Universidad de Concepción

DATA REPORT
CORRIENTES MEDIDAS CON ADCP EN TIEMPO REAL

FIORDO AYSÉN
Septiembre-2009

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Introducción

El fiordo Aysén está centrado a los 45º22'S; 73º05'W, y pertenece a la XI Región de Aysén de Chile. Un primer tramo del fiordo (desde la cabeza) se orienta en dirección NW hasta el sector más al norte del fiordo, y luego cambia de sentido hacia el SW hasta la boca del fiordo, en donde desemboca con el canal Moraleda (**Fig. 1**). Los principales flujos de agua dulce que aportan al fiordo, son en primer grado el río Aysén ubicado en la cabecera, y luego los ríos Cóndor y Cuervo ubicados en el primer tramo (NW) del fiordo.

Para determinar la estructura espacial de las corrientes al interior del fiordo Aysén, se realizaron mediciones con Acoustic Doppler Currentmeter Profiler (ADCP) en transectos a lo largo (~56 km) y a lo ancho (~4-5 km) del estuario, entre los días 22-27 de septiembre del 2009, y que correspondió al periodo mareal entre fines de sicigia y plena cuadratura.

En la transecta a lo largo del fiordo, se obtuvieron perfiles de corrientes hasta aproximadamente 200 m de profundidad desde la cabeza hasta la boca del estuario, cubriendo un track de 56 km en aproximadamente 12 horas de medición. Estas mediciones se realizaron en conjunto con estaciones de CTD y recolección de zooplancton en una segunda embarcación.

En tanto las transectas a lo ancho del fiordo, se realizaron en las localidades cercanas al río Cóndor, río Cuervo y caleta Gato (**Fig. 1**), obteniéndose perfiles de corrientes entre 100-120 m de profundidad, durante un periodo de medición continua de 12-24 horas. Así, debido a que fueron efectuadas durante un periodo de mareas, fue posible ajustar armónicos para aislar el efecto mareal del residual en las componentes de la corriente a lo largo y ancho del fiordo (U,V).

Sin embargo cabe mencionar, que el transecto en caleta Gato no fue incluido en este Data Report debido a perfiles defectuosos detectados durante el procesamiento, los cuales fueron derivados principalmente de la subestimación del tamaño de las celdas de medición durante la previa programación del ADCP150, combinado con las malas condiciones meteorológicas en las que se obtuvieron estas mediciones.

Este informe se centra en presentar las componentes de la corriente a lo largo del fiordo (U) y transversal al fiordo (V). Valores positivos (color rojo) de U indican corrientes hacia fuera del fiordo, mientras que valores negativos de U (color azul) representan las corrientes hacia el interior del fiordo.

Mediciones con ADCP desde la embarcación (SIDE SHIP MOUNTED ADCP)

Para el registro de datos de corrientes, se utilizó un correntómetro perfilador acústico (ADCP) de 150 kHz (ADCP150) marca TRD-Instruments, operada en modo bottom-track (BT), el cual se instaló en un brazo de acero inoxidable a un costado de la embarcación (**Fig. 2**). En forma simultánea a las mediciones de corrientes, se registró la posición geográfica de la embarcación mediante un GPS marca GARMIN modelo GSMAP180C.

Los registros de ADCP remolcado obtenidos en esta campaña, fueron realizados a bordo de la embarcación "Doña Isabeth" a una velocidad máxima de 2 m s^{-1}, y el intervalo de tiempo entre cada medición fue de 2-2.4 s, lo cual implica que se efectuaron perfiles de corrientes a una distancia aproximada de 4 m. Posteriormente, los perfiles fueron promediados cada 1 minuto, lo cual entrega perfiles promedio cada 120 m aproximadamente (el detalle de las diferentes configuraciones utilizadas se muestran en el **ANEXO**).

Procesamiento de la información

El control de calidad de los perfiles de corrientes consideró la eliminación de los datos evidentemente erróneos de cada circuito, además de criterios estándares de bondad (percent good) sobre el 30%, flujo (discharge) <100 m^3 s^{-1} y error menor a 0.02 m s^{-1}, finalmente se consideraron sólo aquellos perfiles cuyas diferencias entre las velocidades registradas por el BT del ADCP y la velocidad registrada por el GPS fueron menores a 3 m s^{-1}.

Un segundo criterio consideró la corrección de la dirección, debido a que el compás magnético del ADCP es afectado por los campos magnéticos generados por el desplazamiento de la embarcación y por la desviación magnética local (**Joyce, 1989; Pollard & Read, 1989; Trump & Marmorino, 1997**). Esta corrección implica la comparación de la velocidad del bottom-track y las obtenidas desde la navegación, de esta forma se obtiene una corrección para el compás (α) y para la magnitud (β), los cuales son usados para corregir el perfil completo de velocidades (**Valle-Levinson & Atkinson, 1999**).

Cabe señalar, que en el fiordo Aysén se identifican a lo menos 3 subcuencas de diferentes profundidades medidas. La primera, entre 160-200 m de profundidad, se ubica desde la cabeza hasta unos 20 km de distancia, con un umbral secundario en la boca de esta subcuenca (~140 m). La segunda subcuenca, es la más profunda (300 m), no posee umbral, tiene un largo aproximado de 15 km y se ubica en el centro del fiordo, desde el río Cuervo hasta el sector norte del fiordo, en donde este cambia de dirección. La tercera subcuenca (~15 km) posee profundidades más irregulares que las anteriores (~220 m), y se caracteriza por tener el umbral más somero del fiordo (~50 m), ubicado en su respectiva boca.

Resultados

Para describir la circulación al interior del fiordo Aysén durante septiembre 2009, se utilizaron principalmente dos formas de recopilar la información, **(1)** un transecto de ADCP remolcado a lo largo del fiordo, desde la cabeza hasta la boca, intentando seguir el eje más

central del fiordo, con una extensión aproximada de 56 km de largo; y **(2)** transectos perpendiculares al fiordo (~4-5 km), con mediciones continuas durante 12 y 24 horas recolectando un total de 34 tracks.

Transectos a lo largo del eje

Debido a que el estuario presenta diferentes orientaciones a lo largo, es que las componentes U y V corregidas con el procesamiento antes descrito, son re-orientadas en función de la dirección del track, la cual se aproxima a la dirección del fiordo (**Fig. 1**). El punto de referencia utilizado (distancia=0), se ubica cerca de la cabeza del fiordo (45º25.51'S; 72º52.62'W), mientras que, el grado de rotación de las componentes (U,V), se obtienen a partir del ángulo entre las posición medidos en función del track. De esta forma, la componente U, representa la velocidad de la corriente a lo largo del track (o el fiordo), mientras que la componente V, contiene las velocidades transversales al track (o el fiordo).

Transectas perpendiculares al eje del fiordo

Las componentes U y V de las transectas efectuadas, se rotaron a lo largo y ancho del fiordo respectivamente, dependiendo de la dirección del track (**Fig. 1**). Así, las componentes de la corriente medidas en el transecto de Cóndor, se rotaron con un ángulo de 300º, mientras que para las corrientes medidas en Cuervo se utilizó un ángulo de 320º.

De esta forma, U representa la componente a lo largo del estuario con valores positivos hacia la boca, y negativos hacia la cabeza. En tanto la componente V, representa las corrientes perpendiculares a la costa del fiordo, con valores positivos hacia la rivera Sur, y negativos hacia la rivera Norte.

Finalmente, las componentes de la corriente fueron interpoladas en grillas de 100 m de distancia horizontal, cada 1.5 m de profundidad en la transecta Cóndor y la transecta a lo largo del fiordo, y cada 1 m en la transecta medida en Cuervo. Con los datos de corriente interpolados, se procedió a estimar el armónico semidiurno (M_2) de la corriente en cada punto de la grilla, y la componente diurna (K_1) en el caso en que la duración del circuito realizado fuera mayor o igual a 24 horas (**Emery & Thompson, 1998**). Además, se incorporan gráficas de la bondad de ajuste de las corriente residual (Goodness of fit).

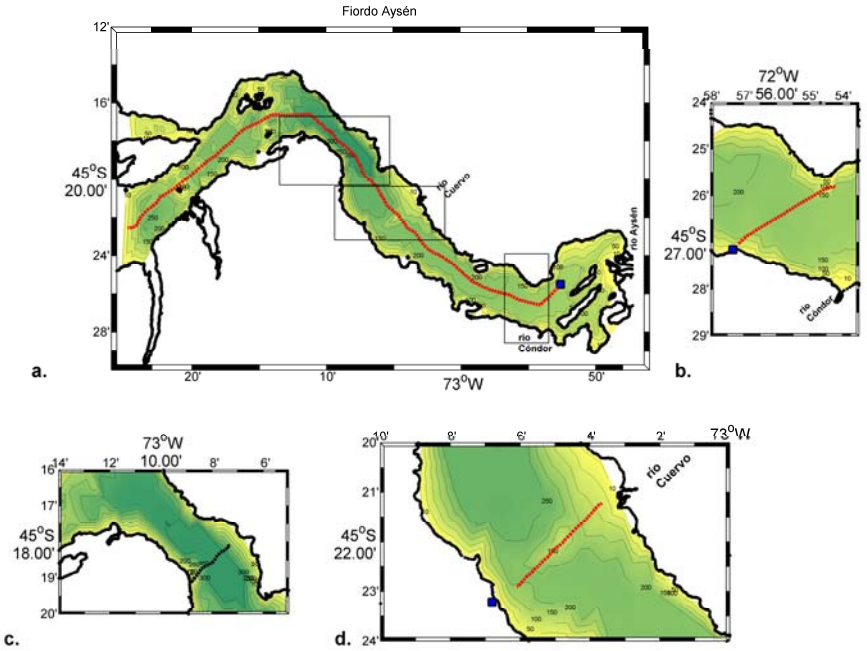

Figura 1. Transectos de ADCP remolcado al interior del fiordo Aysén (línea punteada). Transecta a lo largo del fiordo **(a)**, transecta Cóndor **(b)**, transecta Gato **(c)** y transecta Cuervo **(d)**. El cuadro azul simboliza la posición de referencia para los tracks. La transecta Gato no es incluida en este informe.

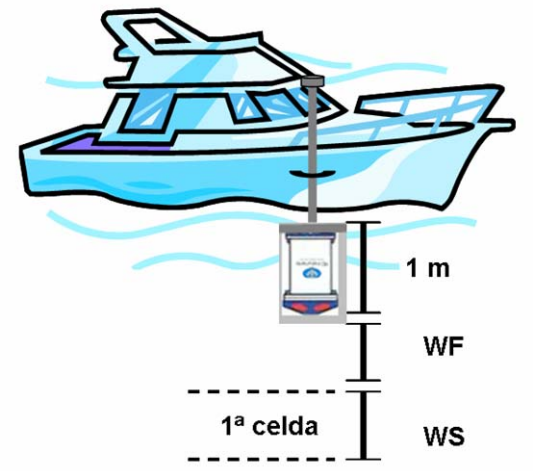

Figura 2. Figura esquemática de mediciones con ADCP, instalado en un brazo de acero inoxidable y remolcado por una embarcación (side-mounted ADCP). La figura muestra la profundidad de los transductores (~1 m), distancia del blanco (WF) y el ancho de la primera celda de medición (WS).

ANEXO

Configuraciones utilizadas para el muestreo

A continuación se presentan las configuraciones de usuario con las cuales se programaron las diferentes mediciones de ADCP desde la embarcación. El programa de toma de datos utilizados fue WINRIVER 1.03, programa que permite la adquisición de datos tanto de ADCP como de GPS. Desde este programa se pueden configurar diversos parámetros del registro a través de comandos. Los principales comandos se listan a continuación:

WN : Número de celdas
WS : Tamaño de la celda en cm (el mín. y máx. depende de cada frecuencia)
TE : Intervalo de medición (ensemble interval, TE00000240 = cada 2.4 s)
BP : Número de bottom pings por cada medición
WP : Número de water pings por cada medición (por lo general, BP = WP)
BX : Máxima profundidad del fondo en dm (ej. 220 m = BX2200)
WF : Distancia del blanco
WV **:** Ambigüedad de la velocidad o velocidad aparente (cm/s)
BC **:** Magnitud mínima de Correlación

Los demás comandos existentes, son utilizados con su valor por defecto y pueden ser consultados en el manual del instrumento. En la siguiente tabla se muestran las configuraciones realizadas durante esta campaña.

Tabla 1: Configuraciones del ADCP 150 kHz, realizado durante la campaña septiembre 2009 al interior del fiordo Aysén.

Transecta	a lo largo del fiordo	Gato	Cóndor		Cuervo
Fecha	22/9/2009	23/09/2009	25/09/2009		27/09/2009
WN	128	250	255	255	255
WS	300	150	100	100	150
TE	00000200	00000240	00000200	00000230	00000240
BP	1	1	1	1	1
WP	1	1	1	1	1
BX	3750	3750	2200	2200	3100
WF	100	100	100	100	100
WV	120	120	120	120	120
BC	110	110	110	110	110

FIGURES

[Side-ship ADCP data from transect

Along Fjord

September-2009]

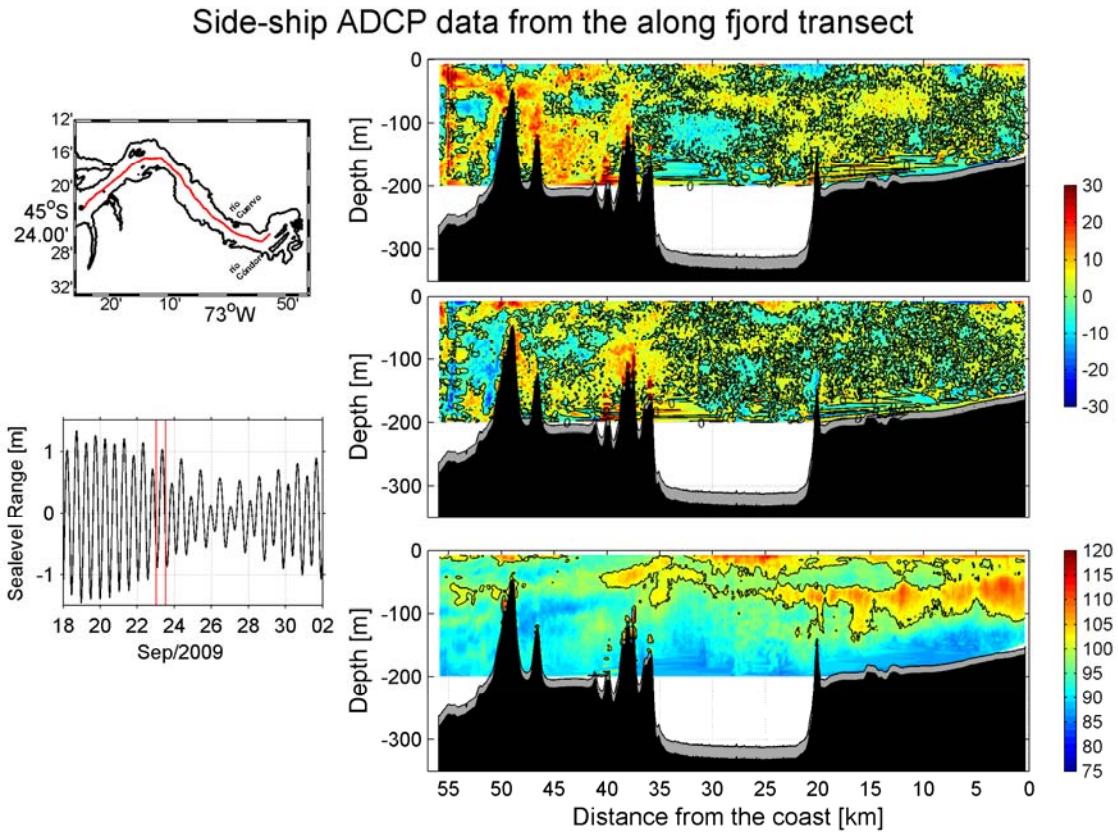

Figure 01: (a) Along-fjord and (b) Cross-fjord components of the current,(c) backscatter of the sound, register in the along fjord track and (upper-left insert), also the sealevel period of the measurements is showed (left-left insert). Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 23/Sep/2009 at 00:53 UTC and 23/Sep/2009 at 12:56 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

FIGURES

[Side-ship ADCP data from transect,
CONDOR
September-2009]

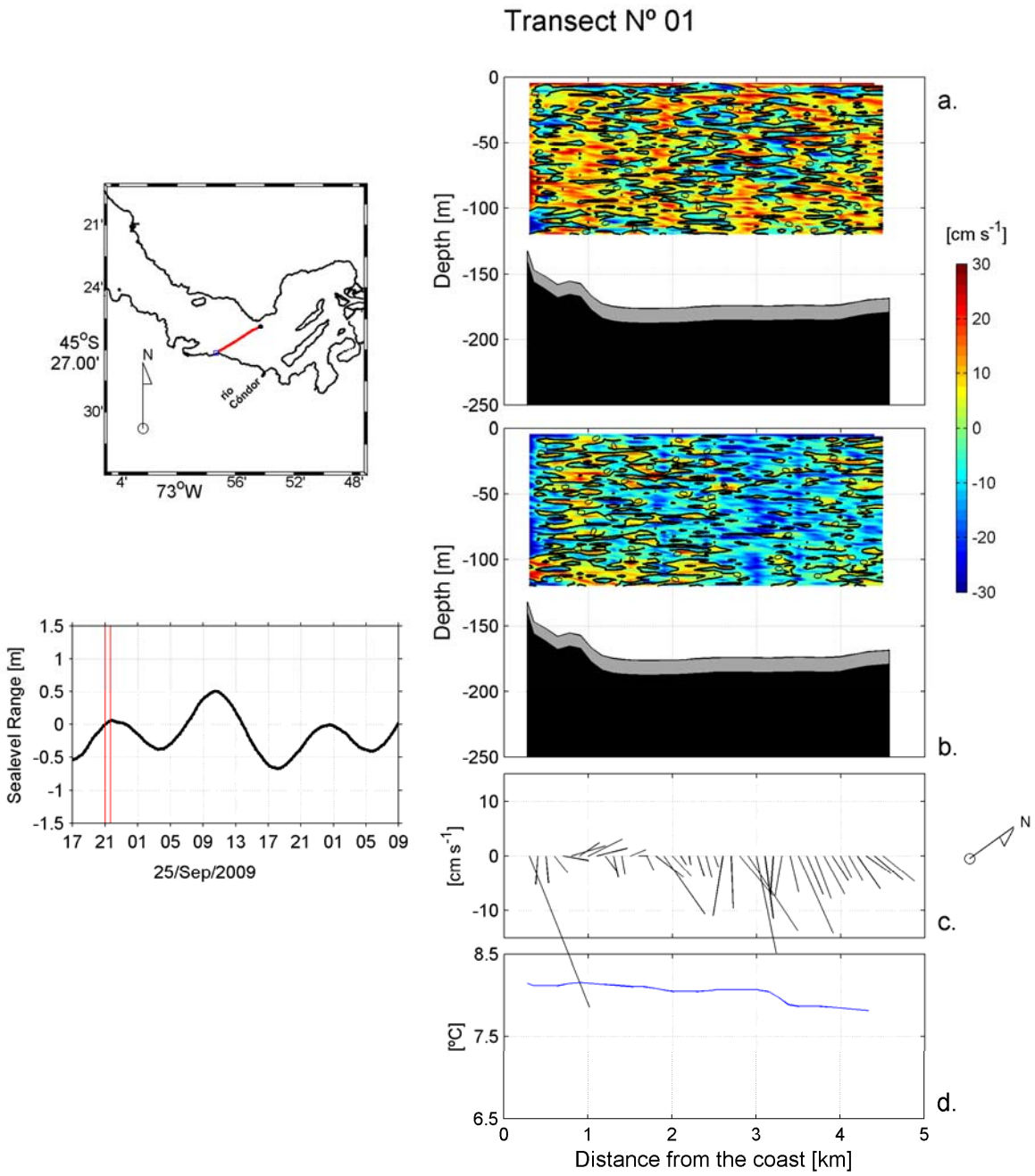

Figure 01: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 25/Sep/2009 at 21:31 UTC and 25/Sep/2009 at 22:10 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

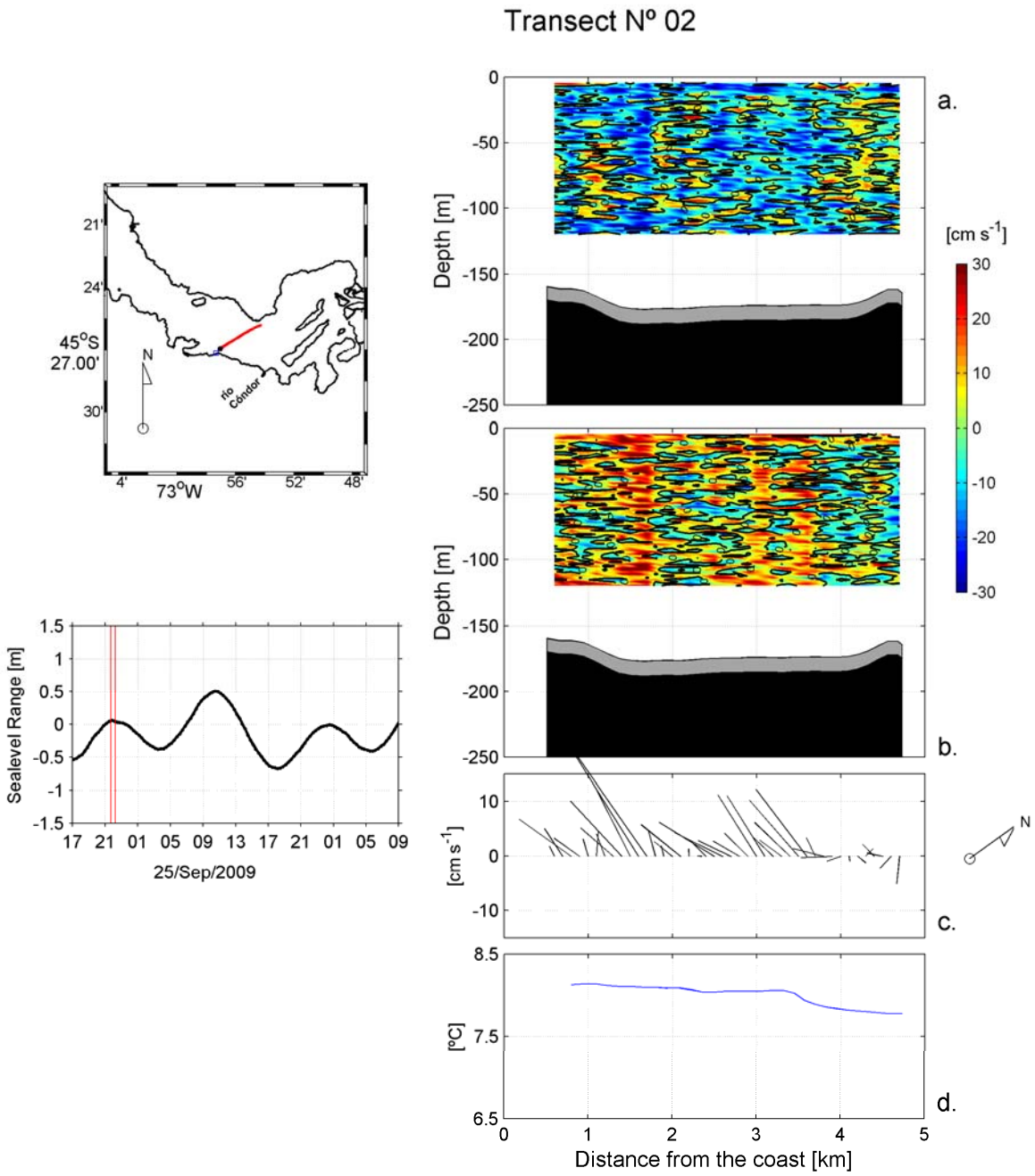

Figure 02: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 25/Sep/2009 at 22:12 UTC and 25/Sep/2009 at 22:44 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

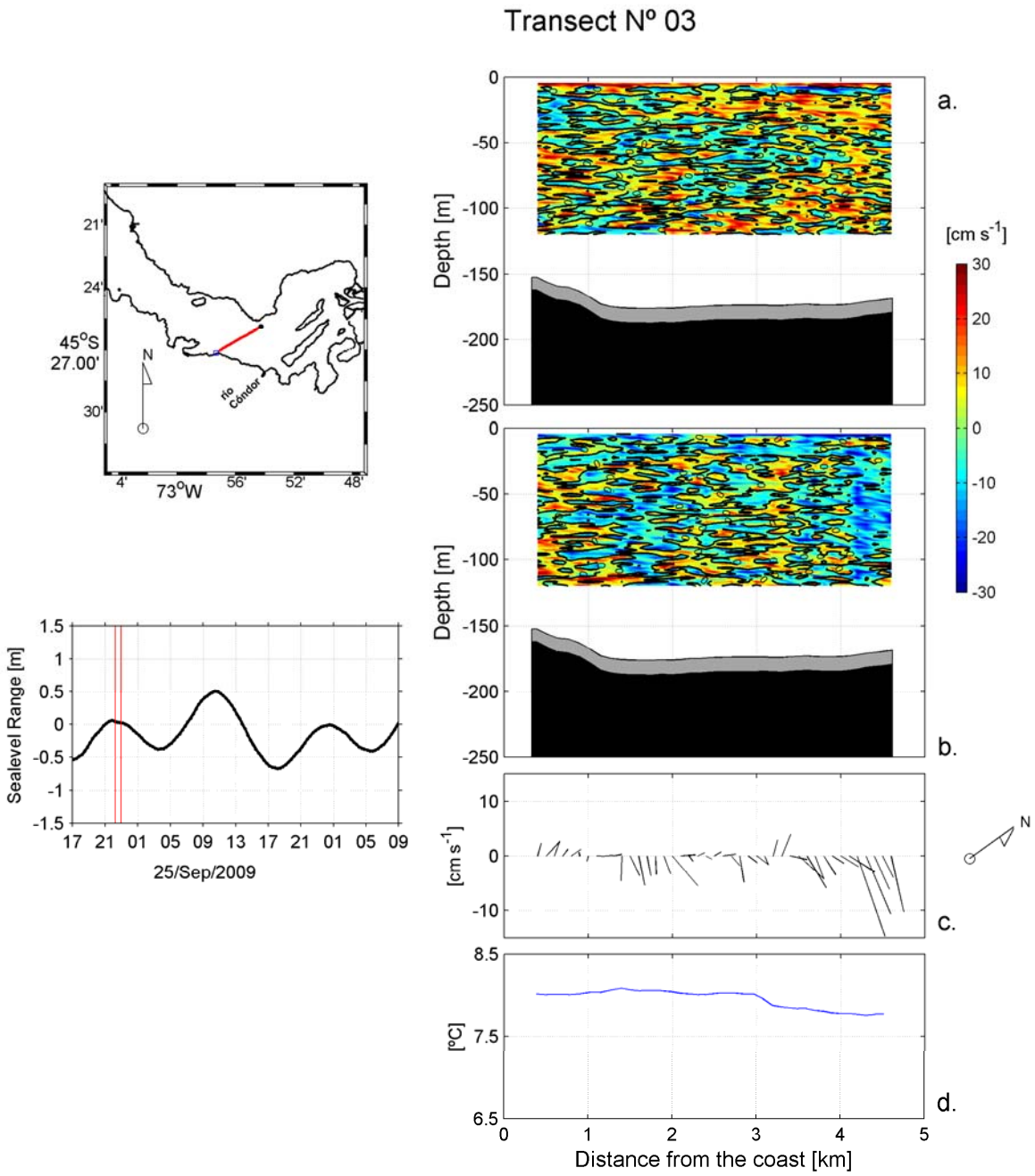

Figure 03: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 25/Sep/2009 at 22:46 UTC and 25/Sep/2009 at 23:27 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

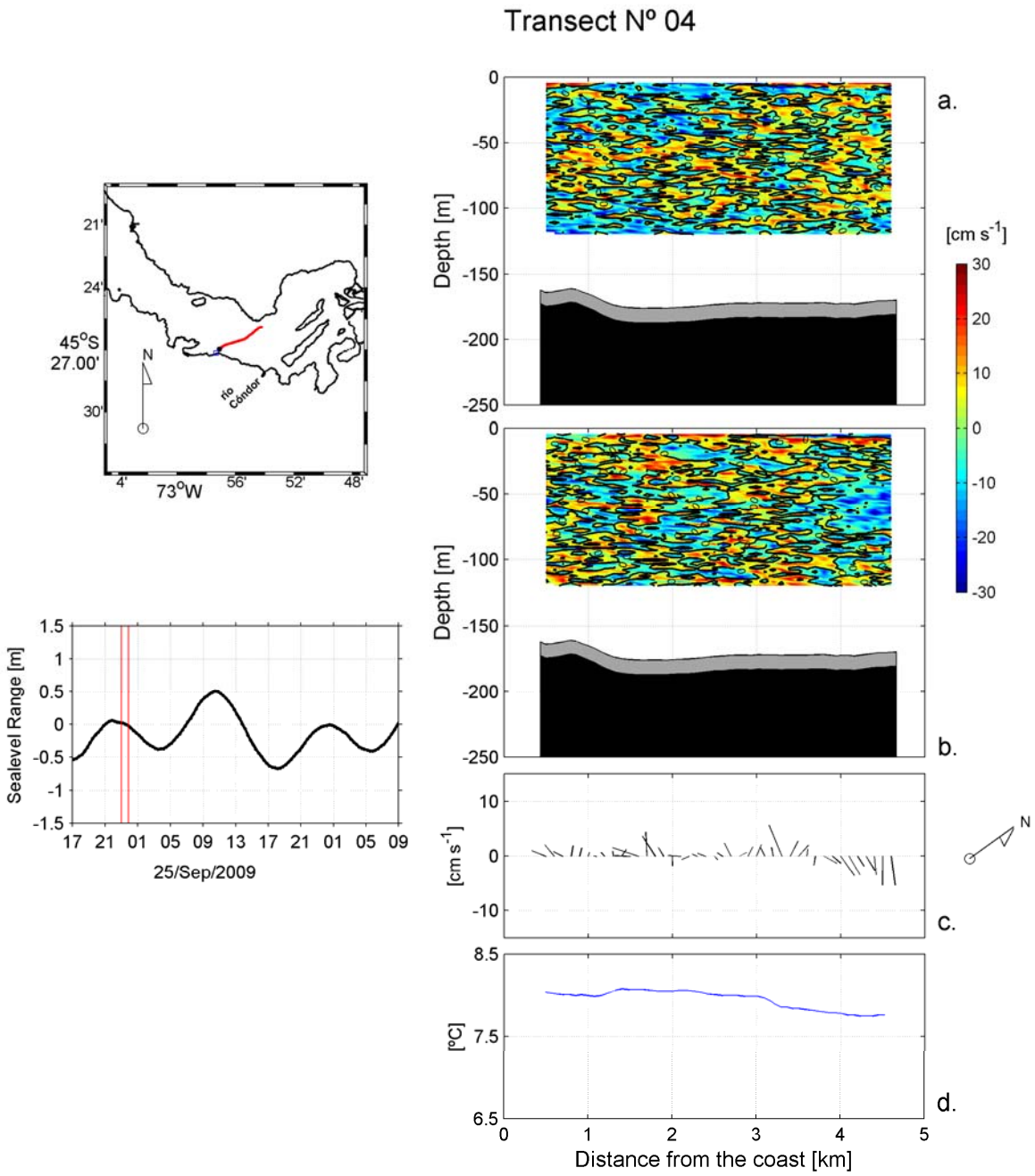

Figure 04: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 25/Sep/2009 at 23:30 UTC and 26/Sep/2009 at 00:26 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

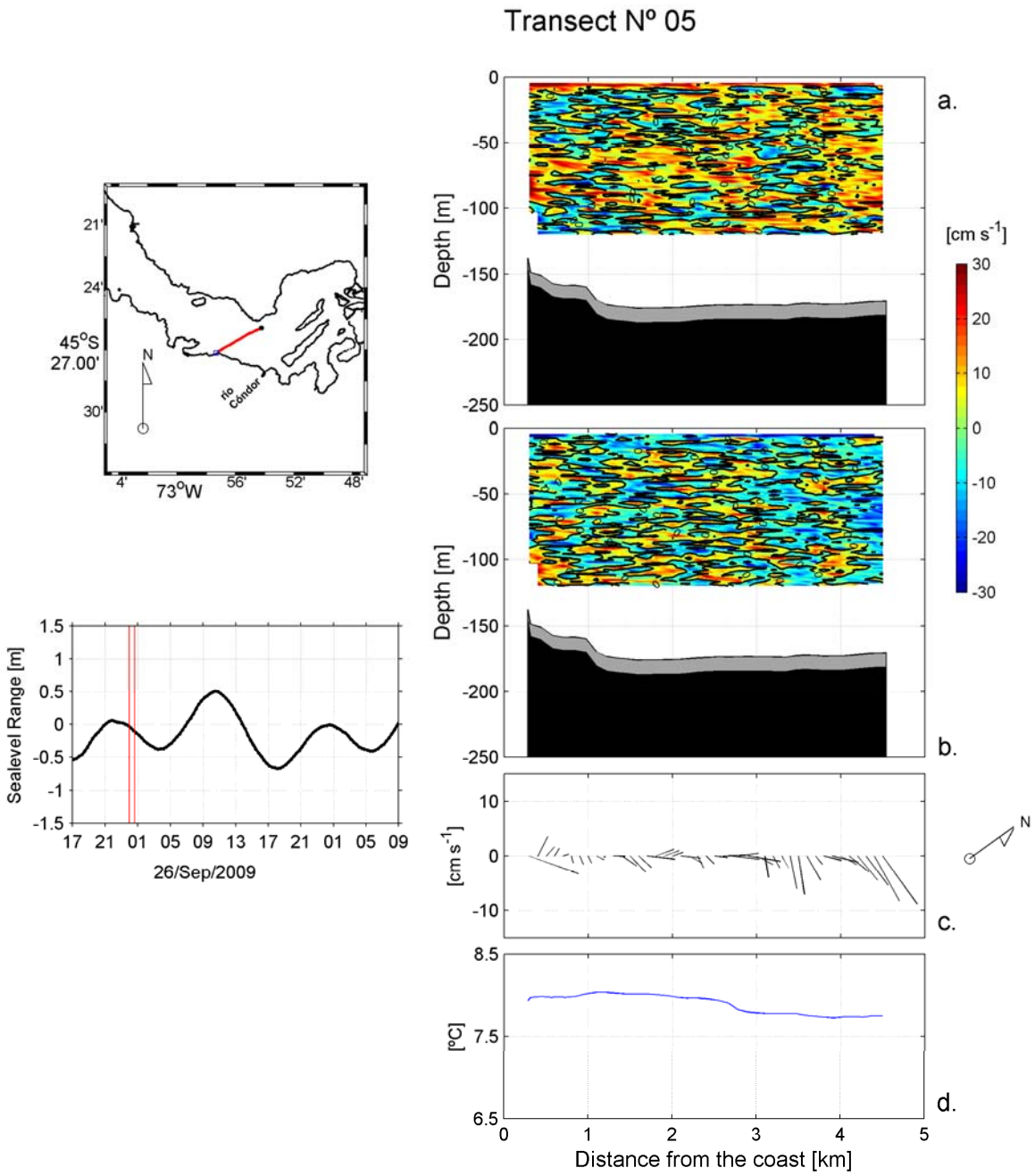

Figure 05: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 00:28 UTC and 26/Sep/2009 at 01:07 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

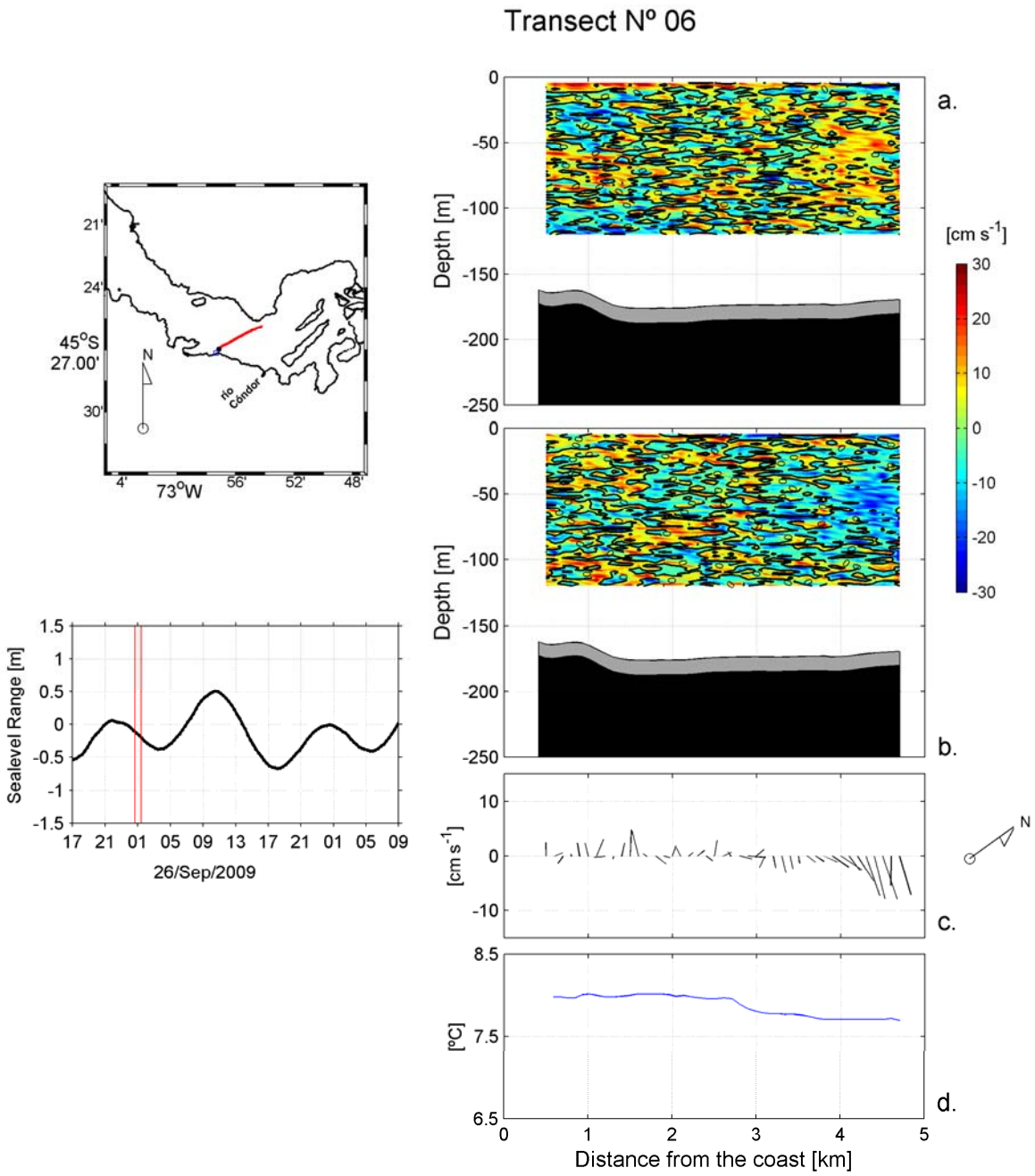

Figure 06: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 01:08 UTC and 26/Sep/2009 at 01:56 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

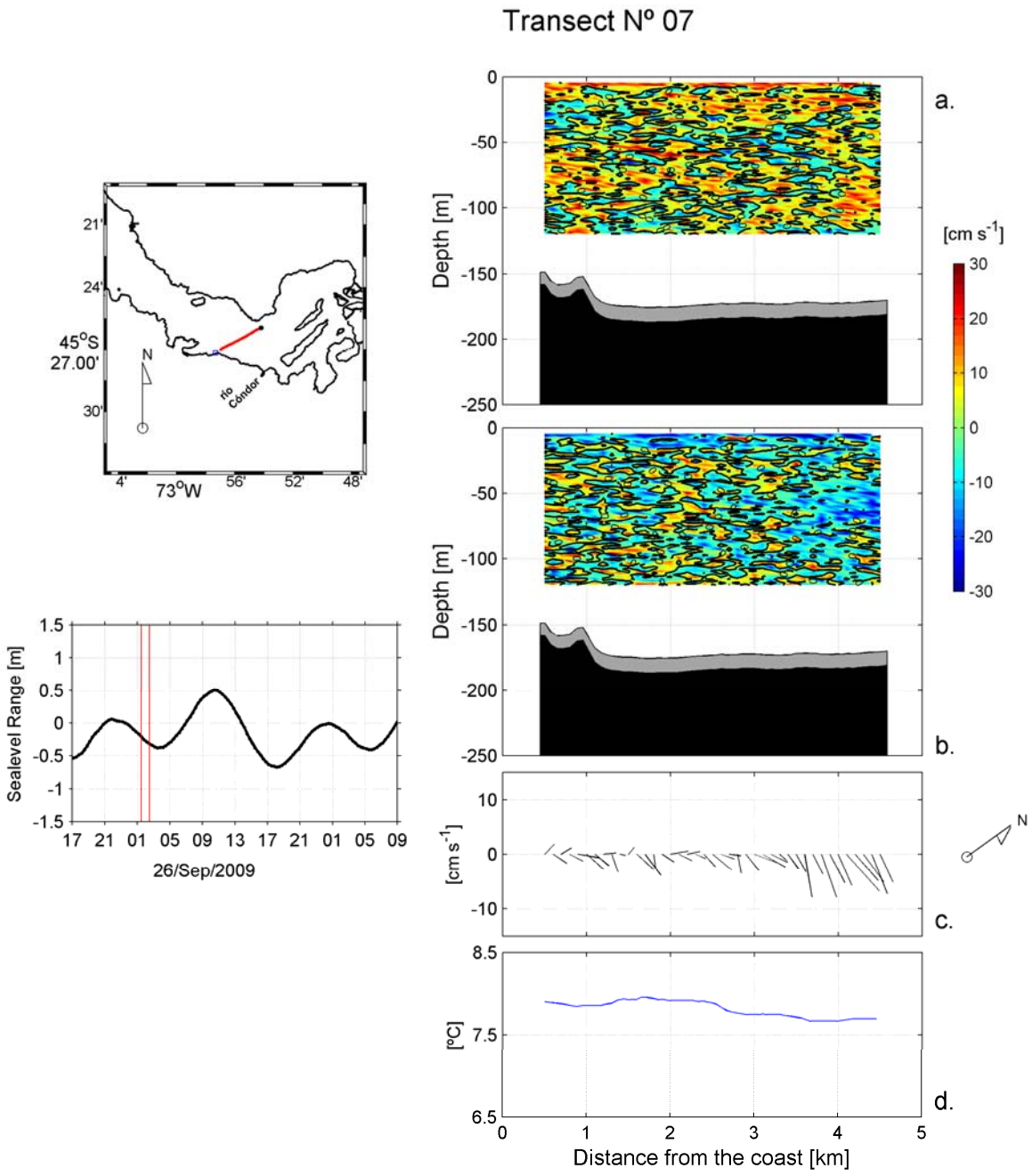

Figure 07: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 01:58 UTC and 26/Sep/2009 at 03:01 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

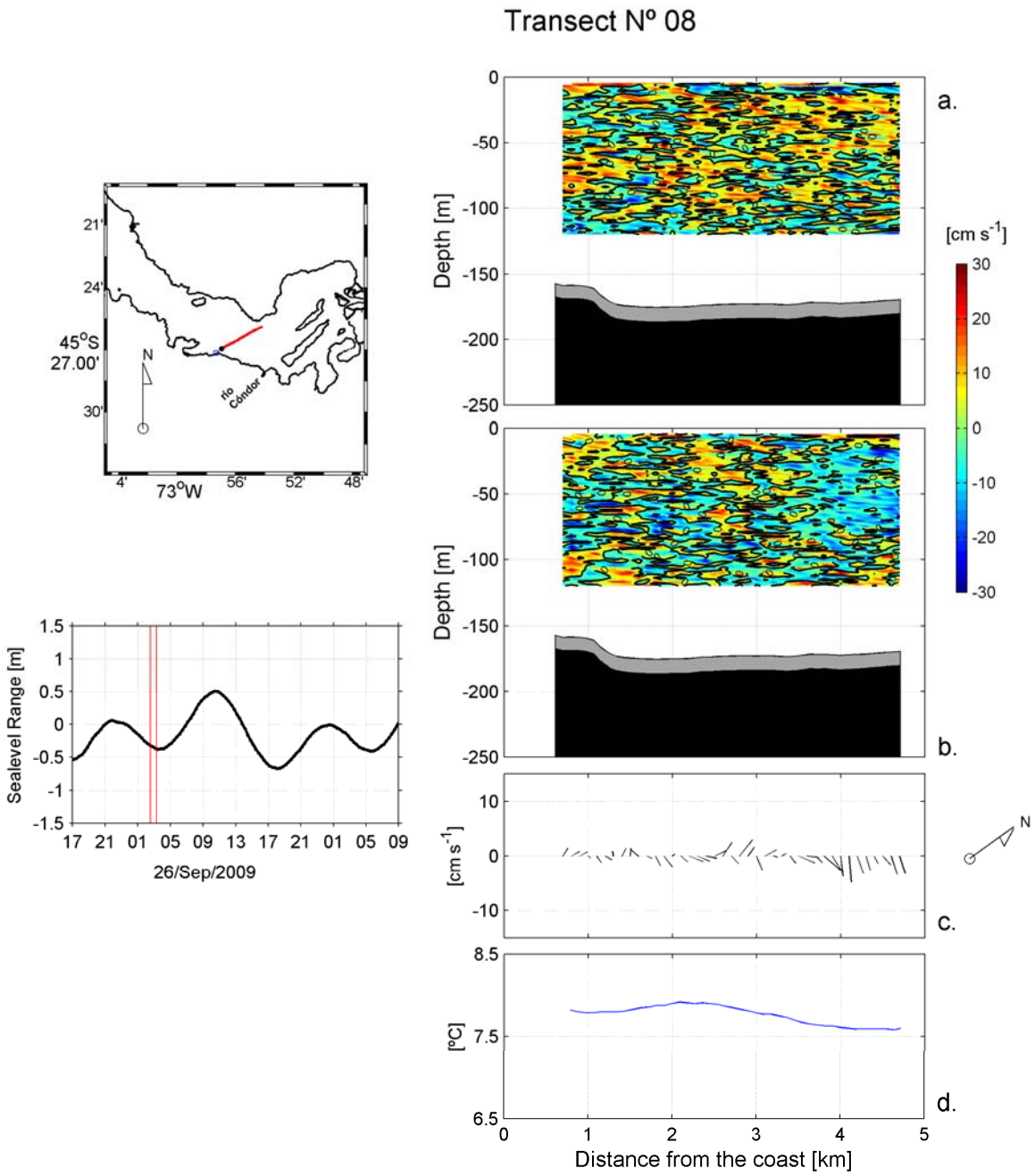

Figure 08: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 03:04 UTC and 26/Sep/2009 at 03:48 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

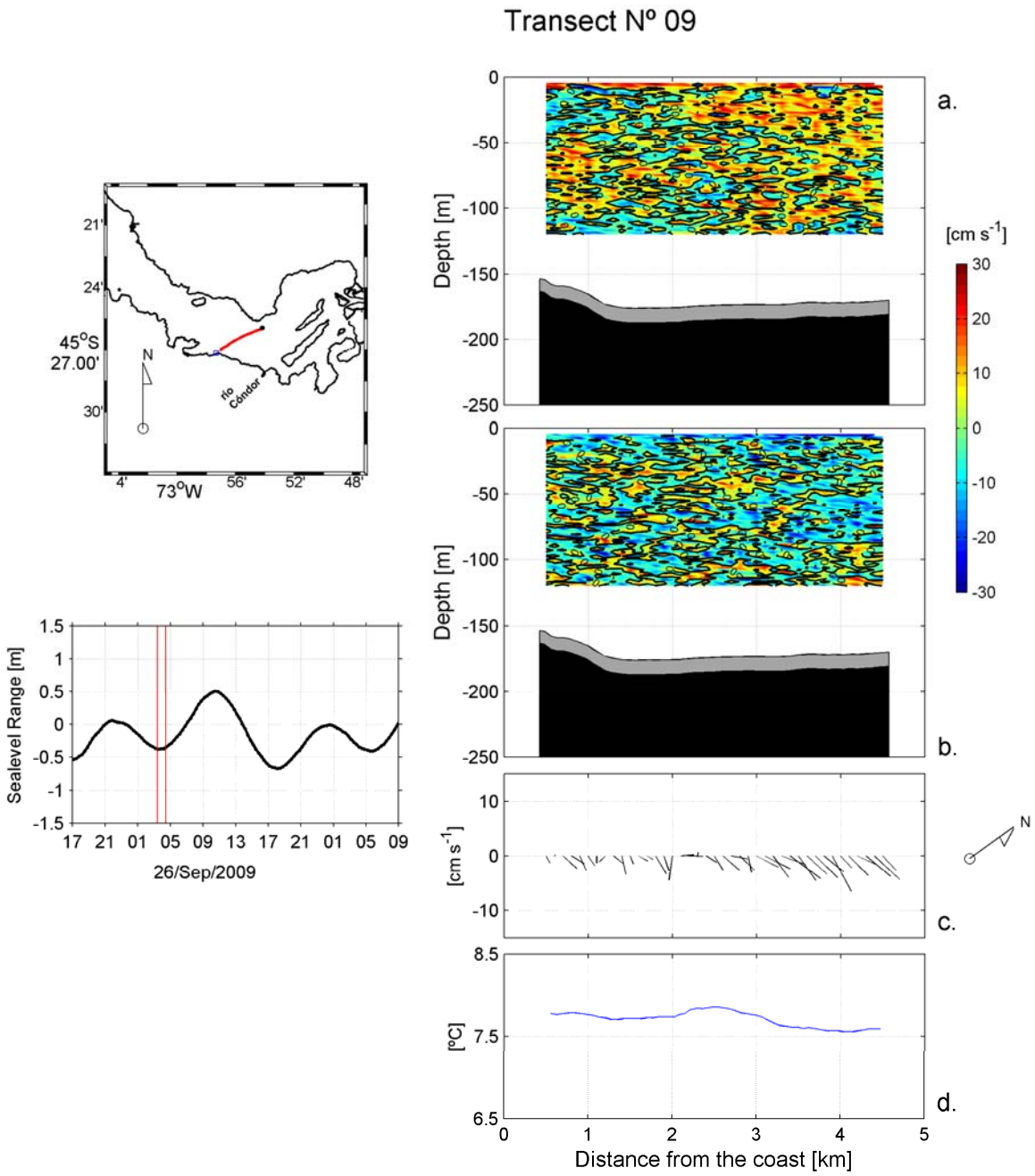

Figure 09: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 03:51 UTC and 26/Sep/2009 at 04:57 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

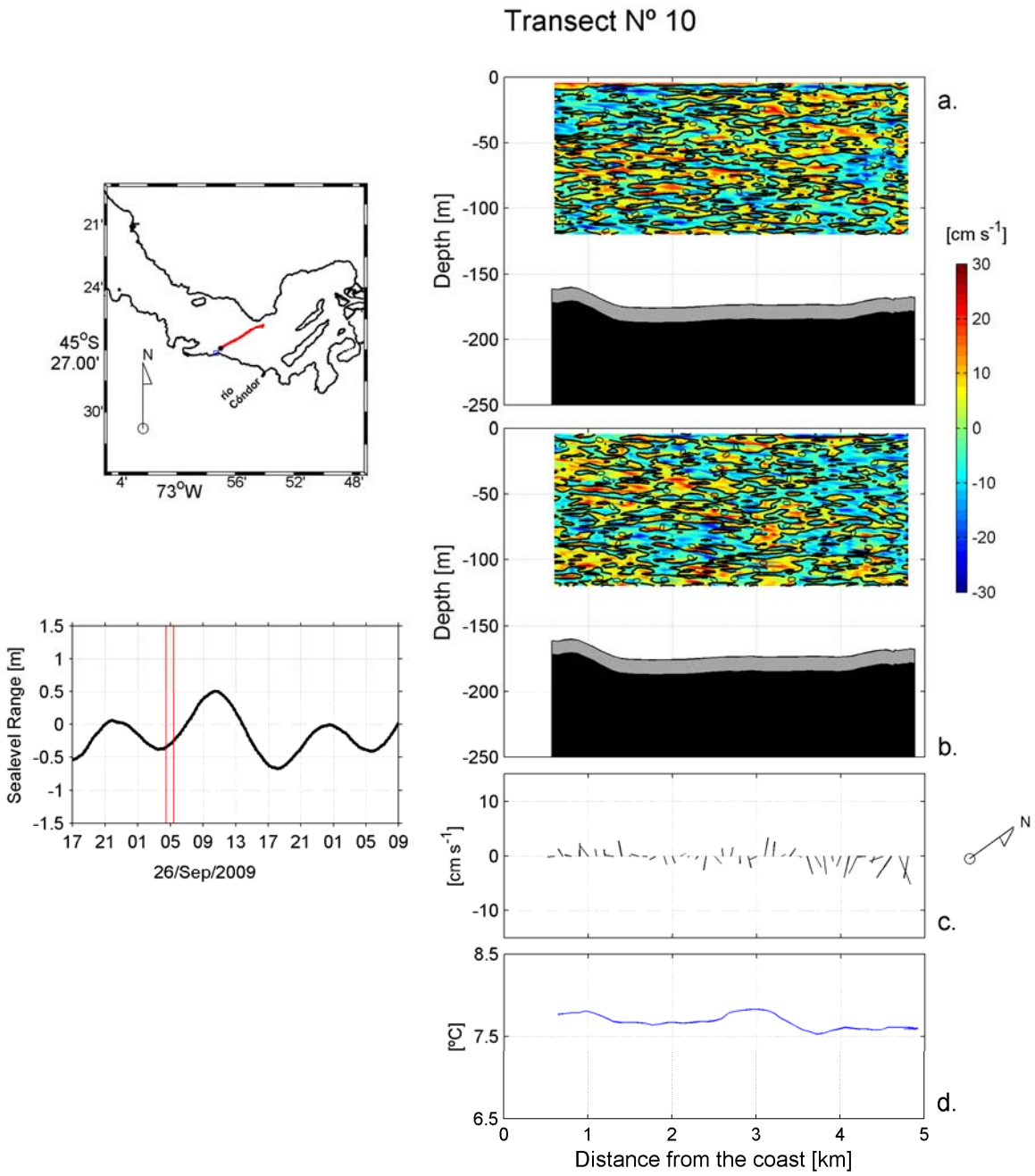

Figure 10: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 04:59 UTC and 26/Sep/2009 at 05:55 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

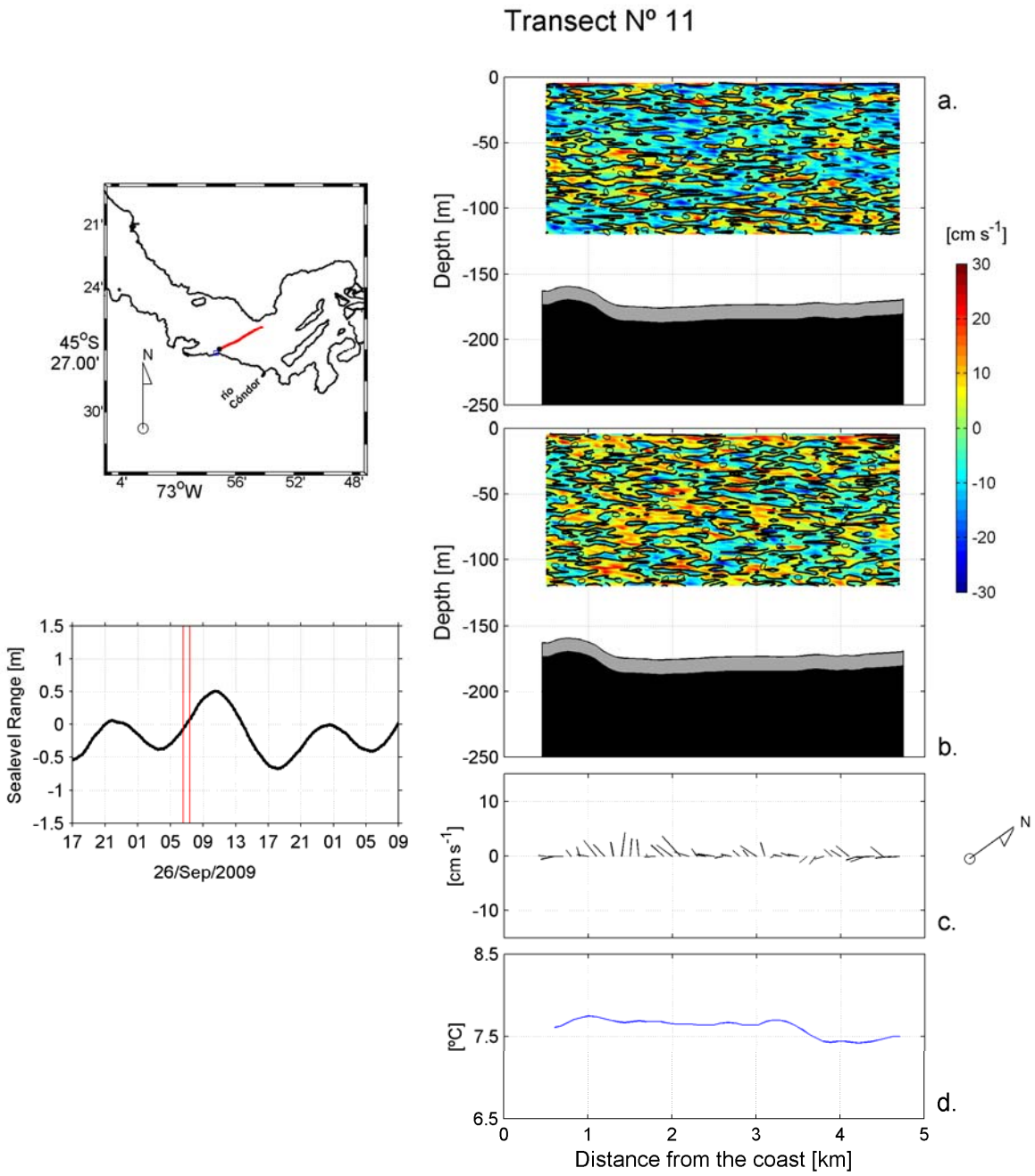

Figure 11: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 07:03 UTC and 26/Sep/2009 at 07:53 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

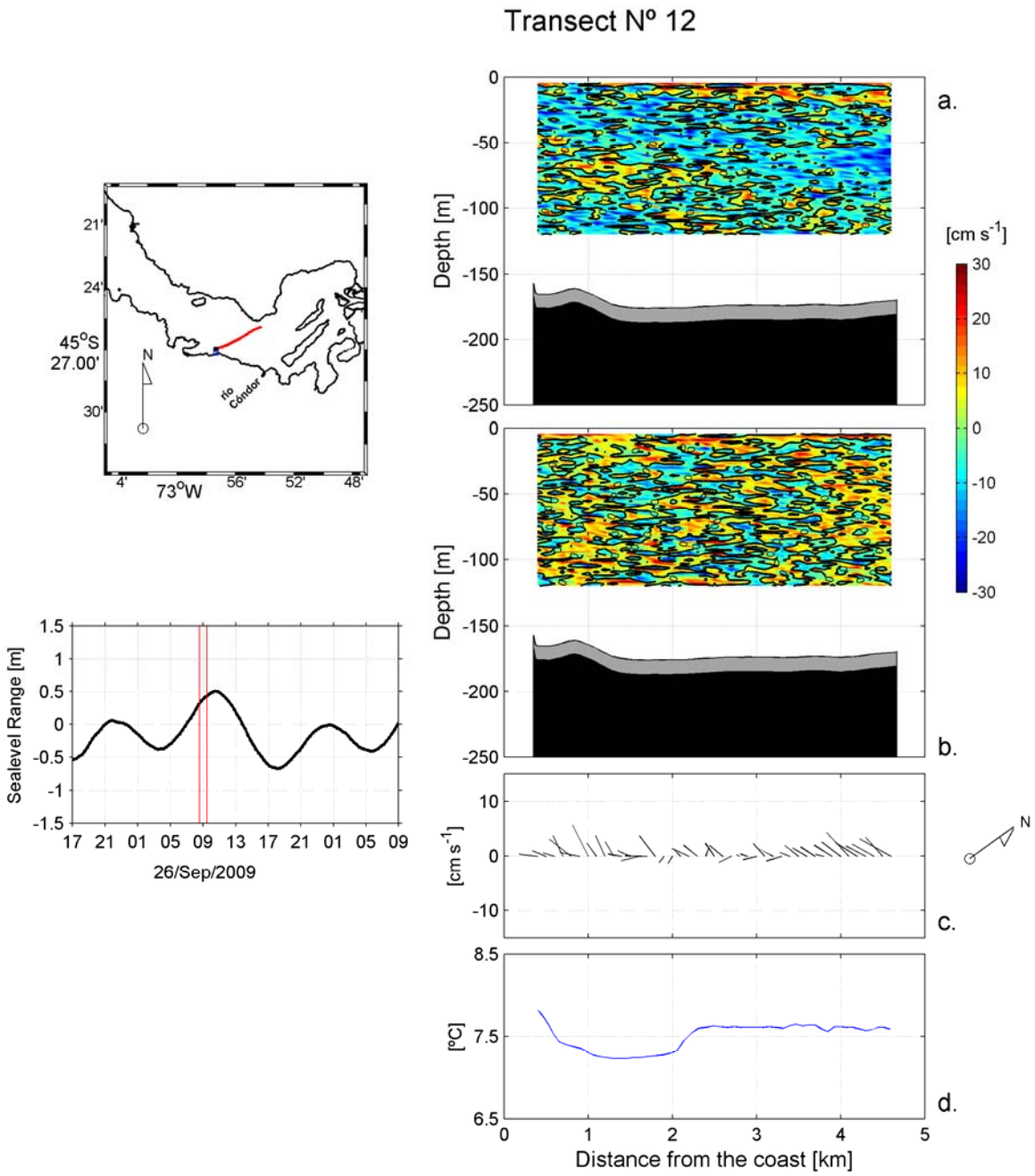

Figure 12: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 09:02 UTC and 26/Sep/2009 at 10:00 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

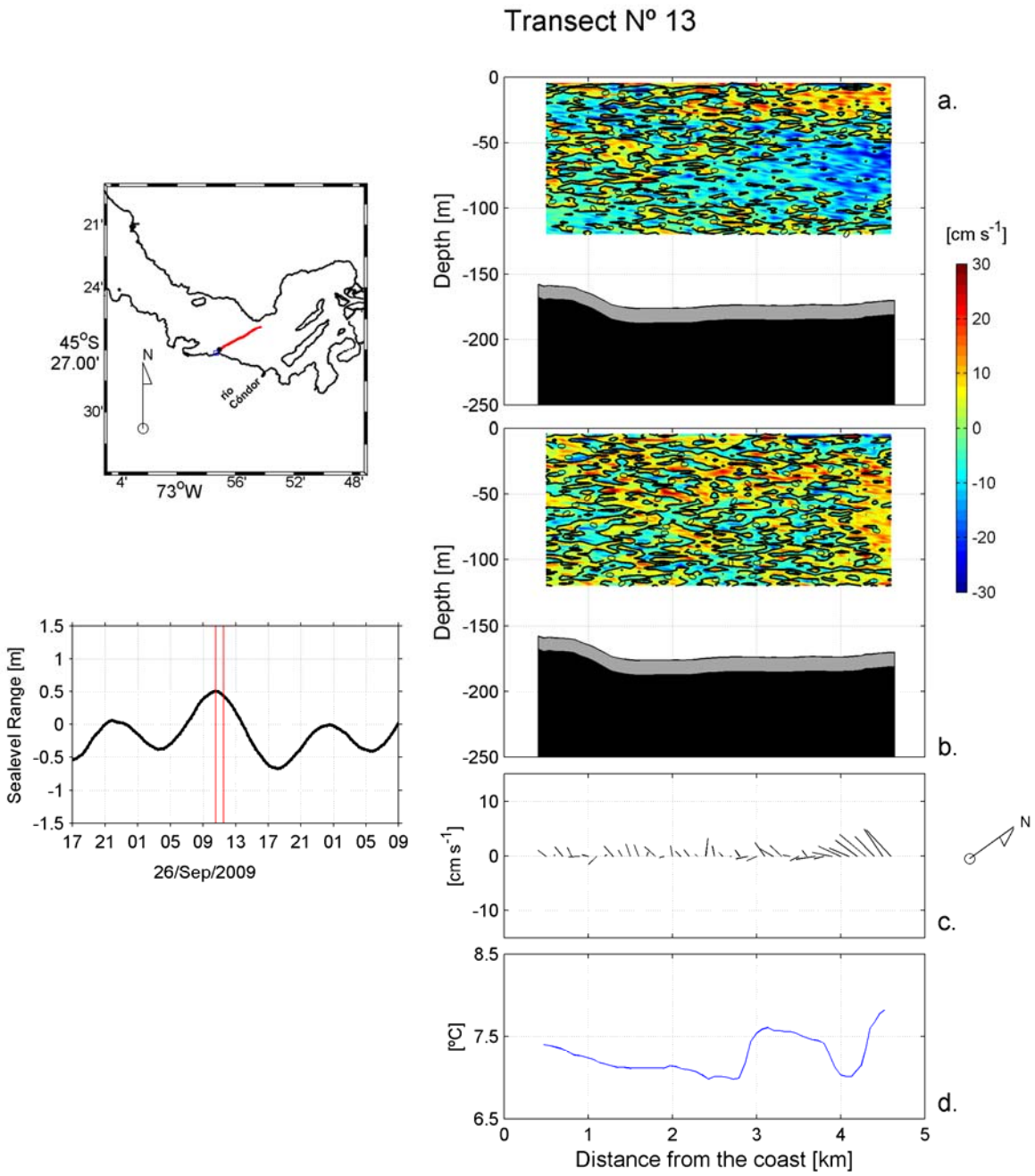

Figure 13: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 11:04 UTC and 26/Sep/2009 at 12:05 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

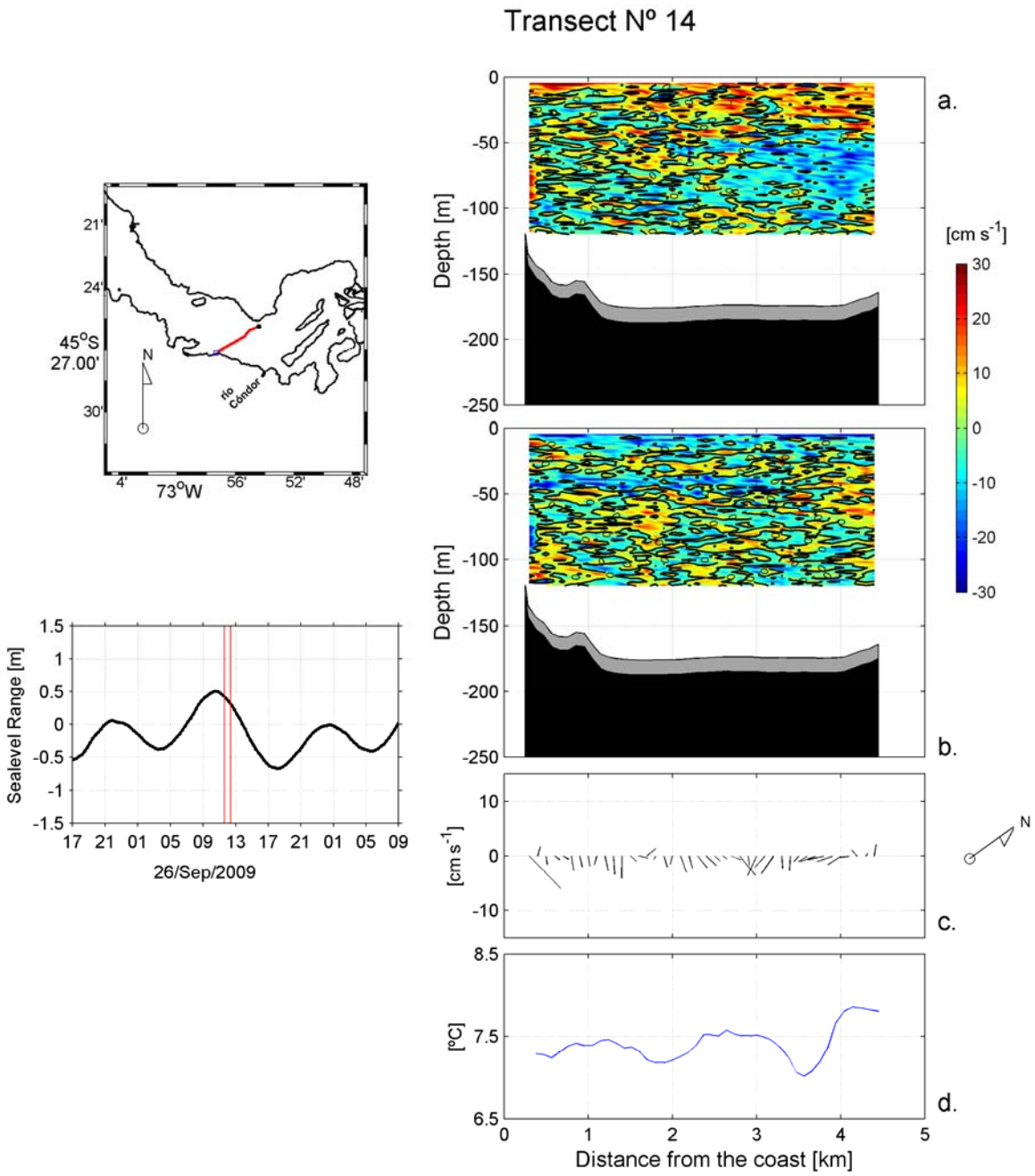

Figure 14: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 12:08 UTC and 26/Sep/2009 at 12:53 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

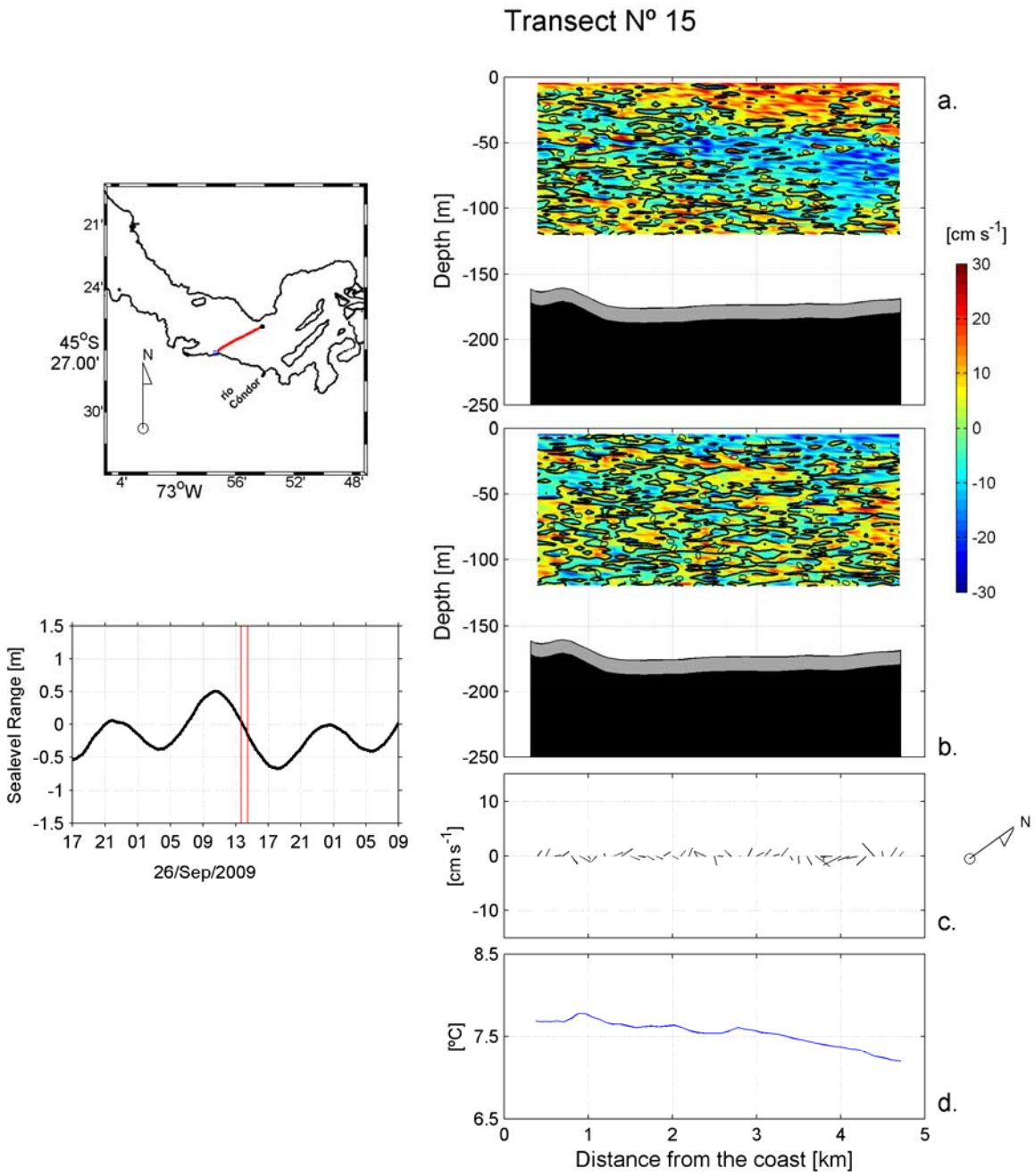

Figure 15: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 14:12 UTC and 26/Sep/2009 at 15:00 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

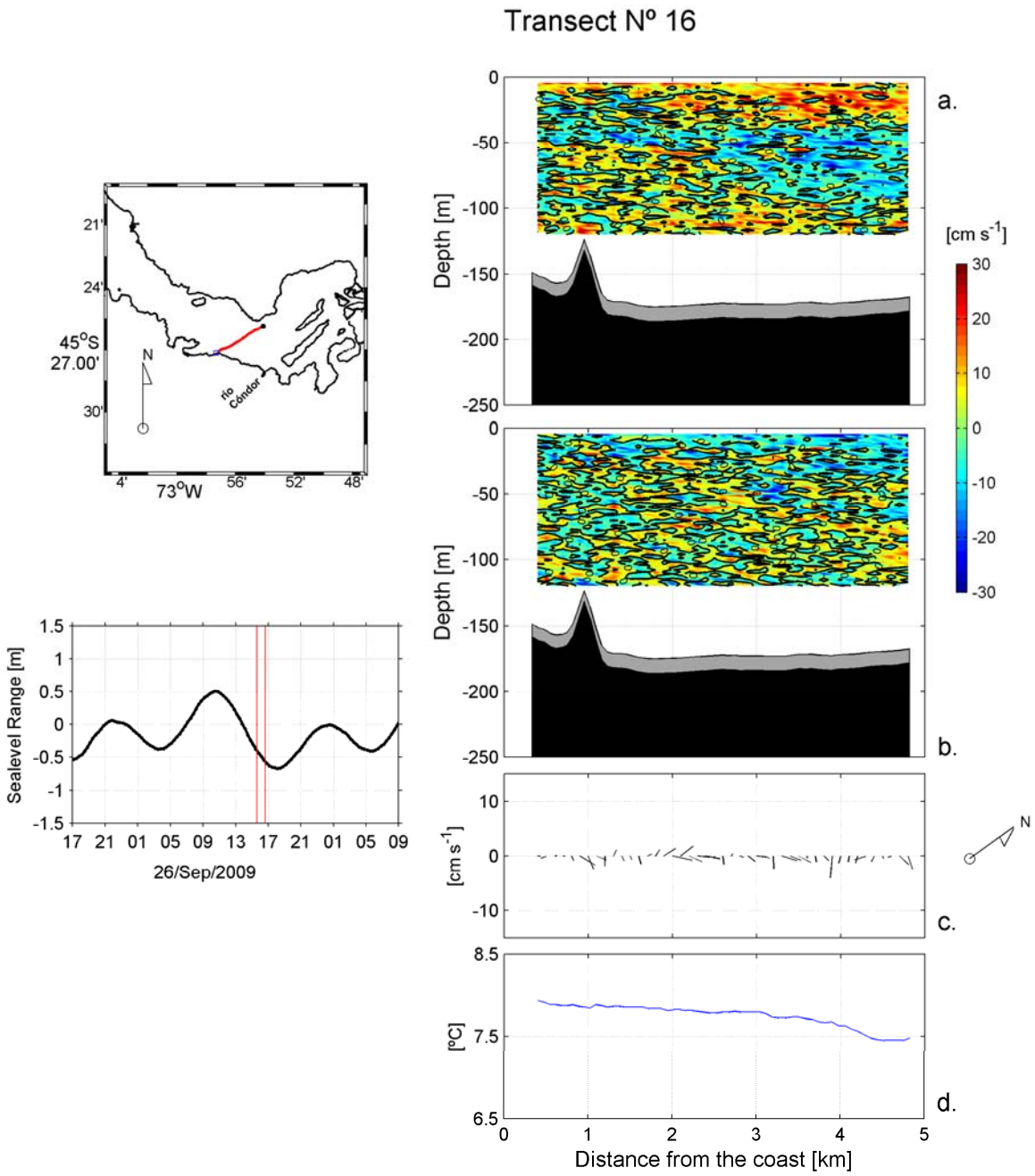

Figure 16: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 16:09 UTC and 26/Sep/2009 at 17:11 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

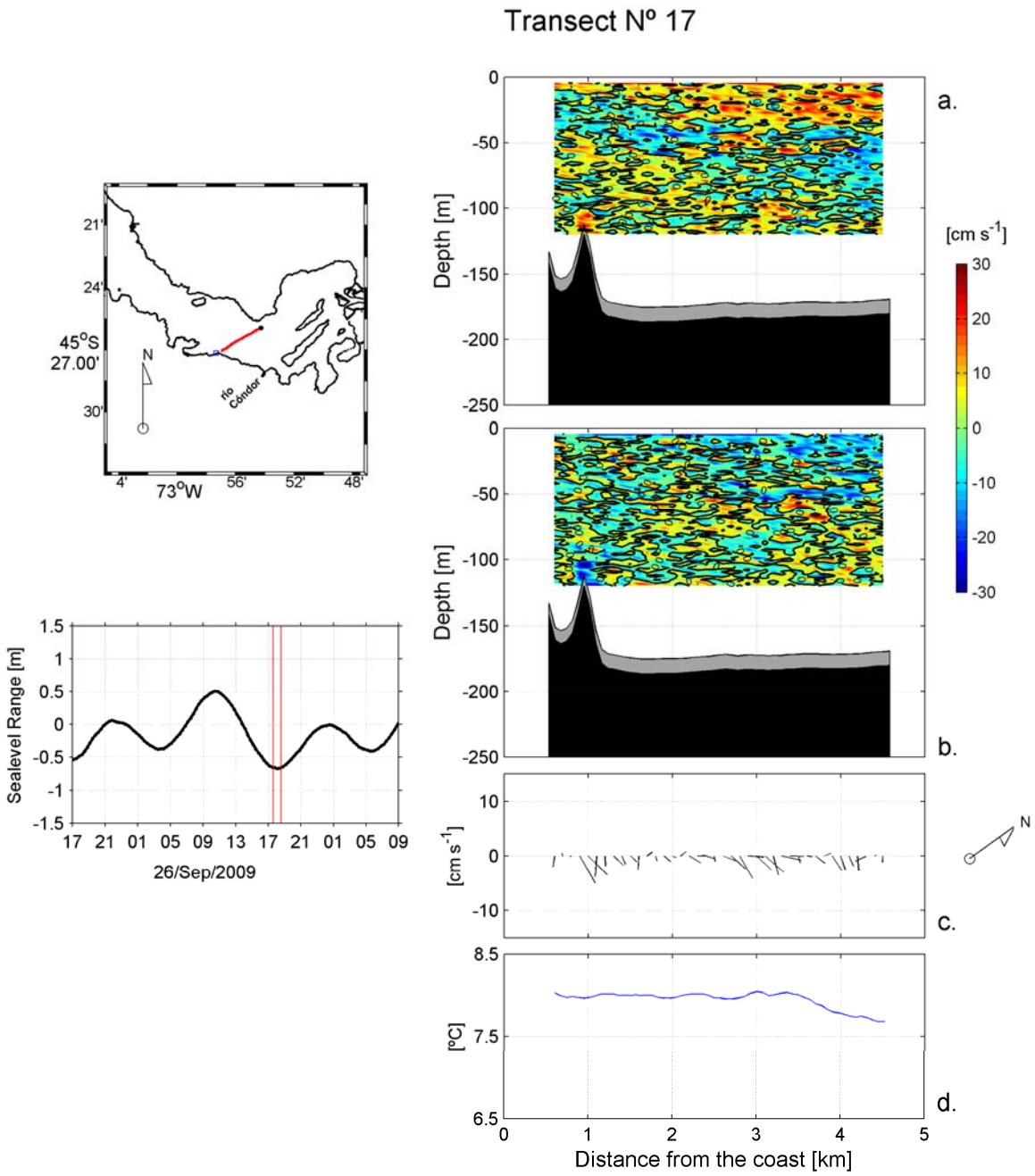

Figure 17: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 18:07 UTC and 26/Sep/2009 at 19:07 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

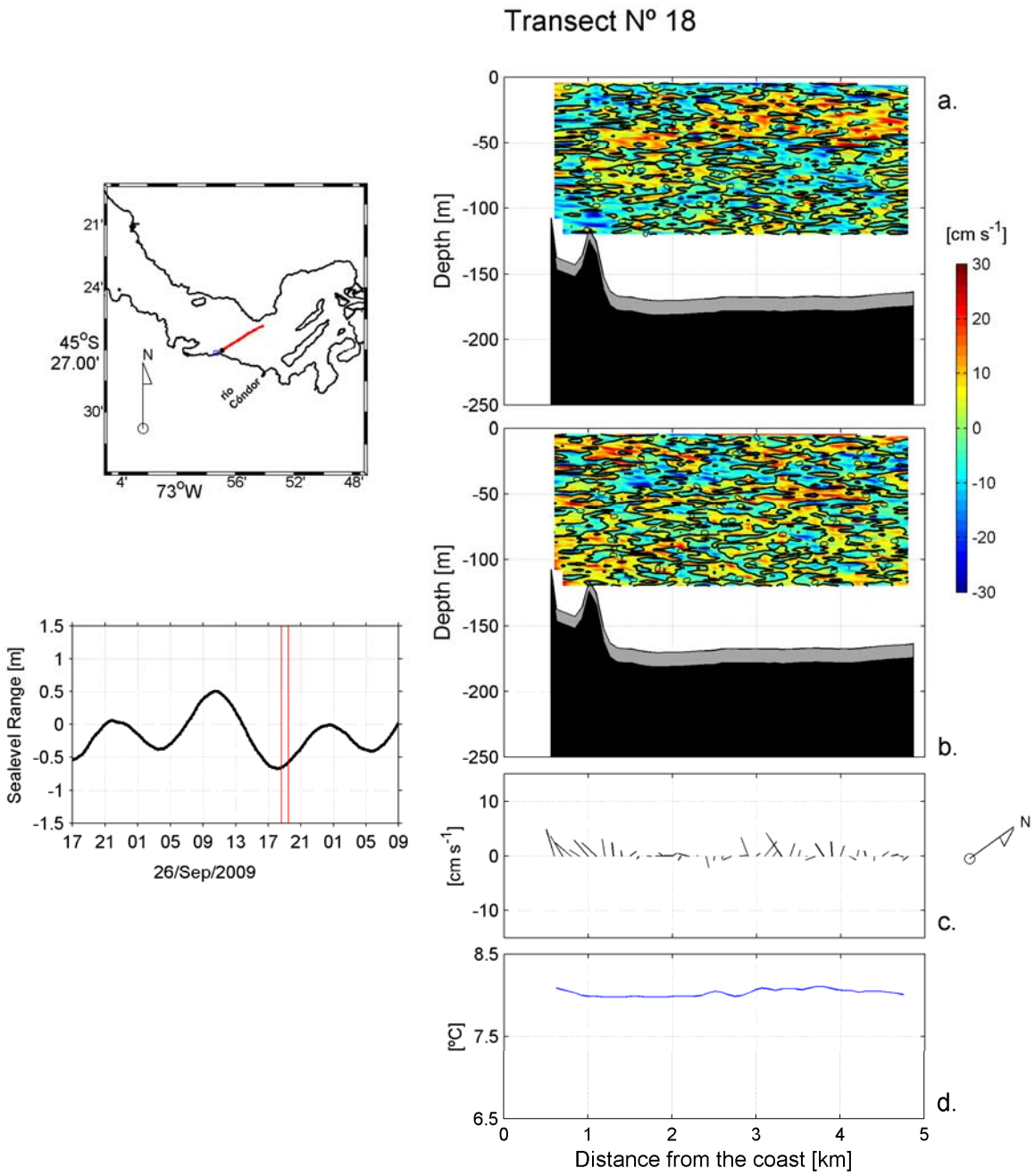

Figure 18: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 19:08 UTC and 26/Sep/2009 at 20:00 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

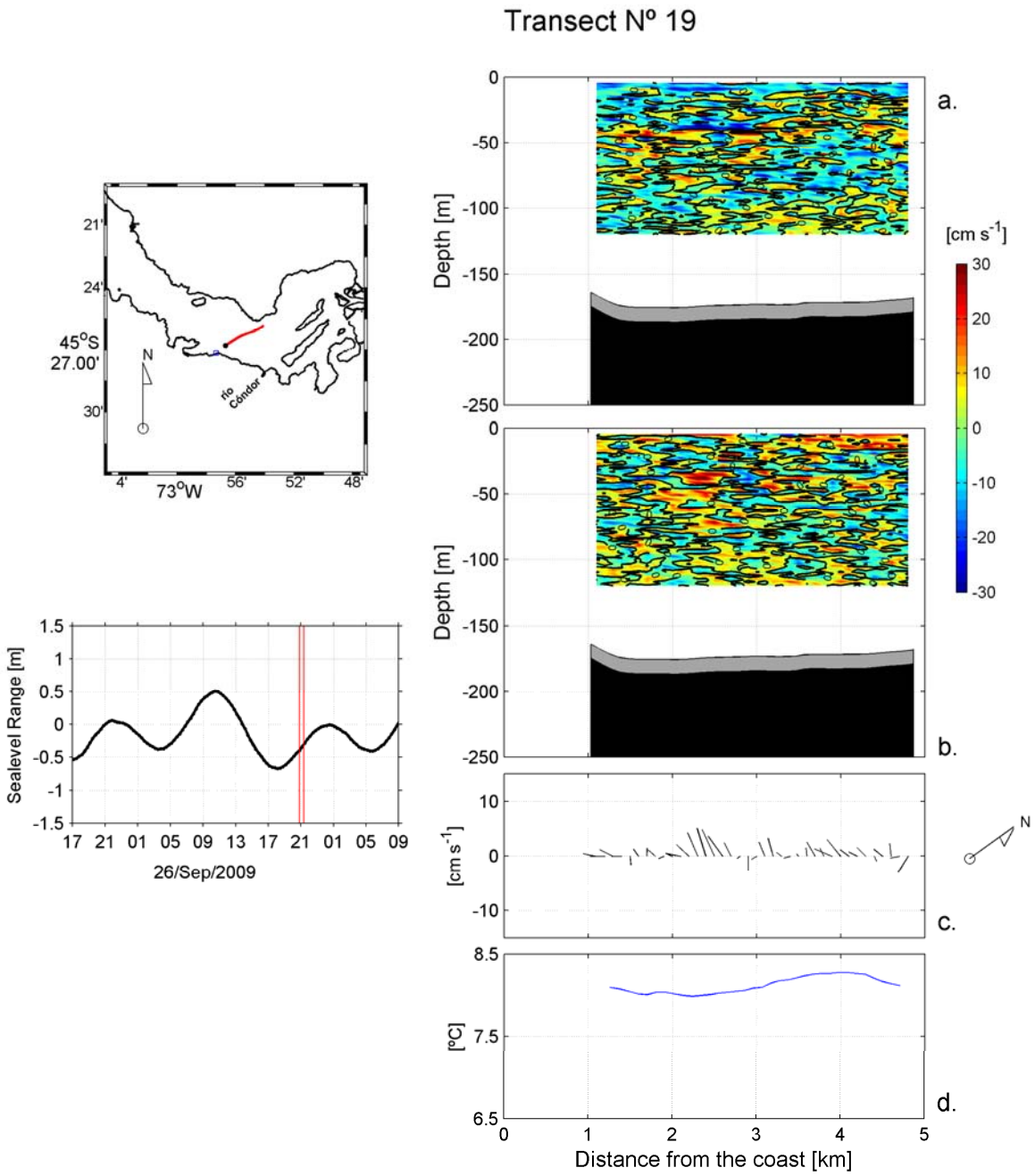

Figure 19: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 26/Sep/2009 at 21:18 UTC and 26/Sep/2009 at 21:55 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

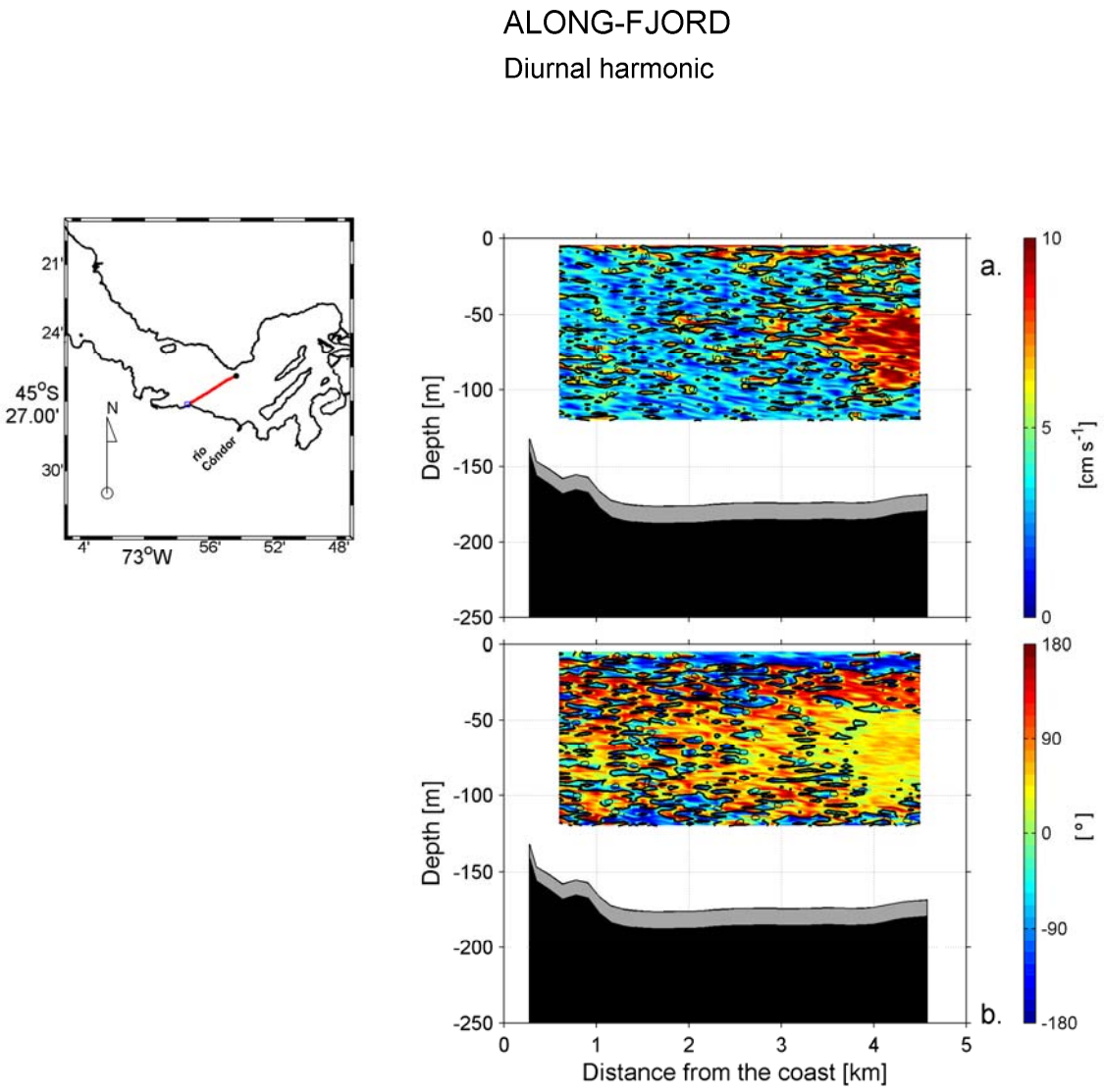

Figure 20: (a) Amplitude and (b) Phase of the along-fjord component, during the study of the Aysen Fjord.

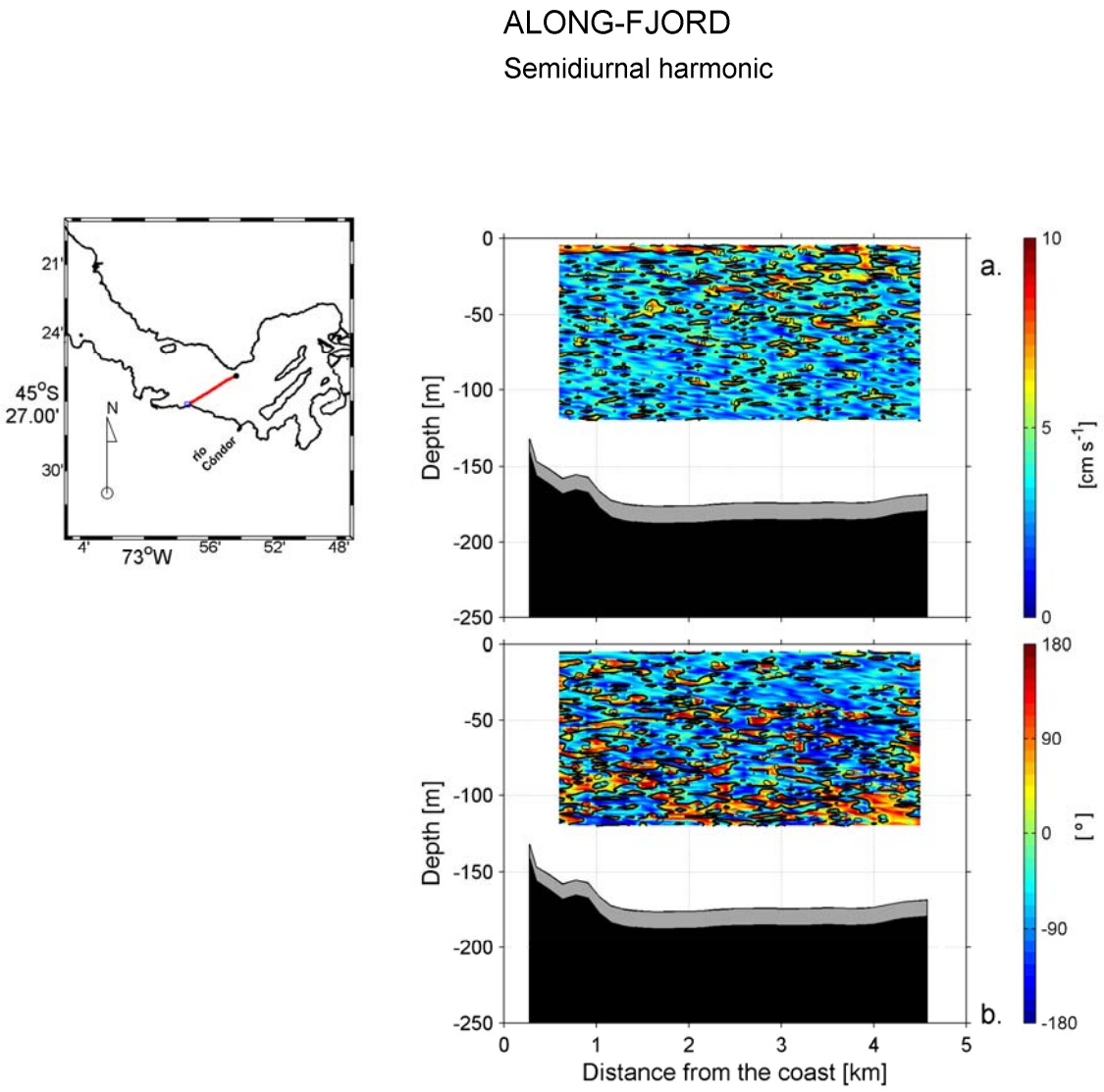

Figure 21: (a) Amplitude and (b) Phase of the along-fjord component, during the study of the Aysen Fjord.

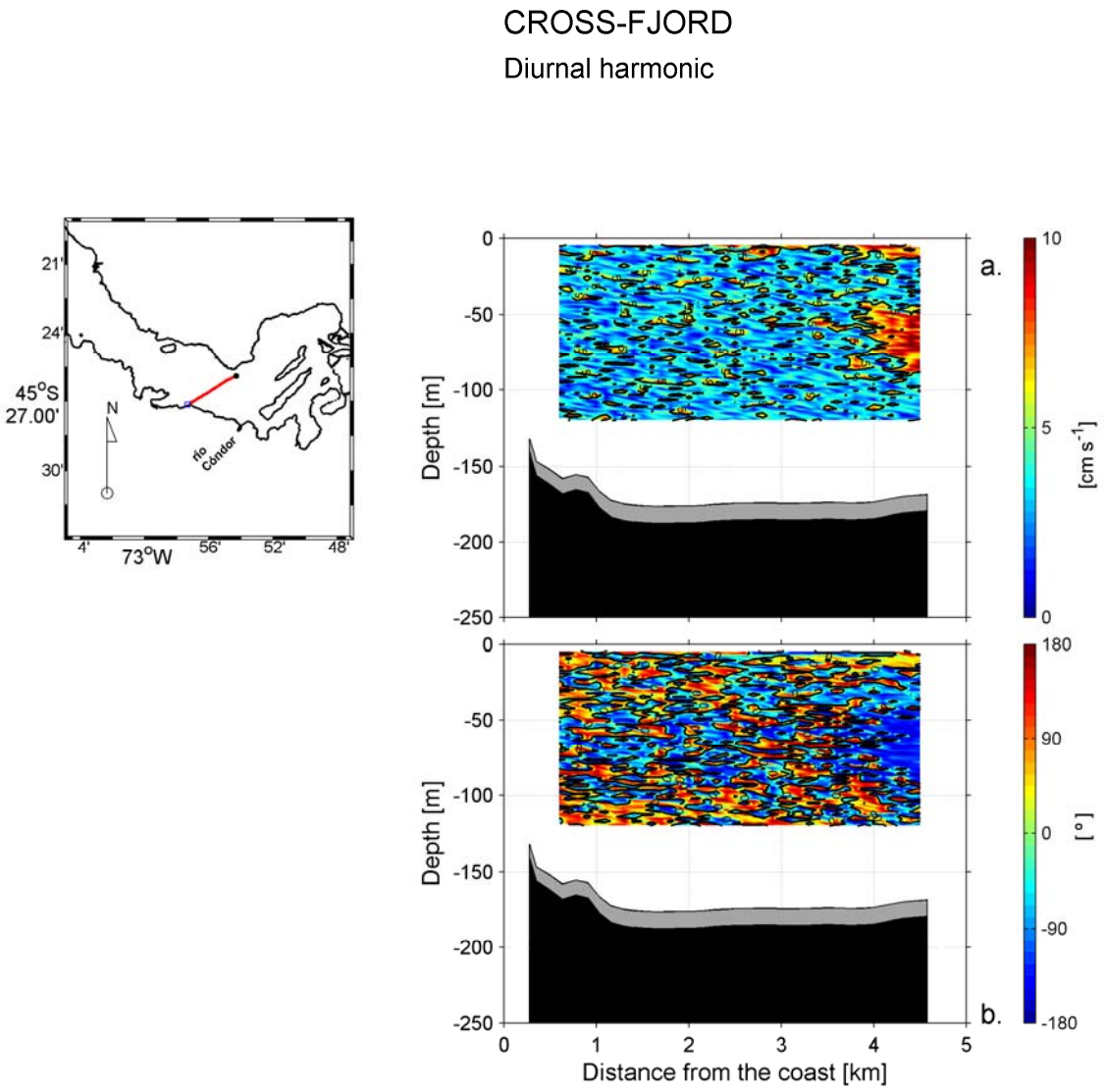

Figure 22: (a) Amplitude and (b) Phase of the cross-fjord component, during the study of the Aysen Fjord.

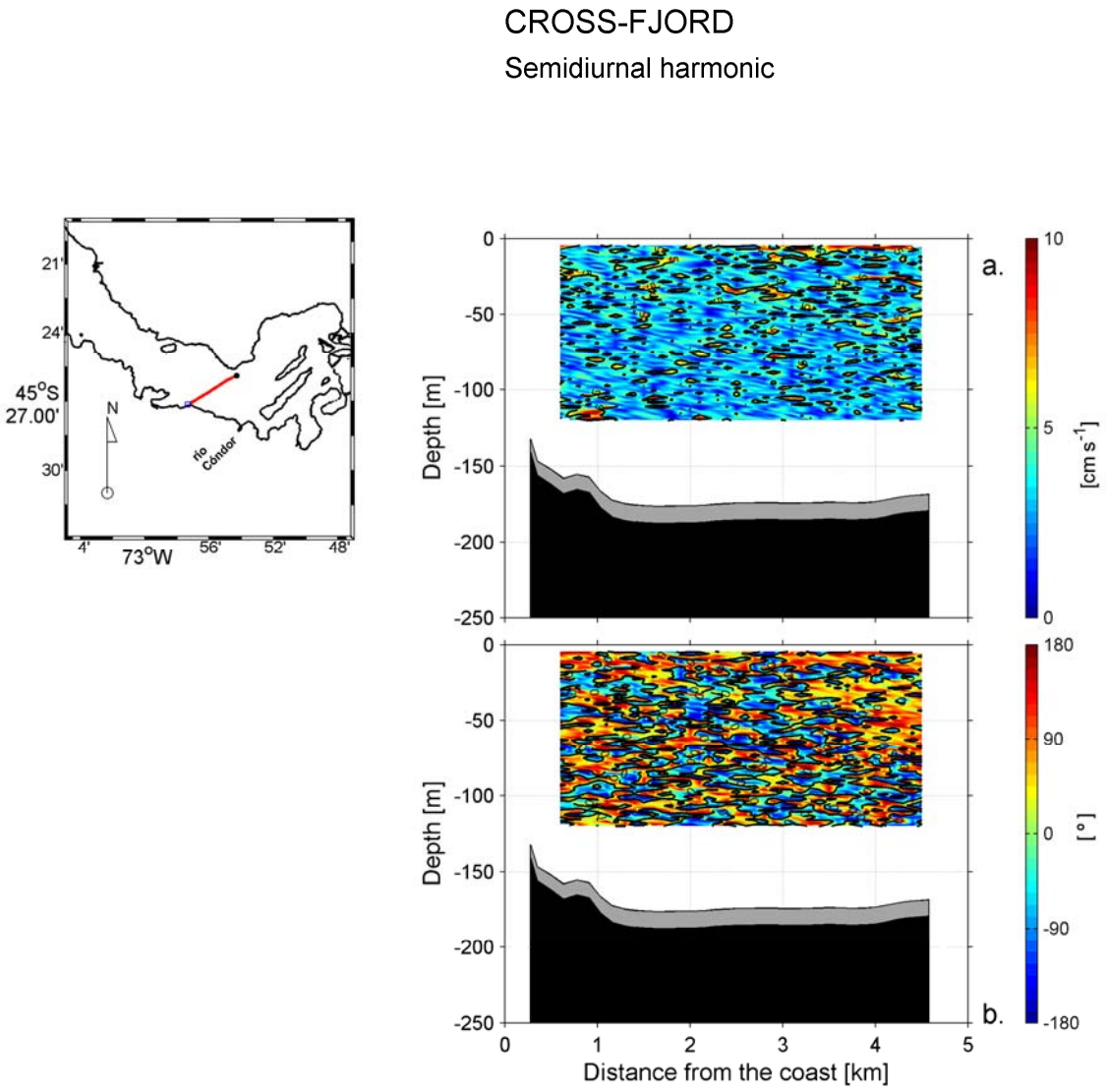

Figure 23: (a) Amplitude and (b) Phase of the cross-fjord component, during the study of the Aysen Fjord.

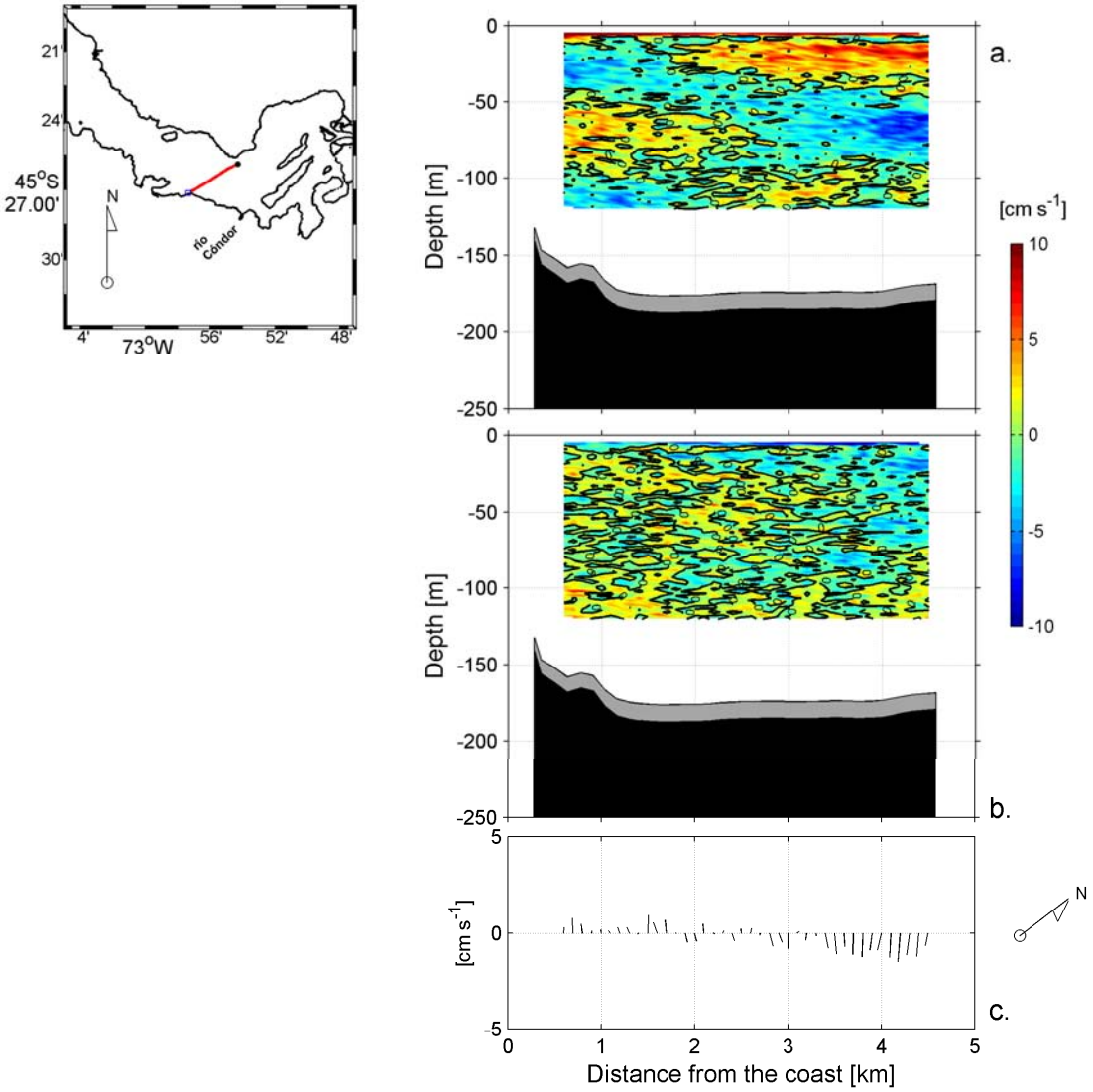

Figure 24: (a) Along-fjord and (b) Cross-fjord residual currents and (c) sticks diagram of residual currents, during the study of the Aysen Fjord.Note that positive (negative) values in Along-fjord component indicate currents trough the mouth (head) of the fjord.

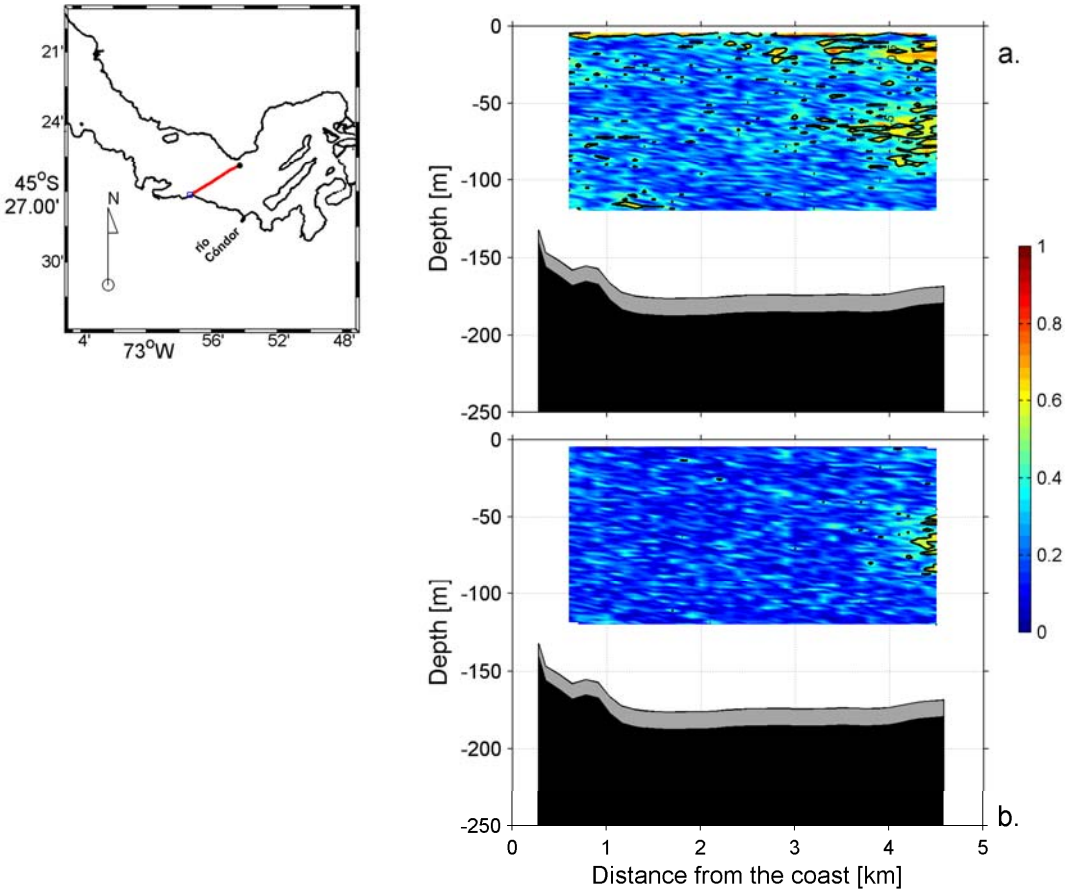

Figure 25: (a) Along-fjord and (b) Cross-fjord components goodness of fit, during the study of the Aysen Fjord.

FIGURES

[Side-ship ADCP data from transect,
CUERVO
September-2009]

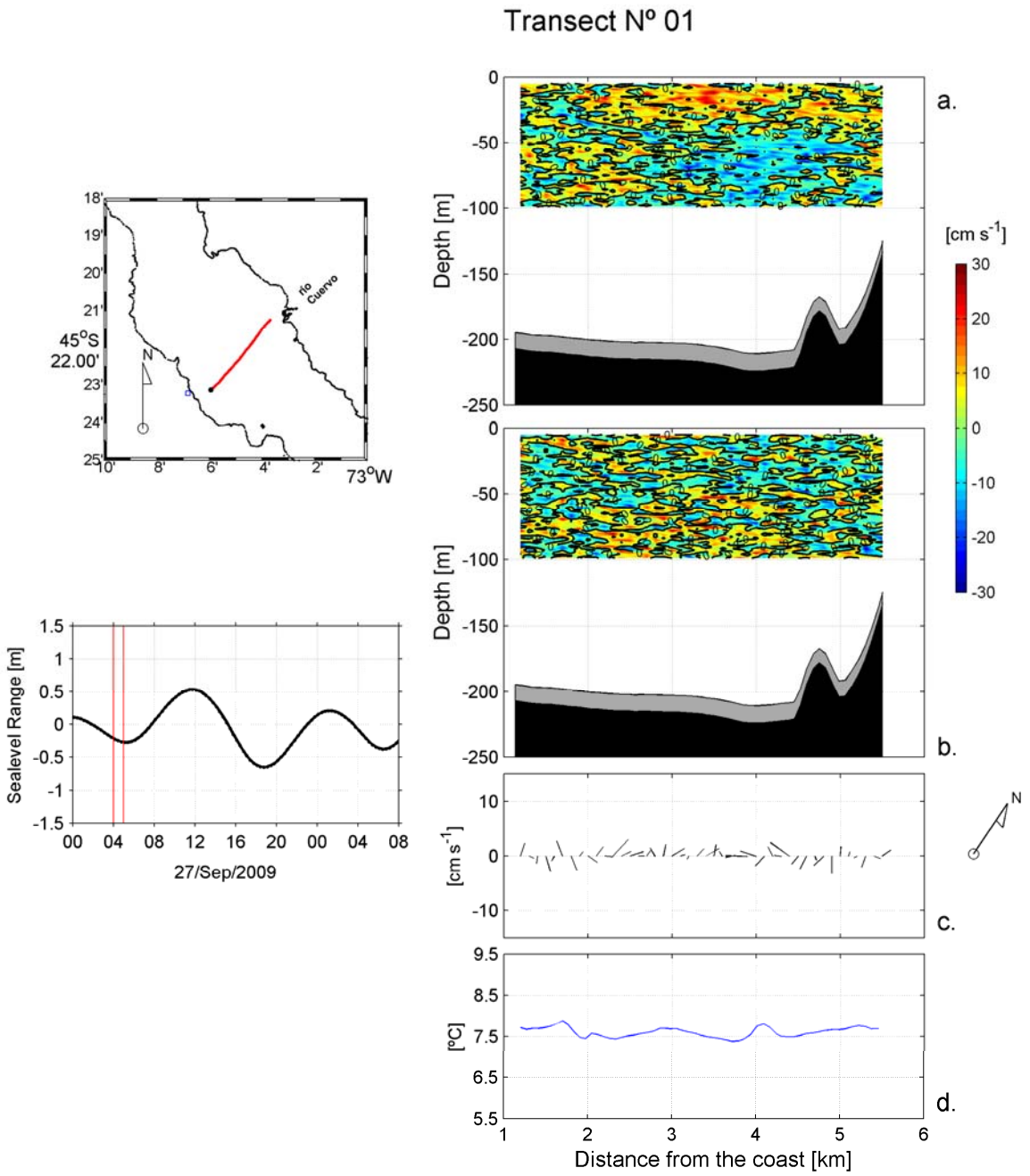

Figure 01: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 04:53 UTC and 27/Sep/2009 at 05:52 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

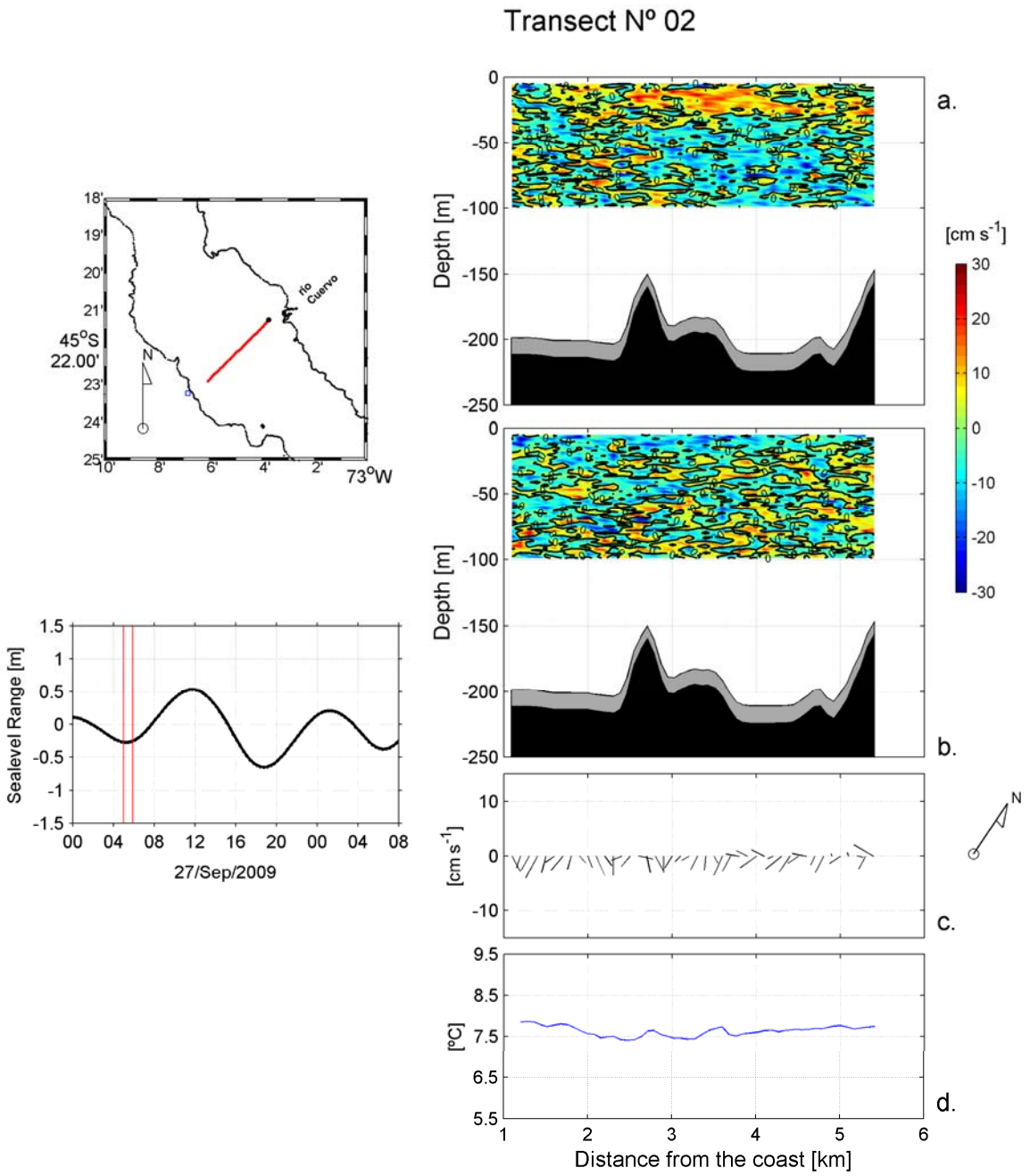

Figure 02: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 05:54 UTC and 27/Sep/2009 at 06:48 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

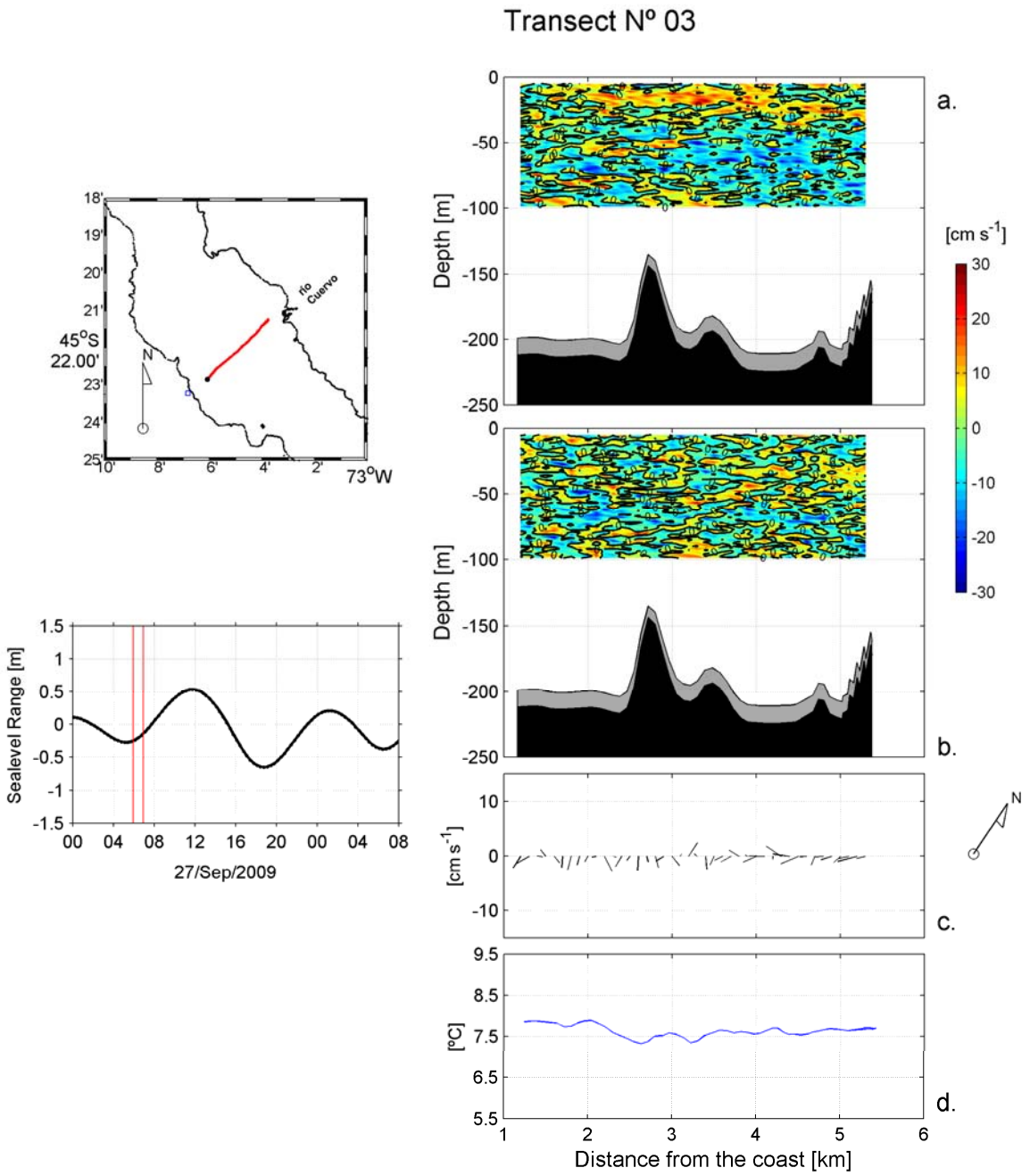

Figure 03: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 06:50 UTC and 27/Sep/2009 at 07:50 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

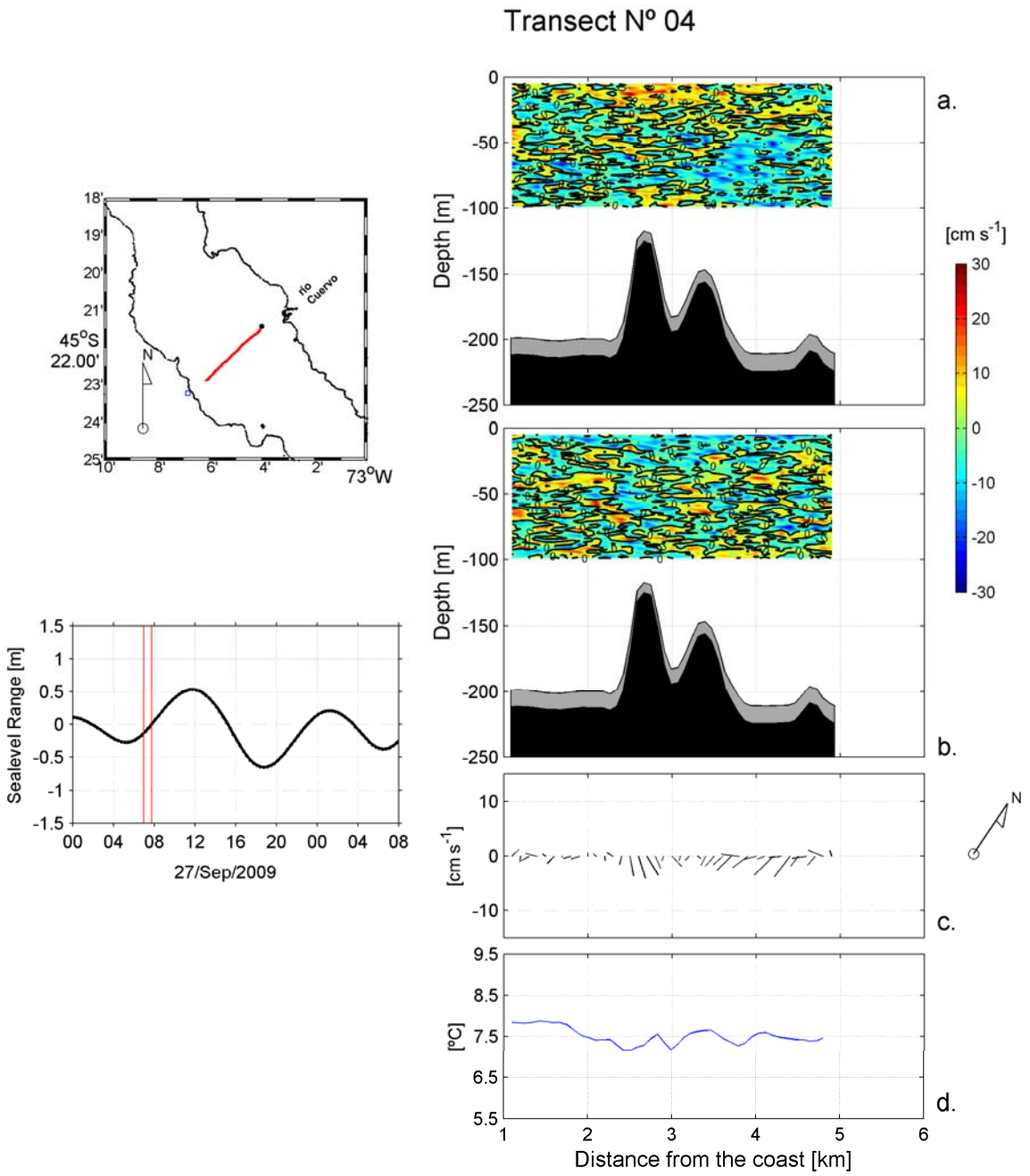

Figure 04: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 07:51 UTC and 27/Sep/2009 at 08:38 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

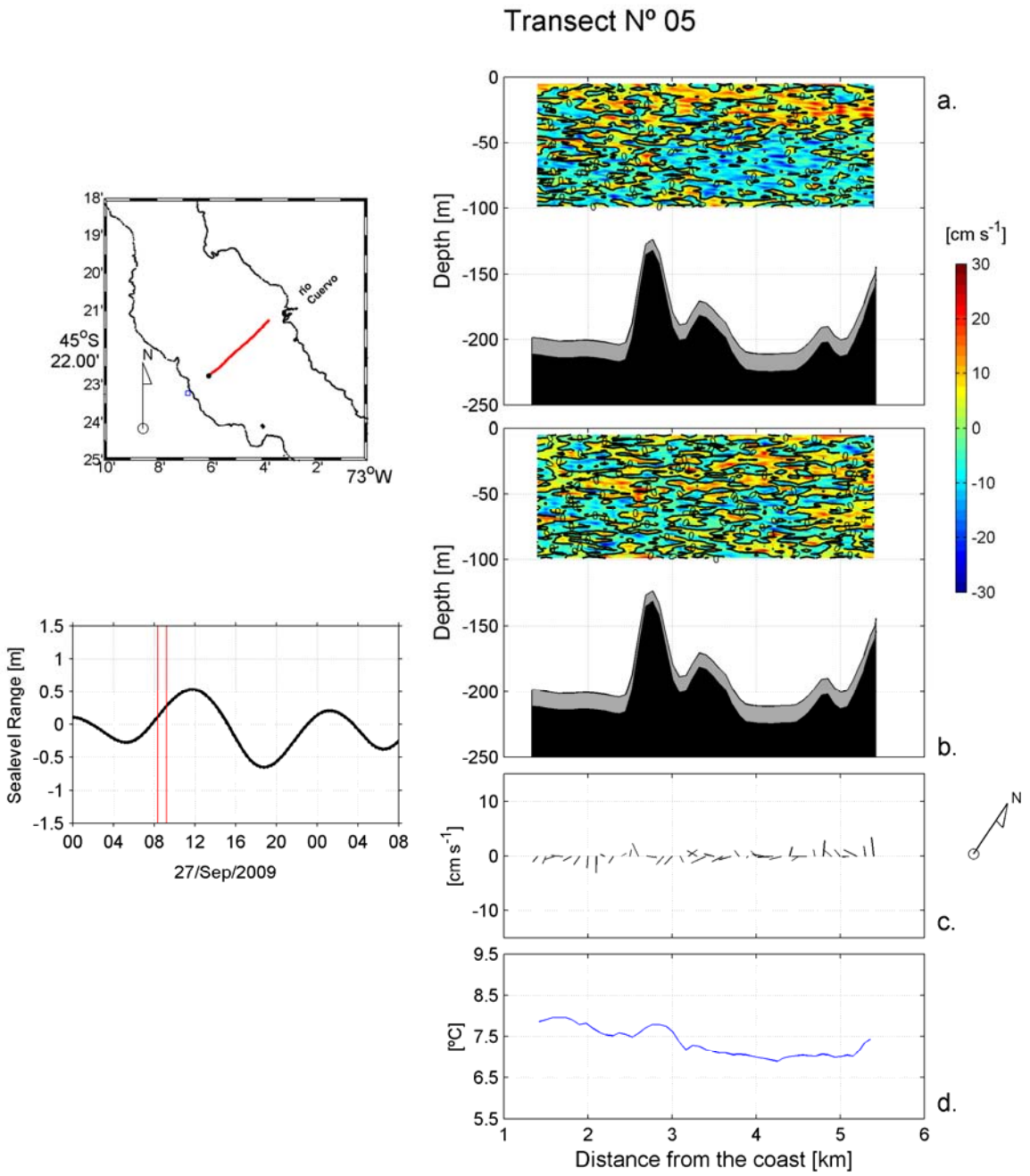

Figure 05: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 09:13 UTC and 27/Sep/2009 at 10:06 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

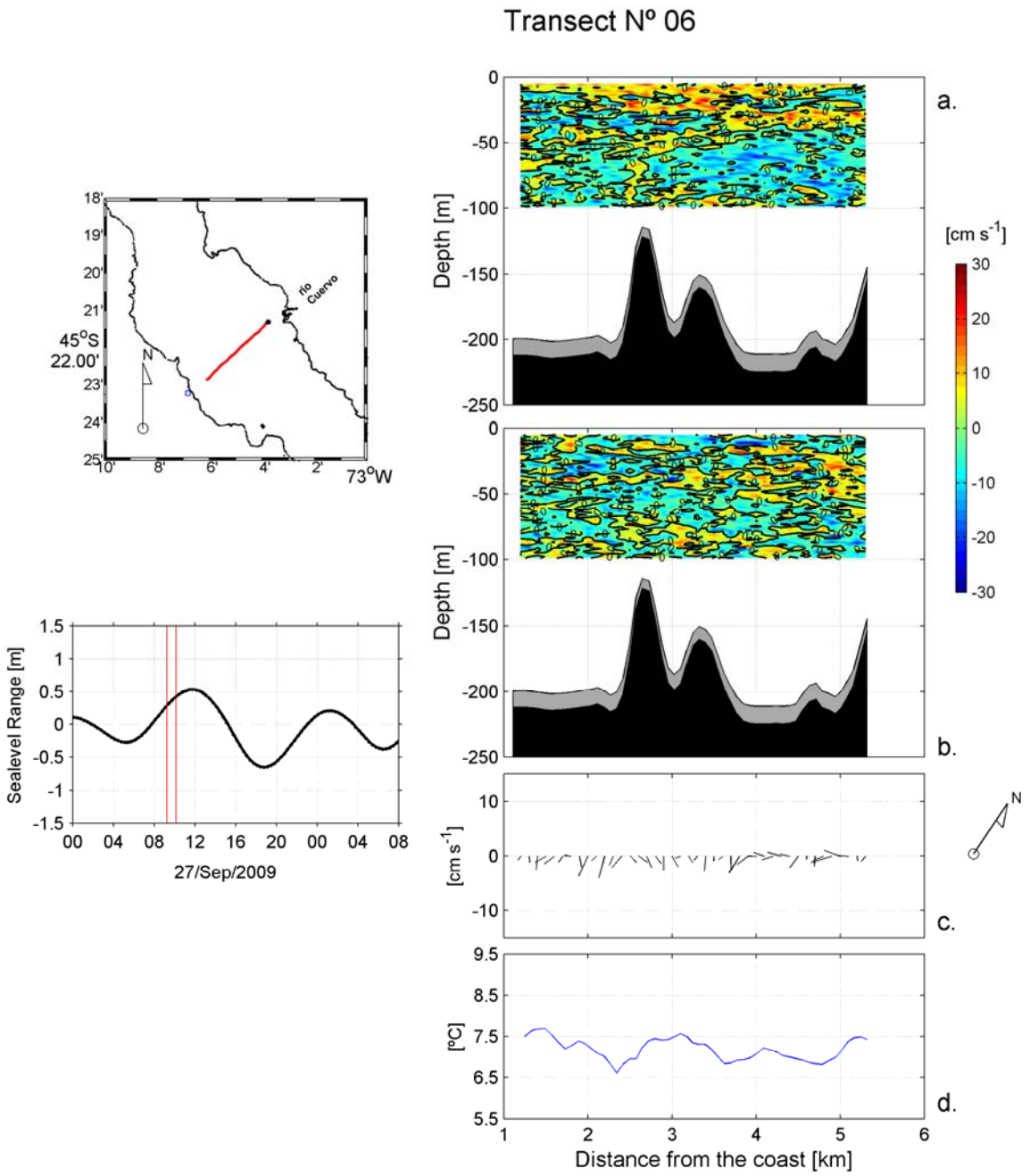

Figure 06: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 10:09 UTC and 27/Sep/2009 at 11:04 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

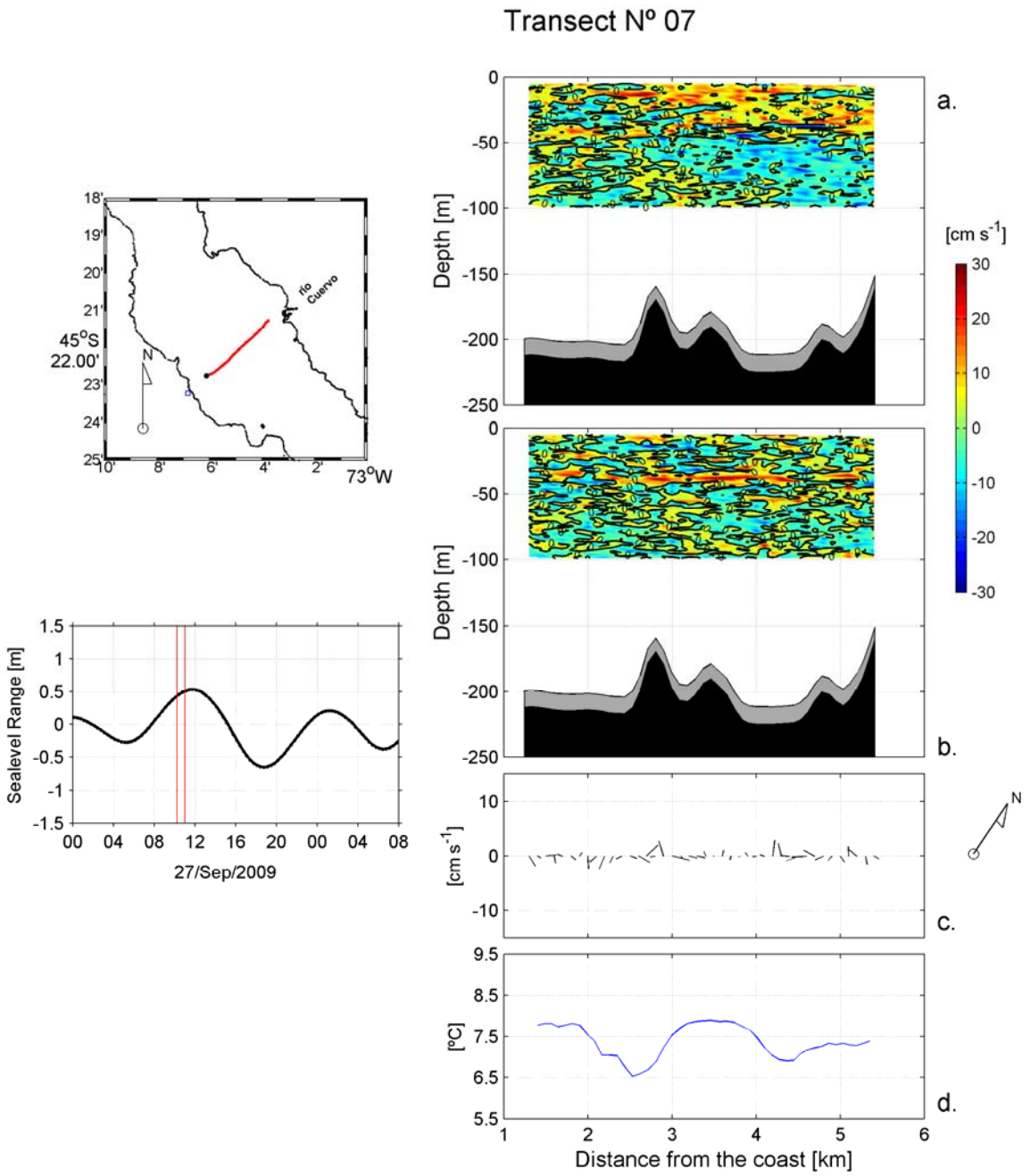

Figure 07: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 11:06 UTC and 27/Sep/2009 at 11:54 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

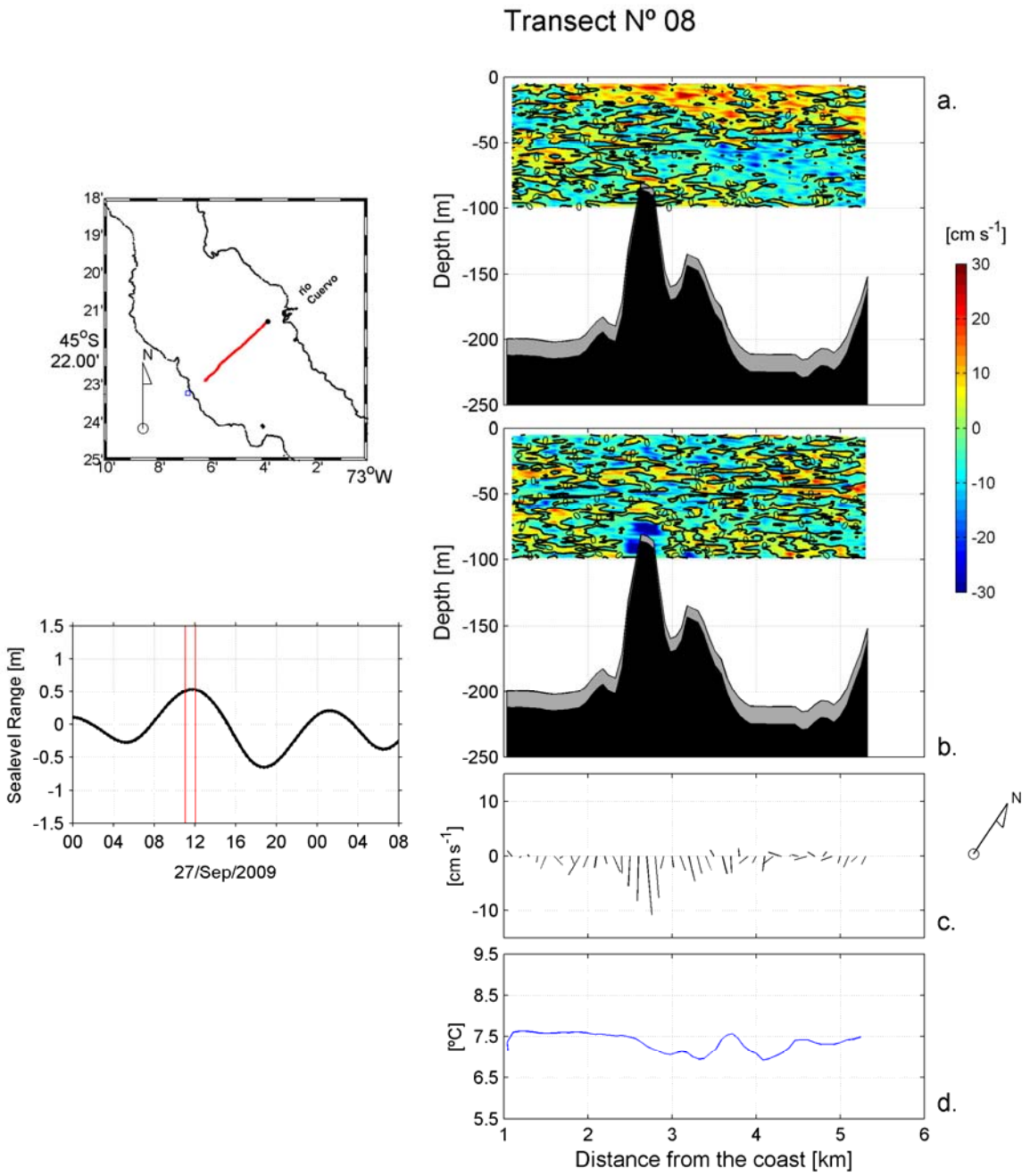

Figure 08: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 11:56 UTC and 27/Sep/2009 at 12:57 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

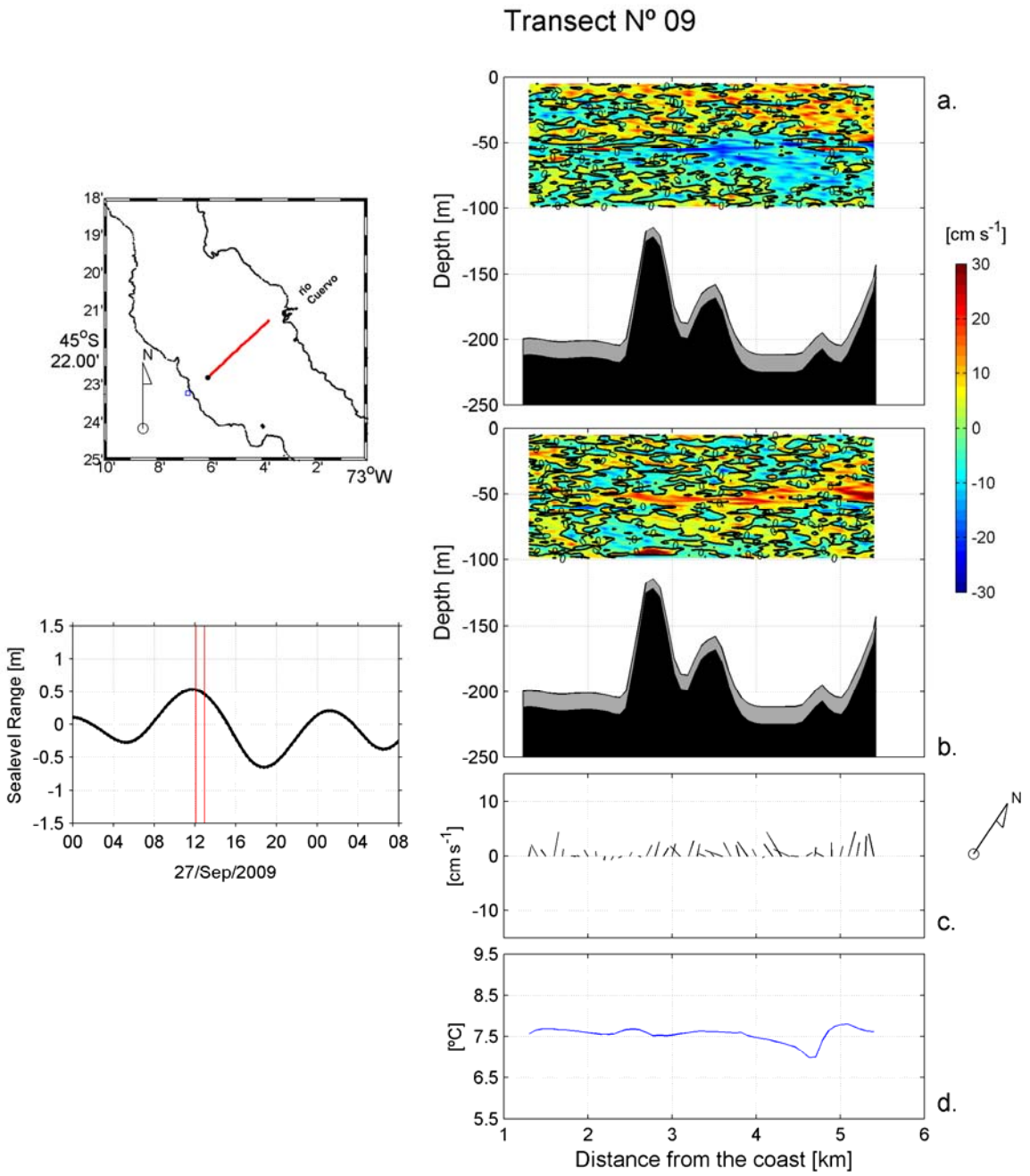

Figure 09: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 12:58 UTC and 27/Sep/2009 at 13:52 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

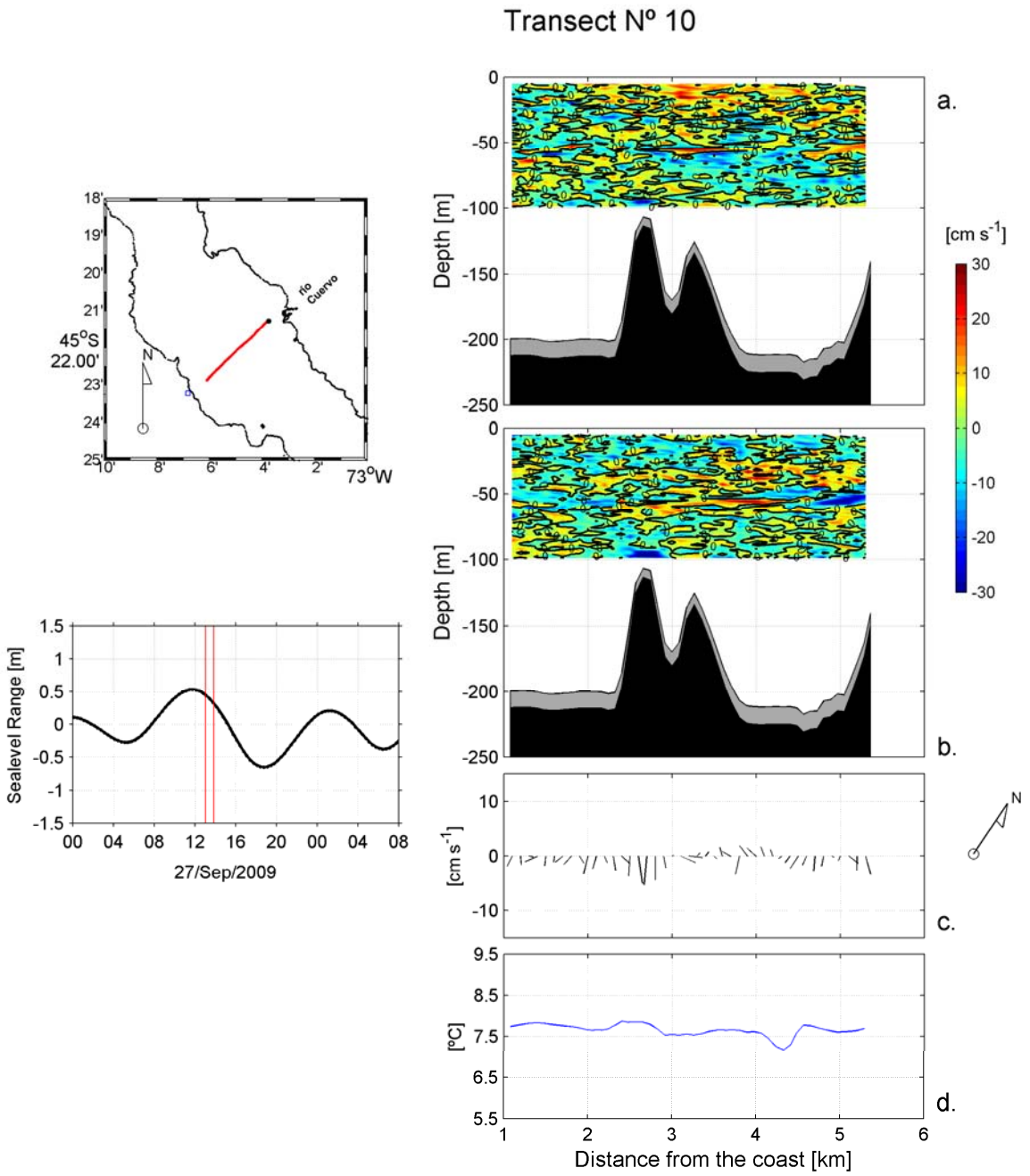

Figure 10: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 13:54 UTC and 27/Sep/2009 at 14:45 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

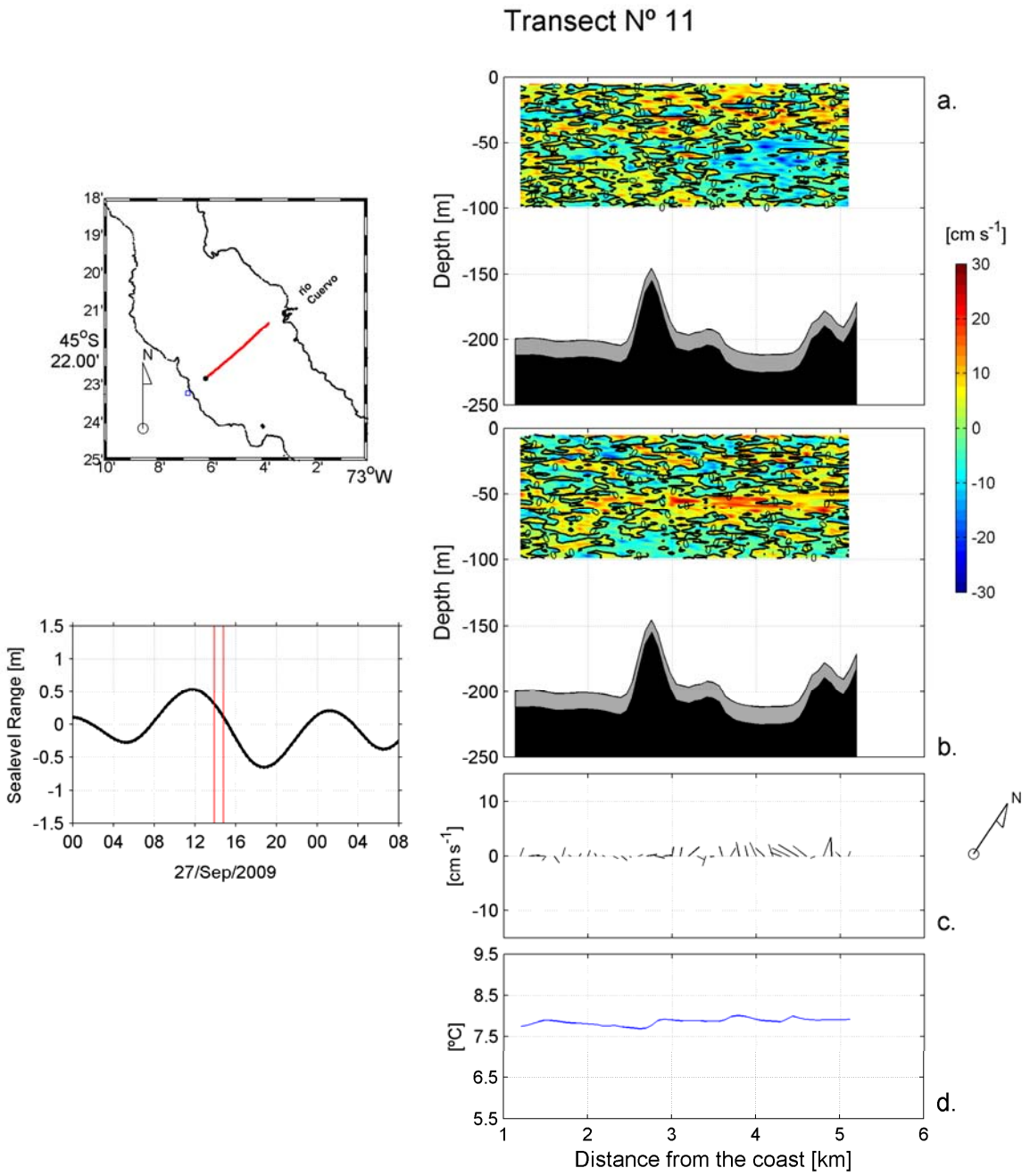

Figure 11: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 14:47 UTC and 27/Sep/2009 at 15:46 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

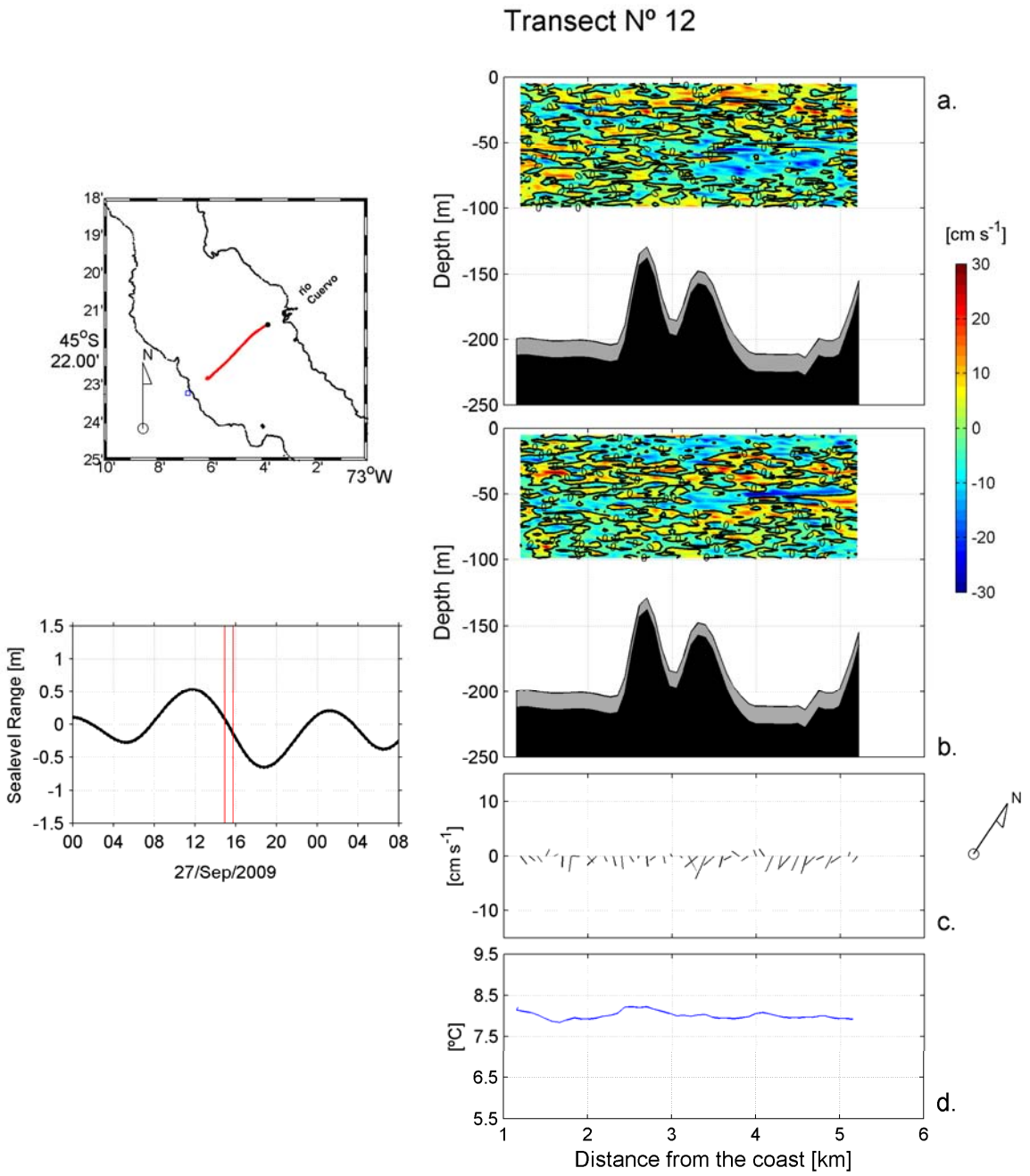

Figure 12: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 15:48 UTC and 27/Sep/2009 at 16:38 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

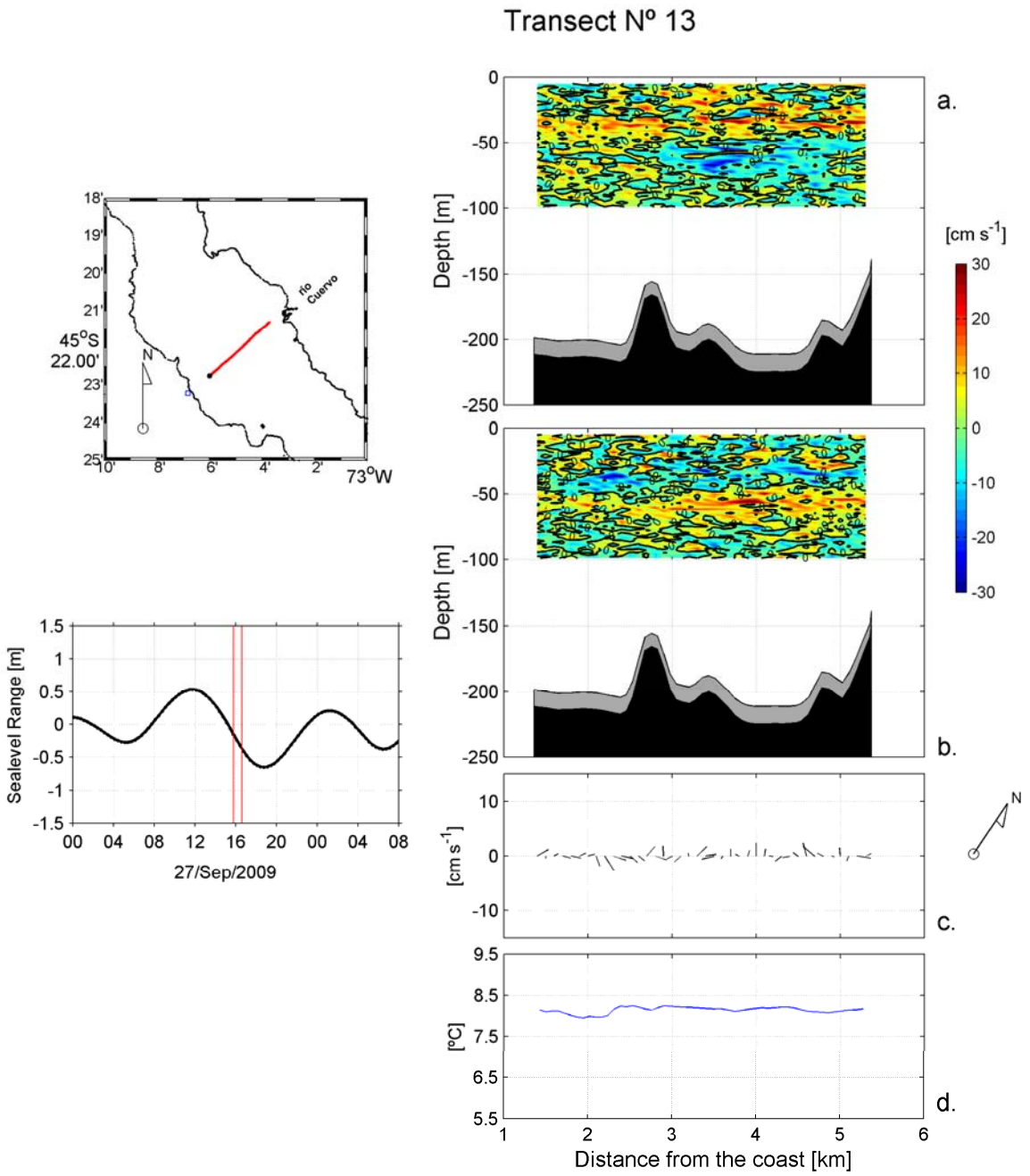

Figure 13: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 16:39 UTC and 27/Sep/2009 at 17:32 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

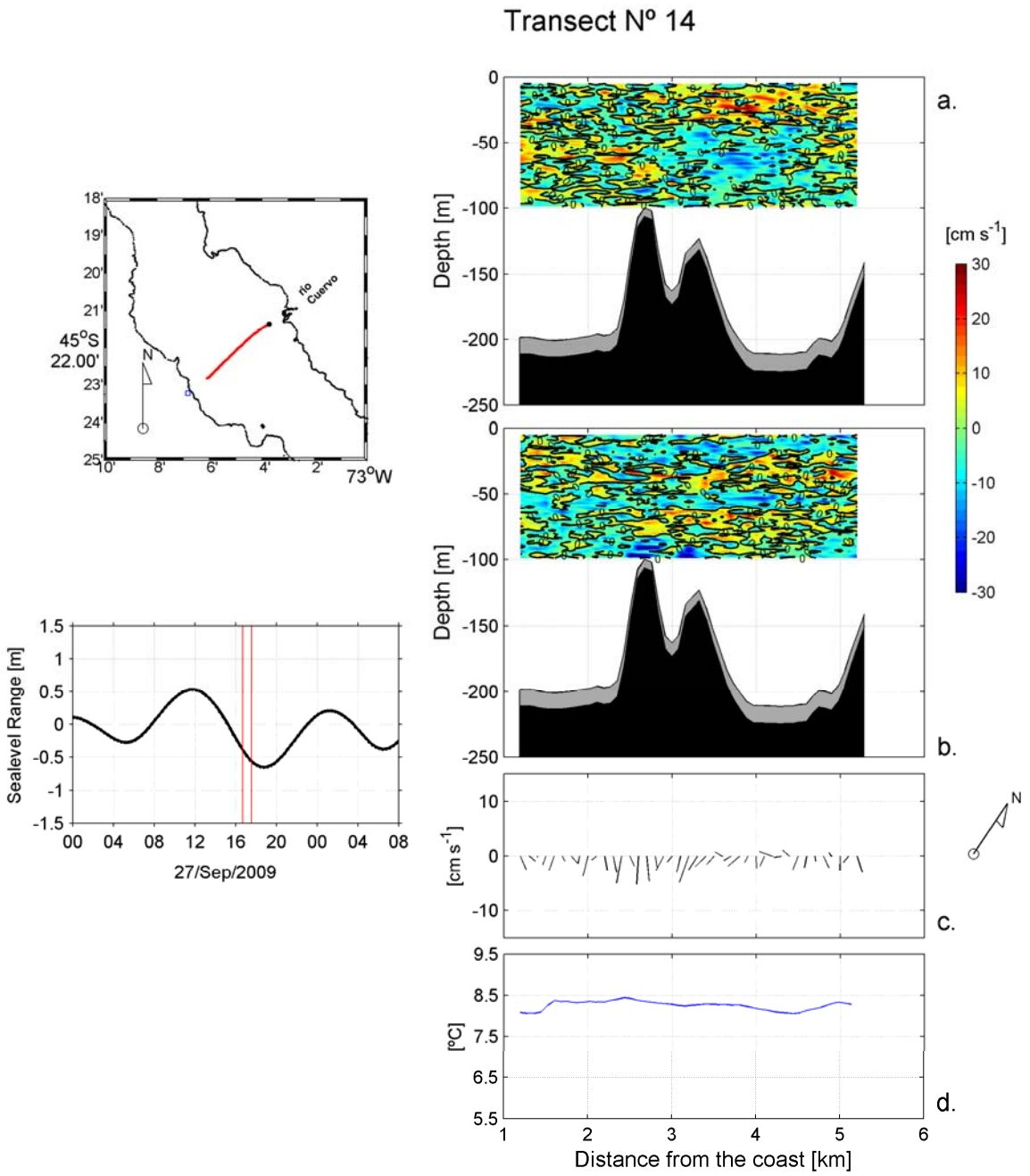

Figure 14: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 17:34 UTC and 27/Sep/2009 at 18:26 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

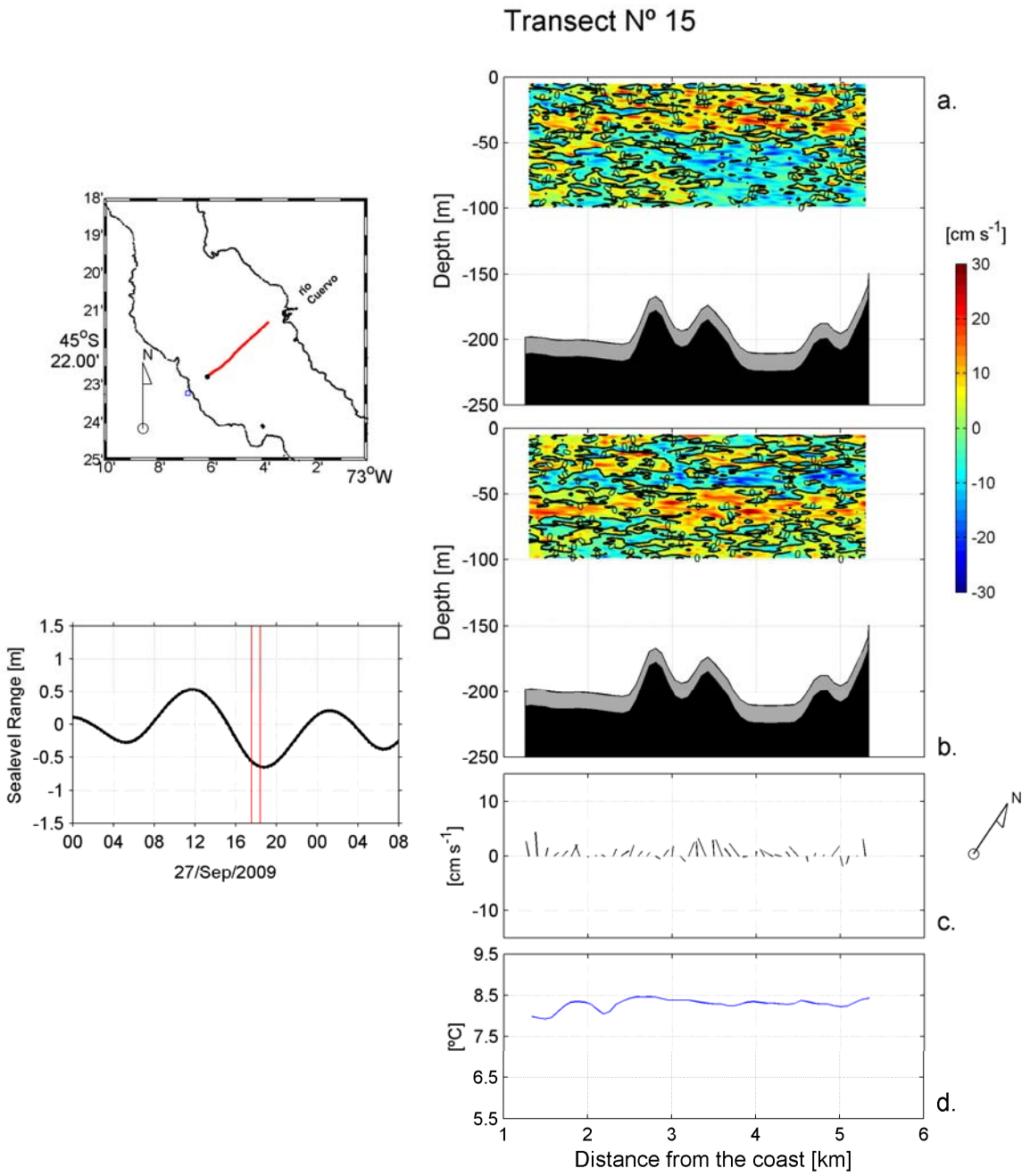

Figure 15: (a) Along-fjord and (b) Cross-fjord components of the current, (c) stick diagrams of mean currents and (d) 1m-depth temperature. Note that positive (negative) values in along-fjord component indicate currents trough the mouth (head) of the fjord. Transect were carried out between 27/Sep/2009 at 18:27 UTC and 27/Sep/2009 at 19:19 UTC. The upper-left insert show the path of each transect (dot indicate the transect end) and the lower-left insert show the sealevel range forecast, where the red lines indicates the transect time.

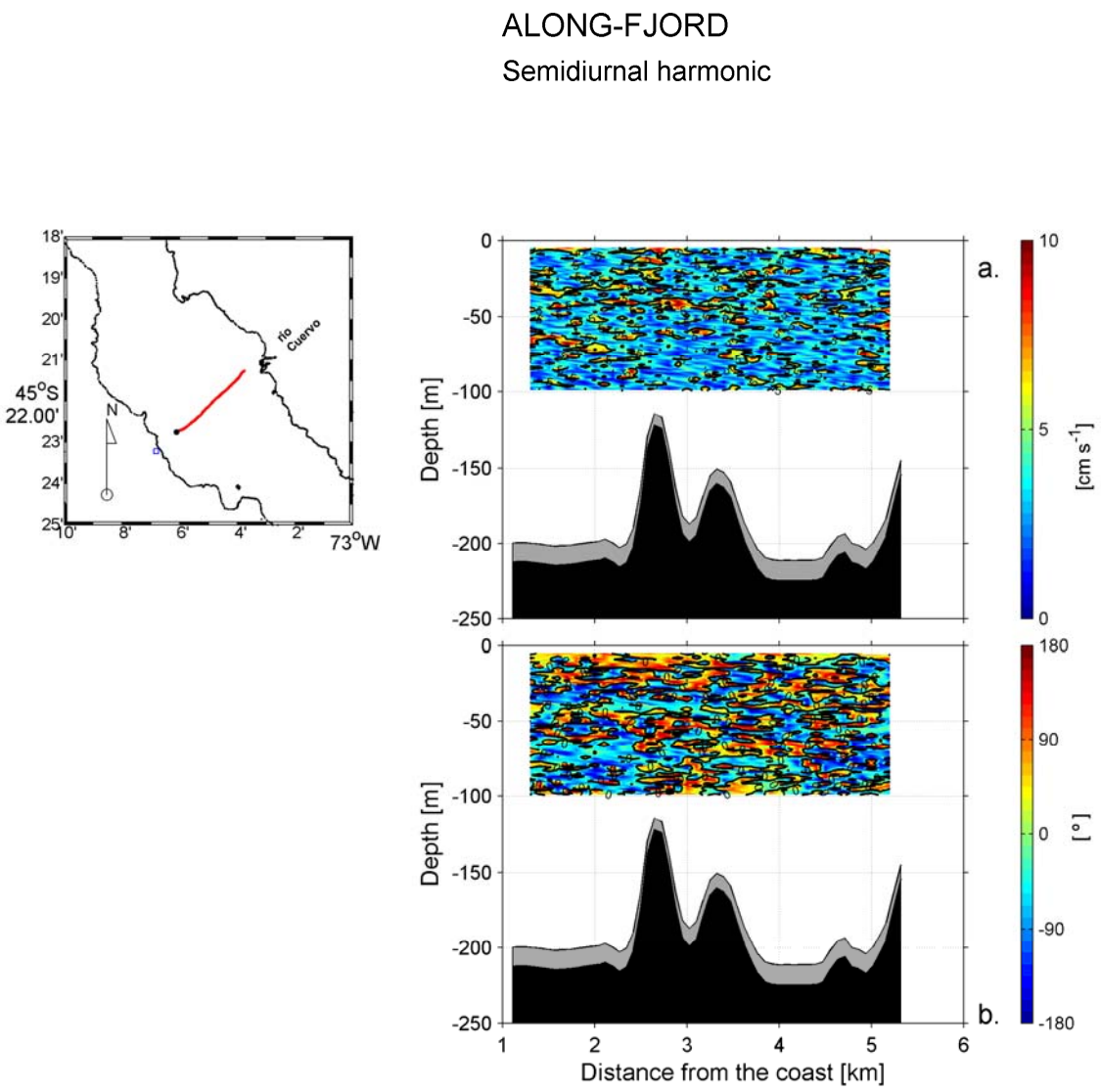

Figure 16: (a) Amplitude and (b) Phase of the cross-fjord component, during the study of the Aysen Fjord.

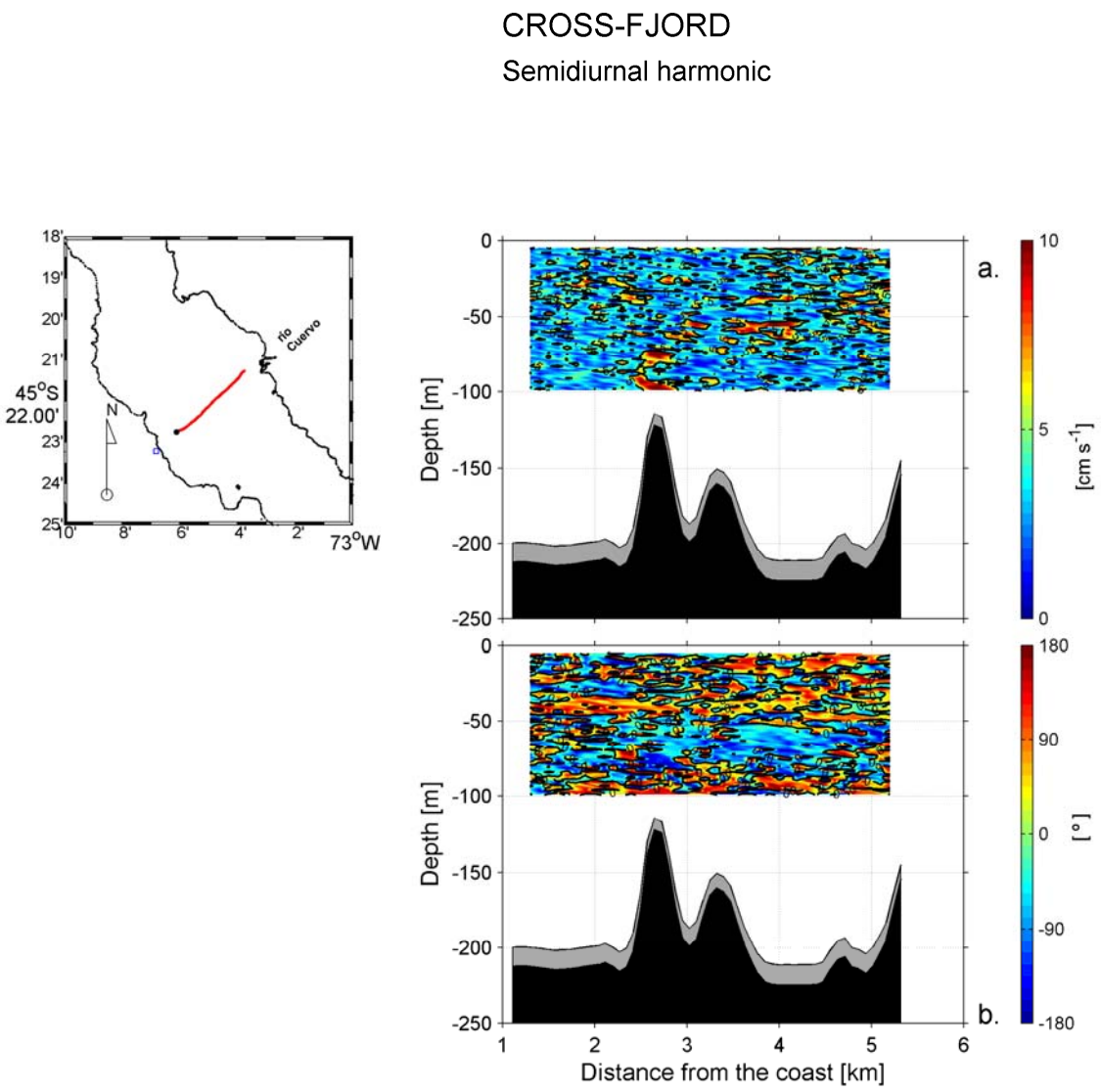

Figure 17: (a) Amplitude and (b) Phase of the along-fjord component, during the study of the Aysen Fjord.

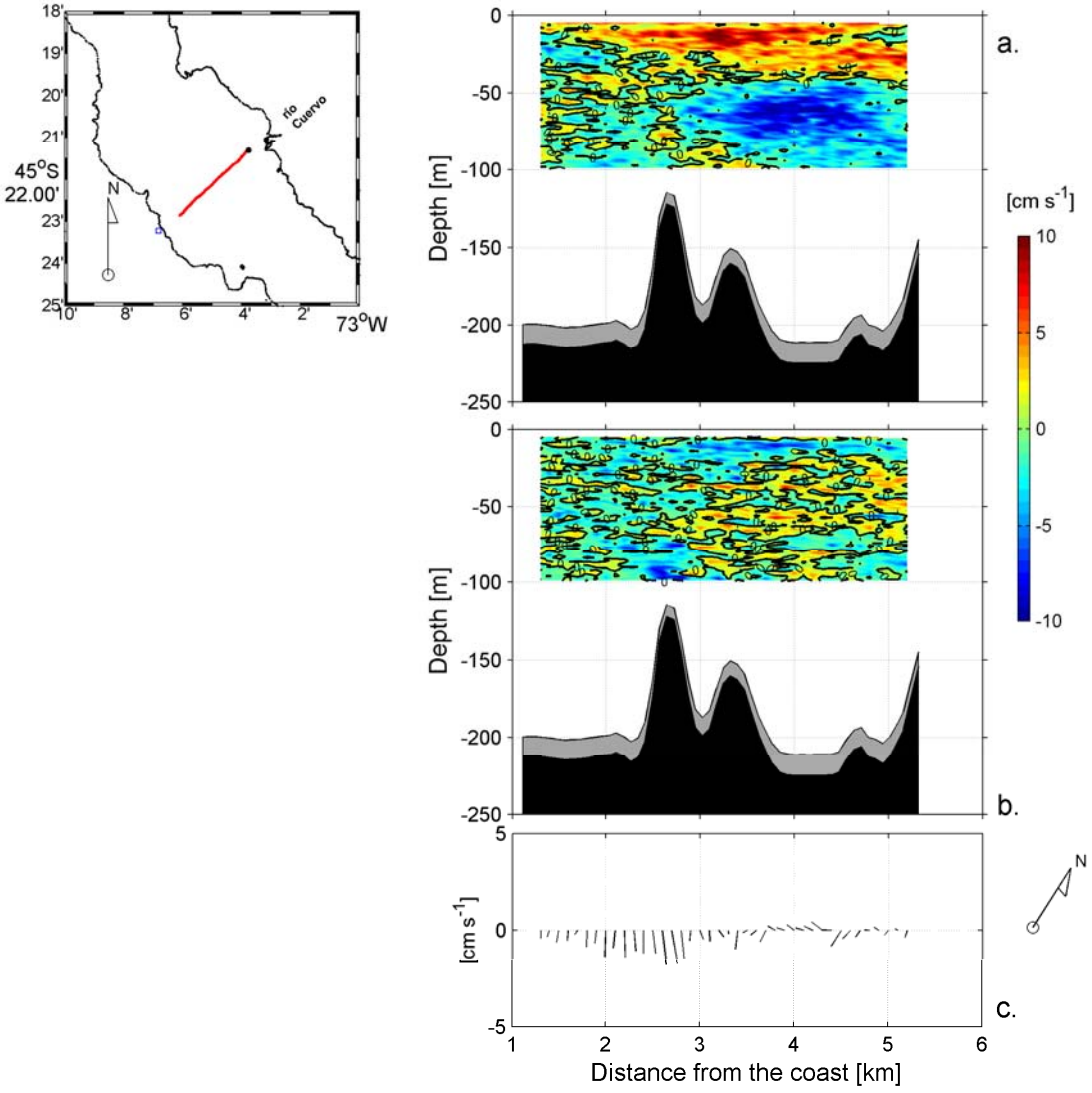

Figure 18: (a) Along-fjord and (b) Cross-fjord residual currents and (c) sticks diagram of residual currents, during the study of the Aysen Fjord.Note that positive (negative) values in Along-fjord component indicate currents trough the mouth (head) of the fjord.

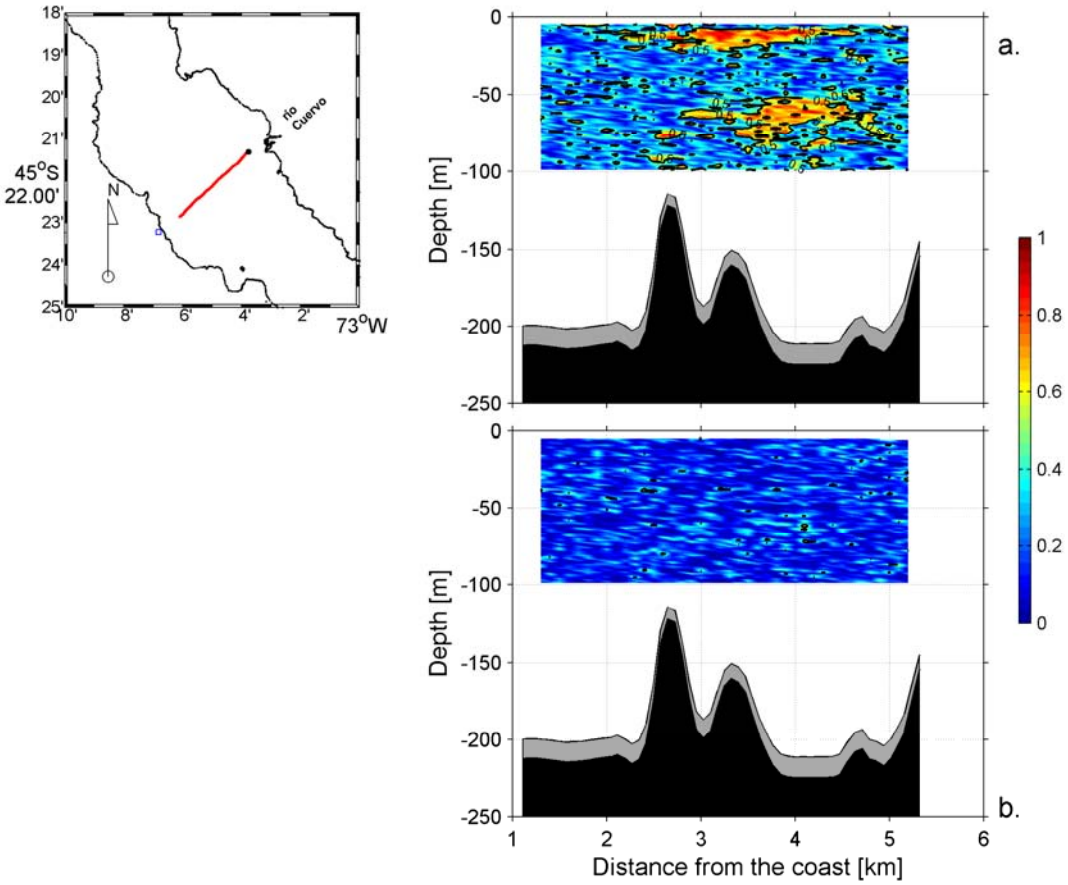

Figure 19: (a) Along-fjord and (b) Cross-fjord components goodness of fit, during the study of the Aysen Fjord.