Oceanum Bass Strait Wave Hindcast

The Bass Strait wave hindcast dataset provides a detailed account of ocean wave parameters within Southeast Australia with a specific focus on the dynamic Bass Strait region (Figure 1). Wave spectra are computed over a 31-year period between 1993-01-01 and 2024-01-01 using the SWAN (Simulating WAves Nearshore) third-generation spectral wave model. The model is driven by inputs from the Oceanum Global Wave Model for spectral boundaries, the ECMWF ERA5 reanalysis for wind data, and the Mercator GLORYS12V1 run for ocean currents. Tidal currents are incorporated into the dataset from the Oceanum 400 m Global Tides Dataset. Bathymetry is derived from the high-resolution depth model for Australia, AusBathyTopo 250m 2023 Grid. The wave data have been calibrated against satellite altimeters (Figure 2), and several wave buoys provided by the Victorian Coastal Monitoring Program (Appendix A) ensuring a high level of accuracy and reliability in capturing real-world conditions.

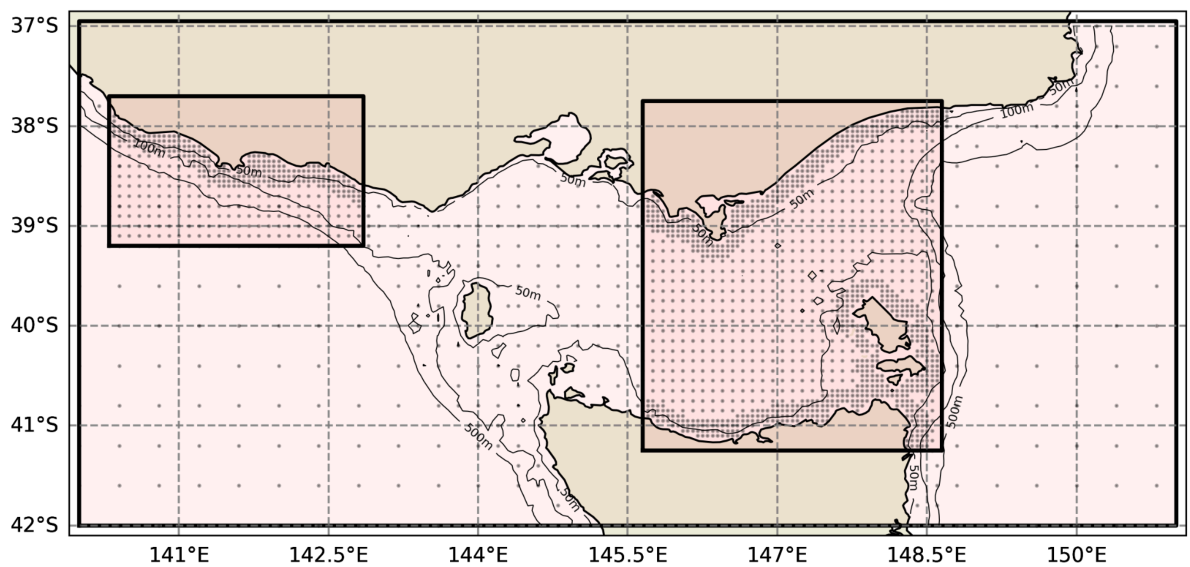


Figure 1. Wave model domains with spectra output locations represented by the dots.

The modelling setup employs the ST6 source term parameterisations. Spectra are discretised into 36 directional bins and 32 frequency bins, spanning the range of 0.037 to 0.7102 Hz at 10% logarithmic increments. The model employs a 2-stage nest, featuring a parent nest at 5 km resolution and two child nests of 1 km resolution, strategically positioned around Portland and the central-eastern Bass Strait region, as illustrated in Figure 1. This nested approach enhances the resolution and accuracy of the wave hindcast, particularly in key geographical areas, making it a valuable resource for diverse applications in marine and coastal studies. As an example, the mean significant wave height Hs from the 5 km domain over the 31-year period is shown in Figure 3.

The dataset provides hourly estimates for an [extensive array of ocean wave parameters] (Appendix B) including spectral quantities integrated over the full spectrum and for spectral partitions (defined from a 8-second split and from the Watershed method). These data are stored over the entire grid at native resolution. Additionally, frequency-direction wave spectra are available at 1921 sites, with resolution increasing from deep ocean areas towards the coast (see Figure 1).

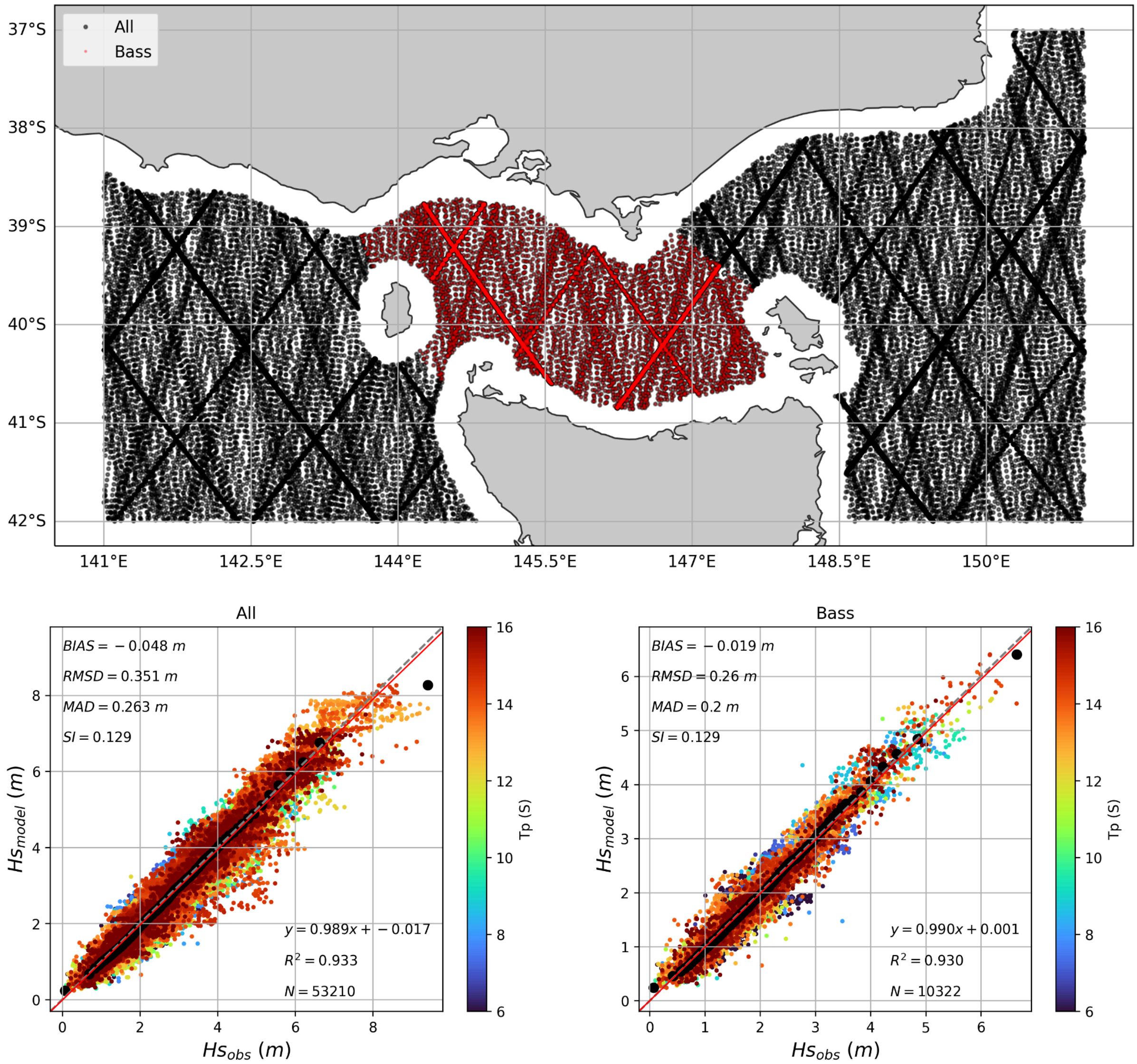


Figure 2. Validation of model significant wave height Hs against satellite altimeters for 2016. Results are presented for the approximate area of the 5 km domain and for the sheltered region inside the Bass Strait (black and red dots on the map, respectively).

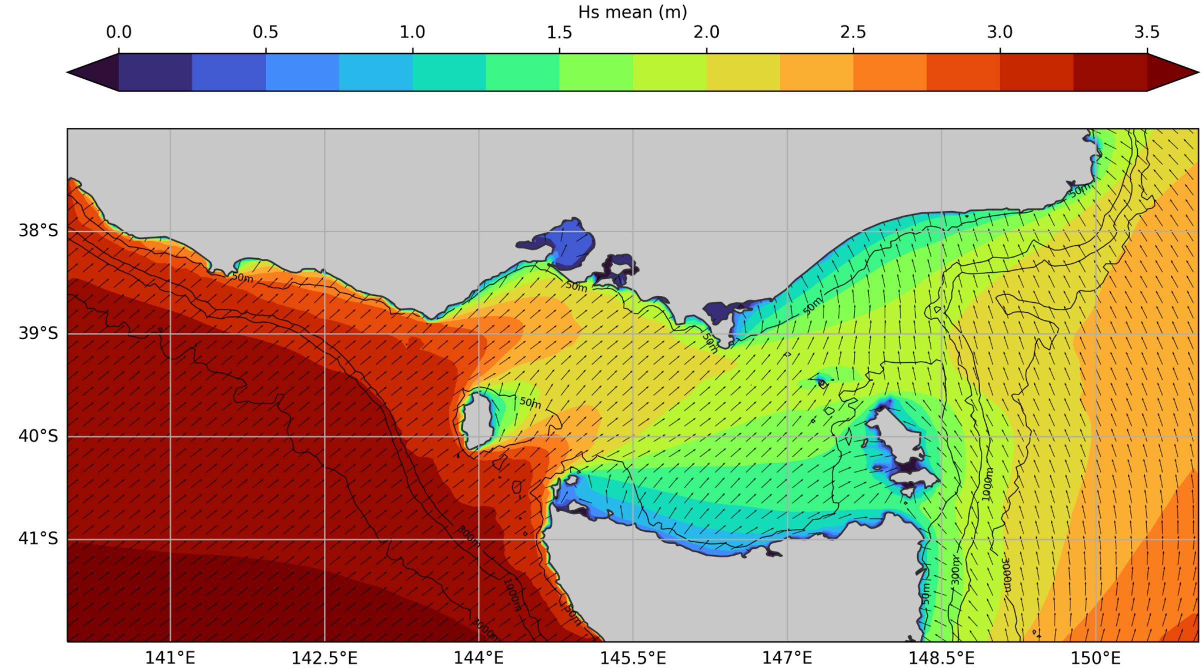


Figure 3. Mean significant wave height Hs from the 5 km Bass Strait domain for 1993-2023.

Table 1. Data description.

Title	Oceanum Bass Strait wave hindcast
Institution	Oceanum
Access	Oceanum Datamesh
Source	SWAN 41.31A
Source terms	ST6
Temporal coverage	1993-01-01 to 2024-01-01
Temporal resolution	Hourly
Spatial coverage	Bass Strait: [140.0, 42.0, 151.0, -37.0] at 0.05 degree Eastern Bass: [145.65, -41.25, 148.65, -37.75] at 0.01 degree Portland area: [140.3, -39.2, 142.85, -37.7] at 0.01 degree
Spectra sites	1921
Frequency discretisation	32 frequencies between 0.037 - 0.7102 Hz at 10% logarithmic increments
Direction resolution	10 deg
Bathymetry	AusBathyTopo 250m 2023 Grid
Winds	ERA5 Reanalysis
Currents	GLORYS12V1 surface merged with Oceanum 400 m global tides
Boundary	Oceanum Global WW3 ERA5
Linked Datamesh datasources	Bass Strait 5 km parameters: oceanum_wave_bass_5km_era5_grid Bass Strait 5 km spectra: oceanum_wave_bass_5km_era5_spec Eastern Bass 1 km parameters: oceanum_wave_ebass_1km_era5_grid Eastern Bass 1 km spectra: oceanum_wave_ebass_1km_era5_spec Portland 1 km parameters: oceanum_wave_ptlan_1km_era5_grid Portland 1 km spectra: oceanum_wave_ptlan_1km_era5_spec

Appendix A: Validation against wave buoys

Validation against wave data[1] provided by the Victorian Coastal Monitoring Program with funding through the Department of Environment, Land, Water and Planning, University of Melbourne and Deakin University. Data was also sourced from Australia's Integrated Marine Observing System (IMOS) – IMOS is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS).

[1] https://vicwaves.com.au/#

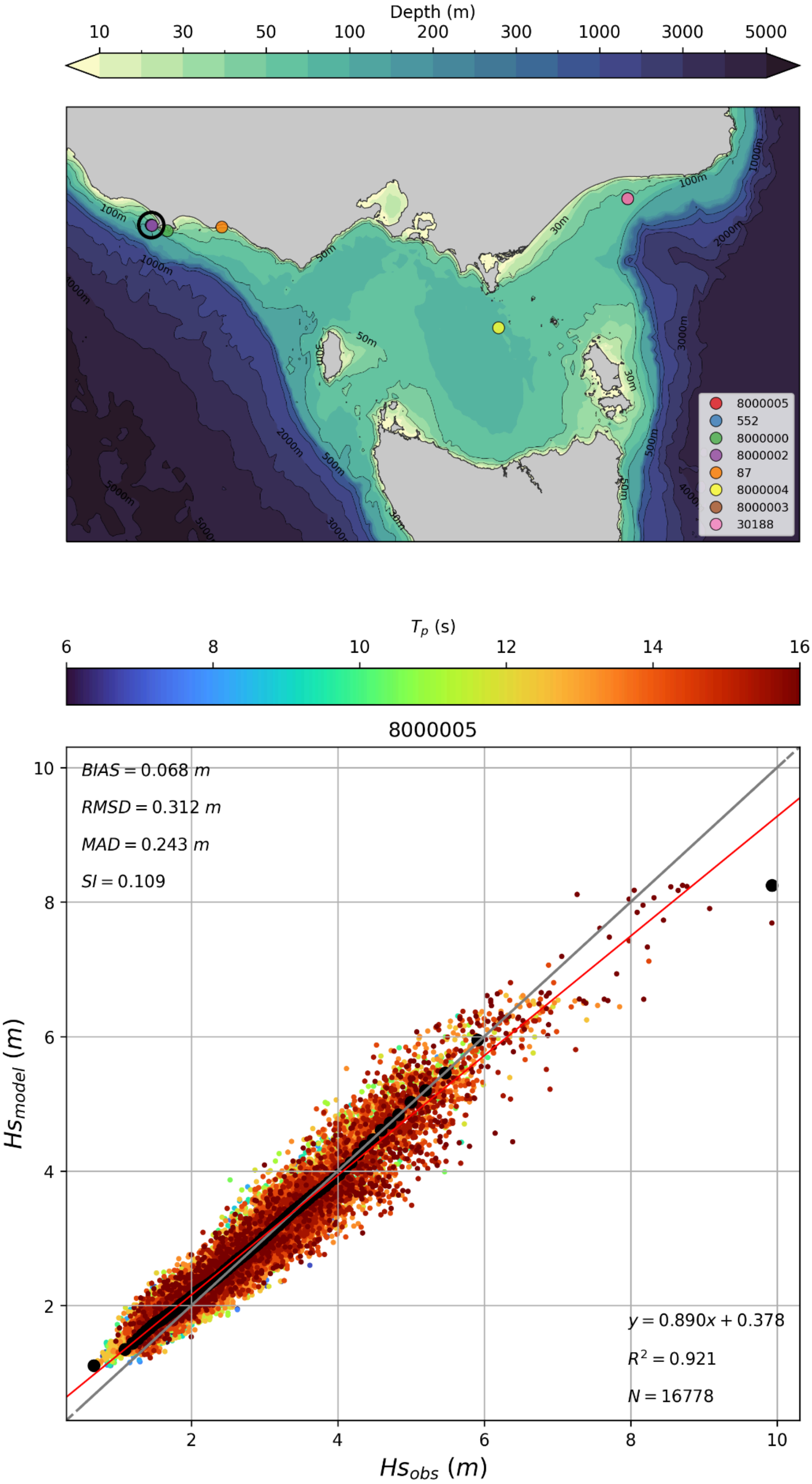


Figure A1. Hindcast validation at wave buoy ID 8000005: (top) model depth map showing the location of historical buoys with the current location highlighted by the black circle, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

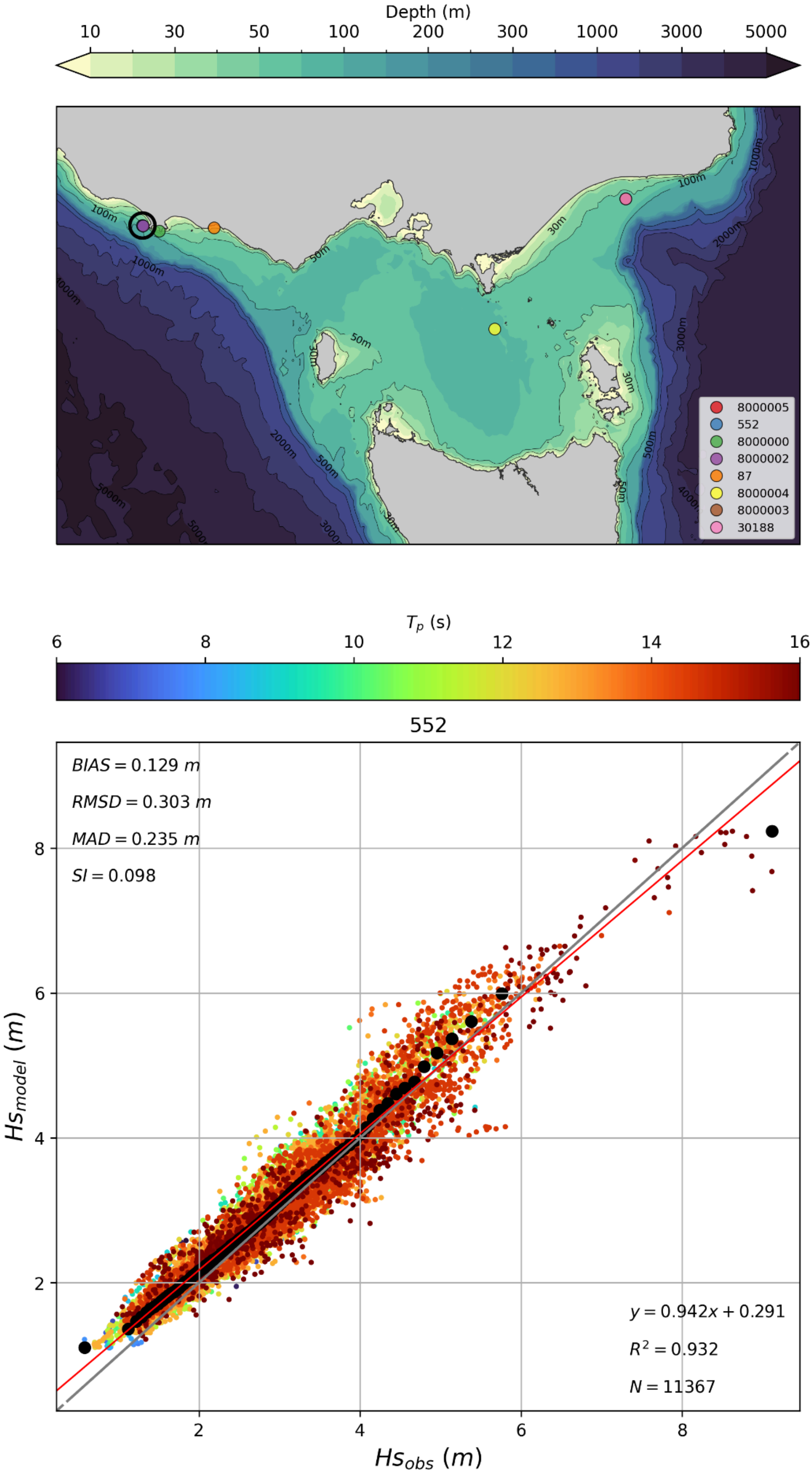


Figure A2. Hindcast validation at wave buoy ID 552: (top) model depth map showing the location of historical buoys with the current location highlighted by the black circle, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

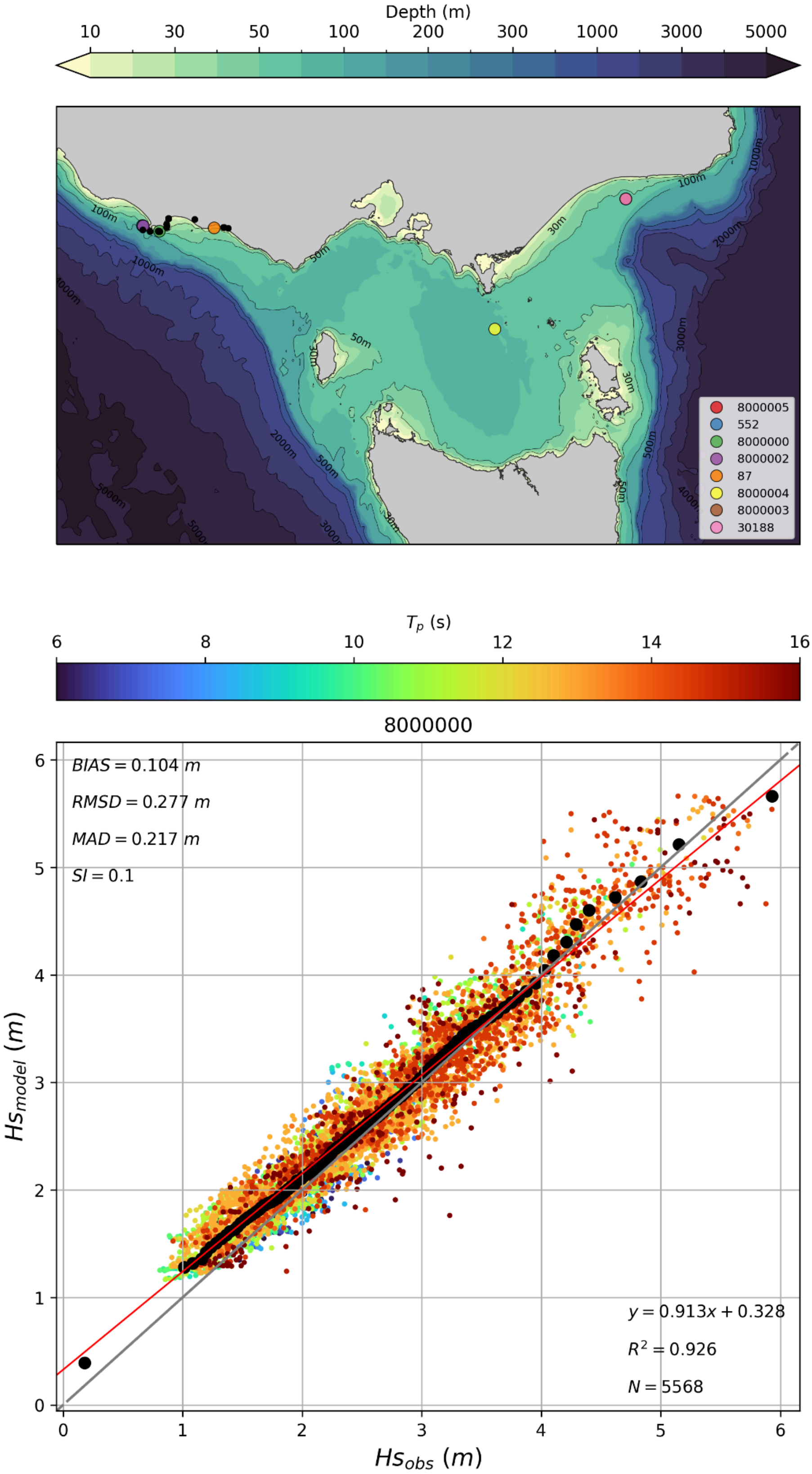


Figure A3. Hindcast validation at wave buoy ID 8000000: (top) model depth map showing the location of historical buoys with the drifting buoy locations highlighted by the black dots, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

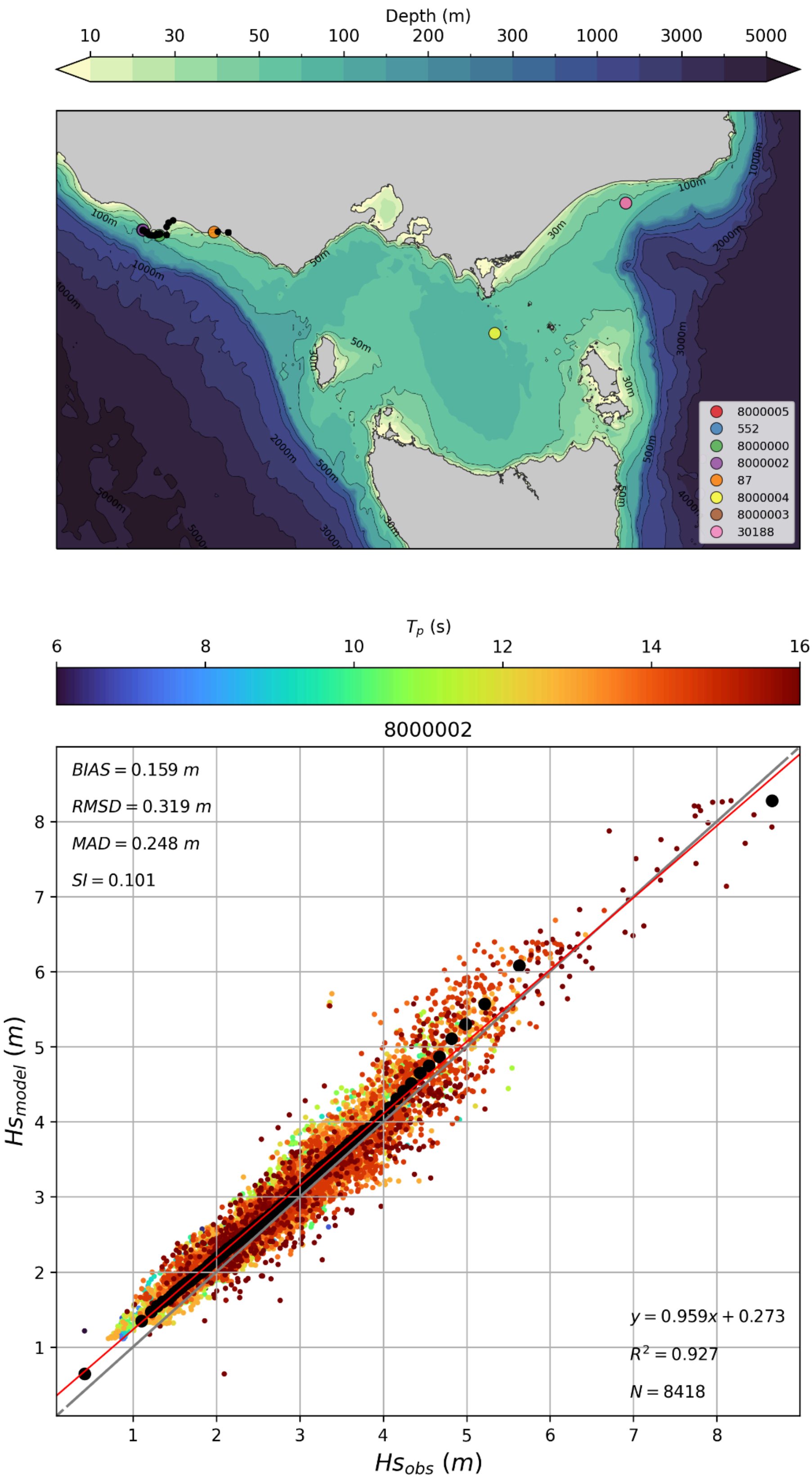
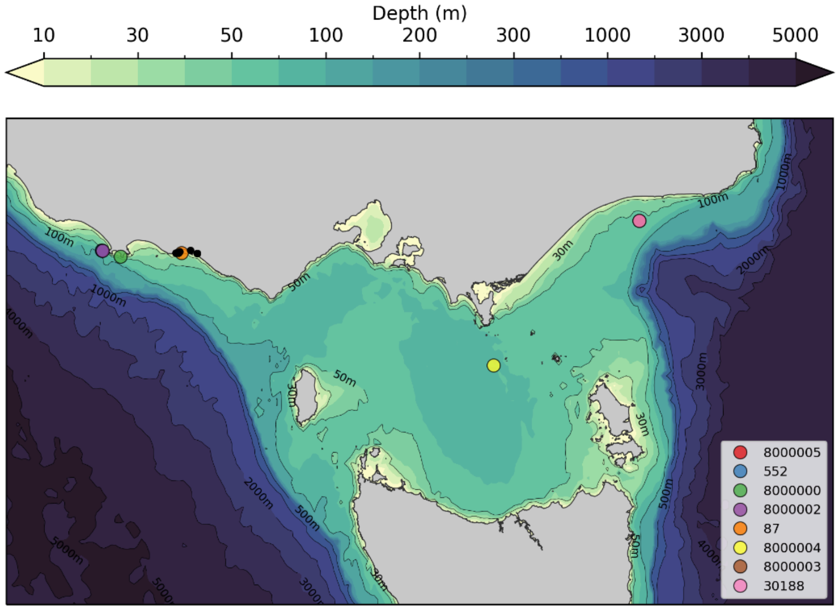


Figure A4. Hindcast validation at wave buoy ID 8000002: (top) model depth map showing the location of historical buoys with the drifting buoy locations highlighted by the black dots, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.



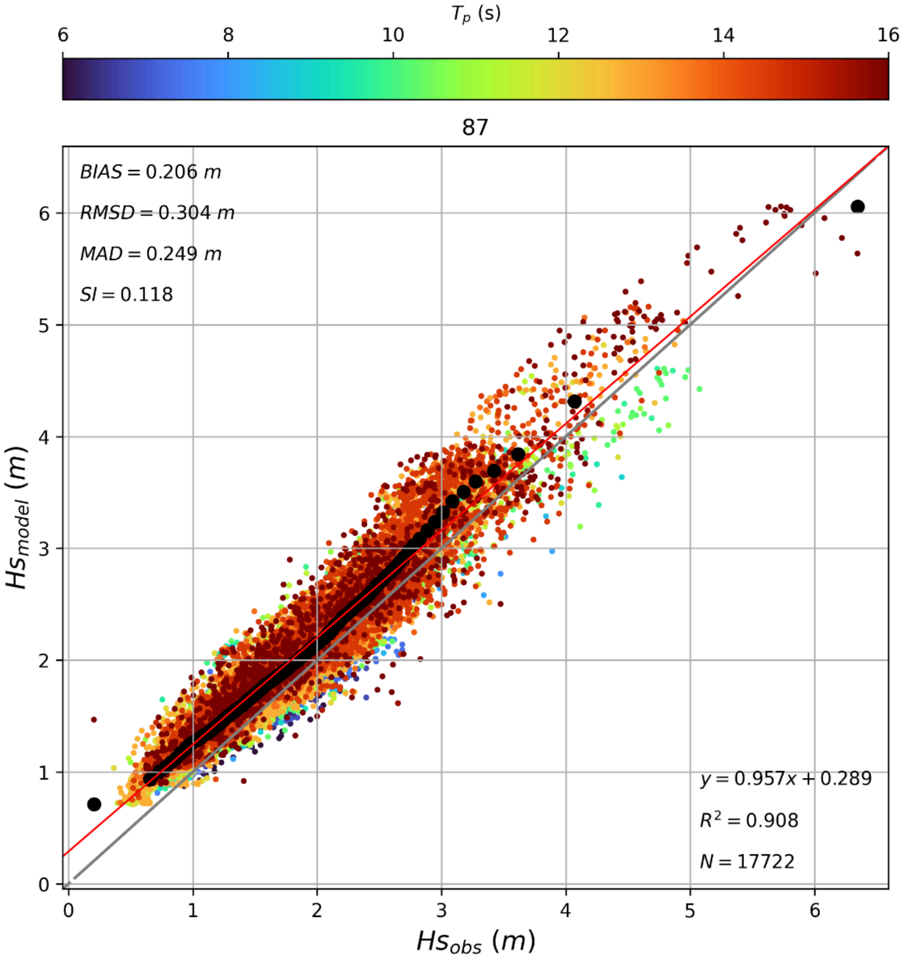


Figure A5. Hindcast validation at wave buoy ID 87: (top) model depth map showing the location of historical buoys with the drifting buoy locations highlighted by the black dots, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

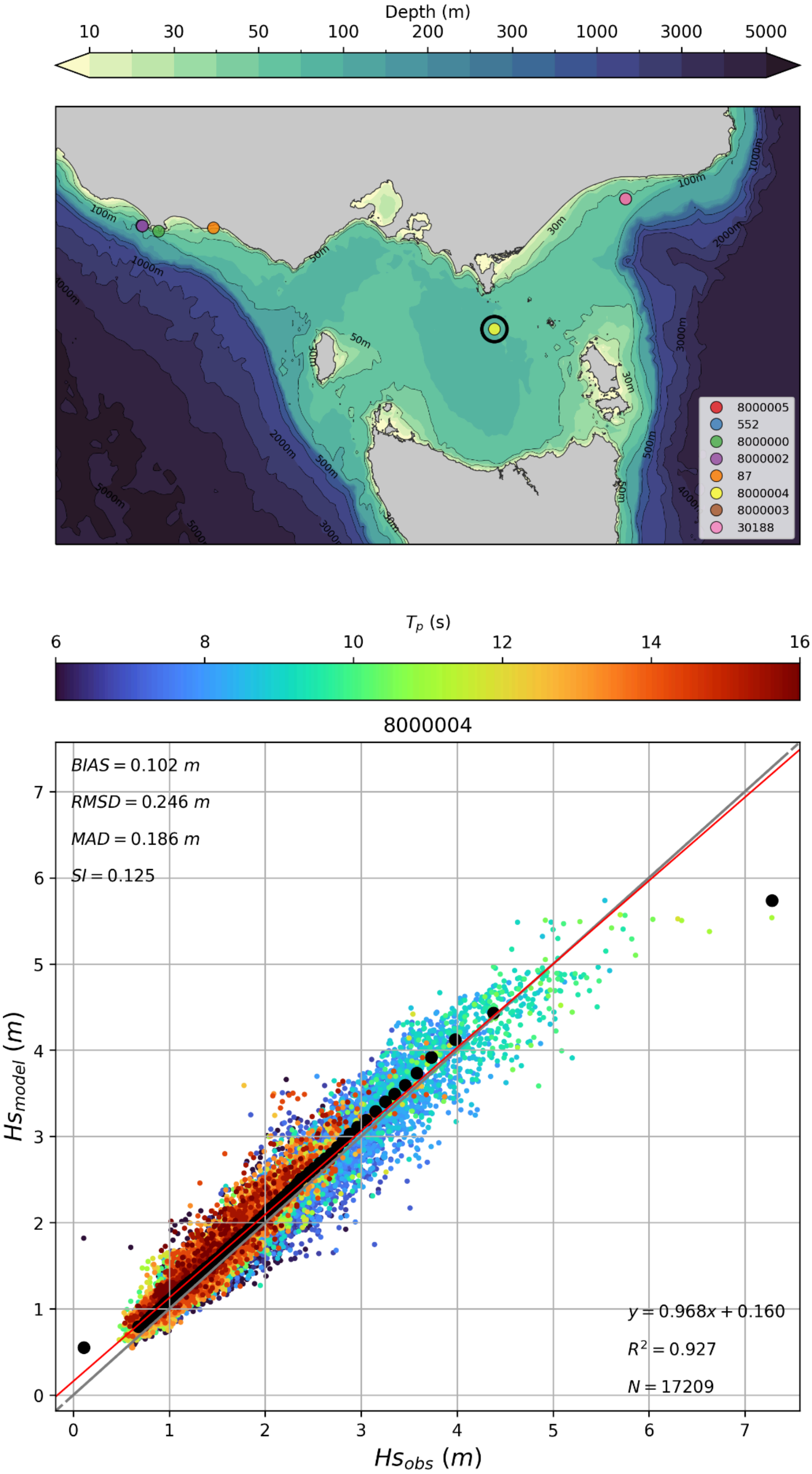


Figure A6. Hindcast validation at wave buoy ID 8000004: (top) model depth map showing the location of historical buoys with the current location highlighted by the black circle, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

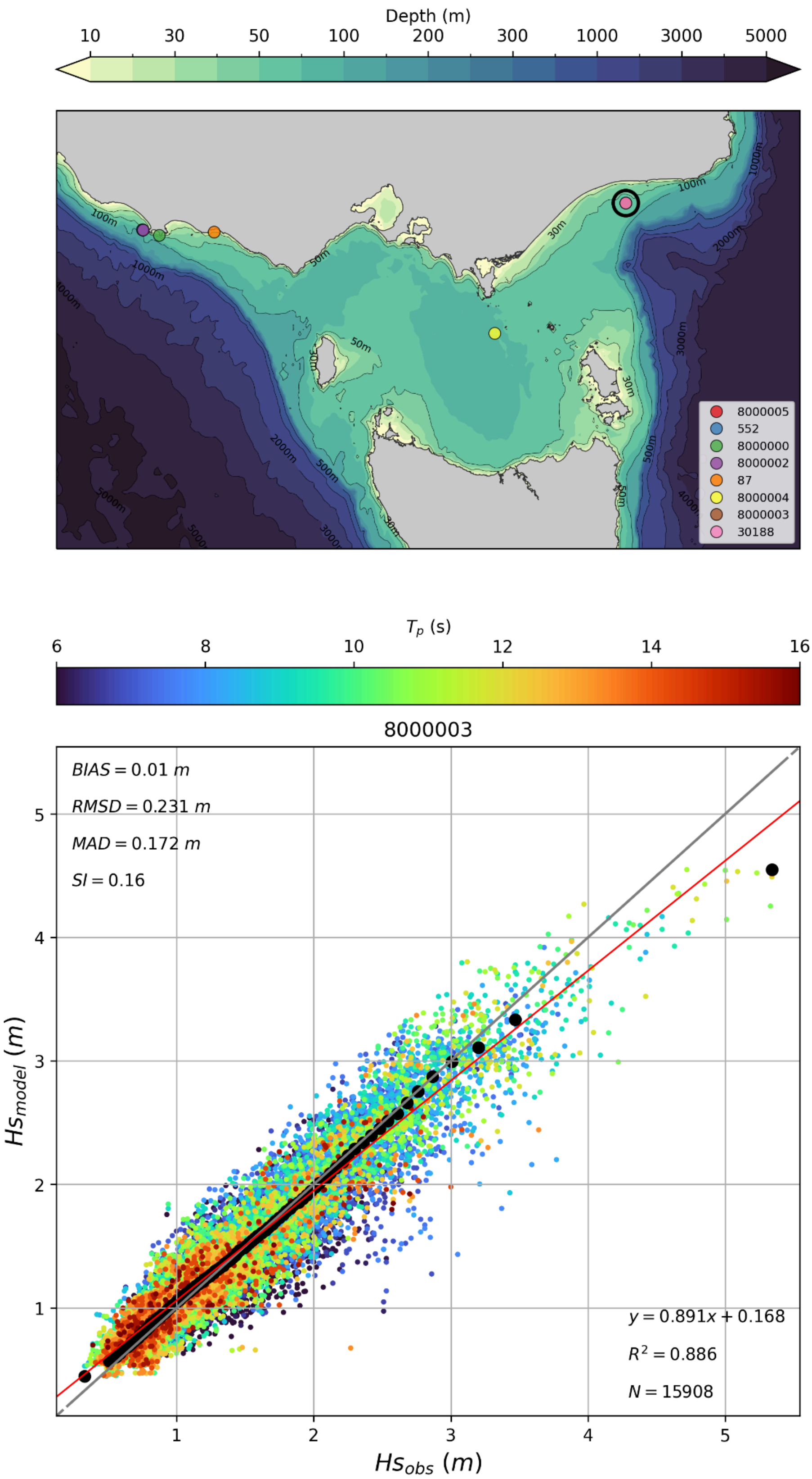


Figure A7. Hindcast validation at wave buoy ID 8000003: (top) model depth map showing the location of historical buoys with the current location highlighted by the black circle, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

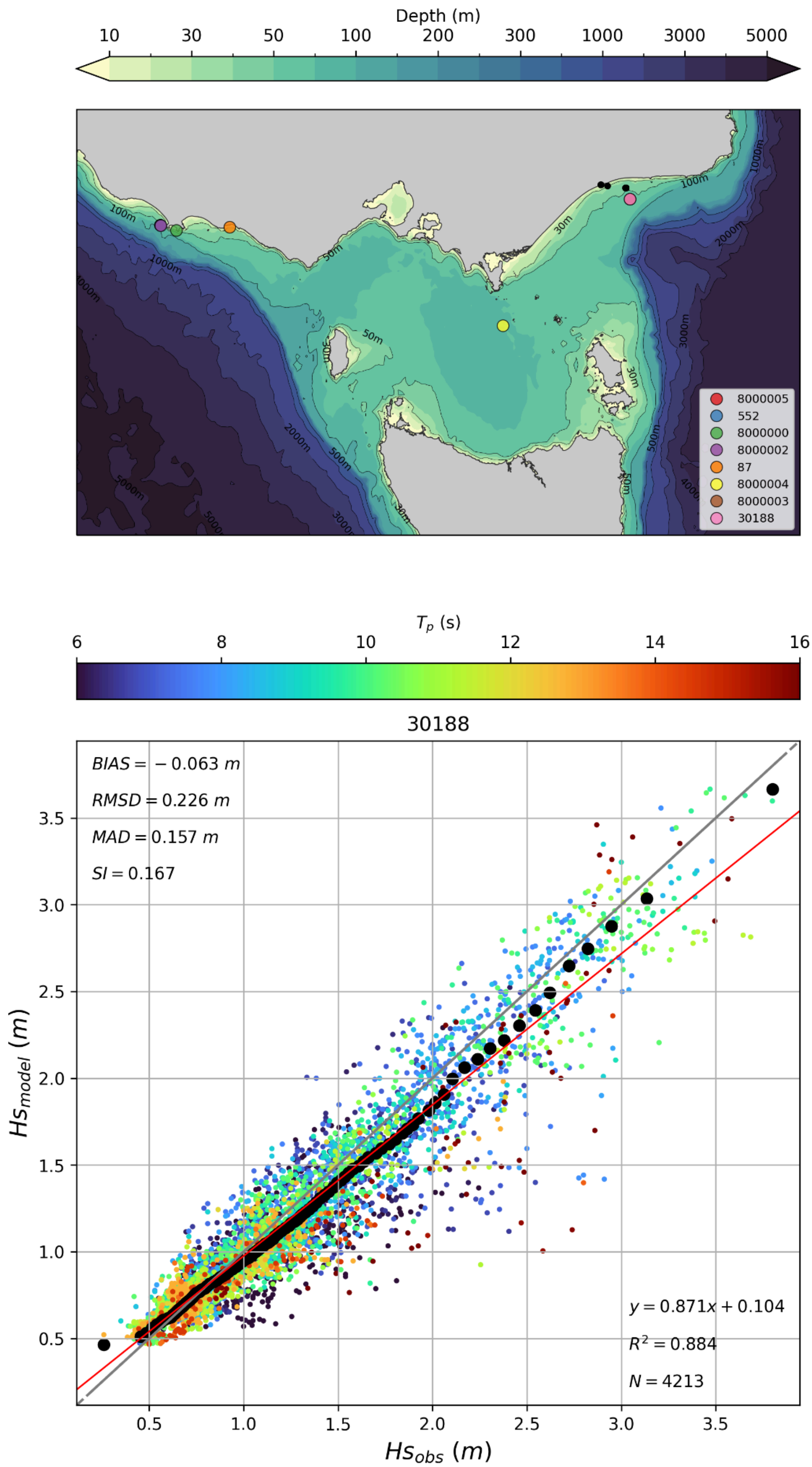


Figure A8. Hindcast validation at wave buoy ID 30188: (top) model depth map showing the location of historical buoys with the drifting buoy locations highlighted by the black dots, and (bottom) comparison between modelled and measured significant wave height Hs with colours representing the measured peak wave period, black circles the Hs quantiles and the red line the linear regression.

Appendix B: Gridded Variables

Variable	Long Name	Units
depth	depth below sea surface	m
dpm	mean direction at the spectral peak of wind and swell waves'	degree
dpmsea	mean direction at the spectral peak of wind waves below 8 seconds period	degree
dpmswe	mean direction at the spectral peak of swell waves above 8 seconds period	degree
dspr	directional spreading of wind and swell waves	degree
fspr	normalised width of the frequency spectrum of wind and swell waves	-
hs	significant height of wind and swell waves	m
hsea	significant height of wind waves under 8 seconds period	m
hswe	significant height of swell waves above 8 seconds period	m
pdir0	directional spreading of wind waves	degree
pdir1	directional spreading of primary swell waves	degree
pdir2	directional spreading of secondary swell waves	degree
pdir3	directional spreading of tertiary swell waves	degree
pdspr0	directional spreading of wind waves	degree
pdspr1	directional spreading of primary swell waves	degree
pdspr2	directional spreading of secondary swell waves	degree
pdspr3	directional spreading of tertiary swell waves	degree
phs0	sea surface wind wave significant height	m
phs1	sea surface primary swell wave significant height	m
phs2	sea surface secondary swell wave significant height	m
phs3	sea surface tertiary swell wave significant height	m
ptp0	sea surface wind wave period at variance spectral density maximum	s
ptp1	sea surface primary swell wave period at variance spectral density maximum	s
ptp2	sea surface secondary swell wave period at variance spectral density maximum	s
ptp3	sea surface tertiary swell wave period at variance spectral density maximum	s
pwlen0	mean wavelength of wind waves	m
pwlen1	mean wavelength of primary swell waves	m
pwlen2	mean wavelength of secondary swell waves	m
pwlen3	mean wavelength of tertiary swell waves	m
tm01	mean absolute wave period of wind and swell waves from the first frequency moment	s
tm02	mean absolute wave period of wind and swell waves from the second	s

	frequency moment	
tps	smooth relative peak wave period of wind and swell waves	s
tpssea	smooth relative peak wave period of wind waves below 8 seconds period	s
tpsswe	smooth relative peak wave period of swell waves above 8 seconds period	s
xwnd	eastward component of wind velocity	m/s
ywnd	northward component of wind velocity	m/s