Alexandra Basin Redevelopment 2

Bringing Dublin Port To 2040

Environmental Impact Assessment Report

Appendix 14-1 Model Calibration and Validation

Volume 3



CALAFORT ÁTHA CLIATH
DUBLIN PORT

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Appendix 14-1 Model Calibration and Validation

This appendix describes the calibration and validation process undertaken to ensure that the hydraulic model systems used to assess the potential impact of the proposed development on coastal processes were accurate and fit for purpose.

14.1 Model Validation

The validation process was undertaken using surface elevation information recorded by the Dublin Port tide gauge and also current regime information recorded by eight individual Acoustic Doppler Current Profilers (ADCPs) that were moored throughout Dublin Bay between 2013 and present as part of various monitoring programmes. The location of the ADCP devices in relation to Dublin Port is illustrated in Figure 1.

The validation process focused on establishing agreement between the model output and recorded observations and thus assessing overall model performance based several key parameters including tidal range, current speed, phase and direction.

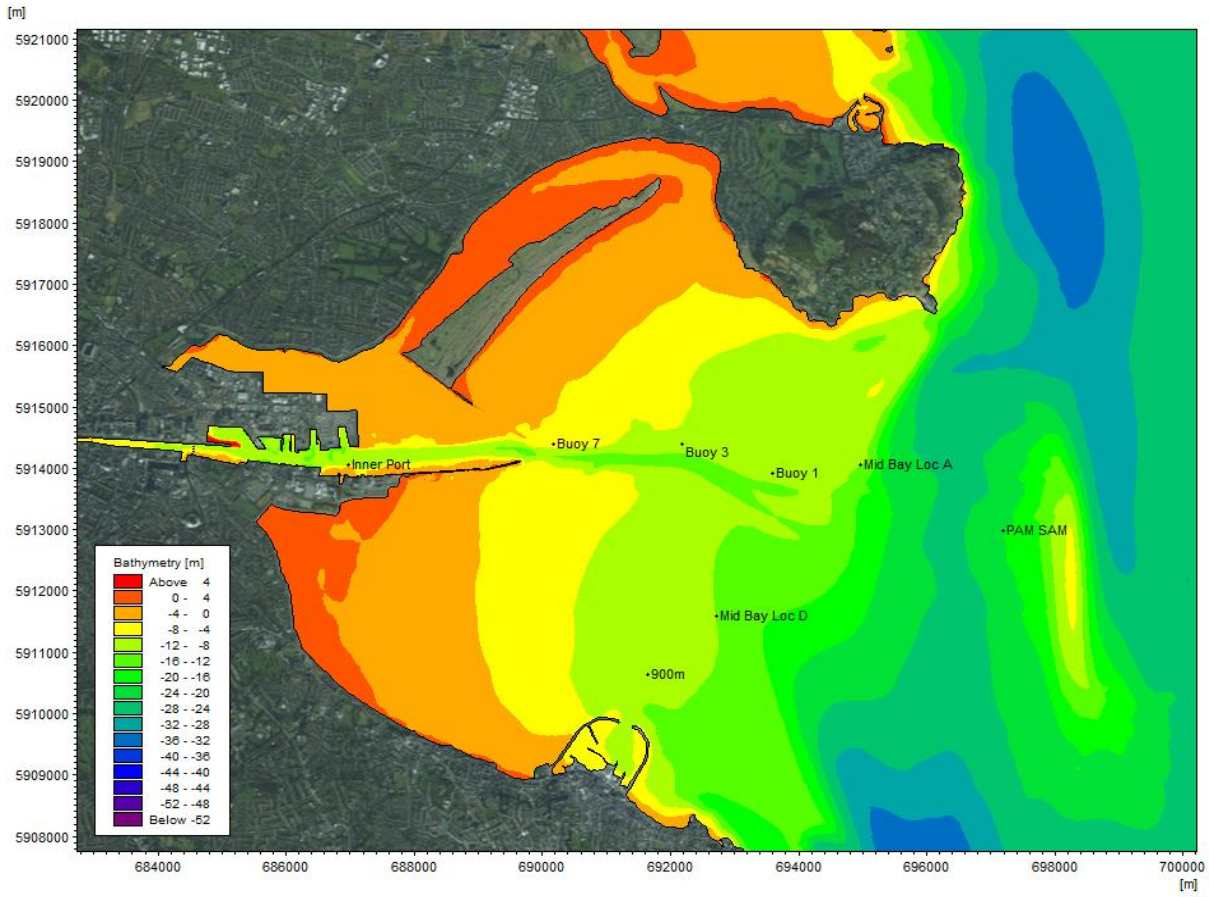


Figure 1: Location of the various measurement recording sites throughout Dublin Bay used to validate TT' baseline numerical model

14.1.1 Validation of simulated tidal ranges

Figure 2 presents a comparison between surface elevation data recorded by the Dublin Tide Gauge over a typical spring neap tidal cycle in 2016, and surface elevation data simulated by the Dublin Bay numerical model for the same period. As can be seen in this figure, the hydrodynamic model simulates the surface elevations in Dublin Port to a very high degree of accuracy.

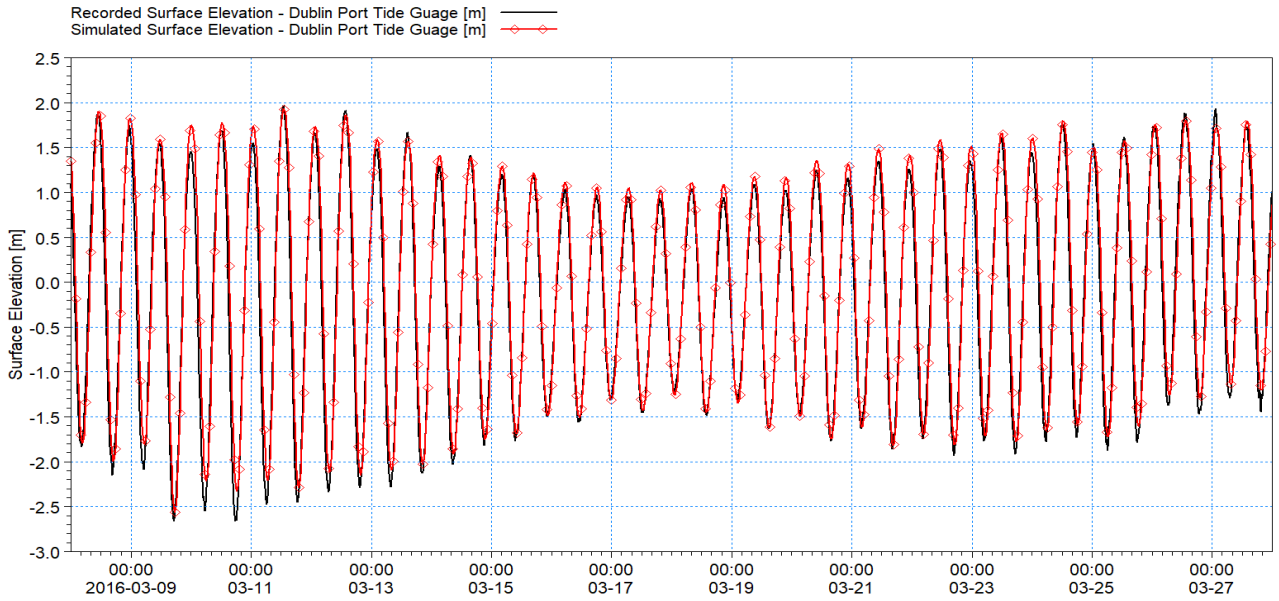


Figure 2: Comparison of recorded and simulated surface elevations at the Dublin Port tide gauge

14.1.2 Validation of simulated current regime

The validation of the simulated tidal current regime was undertaken using data recorded by eight individual ADCP devices that were deployed throughout the model domain at various times between 2013 and present as part of various hydrographic and environmental monitoring programmes. It should therefore be noted that the temporal duration of the validation plots vary depending on the device location.

All ADCP devices were setup to record current speed, phase and direction at multiple depths throughout the water column. The multiple depth recordings were then grouped together to create representative bottom, middle and top layer signals.

To validate the two-dimensional Dublin Bay model, depth averaged simulated data were compared with data recorded at all sites except the inner Port where stratified conditions prevail. For convenience, an index for the various validation plots across spring and neap tidal conditions has been presented in Table 1 overleaf.

Table 1: Index of the validation plots at each of the validation sites for spring and neap conditions

Validation Type	Validation Site	Spring Conditions	Neap Conditions
Depth averaged (2D)	Buoy 1	Figure 3	Figure 10
	Buoy 3	Figure 4	Figure 11
	Buoy 7	Figure 5	Figure 12
	Mid Bay A	Figure 6	Figure 13
	Mid Bay D	Figure 7	Figure 14
	VD 900	Figure 8	Figure 15
	PAM SAM	Figure 9	Figure 16

Examination of the two-dimensional depth averaged plots used to validate simulated date model outside of the Port demonstrate that the hydrodynamic model predicted current speed, phase and direction during both spring and neap tidal conditions throughout the entire model domain to a very high degree of accuracy. At all validation sites the simulated depth averaged current speed, phase and direction values nearly always falls between the range values observed in the top and bottom layers. It may be noted that there is a minor difference between the modelled and recorded data in the top layer at buoys 3 and 7, however this difference can be attributed to prevailing weather conditions such as high surface winds etc. which would not have been account for in the hydrodynamic model.

Overall, the validation process demonstrated that TT' two-dimensional baseline model of Dublin Bay simulated the current speed, phase, range and direction to a high degree of accuracy throughout the entire model domain. The current regime within the inner harbour flow is complex with some level of circulation, stratification and bi-directional flows; however, these phenomena are all well represented by the model. The validation process therefore considered the models to be fit for purpose and adequate to assess the coastal processes in Dublin Port in context of the ABR2 Project.

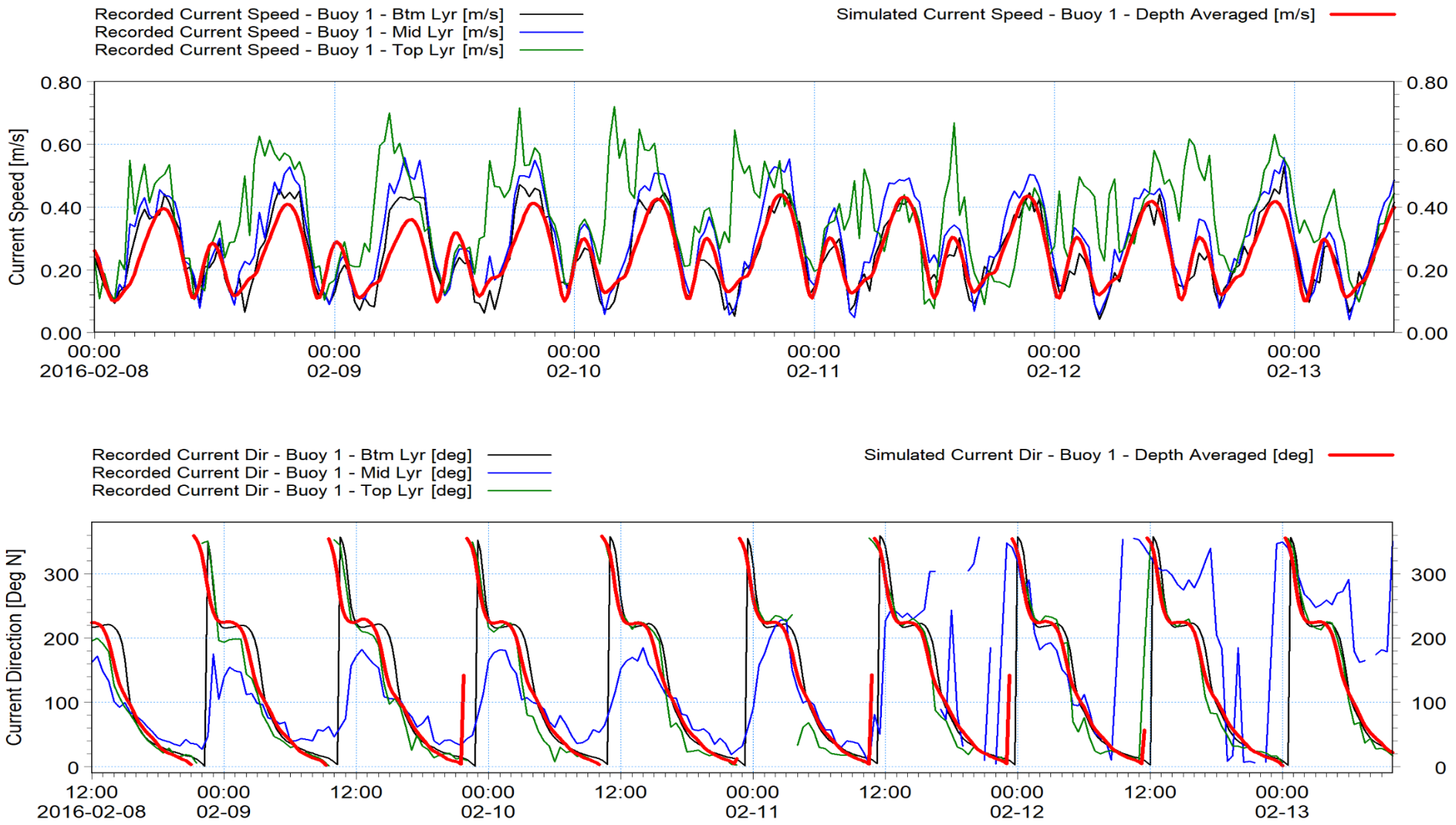


Figure 3: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Buoy 1 - Spring Tides

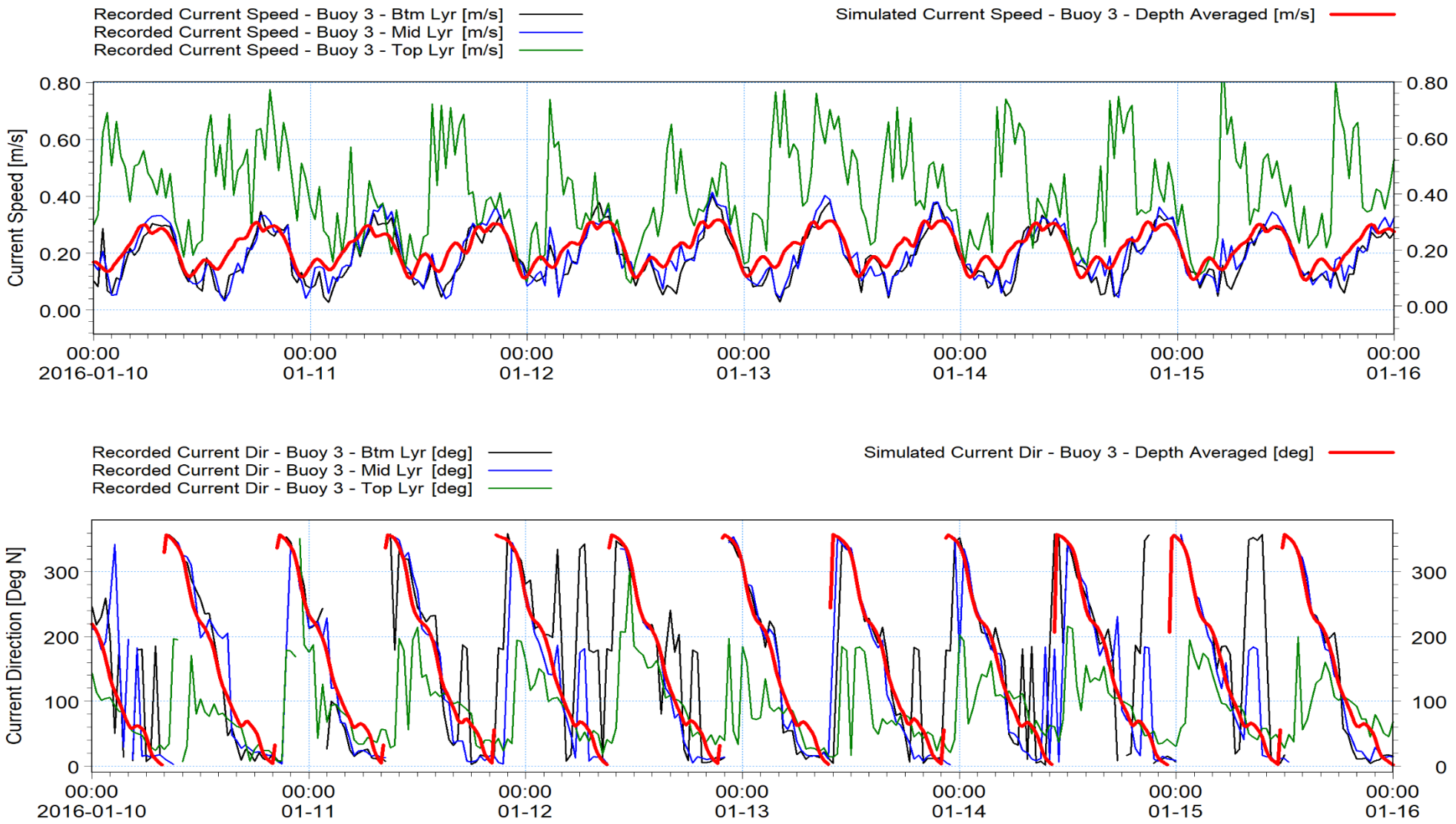


Figure 4: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Buoy 3 - Spring Tides

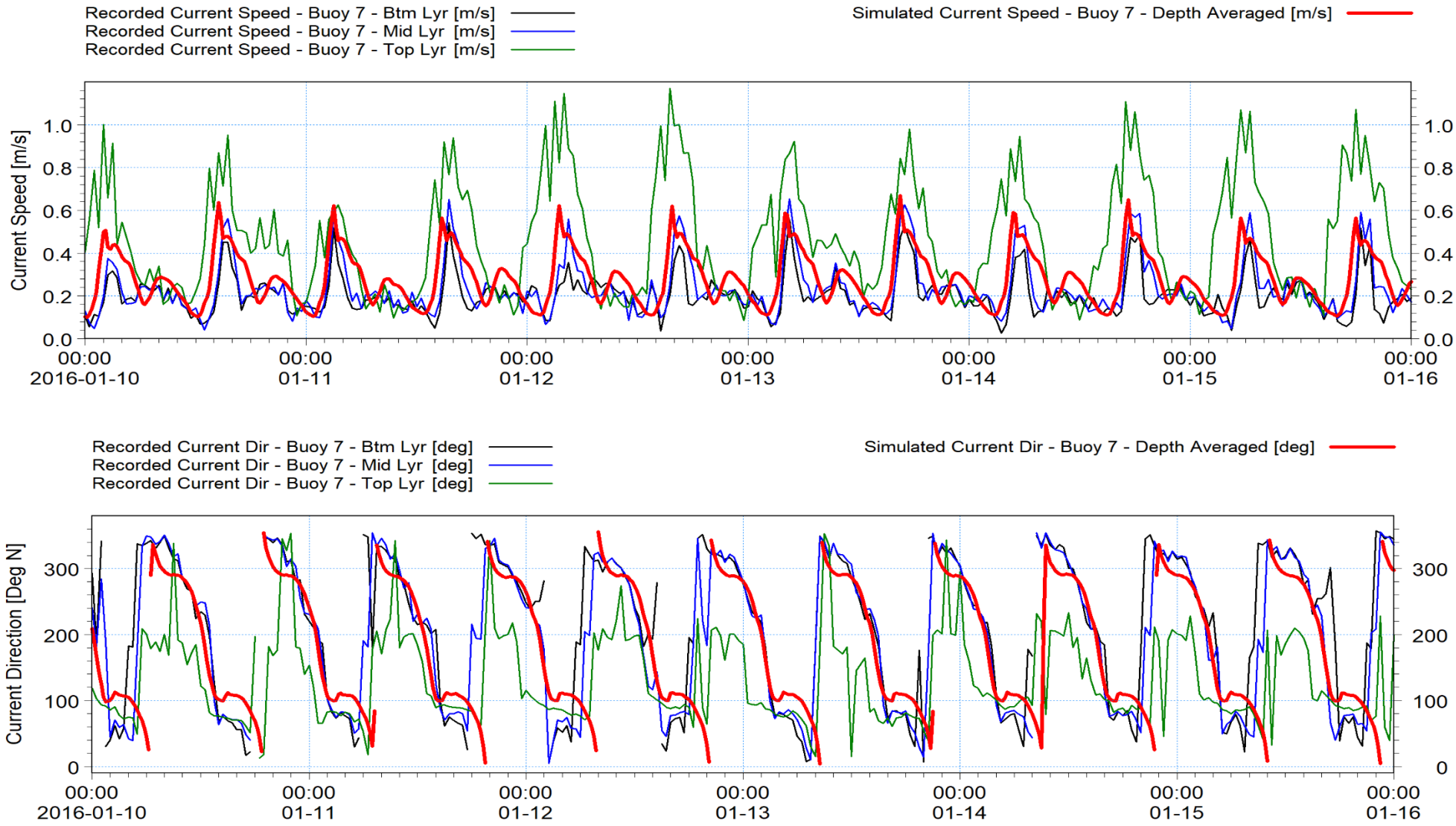


Figure 5: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Buoy 7 -Spring Tides

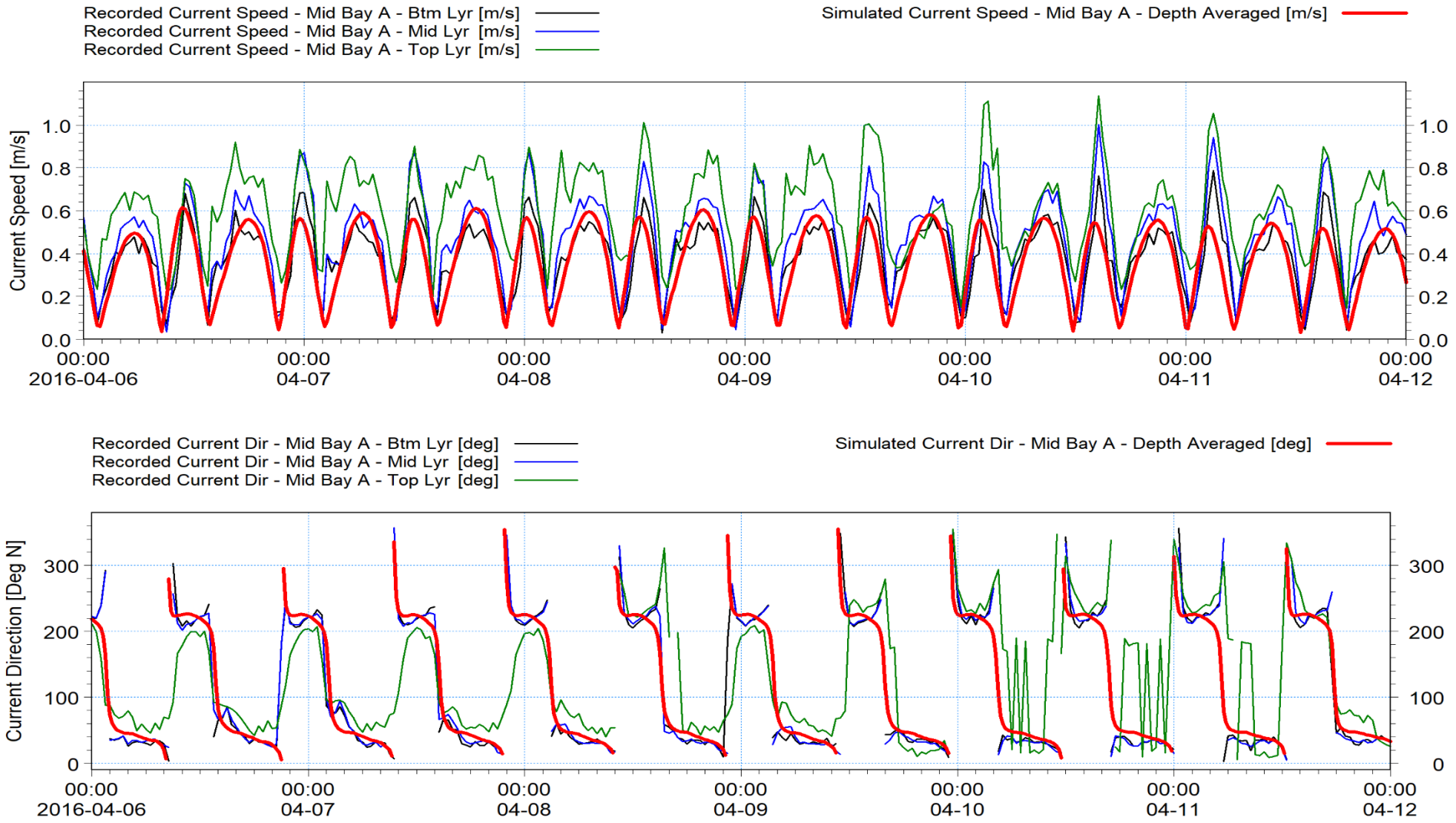


Figure 6: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Mid Bay A - Spring Tides

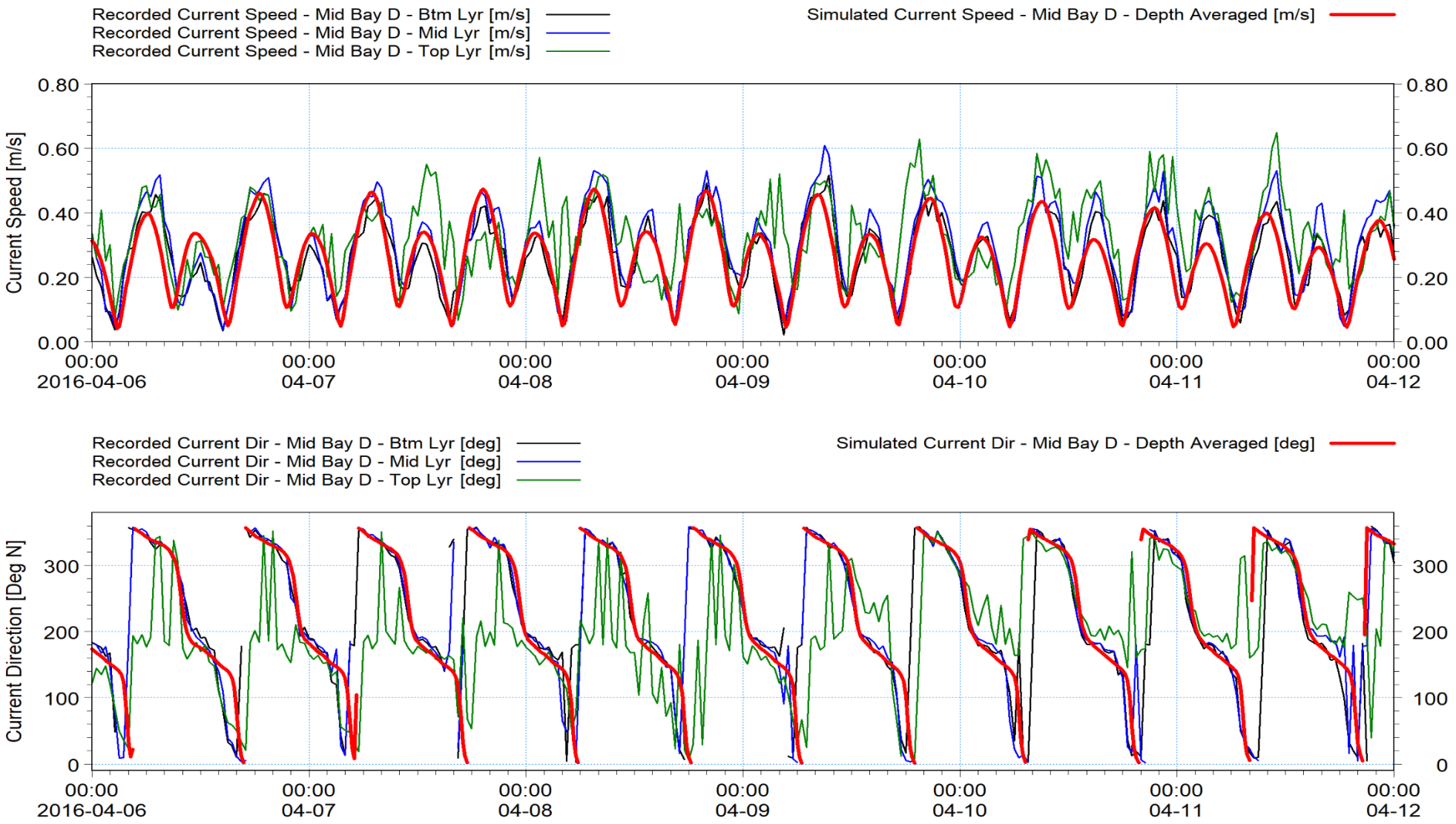


Figure 7: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Mid Bay D - Spring Tides

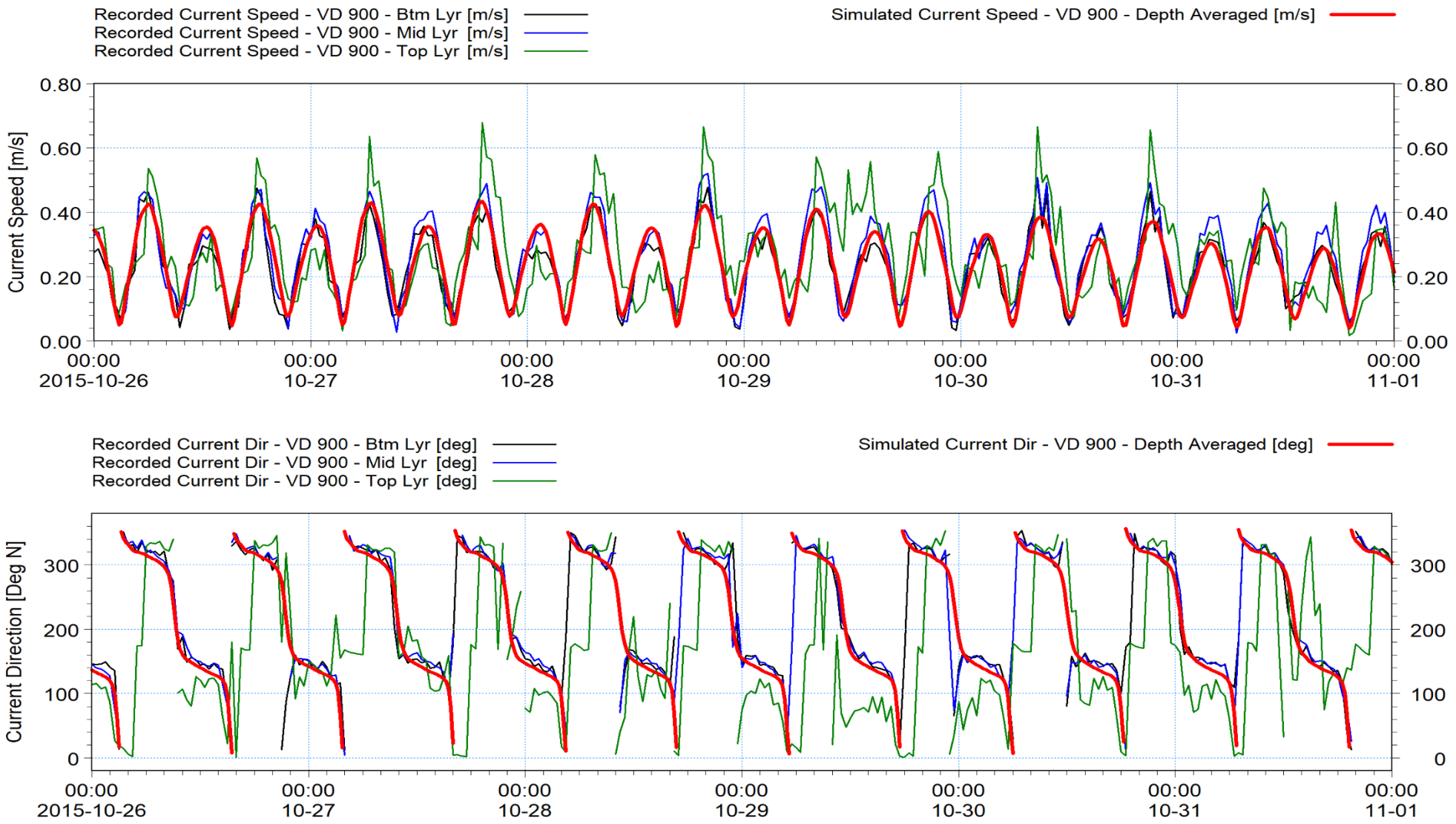


Figure 8: Comparison of recorded and simulated current speeds (upper) and directions (lower) at VD 900 -Spring Tides

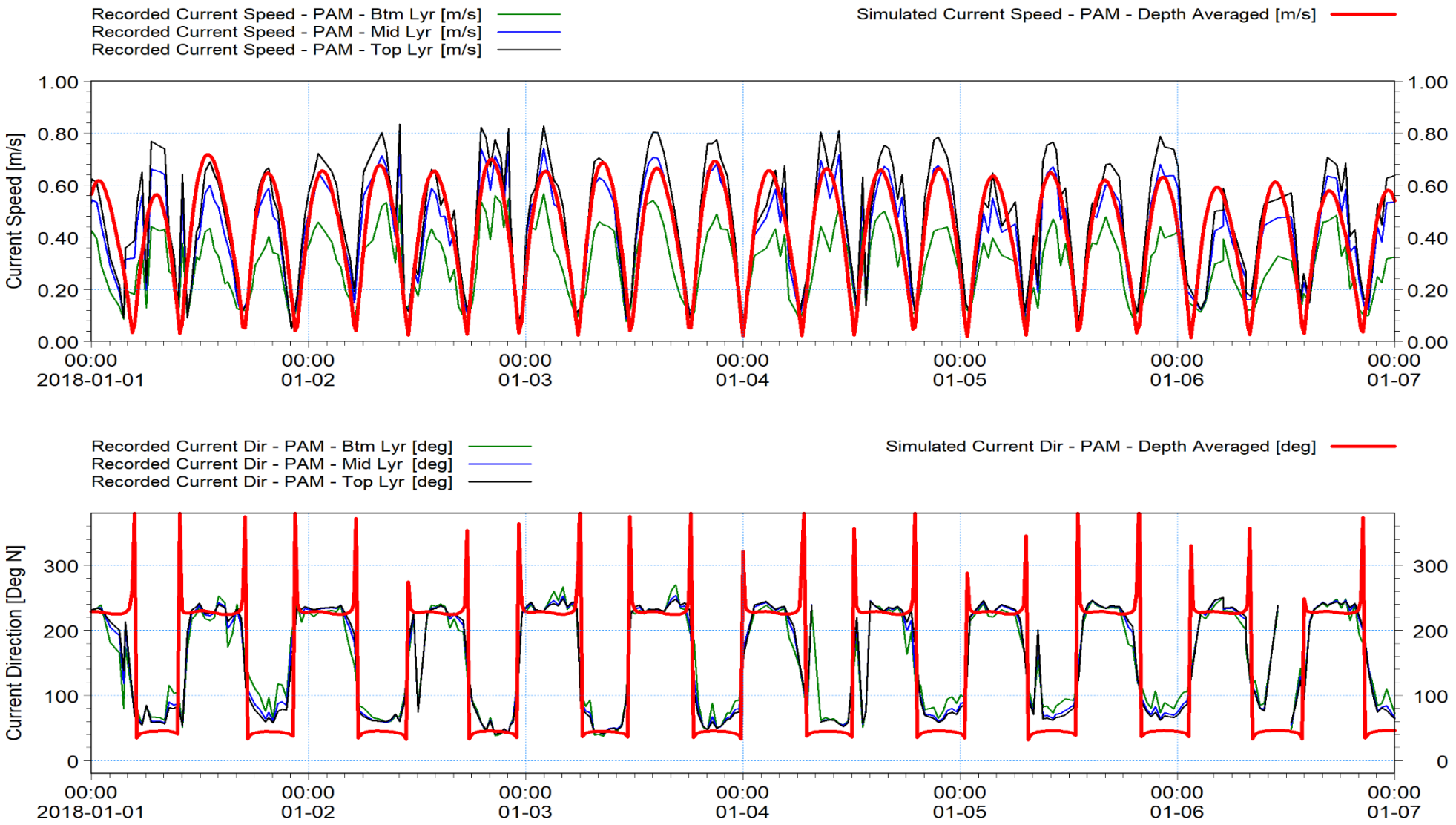


Figure 9: Comparison of recorded and simulated current speeds (upper) and directions (lower) at PAM Site -Spring Tides

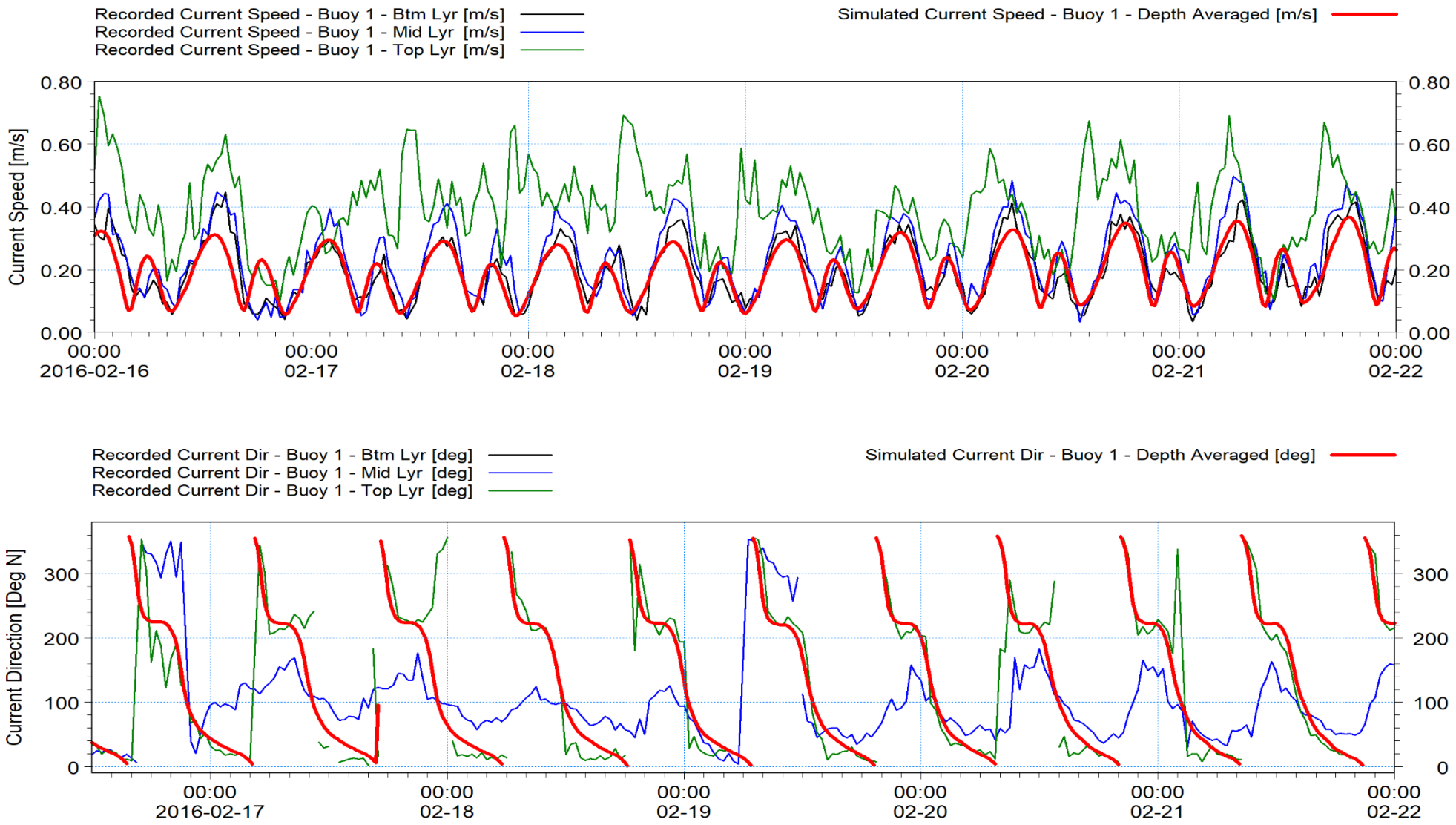


Figure 10: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Buoy 1 -Neap Tides

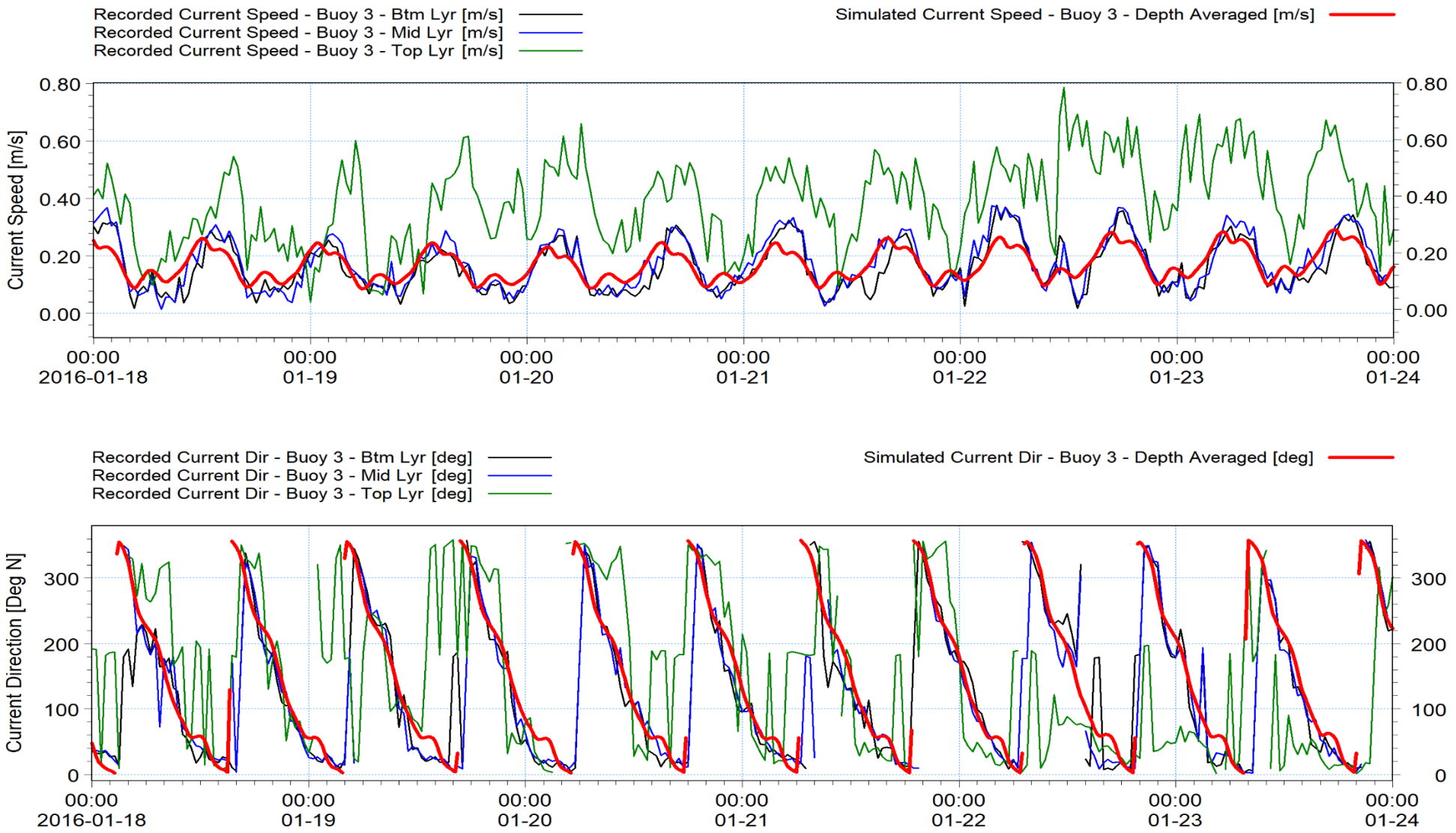


Figure 11: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Buoy 3 -Neap Tides

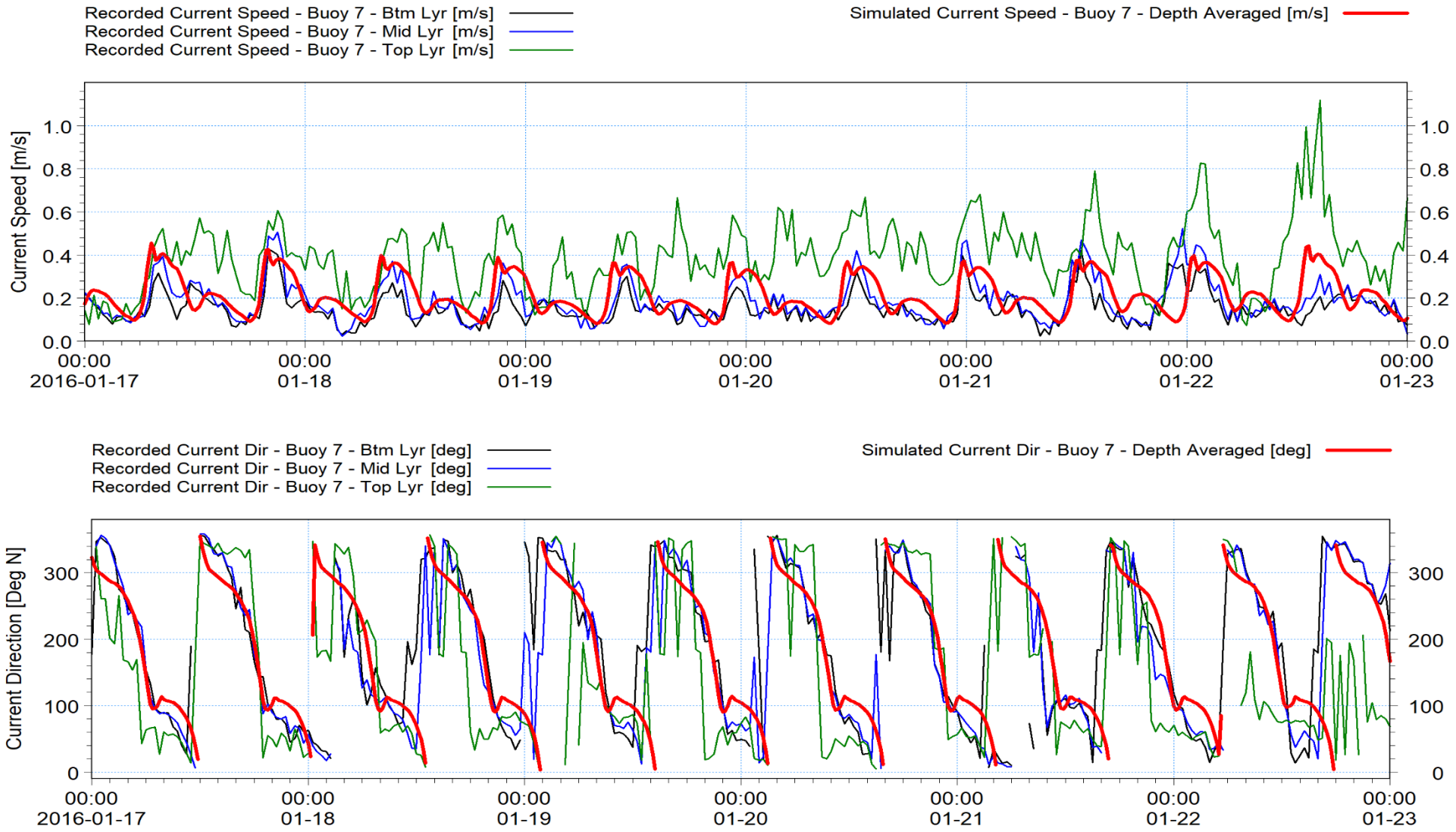


Figure 12: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Buoy 7 - Neap Tides

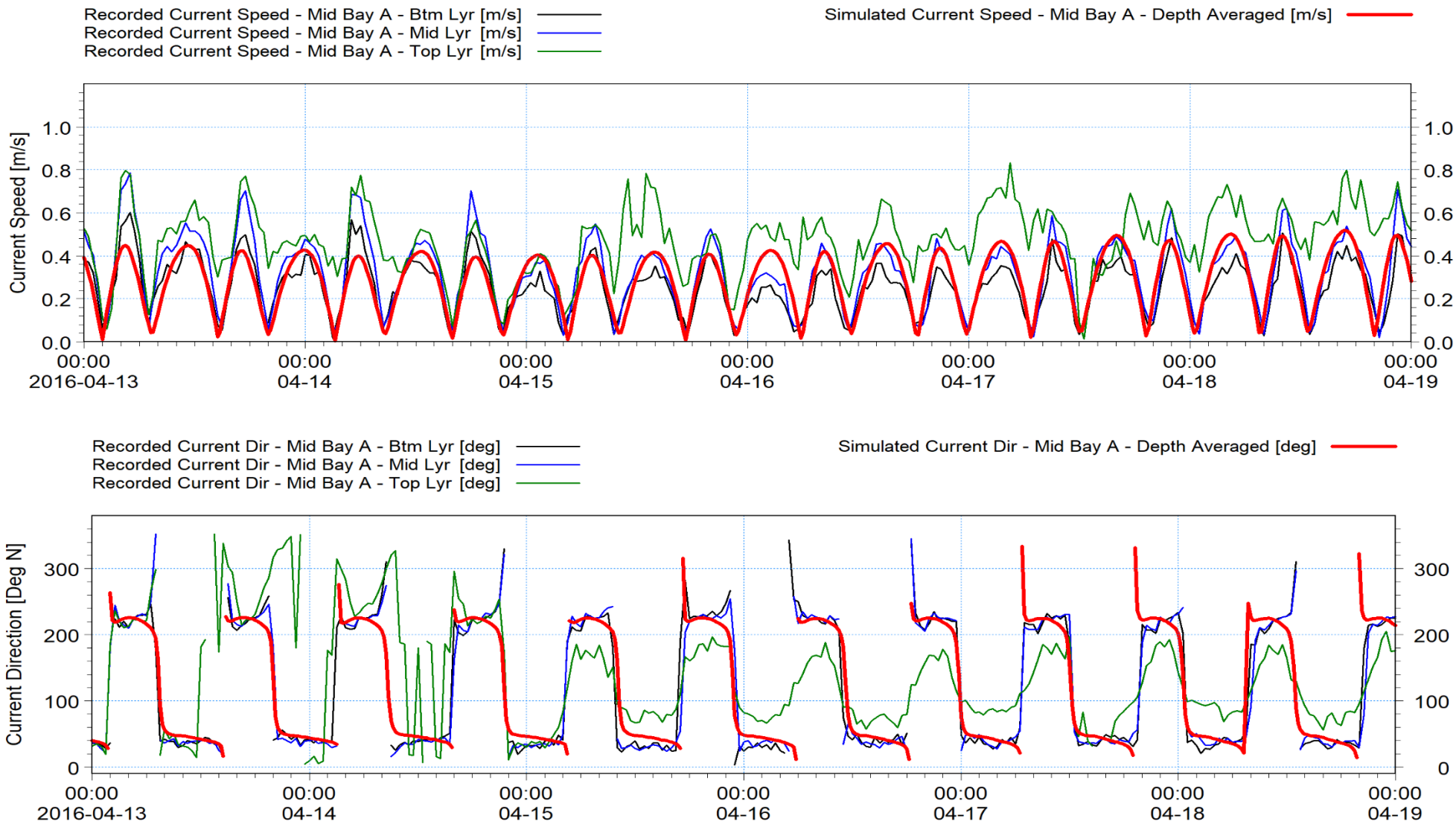


Figure 13: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Mid Bay A -Neap Tides

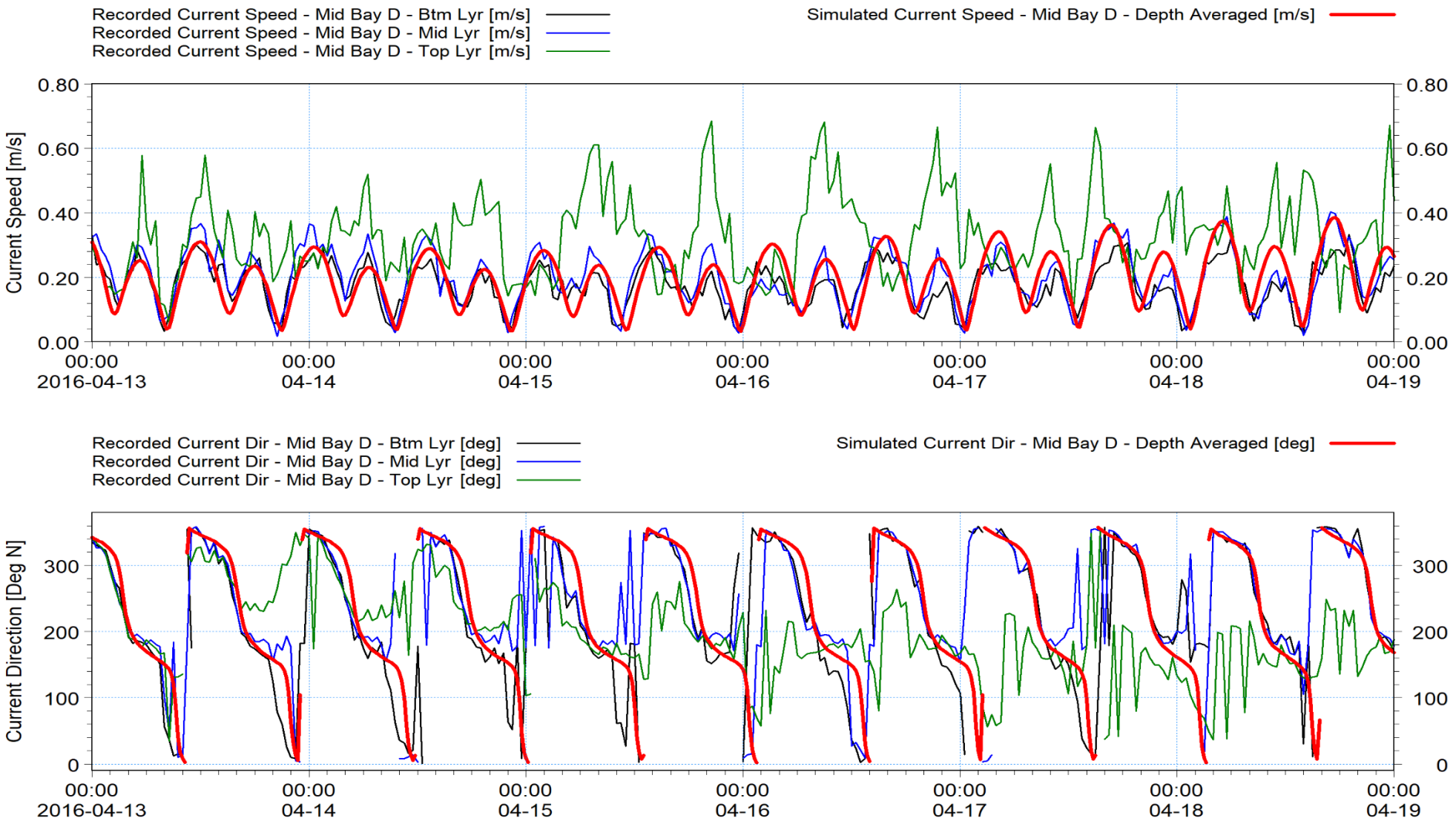


Figure 14: Comparison of recorded and simulated current speeds (upper) and directions (lower) at Mid Bay D -Neap Tides

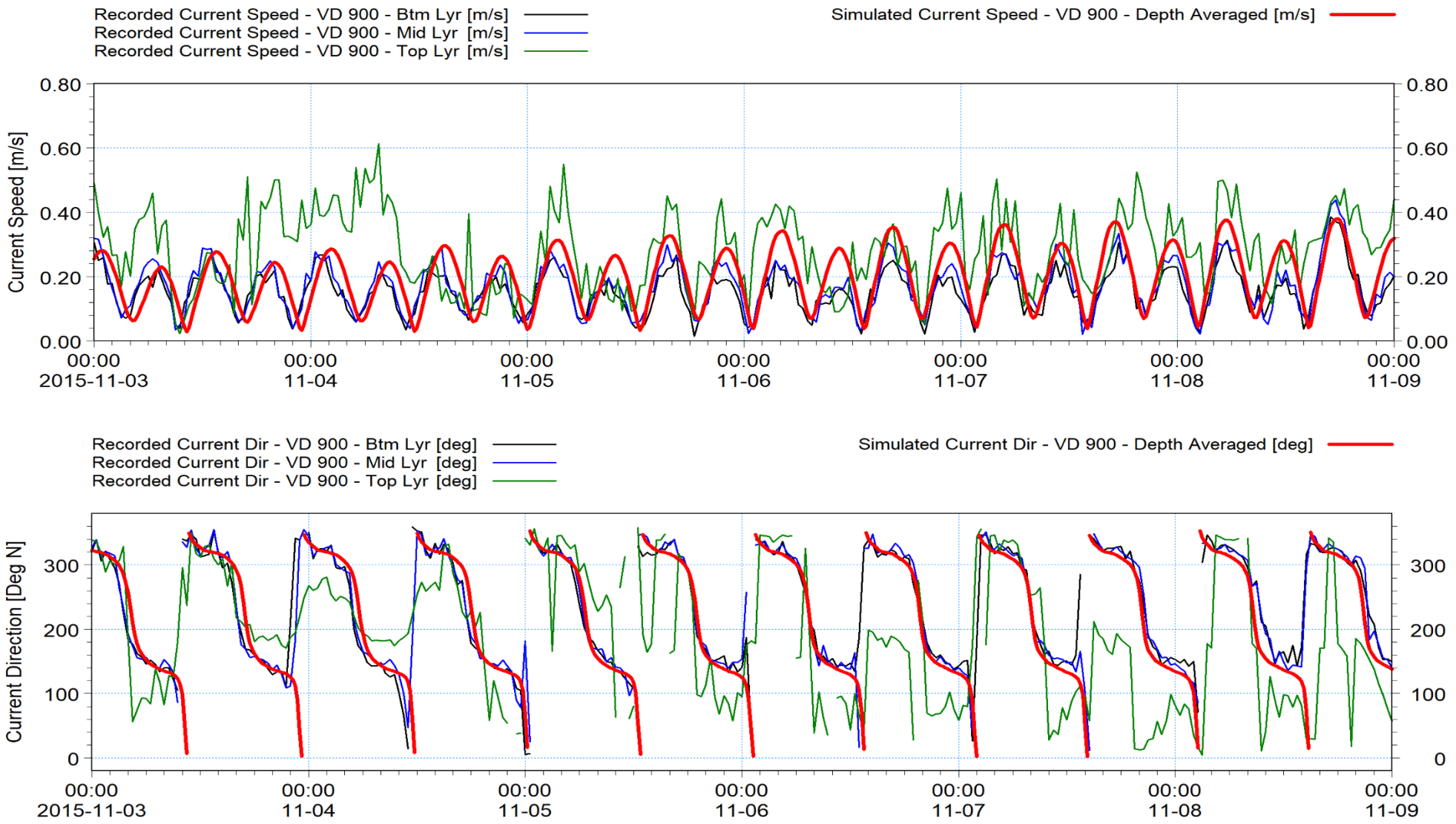


Figure 15: Comparison of recorded and simulated current speeds (upper) and directions (lower) at VD 900 -Neap Tides

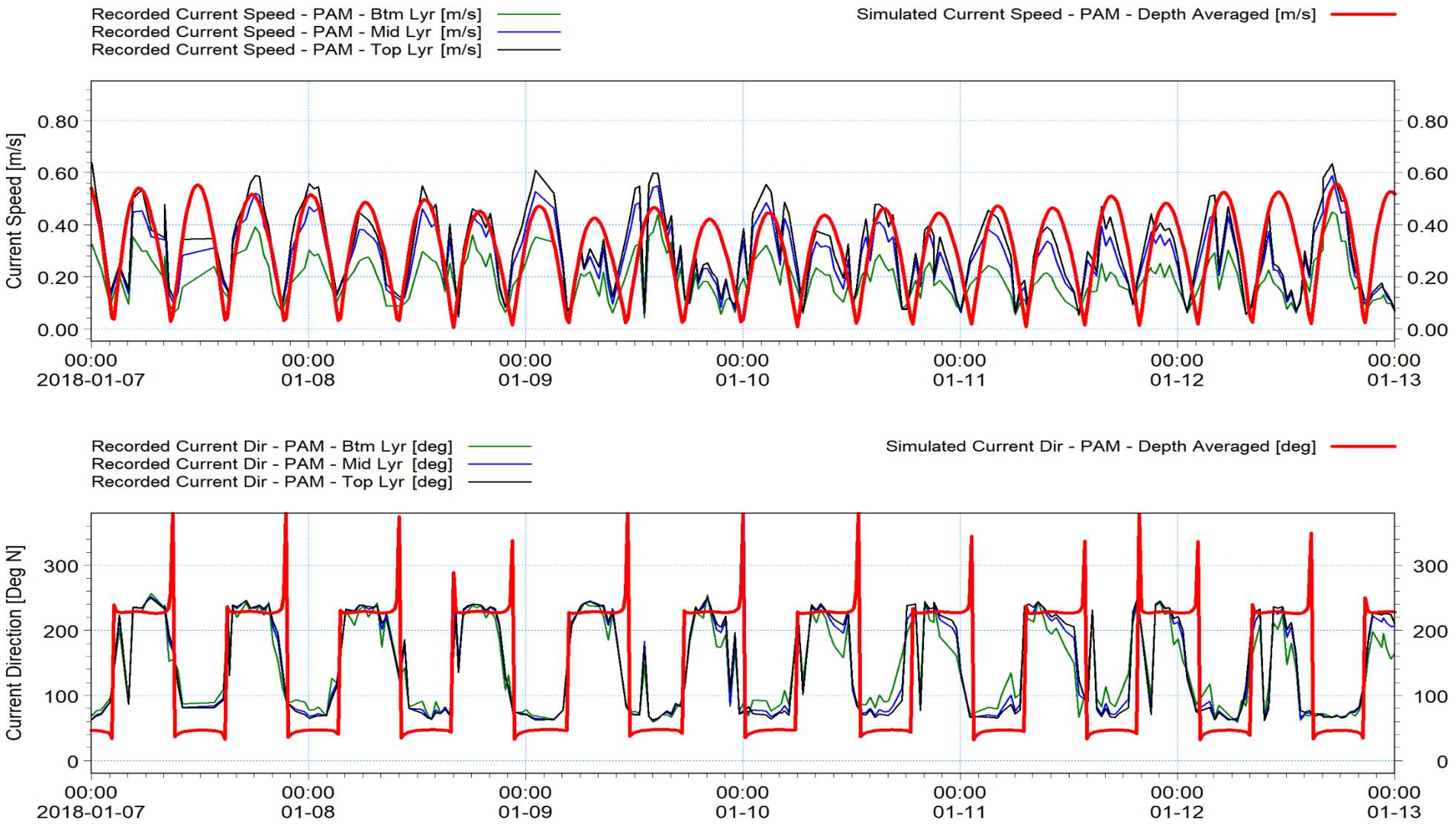


Figure 16: Comparison of recorded and simulated current speeds (upper) and directions (lower) at PAM Site -Neap Tide