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Supplement of

Gap-filled sub-surface mooring dataset off Western Australia during 2010–2023

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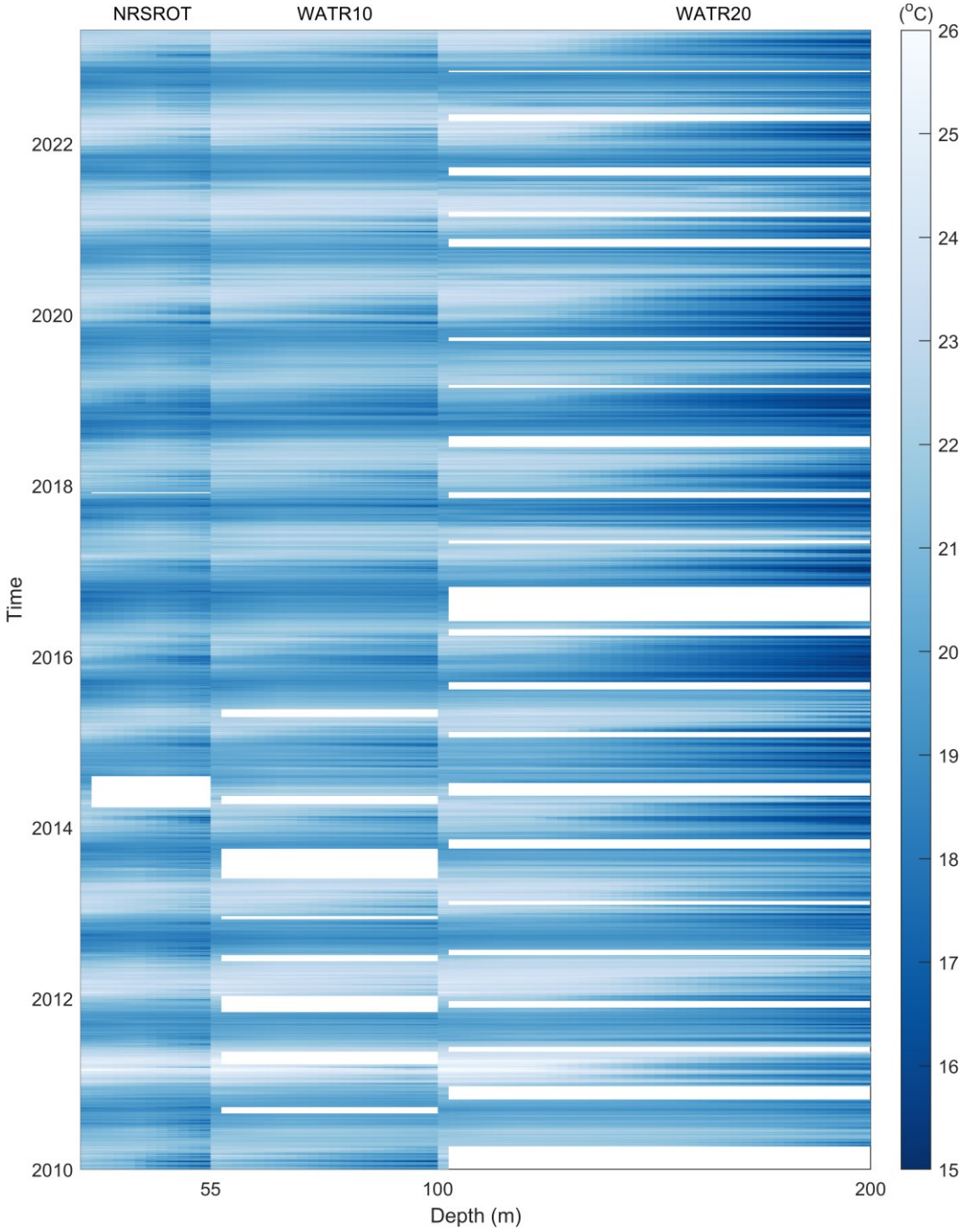


Figure S1. Data matrix of gridded daily, 5m-vertical resolution temperatures for NRSROT, WATR10 and WATR20. The bottom x axis shows the maximum depth of each moorings, while y axis presents time period from Jan 2010 to May 2023. Note that 0m follows directly after preceding mooring. The SST data are derived from the Regional Australian Multi-Sensor SST Analysis (RAMSSA) version 1.0. White space indicates missing observations.

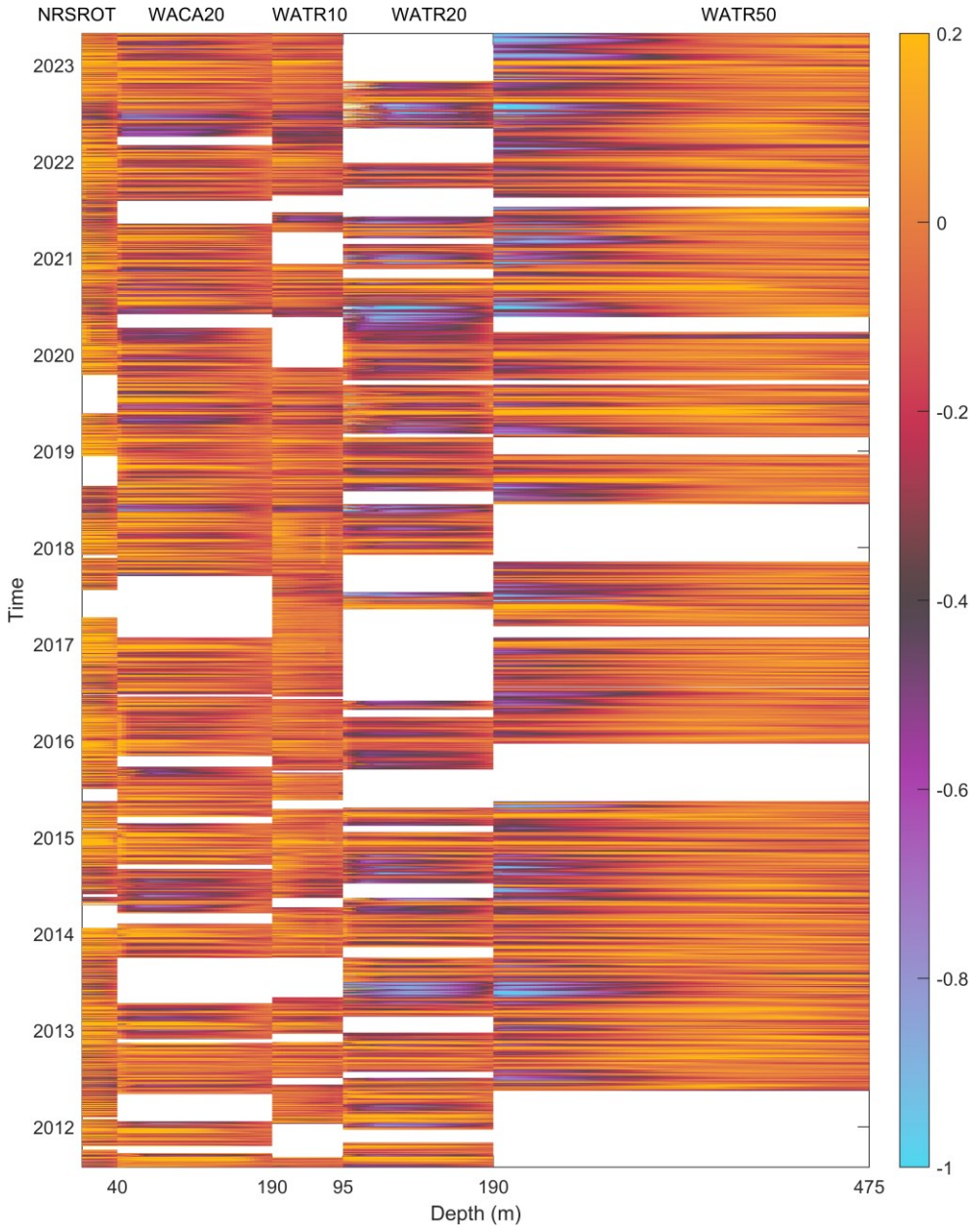


Figure S2. Data matrix of gridded daily, 5m-vertical v-velocity-component for the five moorings off the Rottnest shelf. The y axis presents time period from August 2011 to May 2023, while the bottom x axis shows the maximum depth of each moorings. Vertical profiles are NRSROT: 5-40 m; WACA20: 20-190 m; WATR10: 20-95 m; WATR20: 25-190 m and WATR50: 50-475 m. Negative v velocity is southward. Unit in m s^{-1}. White space indicates missing observations.

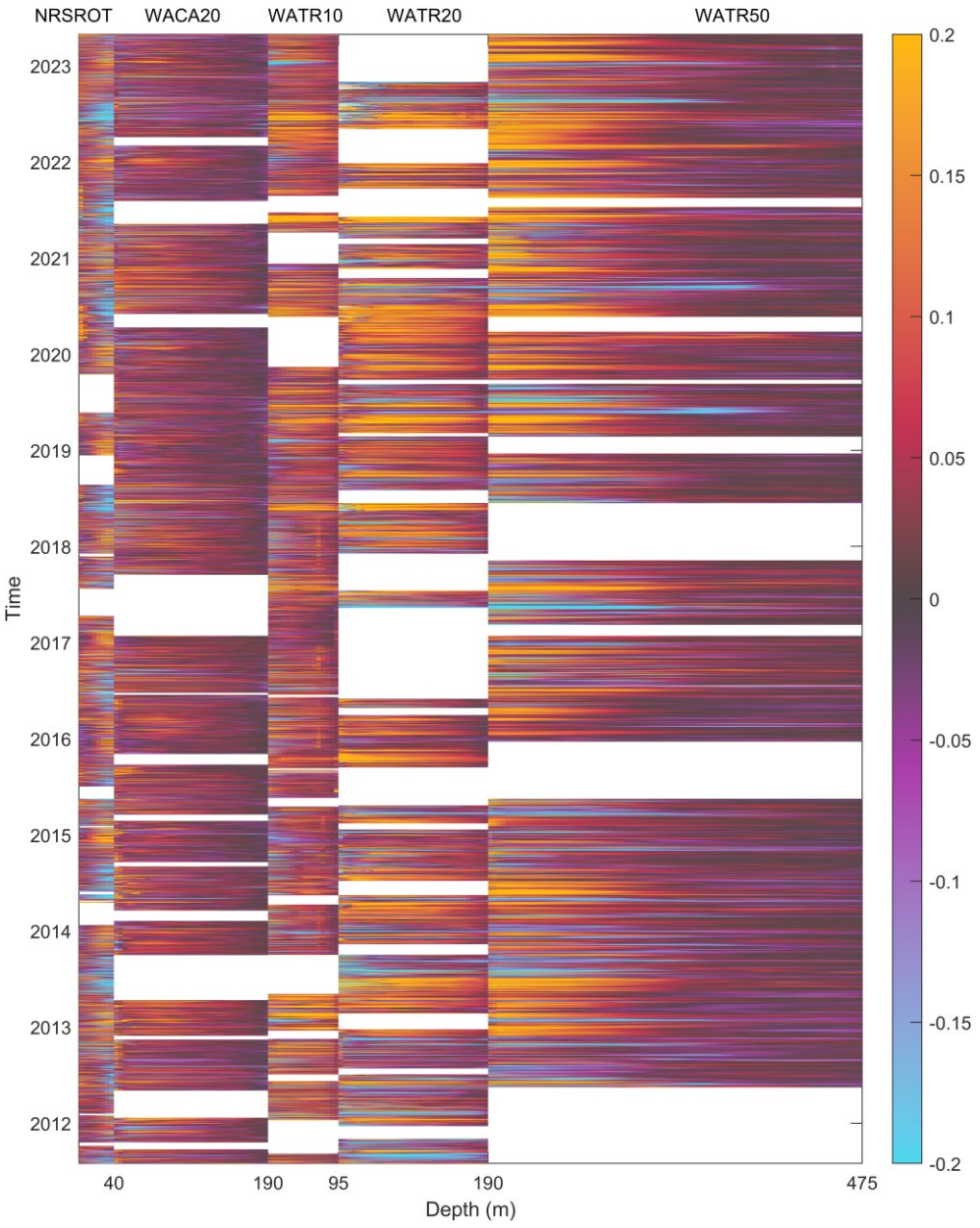
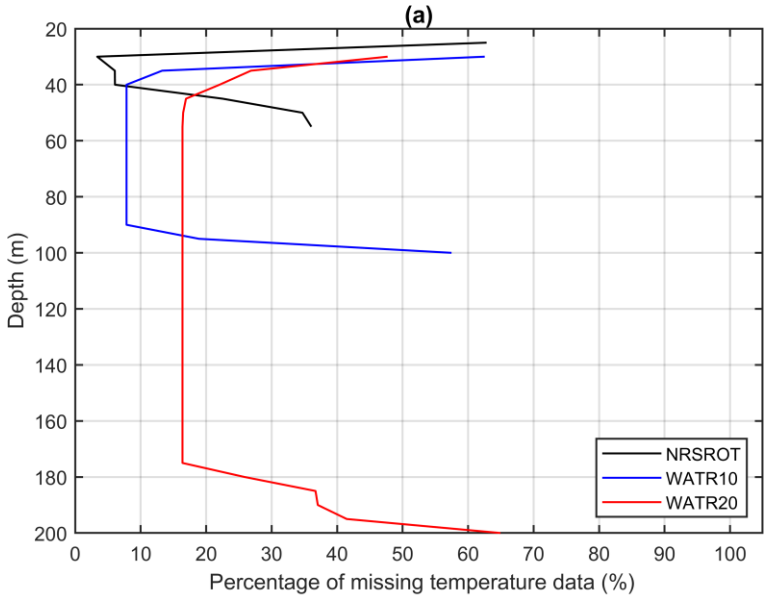


Figure S3. As in Figure S2, but for u-velocity component. Negative u velocity is westward (offshore).



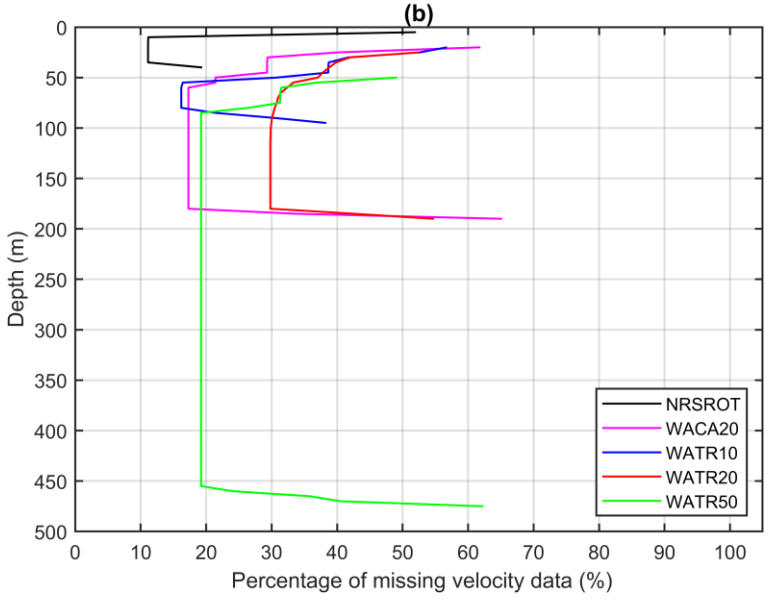


Figure S4. (a) Percentage of missing temperature data at three moorings by depth; (b) Percentage of missing velocity data at five moorings by depth, noting large missing data at the bottom due to changing depths of deployments with time.

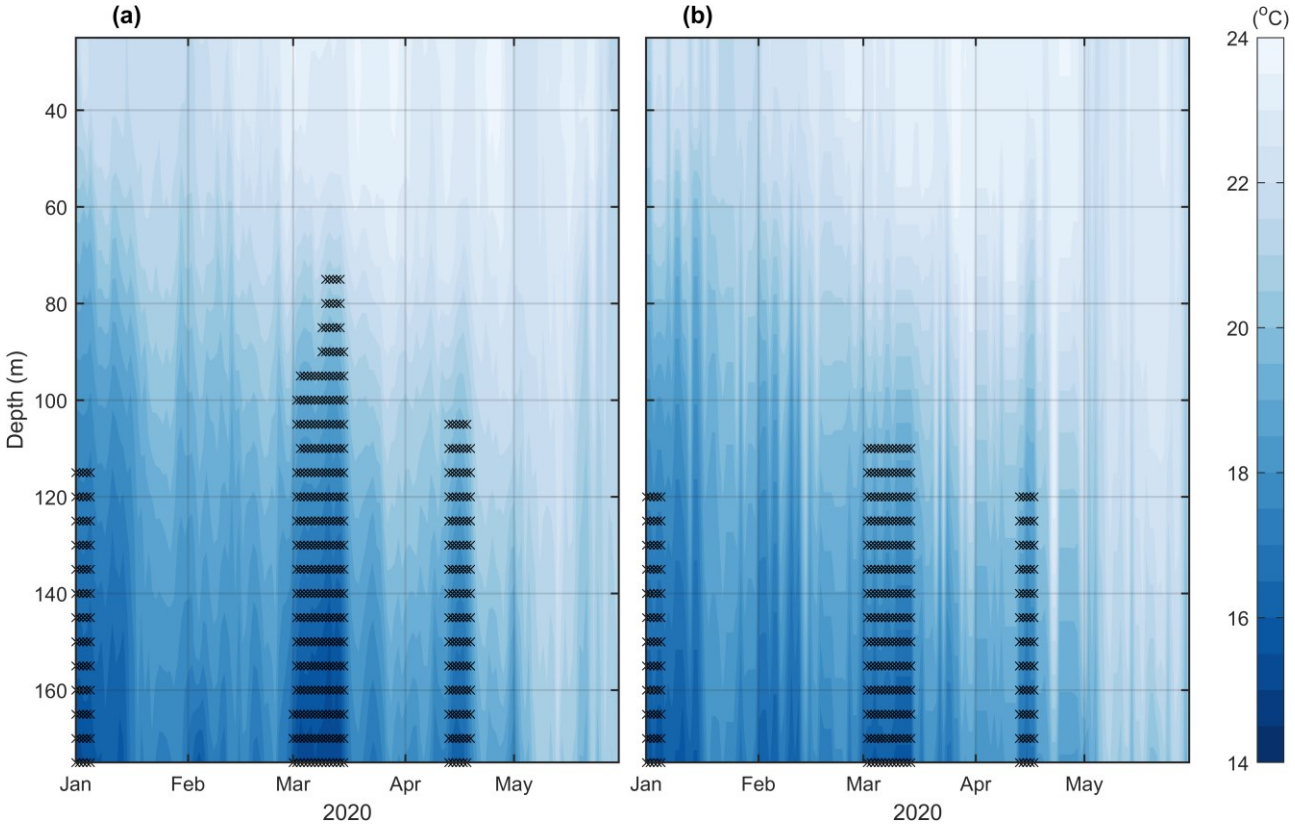


Figure S5. (a) Observed and (b) SOM-predicted temperatures at WATR20 during the validation period (January 1 to May 30, 2020). Black crosses in both panels indicate days identified as marine cold spells (MCS), defined as temperatures below the 10th percentile for a minimum of five consecutive days (Hobday et al., 2016). The SOM-predicted temperatures (b) effectively captured MCS events, showcasing the SOM's capability to accurately reconstruct extreme temperature patterns.

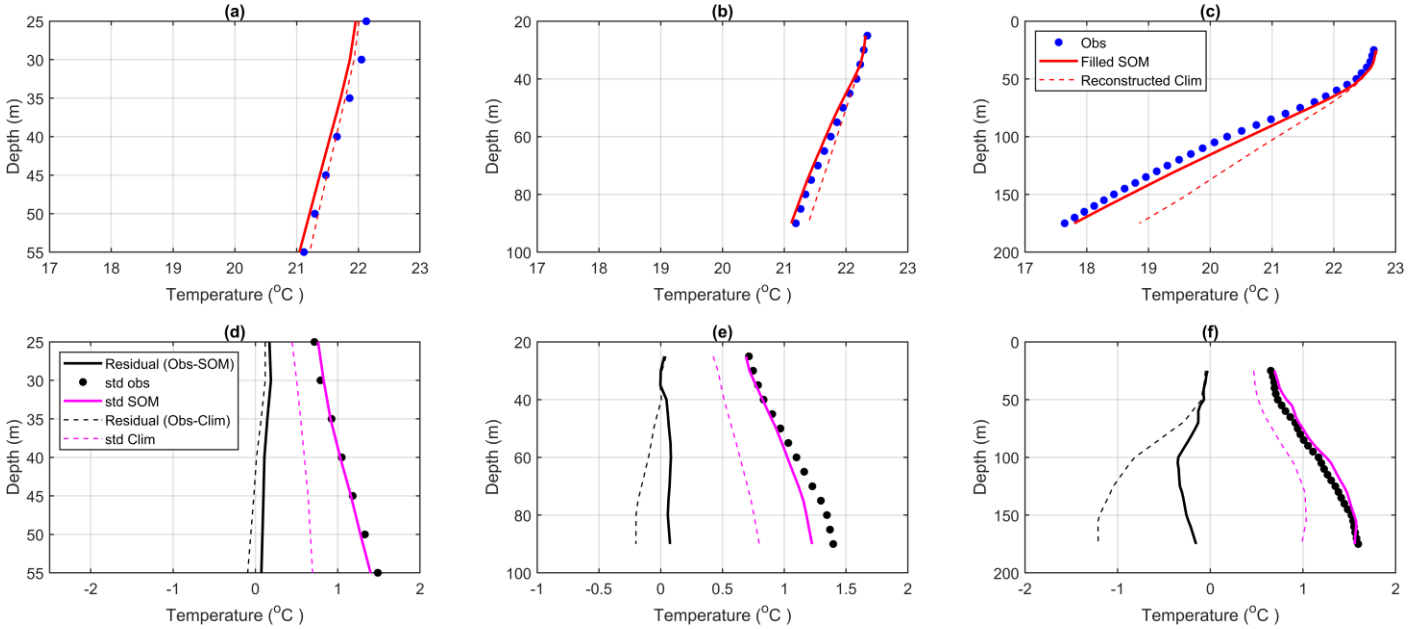


Figure S6. Upper panels: Comparison of the temporal averages of observed (blue dots), SOM-derived (red solid lines), and climatology (red dashed lines) vertical temperature profiles for a) NRSROT, b) WATR10 and c) WATR20 during the validation period between 1/1/2020 and 30/5/2020. Lower panels: mean bias of the reconstruction. Black solid lines: bias of SOM estimate, that is, observed minus SOM-derived values; black dashed lines: bias of climatology estimate, that is, observed minus climatology values, during 1/1/2020 and 30/5/2020. Also the standard deviations of observed (black dots), SOM-derived (magenta continous lines) and climatology (magenta dashed lines) temperature profiles for d) NRSROT, e) WATR10 and f) WATR20 are shown. For the climatology estimate, the temperatures observed during the validation period were withheld to estimate the daily climatology based on an 11-day moving window (Hobday et al., 2016).

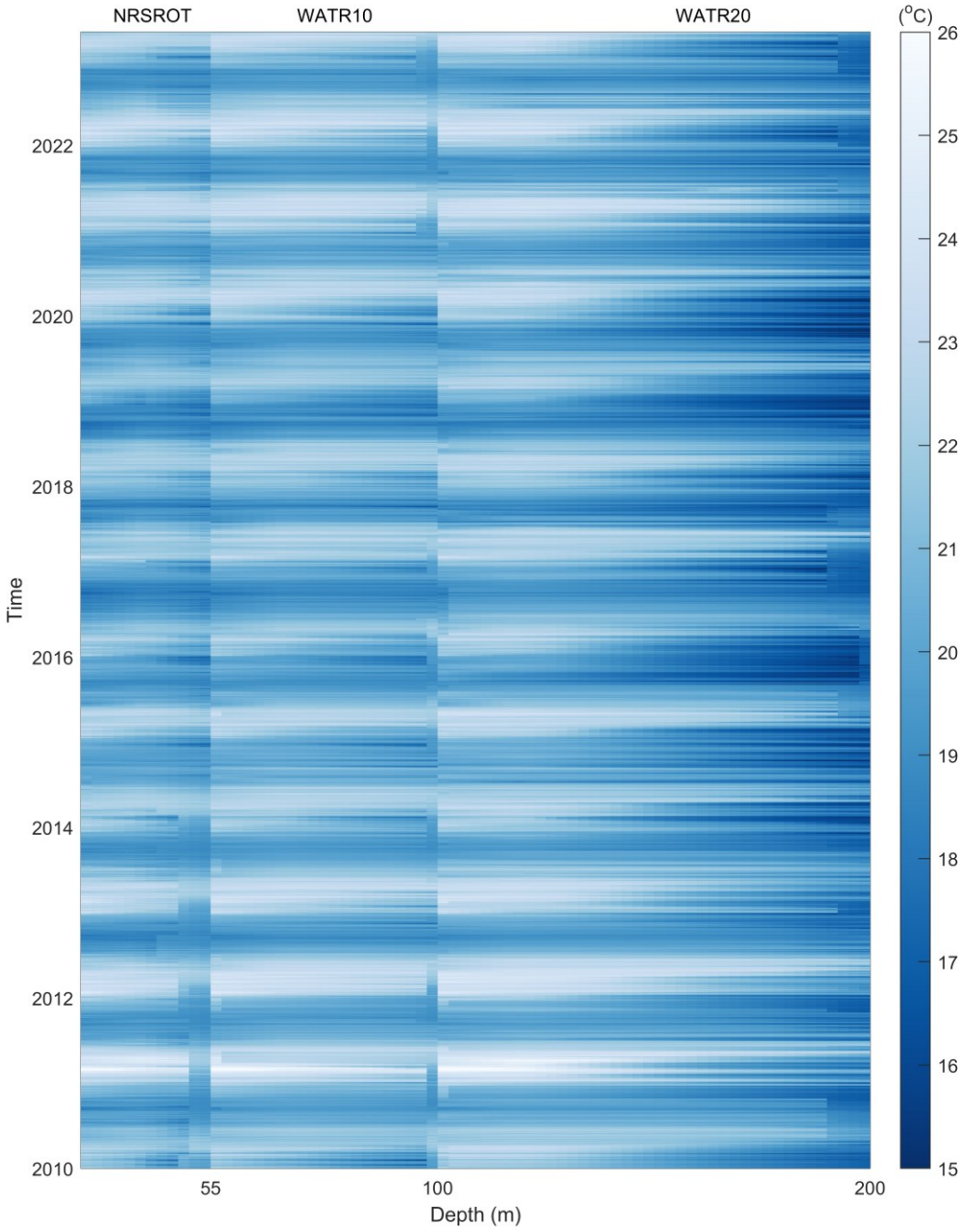


Figure S7. Data matrix of daily gridded, 5m resolution gap-filled temperatures for NRSROT, WATR10 and WATR20, but without extrapolating temperatures near the bottom. There were inconsistencies in the vertical temperature profiles near the bottom, for instance the temperatures near the bottom at WATR20 were abnormal warmer during austral winter 2016.

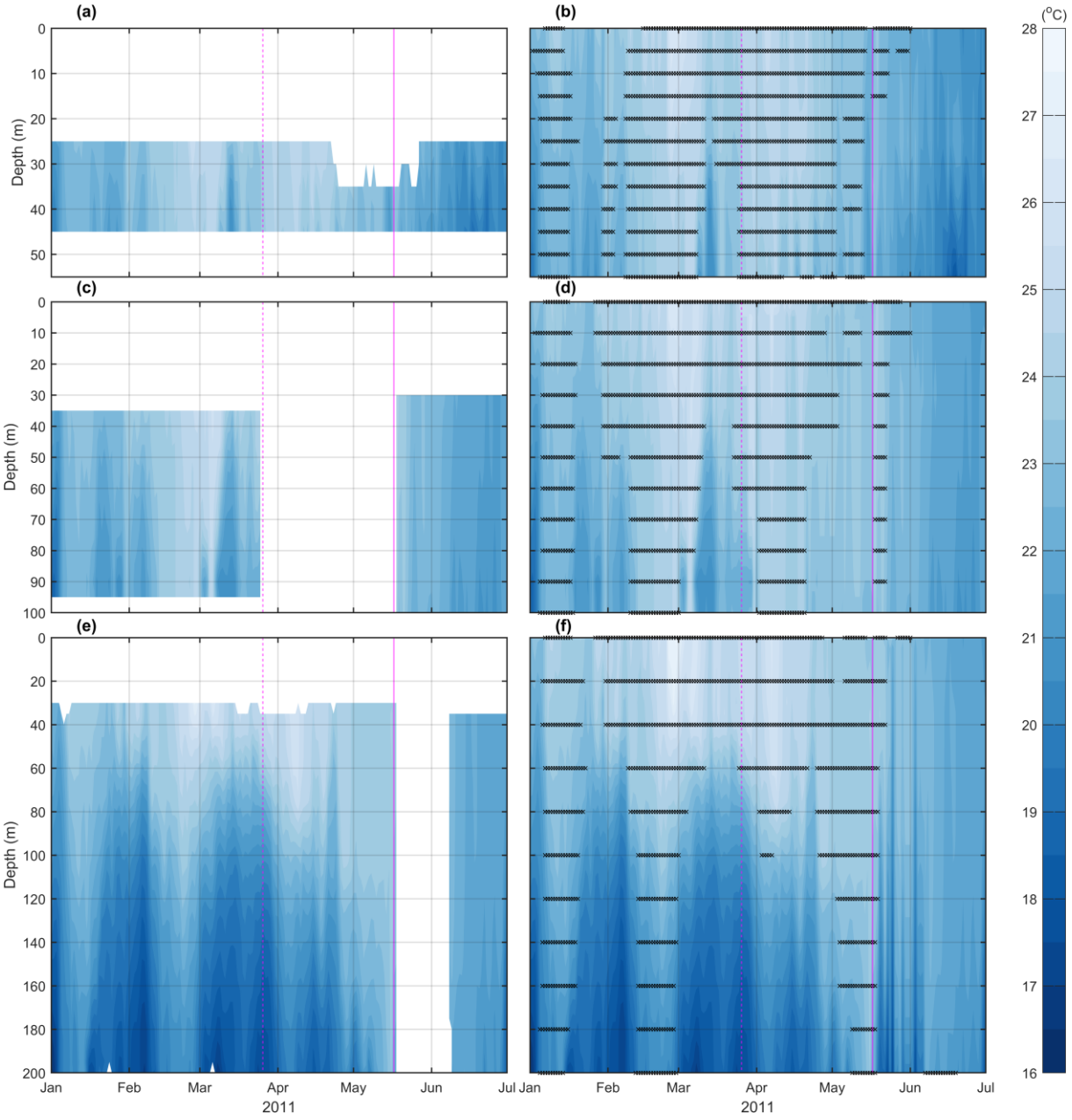


Figure S8. Comparison of observed and gap-filled temperatures in 2011 for NRSROT (a, b), WATR10 (c, d), and WATR20 (e, f). The left panels depict observed temperatures, while the right panels display gap-filled data. Black crosses in panels (b), (d), and (f) mark days classified as marine heatwaves (MHW), characterized by observed temperatures above the 90th percentile for at least five consecutive days (Hobday et al., 2016). Magenta dashed lines indicate the onset of missing temperature blocks at WATR10, and magenta solid lines denote their conclusion.

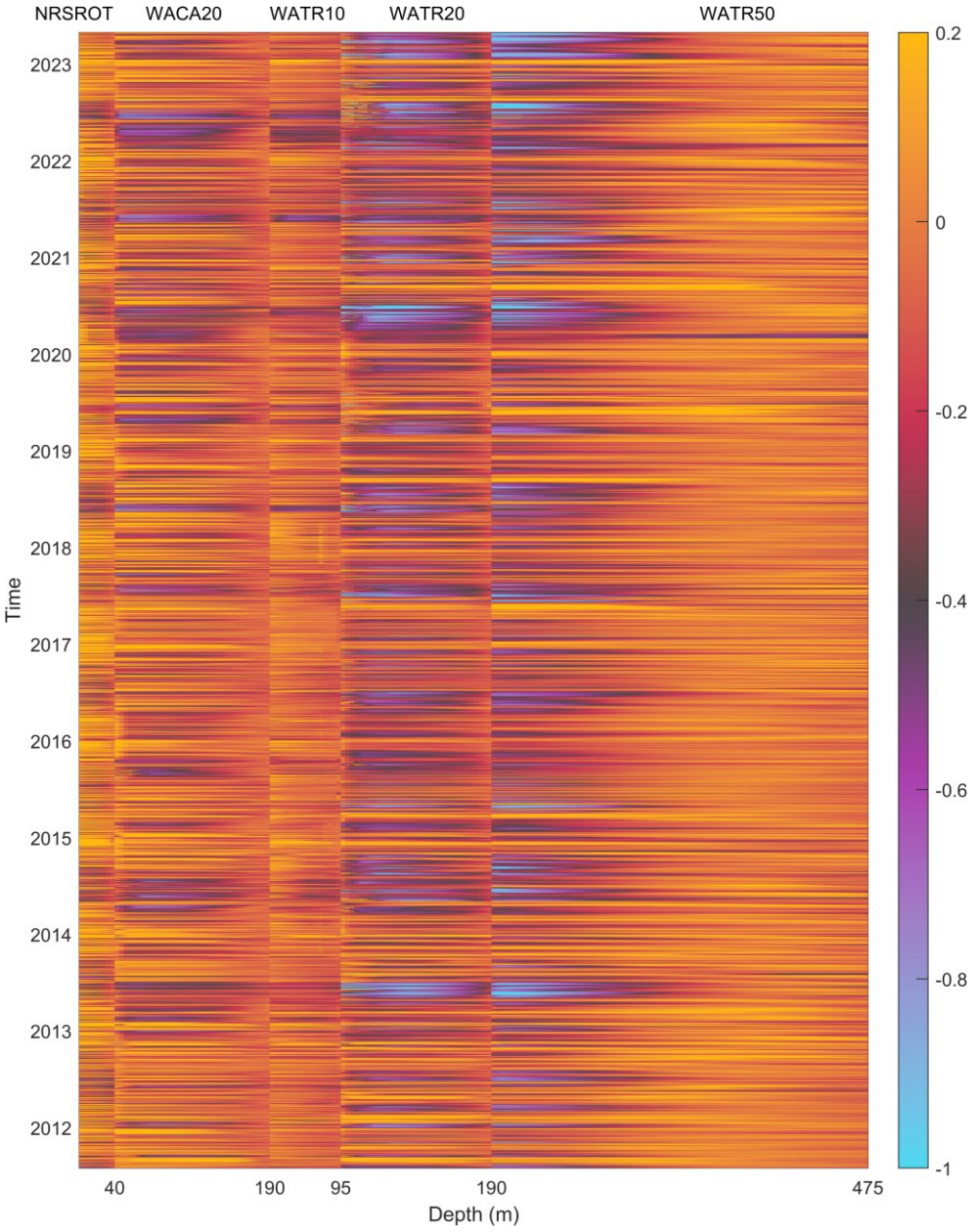


Figure S9. As in Figure S2, but for filled v-velocity-component.

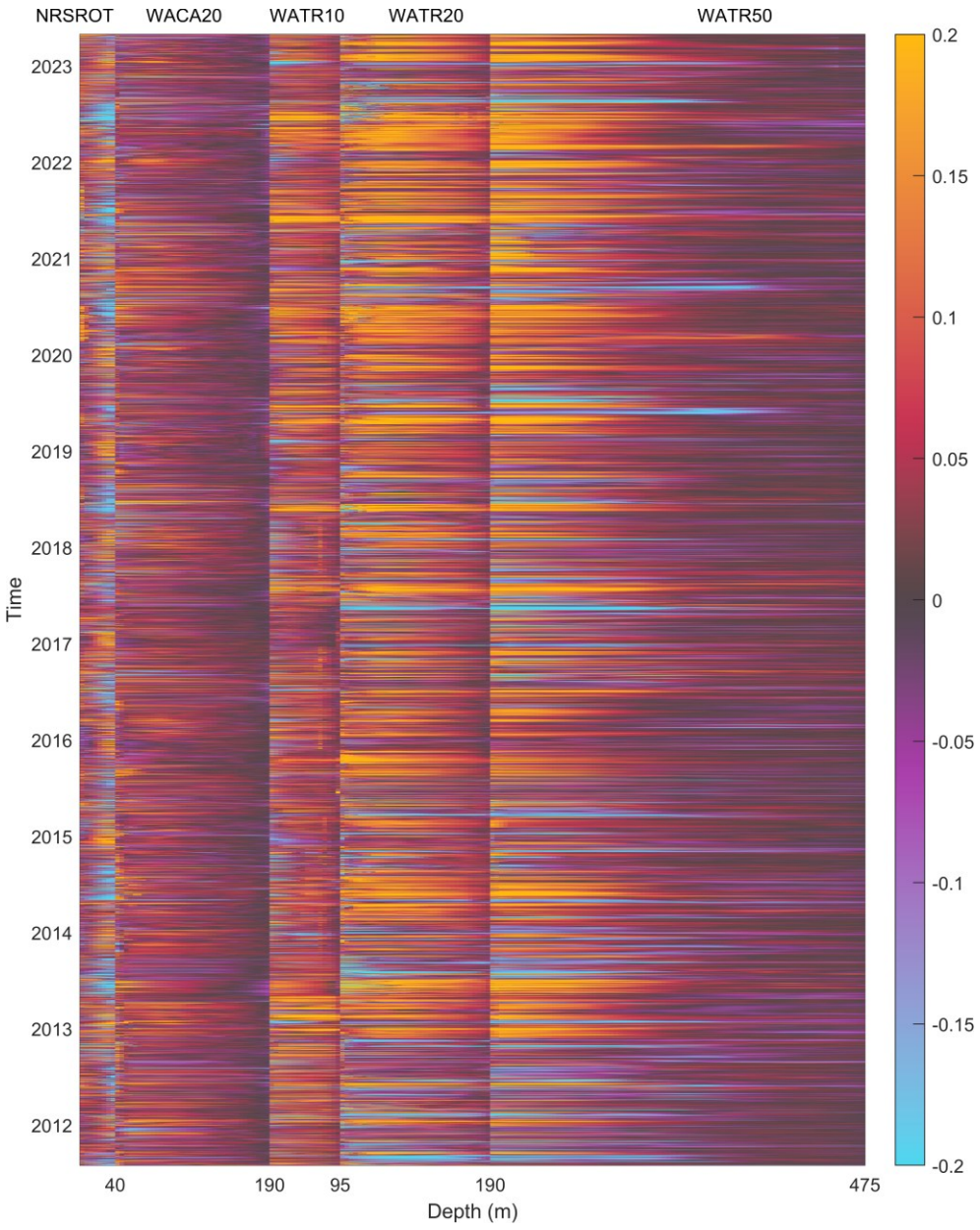


Figure S10. As in Figure S3, but for filled u-velocity-component.

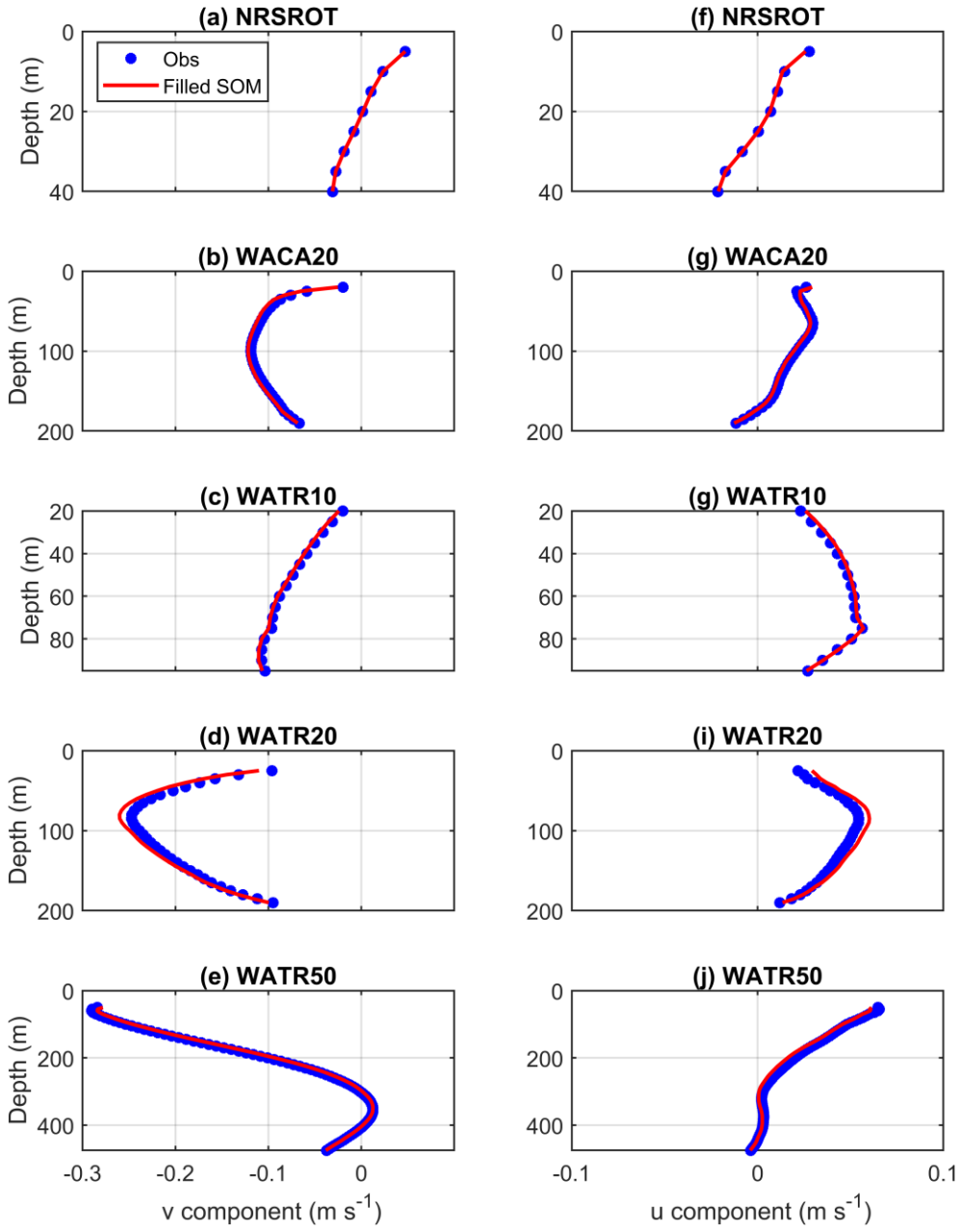


Figure S11. Comparison of observed and filled mean vertical profile velocity for a-f) NRSROT, b-g) WACA20, c-g) WATR10, d-i) WATR20 and e-j) WATR50. Left panels show v component, while right panels present u component.

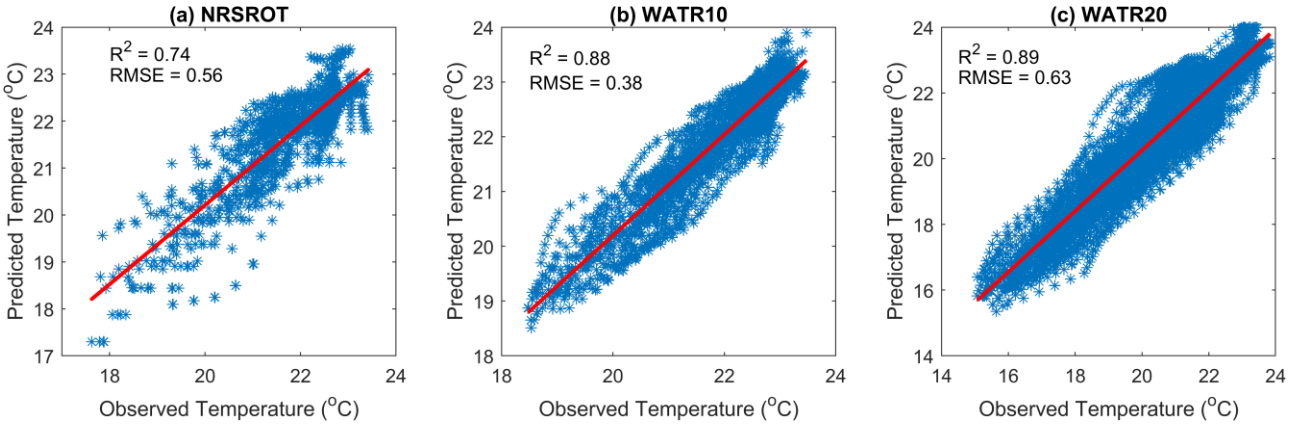


Figure S12. Temperatures at the three moorings were observed and estimated between 1/1/2020 and 30/5/2020, with the local wind included during the SOM training. The wind data was sourced from ERA5, covering the regional area of 32.5°S-31.5°S and 115°E-115.5°E.