

ADELAIDE DESALINATION PROJECT



WATER QUALITY CHARACTERISATION STUDY

December 2011

Report prepared by



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1 Introduction

The scope of this study is to characterise the ambient water quality in the Port Stanvac region, before the desalination plant becomes operational.

Specific aims for the study are:

1. To conduct monthly water column profiling 100 m, 500 m and 5 km north and south of the Adelaide Desalination Plant outfall, at a water depth of 5 m, 10 m, 15 m, 20 m and 25 m; and
2. To conduct monthly water column profiling of three offshore reference sites to determine natural changes in background concentrations in Gulf St Vincent.

The results presented in this report are from a water quality survey conducted on 7th December, 2011.

2 Results and Discussion

2.1 Salinity (Specific Conductivity and TDS)

TDS concentrations in the region surveyed, ranged between 36.6 g/L and 36.9 g/L (± 0.1 g/L).

On the seafloor, TDS concentrations were greater inshore than offshore, with a maximum concentration of 36.9 g/L observed north east of Port Stanvac (Hallett Cove; Figure 1). The minimum concentration observed was 36.6 g/L, north west of Port Stanvac in the deep water offshore from Hallett Cove.

There was evidence of haloclines forming in the region (Figure 11), at a depth of 4 m to 6 m. It is unclear whether these haloclines would persist after a change in the tidal cycle.

2.2 Water temperature

Water temperature in the region ranged between 18.4 °C and 20.3 °C (± 0.15 °C).

Seawater temperature on the seafloor was generally cooler offshore when compared to inshore (Figure 2), with a temperature change of up 0.9 °C across the region. The maximum water temperature observed on the seafloor (15.3 °C) occurred around the Adelaide Desalination Plant outfall.

Surface waters were generally warmer than the water temperature close to the seafloor, by 0.2 to 1.1 °C (Figure 6). There was evidence of stratification occurred in the water column at a depth of 4 m to 5 m. It is not clear whether the stratified layer persisted across changes in the tidal cycle.

2.3 Dissolved Oxygen

Dissolved oxygen (DO) concentration in the region ranged between 7.7 mg/L and 8.0 mg/L (± 0.1 mg/L), which equates to an oxygen saturation of 102 %-107 % (Figure 4).

Oxygen concentrations were variable close to the surface, which was perhaps due to temperature differences and wind disturbance influencing concentrations in the water column (Figure 7).

2.4 Chlorophyll

Chlorophyll concentrations in the region were generally less than 1 μ g/L (sensor sensitivity is ± 1 μ g/L).

There is a general trend of higher chlorophyll concentrations west of the outfall location, in the deep water, when compared to the rest of the region (Figure 5).

2.5 Turbidity

Turbidity in the water column was less than 2 NTU, throughout the region.

The sensor's accuracy is ± 2 NTU, therefore when turbidity concentrations are less than 2 NTU the sensor may provide a reading that falls between -2 and 2 NTU. This was observed at all sites (Figure 8).

2.6 pH

Average pH in the water column was 8.2 (± 0.2 pH unit). Seawater is highly buffered due to high concentrations of bicarbonate ions in solution and as a consequence pH remains constant (Figure 9).

3 Appendix A – Spatial Plots

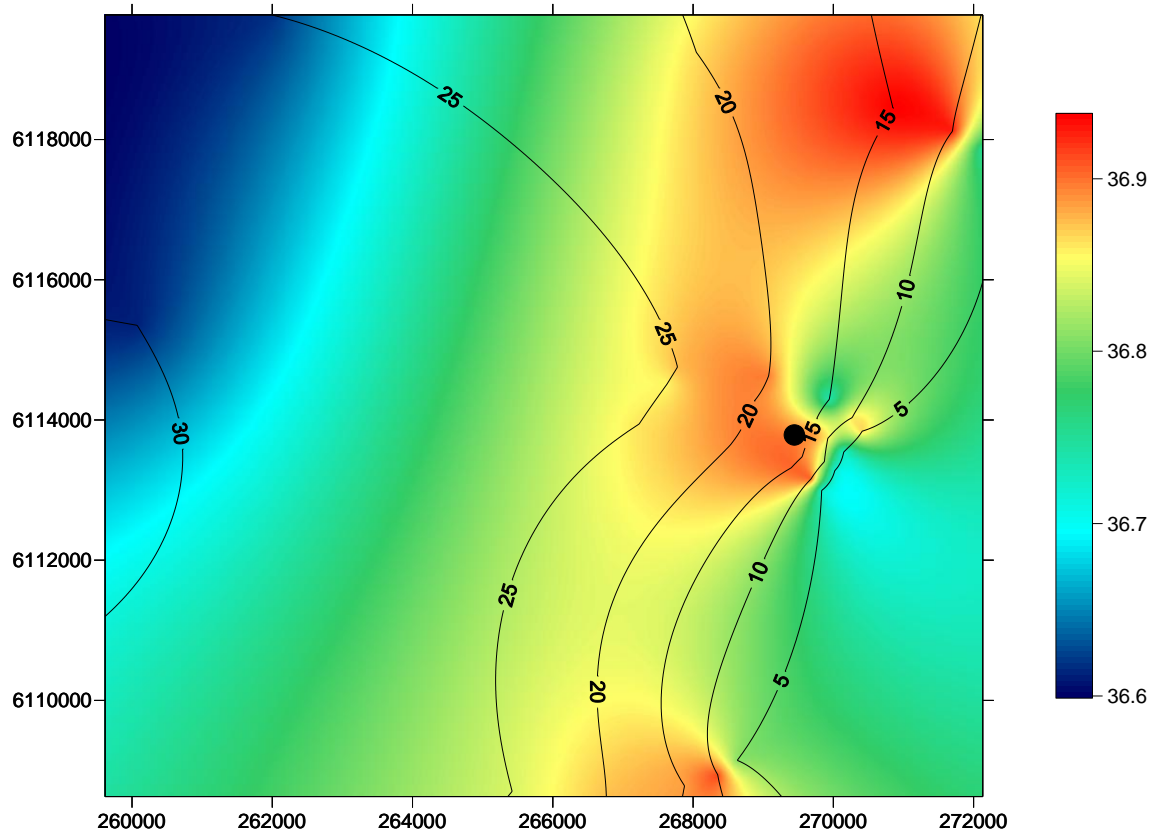


Figure 1 Spatial change in TDS (g/L) concentration, on the seafloor, in the Port Stanvac region. The coloured scale bar represents changes in TDS concentration between 36.6 g/L and 36.9 g/L (± 0.1 g/L). Contour lines denote a five metre change in depth. The bottom scale bar represents distance in metres across the region. X coordinates refer to eastings and Y coordinates refer to northings measured in metres. Black dot represents position of ADP outfall.

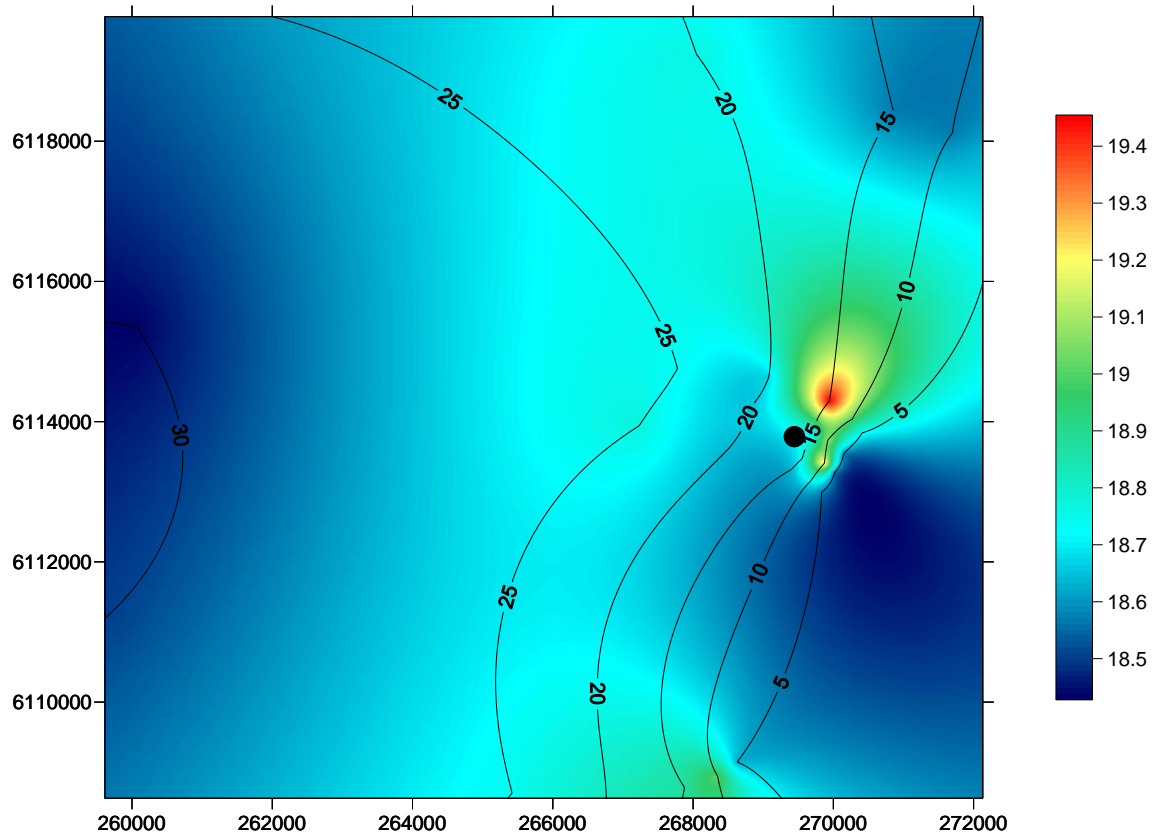


Figure 2 Spatial change in water temperature, on the seafloor, in the Port Stanvac region. The coloured scale bar represents temperature changes between 18.5 °C and 19.4 °C ($\pm 0.15^\circ\text{C}$). Contour lines denote a five metre change in depth. The bottom scale bar represents distance in metres across the region. X coordinates refer to eastings and Y coordinates refer to northings measured in metres. Black dot represents position of ADP outfall.

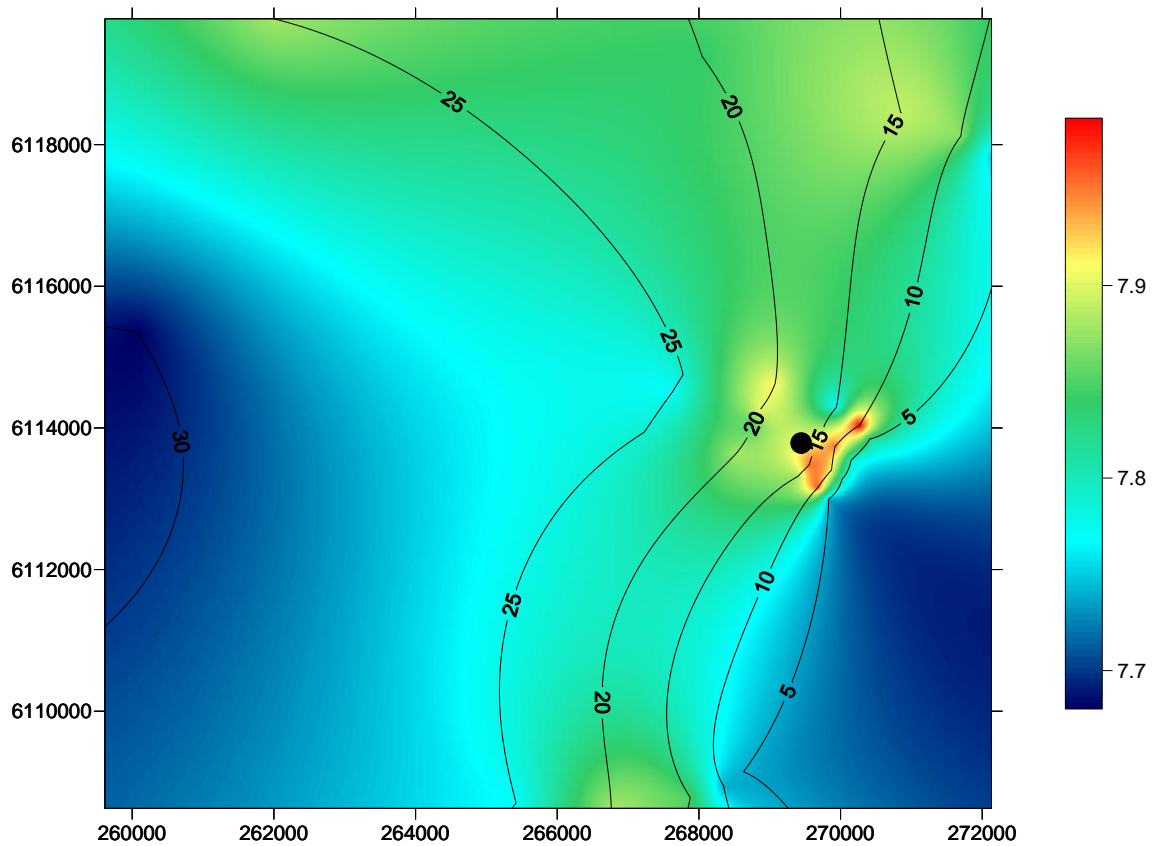


Figure 3 Spatial change in dissolved oxygen concentration, on the seafloor, in the Port Stanvac region. The coloured scale bar represents a change in the dissolved oxygen concentration between 7.7 mg/L and 8.0 mg/L (± 0.1 mg/L). Contour lines denote a five metre change in depth. The bottom scale bar represents distance in metres across the region. X coordinates refer to eastings and Y coordinates refer to northings measured in metres. Black dot represents position of ADP outfall.

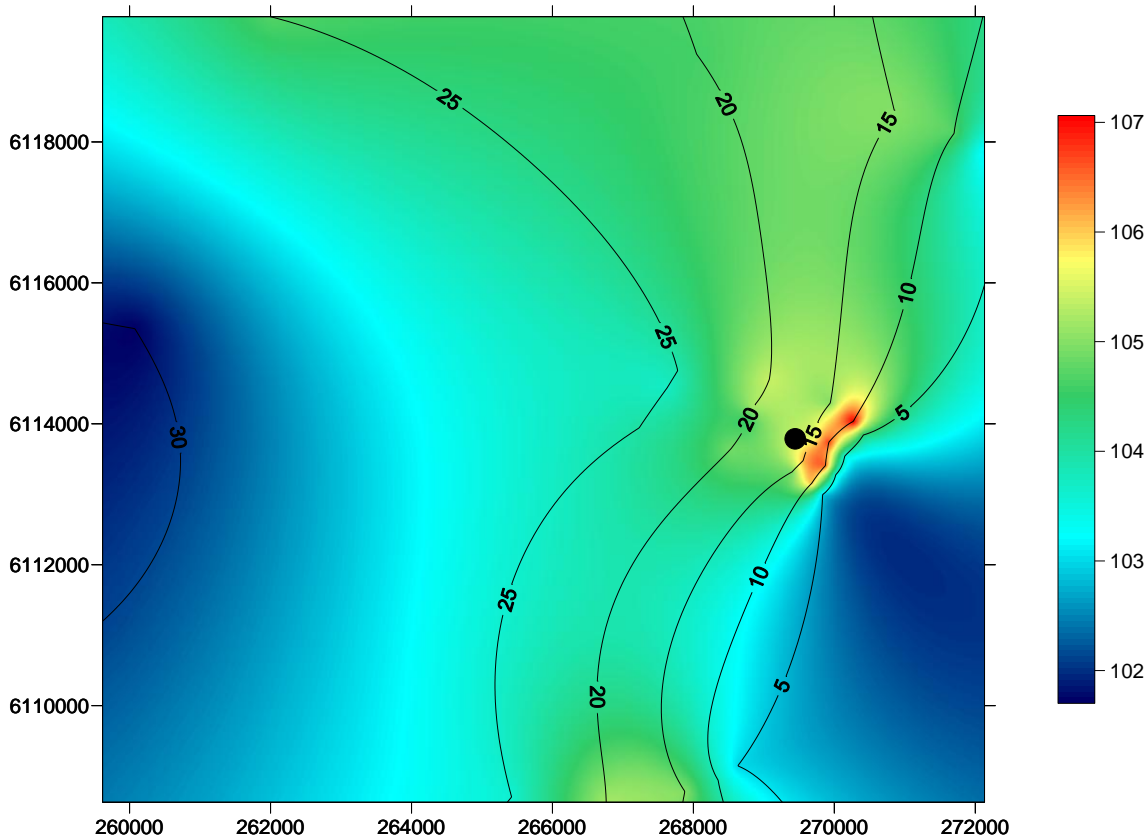


Figure 4 Spatial change in dissolved oxygen concentration (expressed as percentage saturation), on the seafloor, in the Port Stanvac region. The coloured scale bar represents a change in the dissolved oxygen concentration between 102 % and 107 %. Contour lines denote a five metre change in depth. The bottom scale bar represents distance in metres across the region. X coordinates refer to eastings and Y coordinates refer to northings measured in metres. Black dot represents position of ADP outfall.

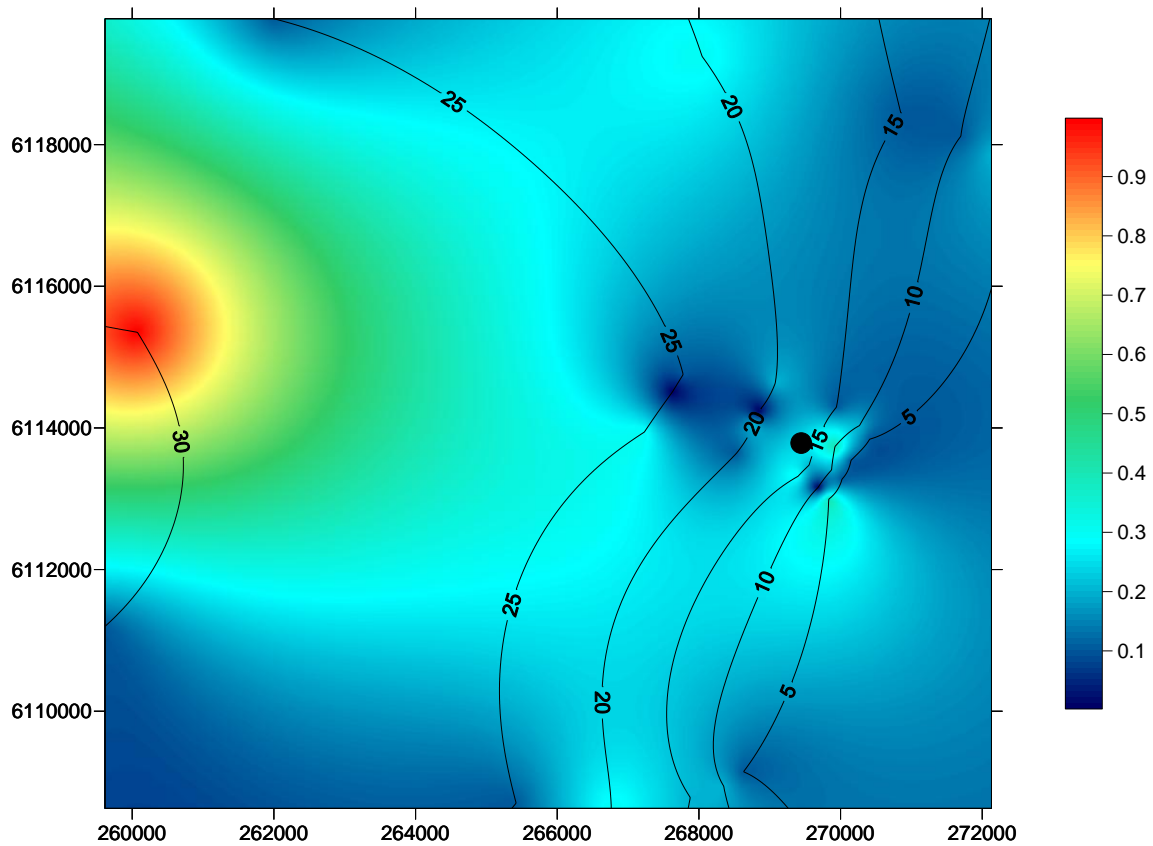


Figure 5 Spatial change in chlorophyll a concentration, one metre below the surface, in the Port Stanvac region. The coloured scale bar represents a change in chlorophyll concentration between 0 $\mu\text{g/L}$ and 1.0 $\mu\text{g/L}$. Note sensor sensitivity is $\pm 1 \mu\text{g/L}$. Contour lines denote a five metre change in depth. The bottom scale bar represents distance in metres across the region. X coordinates refer to eastings and Y coordinates refer to northings measured in metres. Black dot represents position of ADP outfall.

4 Appendix B - Vertical profiles

The following graphs illustrate specific conductivity ($\mu\text{S}/\text{cm}$), total dissolved solids (g/L) temperature (degrees Celsius), dissolved oxygen (mg/L), turbidity (NTU) and pH, relative to depth for May 2011. Water column profiles were undertaken 5km, 500m and 100m north and south of the outfall diffusers at water depths of 5m, 10m, 15m, 20m and 25m. Water column profiles were also undertaken at three control sites, approximately 10 km offshore adjacent to Hallett Cove, Port Stanvac and Noarlunga. The legend below applies to all graphs.

Dotted lines represent water quality profiles conducted south and solid lines are sites north of the diffuser location. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser. Water quality profiles were conducted at a depth of 5 m, 10 m, 20 m and 25 m. There were no 25 m profiles undertaken north of the diffuser due to insufficient water depth. Control sites were located approximately 10 km offshore, adjacent to Hallett Cove (blue), Port Stanvac (orange) and Noarlunga (green).

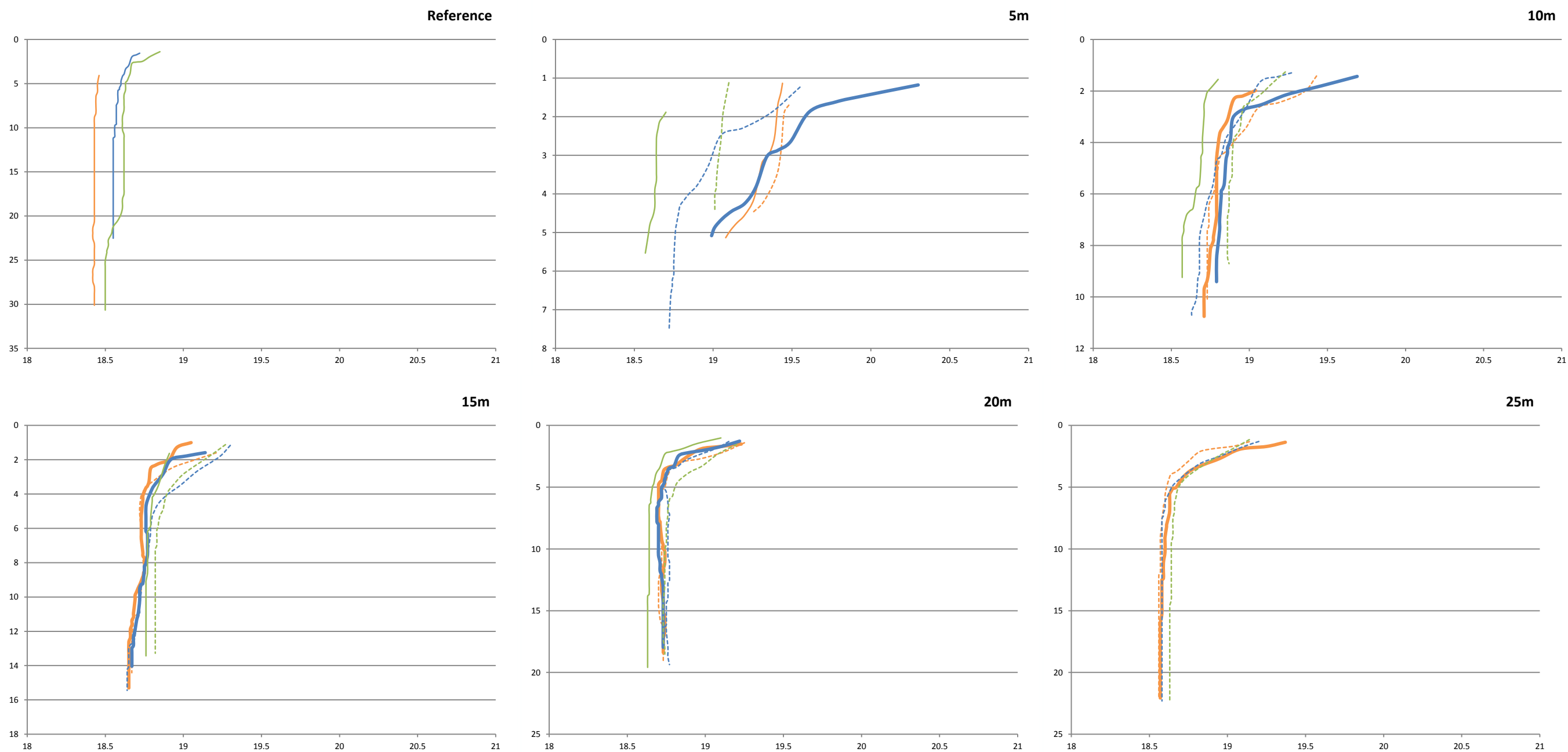


Figure 6 Change in water temperature (x axis; degrees Celsius) at different depths (y axis; metres) throughout the water column. Water quality profiles were conducted at a depth of 5 m, 10 m, 15 m, 20 m, 25 m and 10 km offshore (Reference sites); north (solid lines) and south (broken line) of the ADP diffuser. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser.

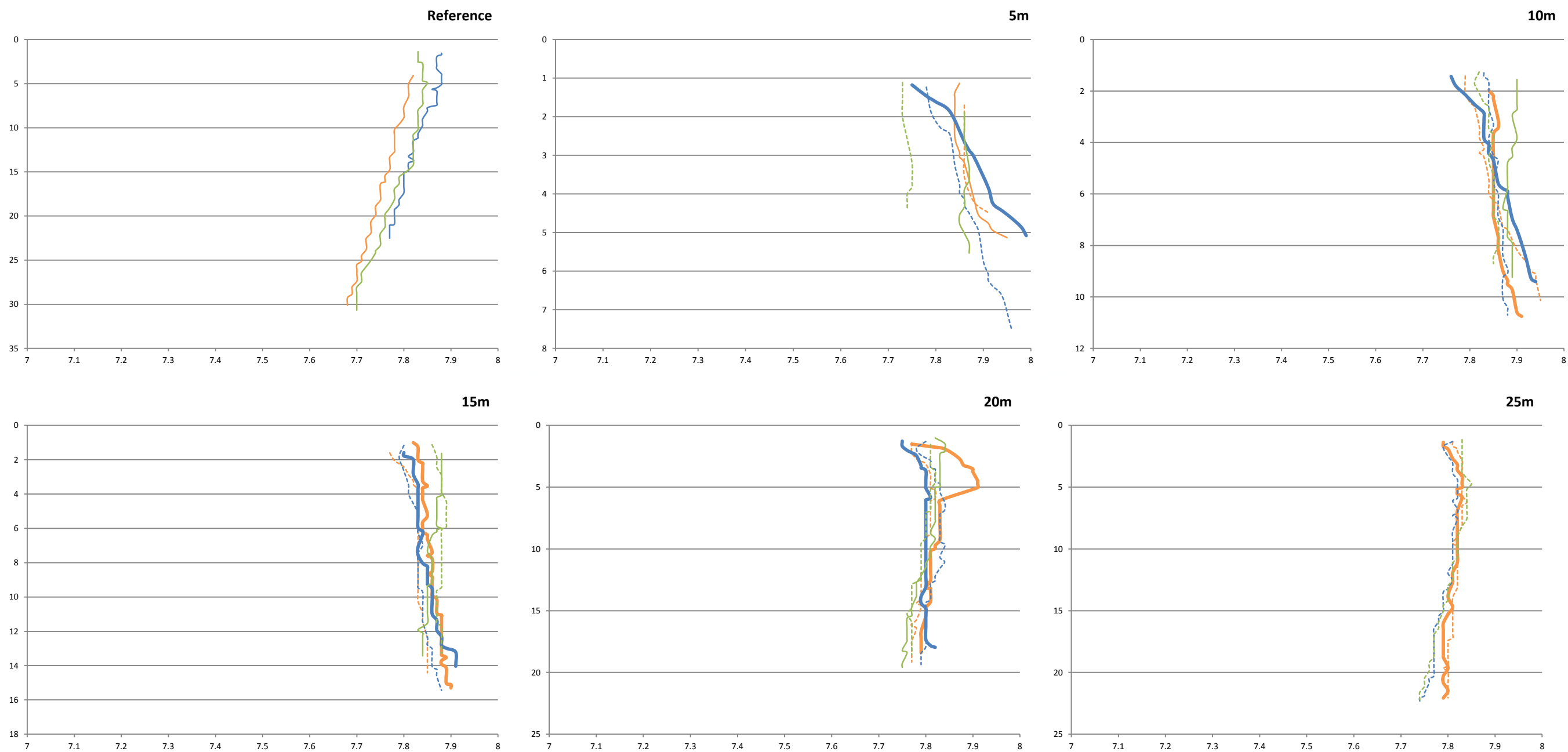


Figure 7 Change in dissolved oxygen (x axis; mg/L) at different depths (y axis; metres) throughout the water column. Water quality profiles were conducted at a depth of 5 m, 10 m, 15m, 20 m, 25 m and 10 km offshore (Reference sites); north (solid lines) and south (broken line) of the ADP diffuser. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser.

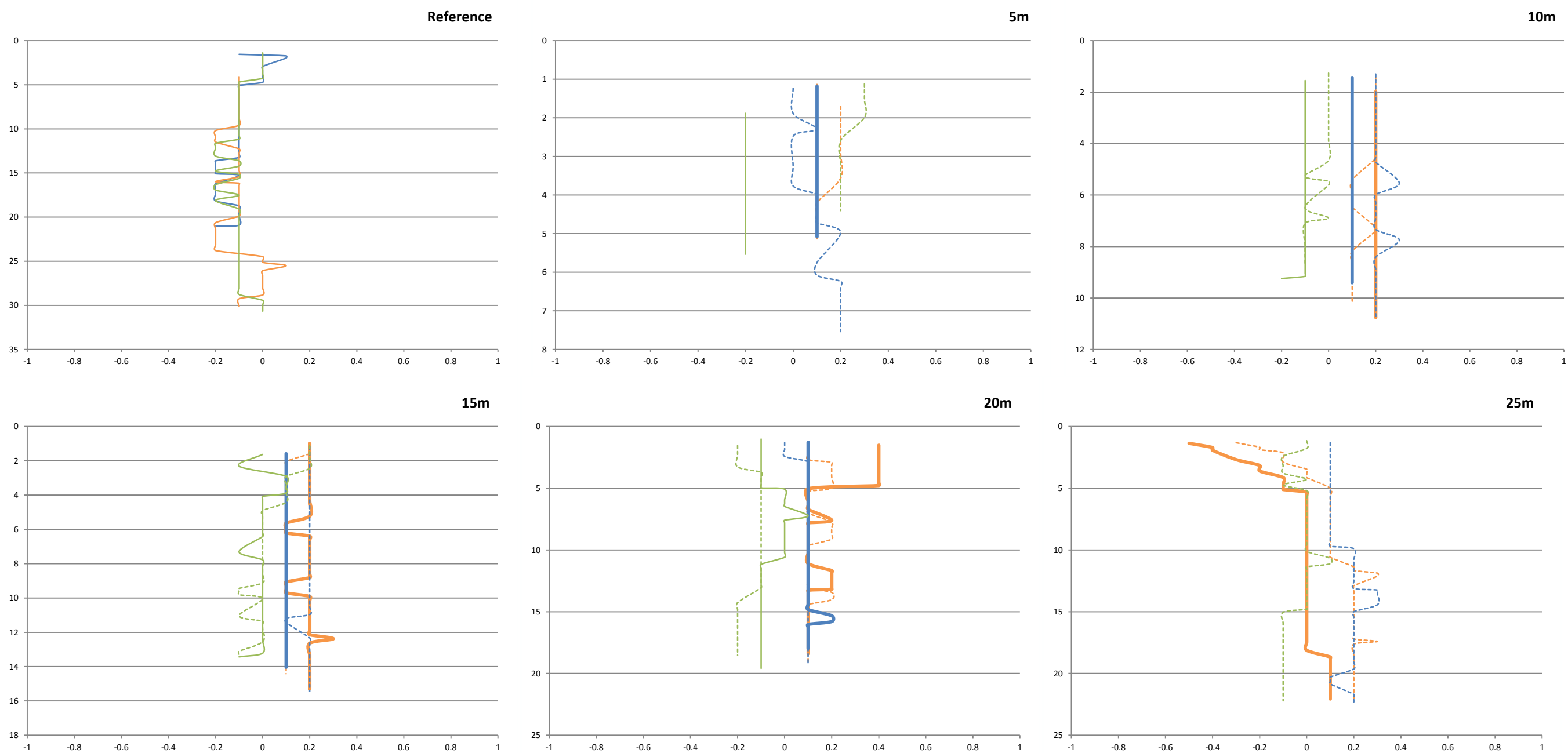


Figure 8 Change in turbidity (x axis; NTU) at different depths (y axis; metres) throughout the water column. Water quality profiles were conducted at a depth of 5 m, 10 m, 15m, 20 m, 25 m and 10 km offshore (Reference sites); north (solid lines) and south (broken line) of the ADP diffuser. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser.

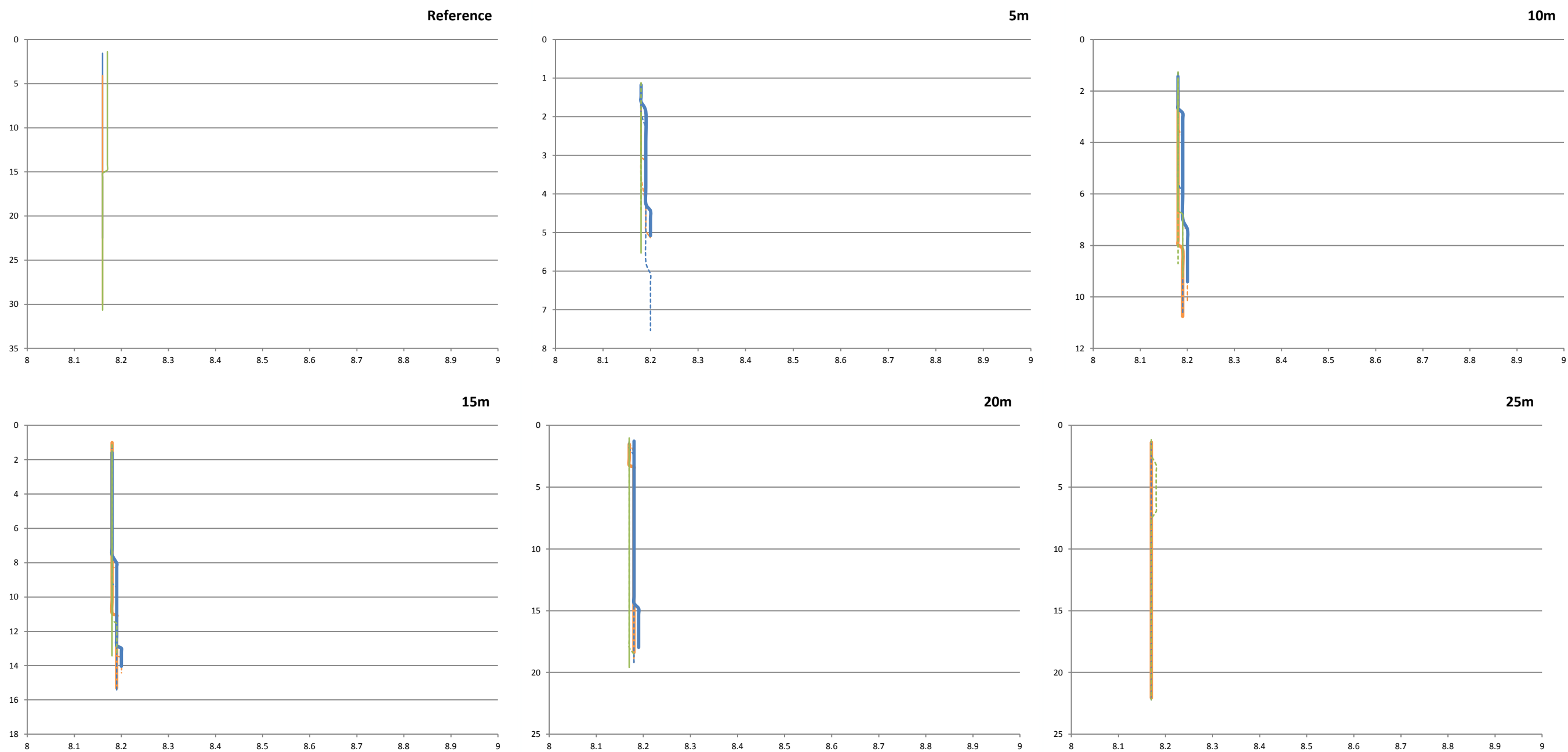


Figure 9 Change in pH (x axis; pH units) at different depths (y axis; metres) throughout the water column. Water quality profiles were conducted at a depth of 5 m, 10 m, 15m, 20 m, 25 m and 10 km offshore (Reference sites); north (solid lines) and south (broken line) of the ADP diffuser. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser.

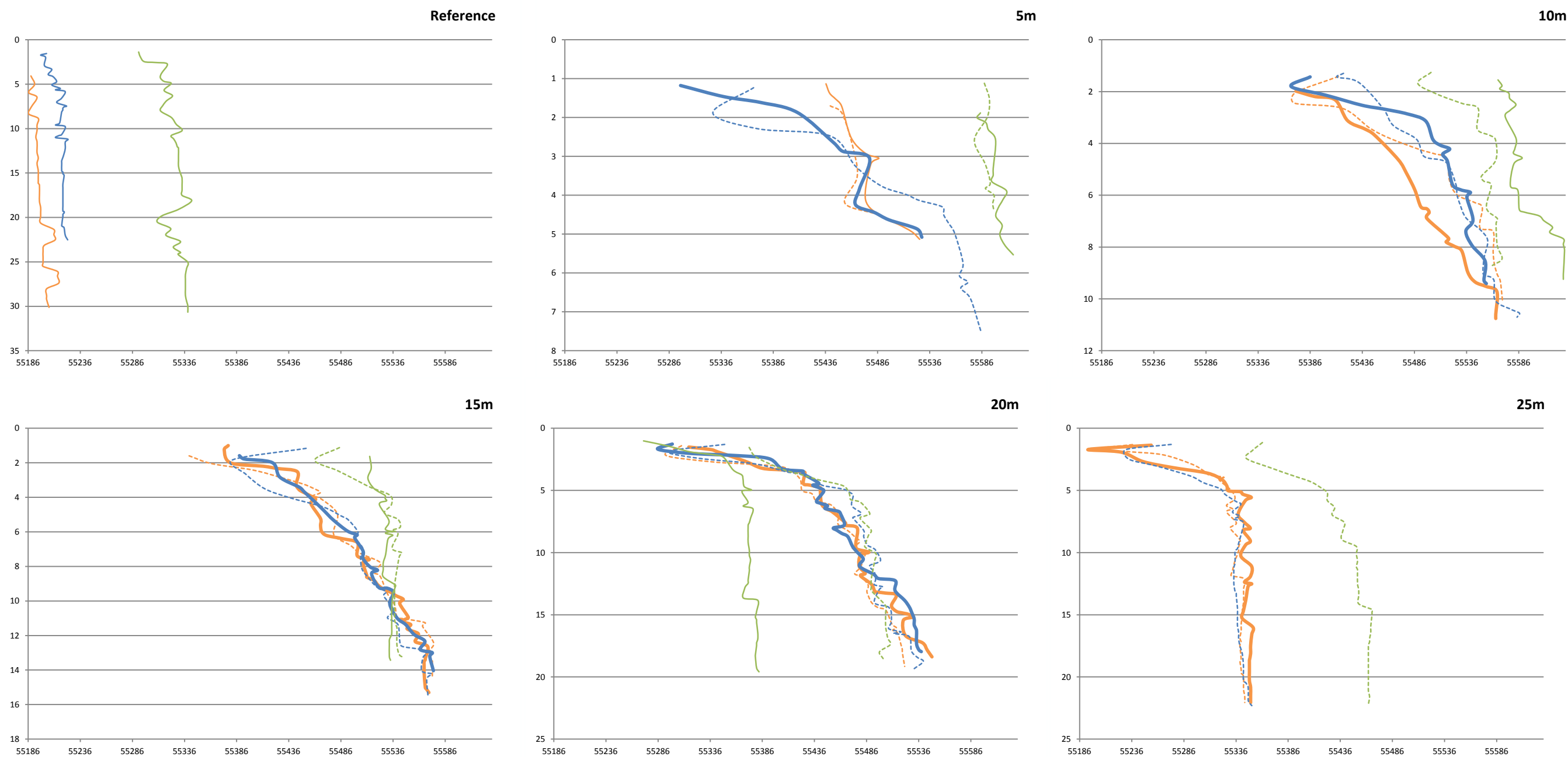


Figure 10 Change in specific conductivity (x axis; $\mu\text{S}/\text{cm}$) at different depths (y axis; metres) throughout the water column. Water quality profiles were conducted at a depth of 5 m, 10 m, 15m, 20 m, 25 m and 10 km offshore (Reference sites); north (solid lines) and south (broken line) of the ADP diffuser. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser.

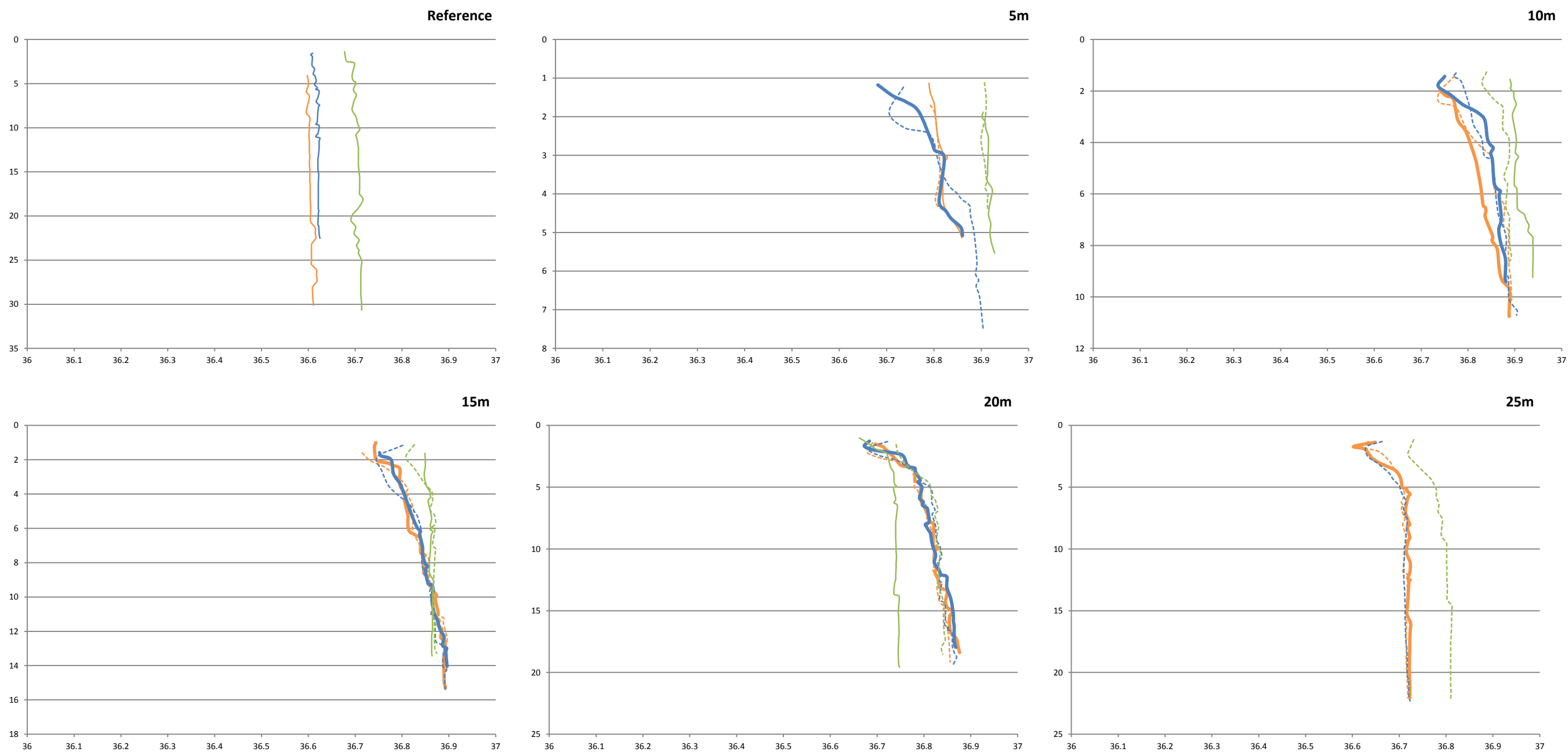


Figure 11 Change in total dissolved solids (x axis; g/L) at different depths (y axis; metres) throughout the water column. Water quality profiles were conducted at a depth of 5 m, 10 m, 15m, 20 m, 25 m and 10 km offshore (Reference sites); north (solid lines) and south (broken line) of the ADP diffuser. Orange represents 100 m, blue 500 m and green 5 km either north or south of the diffuser.