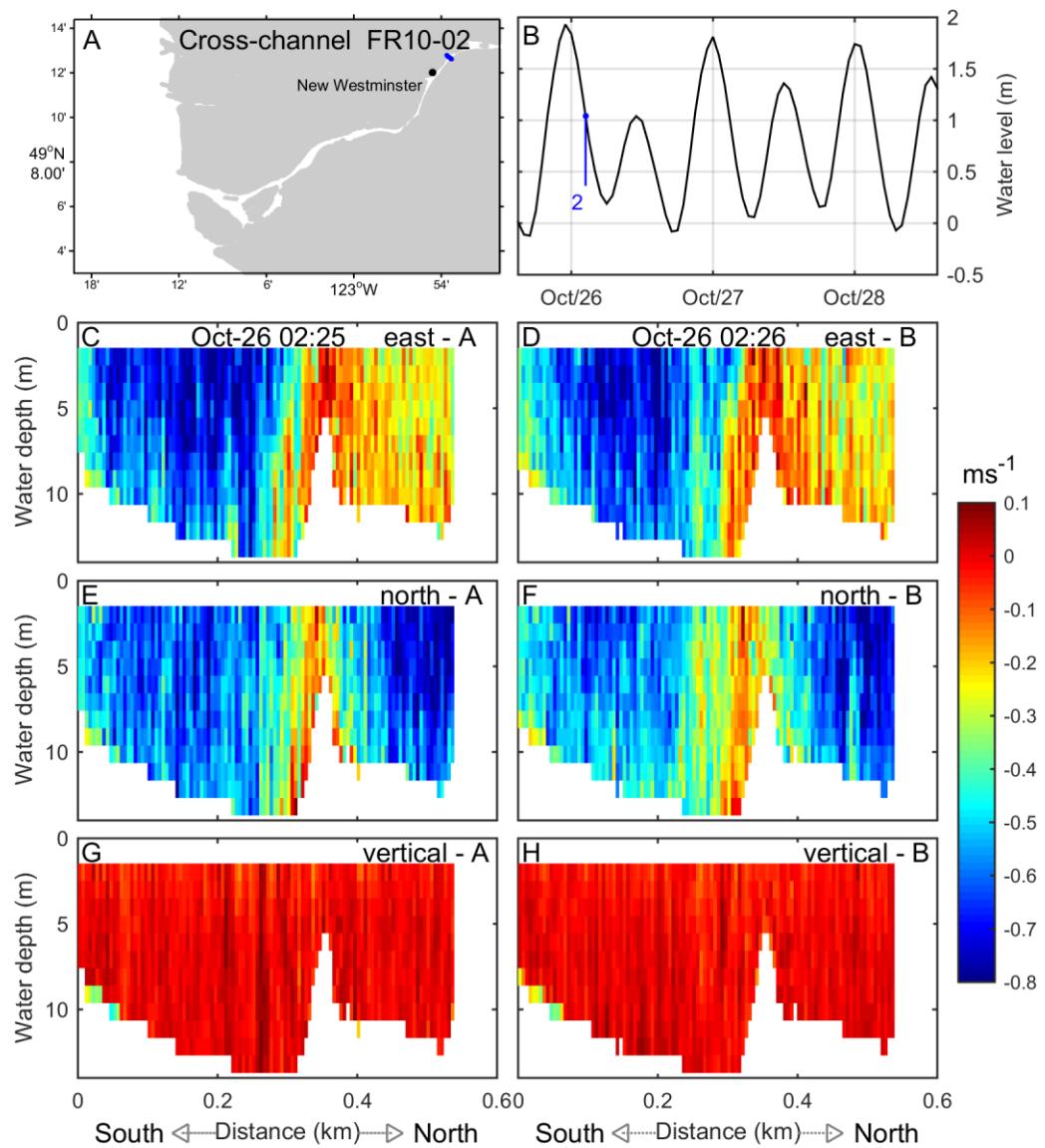


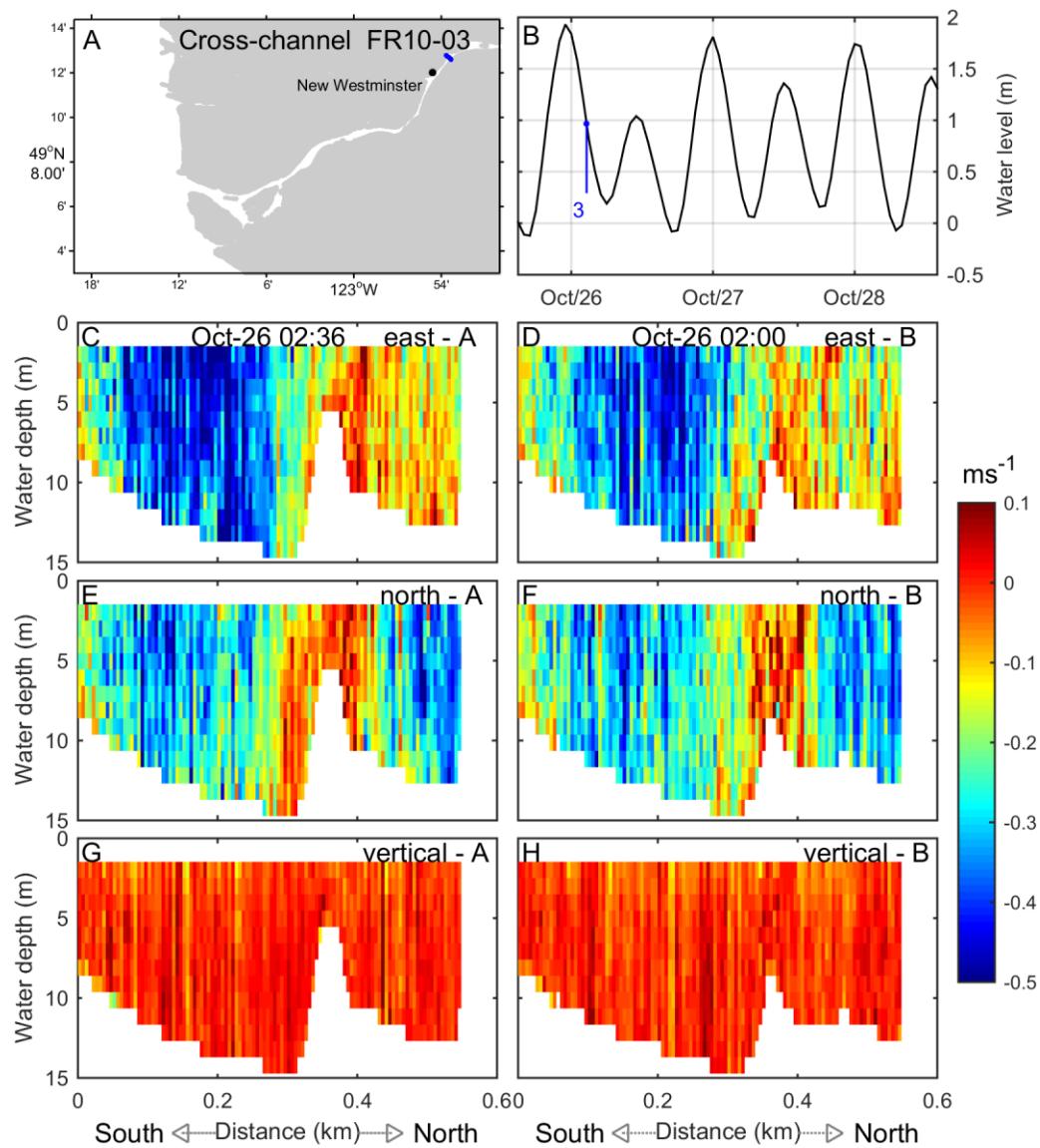


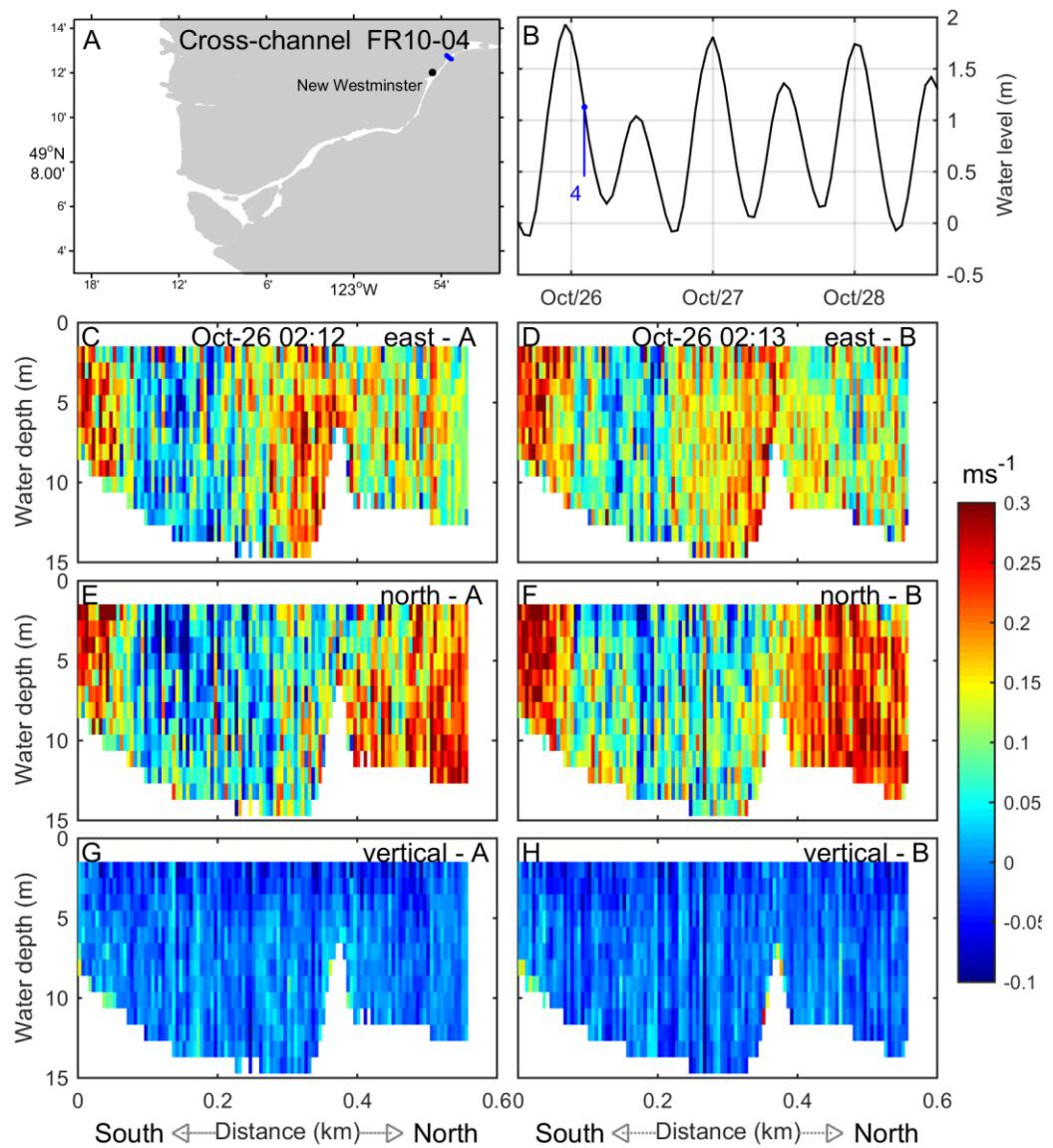


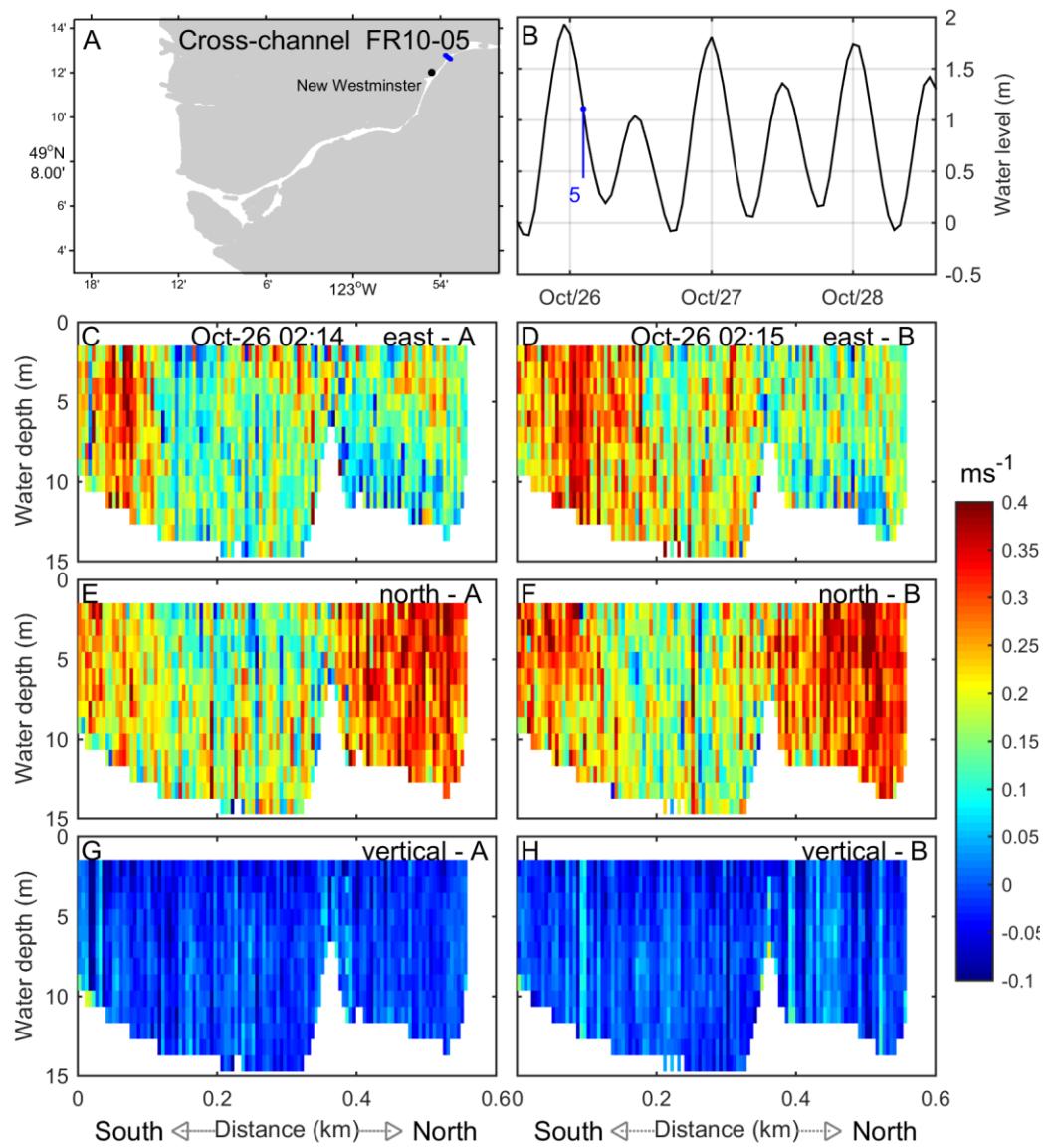


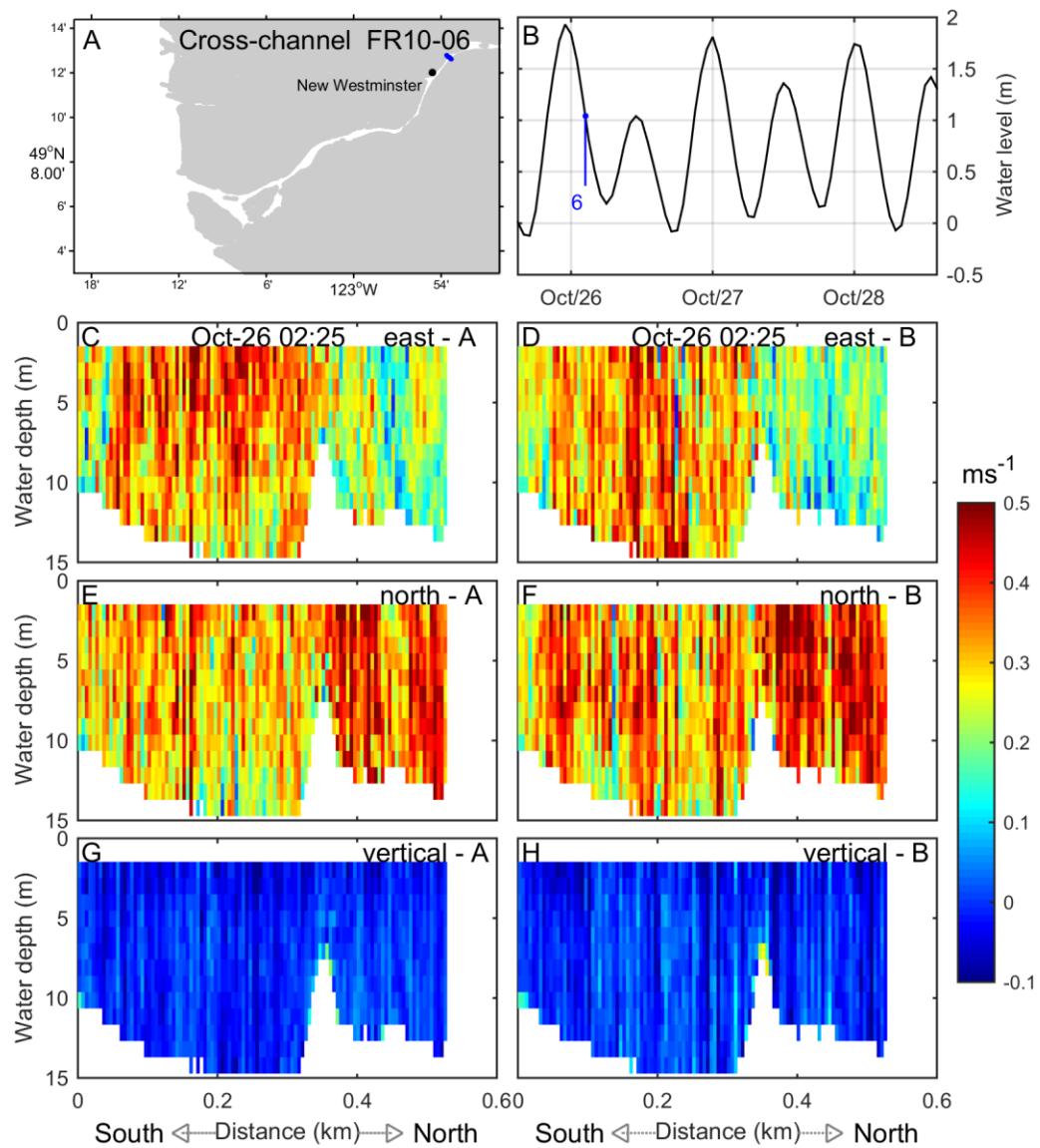


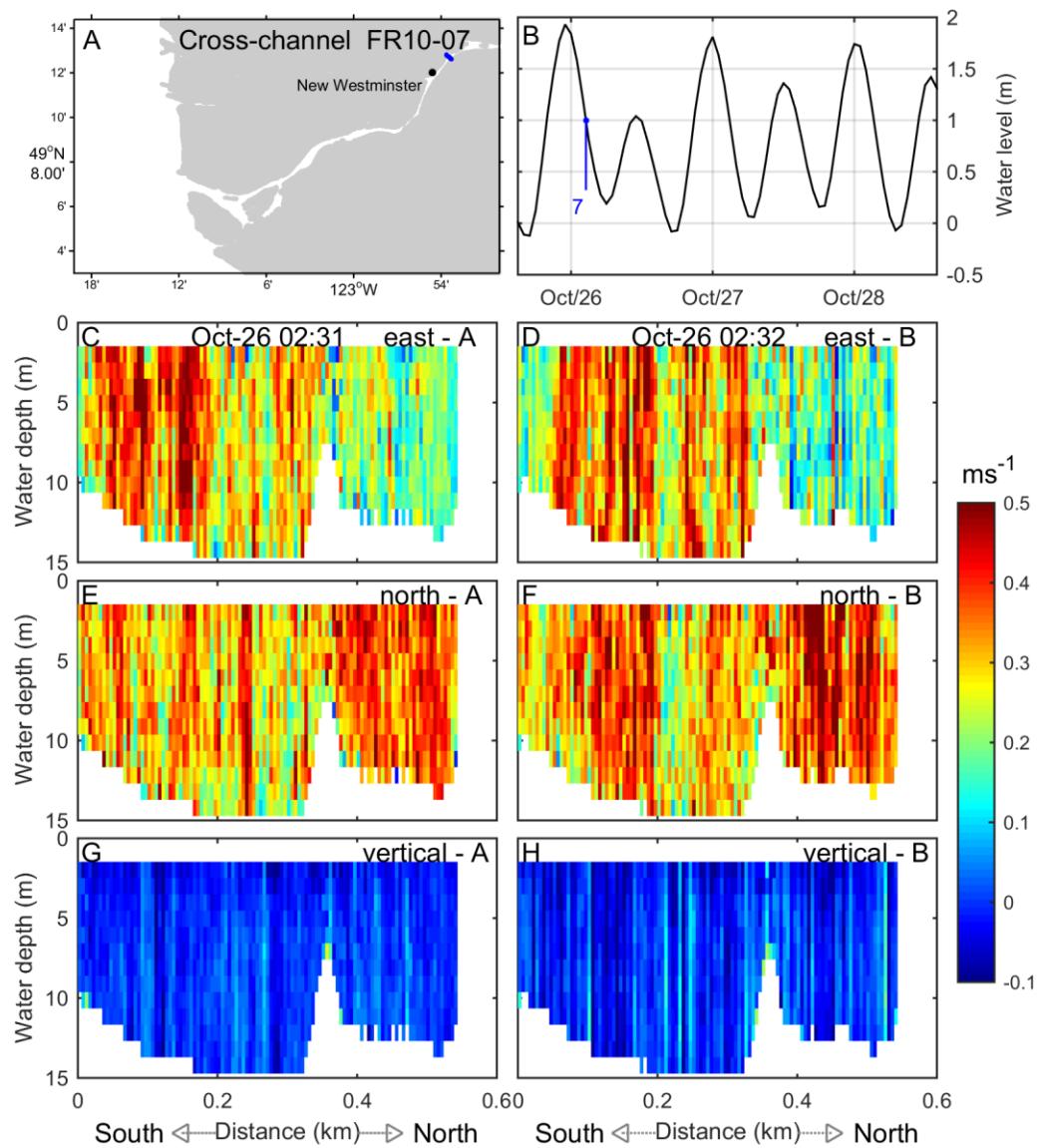


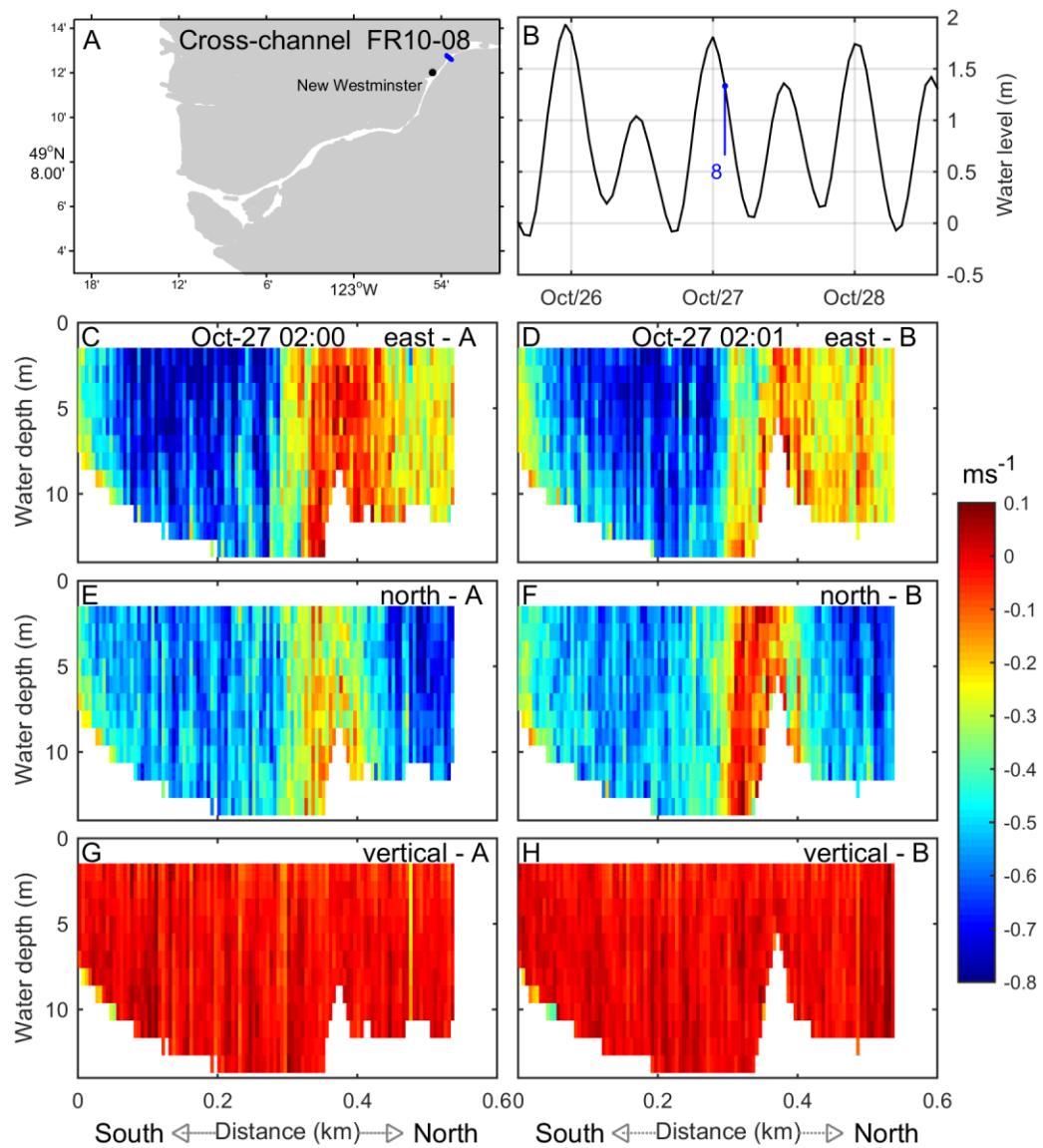


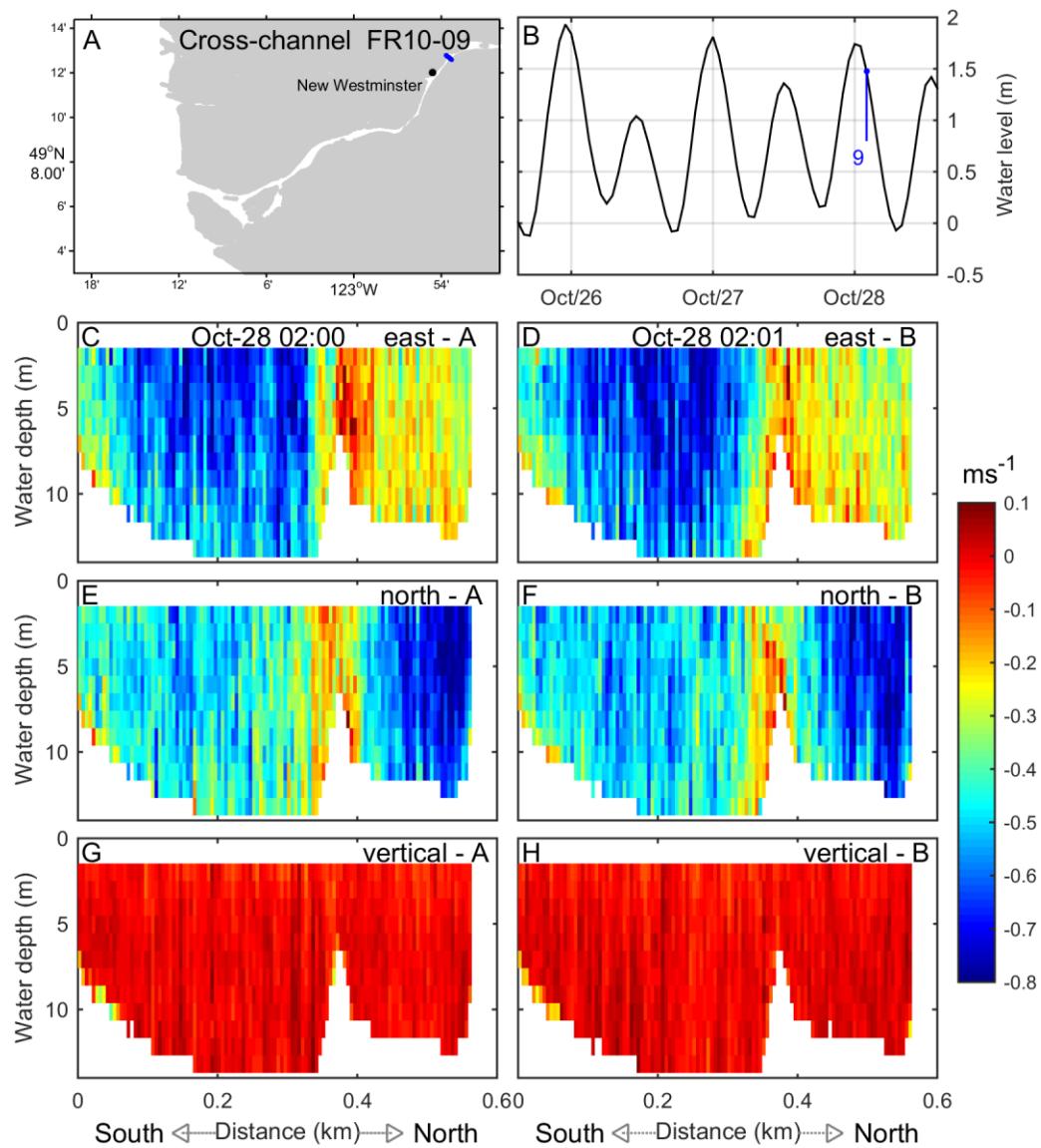


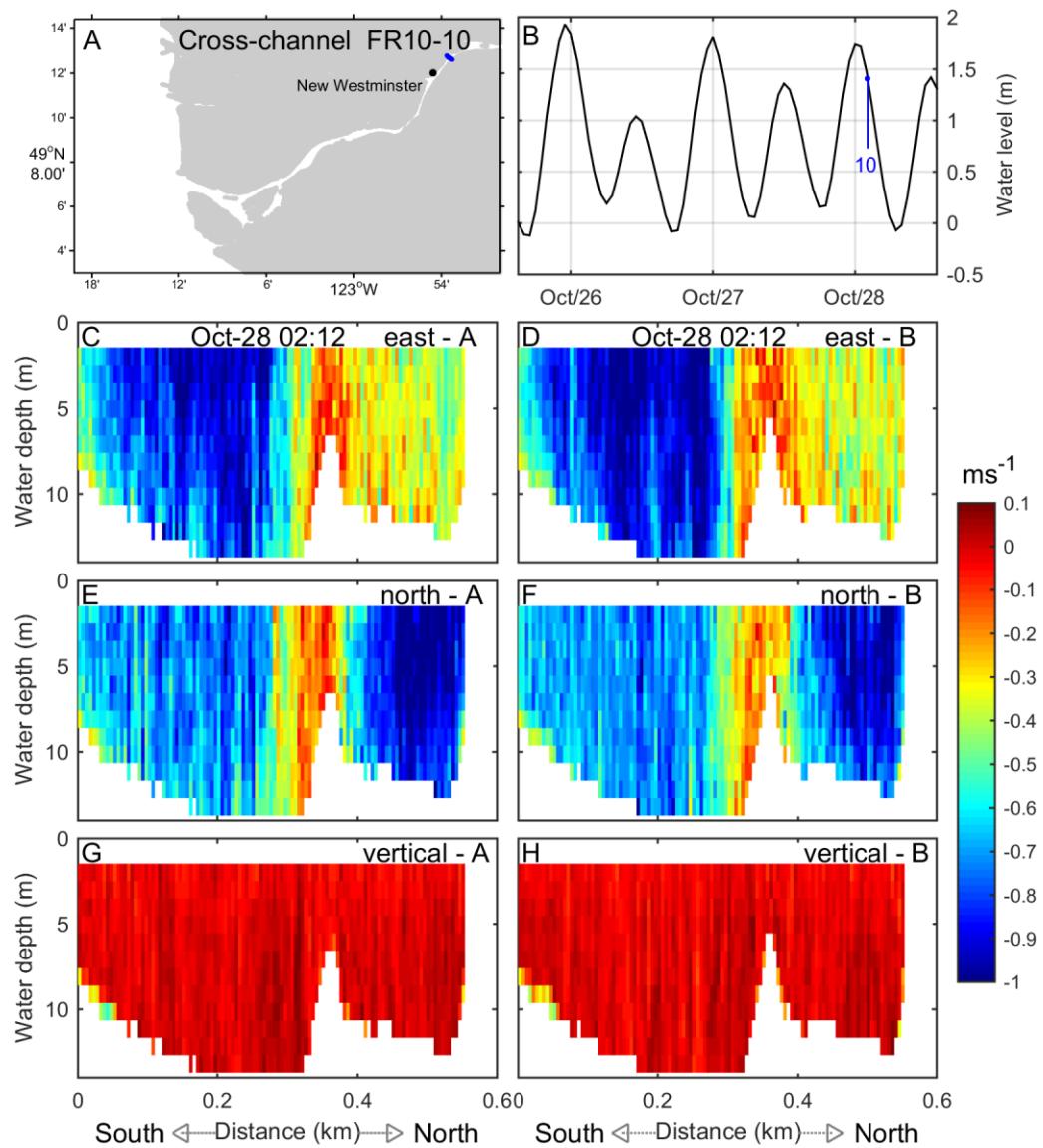


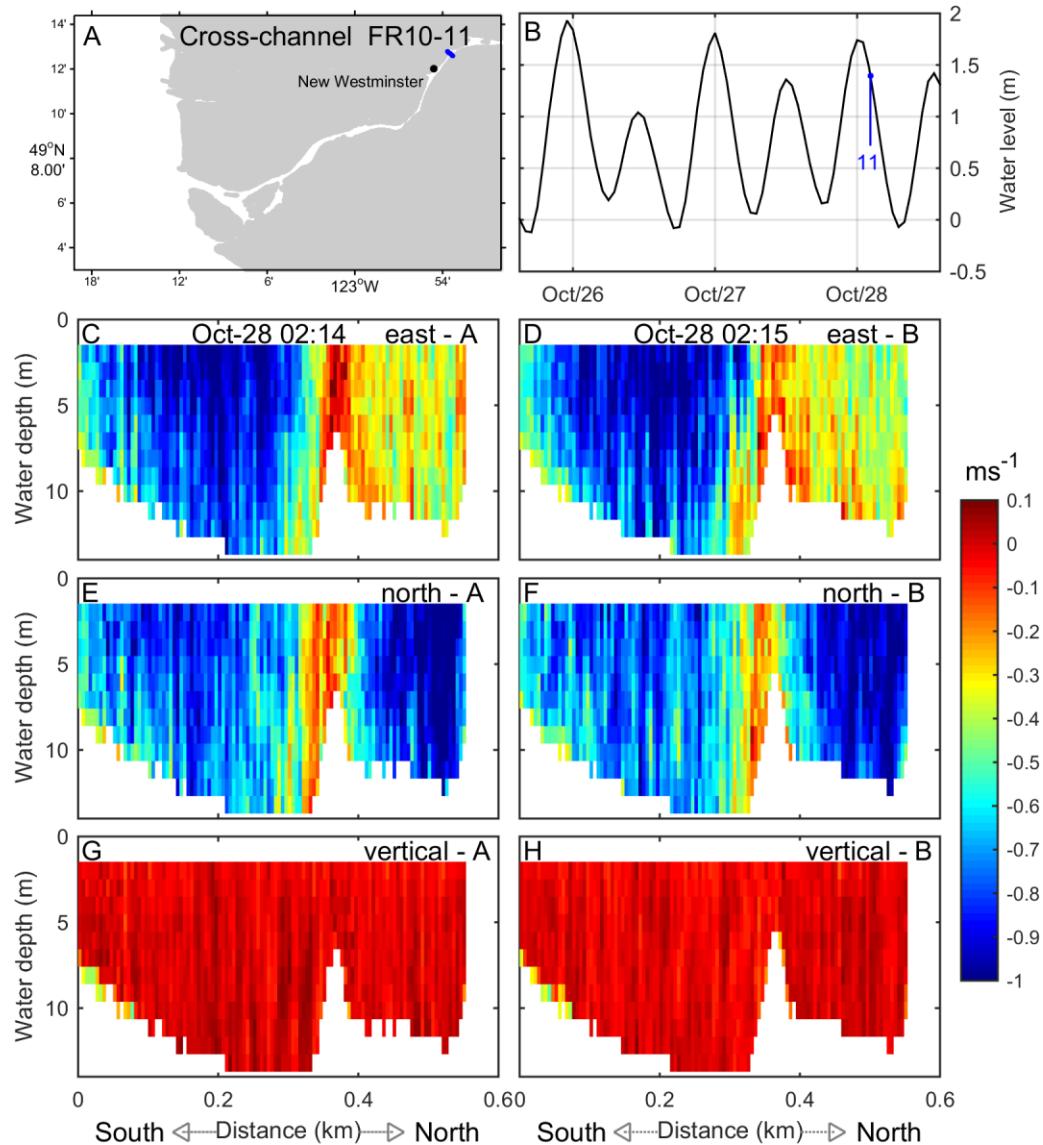












7.2.2 October Velocity Data Quiver Plots

The following figures contain quiver plots (subplots B and above) for different sampling days at a single location. The plots show surface velocity for along-channel and cross-channel transects measured in October 2016. The figures show the tidal cycle (subplot A) with the time of sampling depicted on the tidal cycle plot with the letter of the corresponding quiver plot. The units are in ms^{-1} .

