Supplementary Material

Accuracy of the satellite-derived data

High-resolution (300 m) regionally-tuned (OC4ME_RG algorithm [48]) ocean colour data from OLCI Sentinel 3A was used to validate the long term OC-CCI (1 km resolution) dataset used in this study. The climatologies of several areas were compared and our analysis revealed that the two datasets are in agreement, with the exception of Sindala (Figure S1) due to the complex topography of the area. Using the OLCI dataset (300 m) in Figure S2, we can see four pools within Sindala, surrounded by shallow areas such as sand flats and coral reefs, which skew the observations of the OC-CCI 1 km observations. Therefore, we opted to use the OLCI dataset (higher resolution) to describe the seasonal cycle in Sindala, since it was possible to extract only the data points that were within those pools.

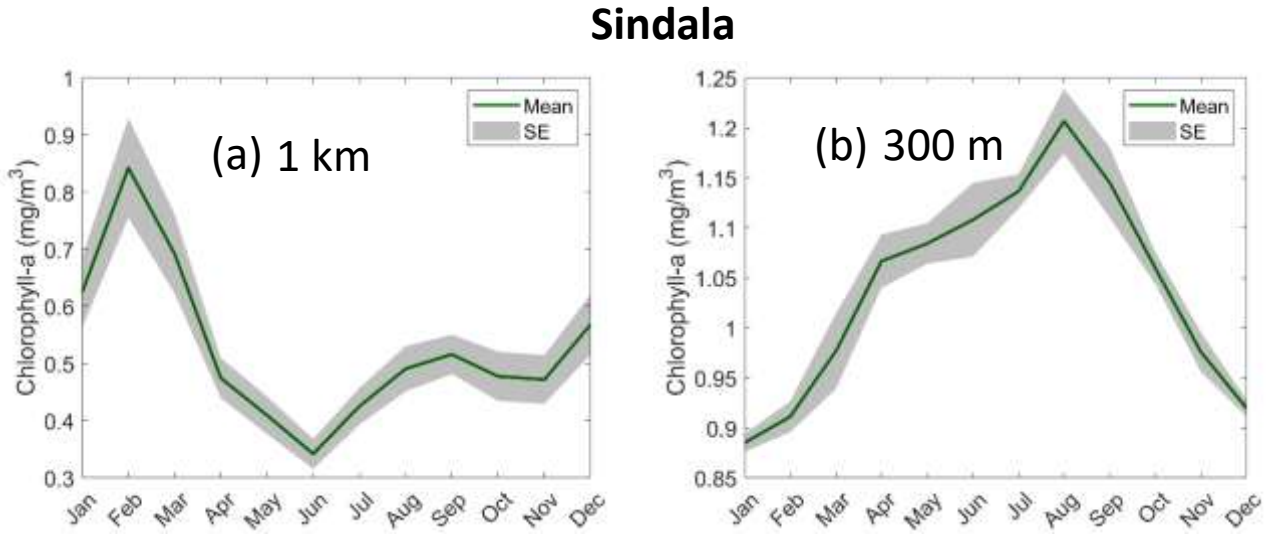

Figure S1. Comparison of Sindala climatology using (a) 21 years of OC-CCI ocean colour data with 1 km resolution, and (b) 3 years (2018-2020) of OLCI Sentinel 3A ocean colour data with 300m resolution. Both datasets have been regionally tuned.

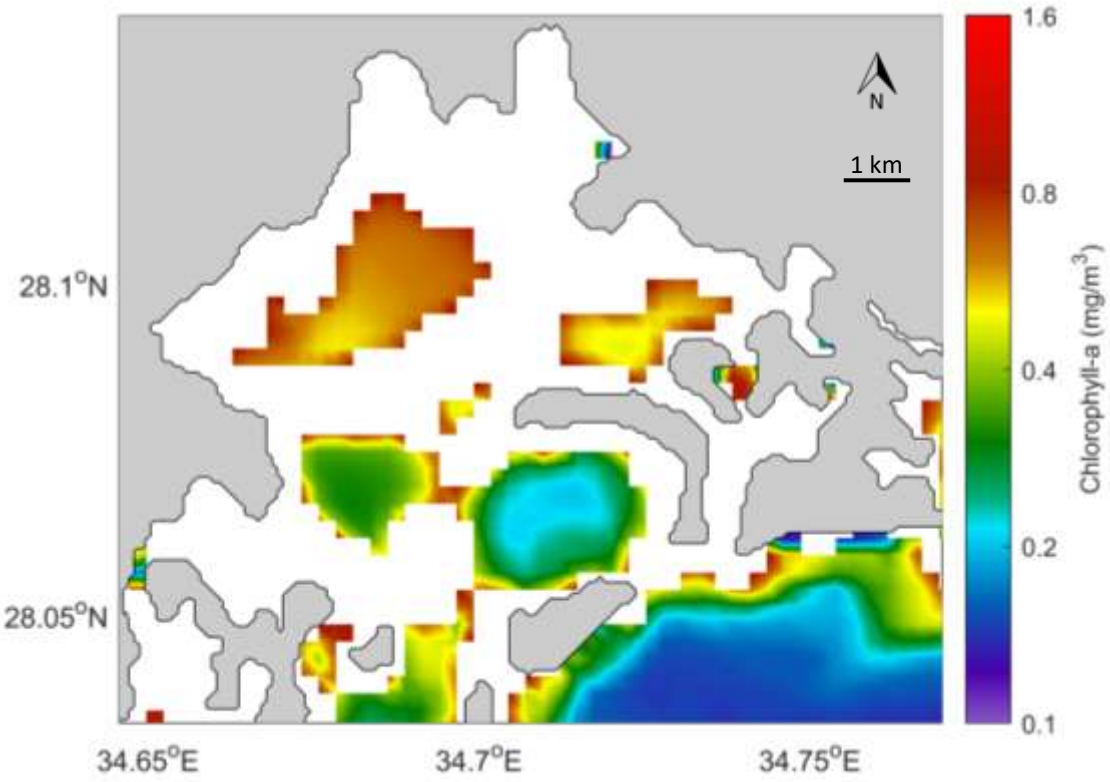

Figure S2. Spatial plot of the mean Chl-a concentration in Sindala from May 2018 - June 2020. Gray areas represent land, while white areas either have no observations or the observations were masked due to the topography.

The OC-CCI 1 km dataset compares reasonably with the *in situ* observations as shown by the satellite match-ups (Figure S3). There is a significant correlation (r = 0.81) between the two datasets, despite a slight underestimation by the OC-CCI data. This is likely related to the algorithms used during processing [48]. For the purpose of this study, this slight underestimation does not affect the long-term seasonal cycles that were presented and analysed. Absolute values were not the focal point of our analysis, and the primary findings are generally discussed without mentioning them. They are mainly referred to when large differences occur, such as in the cases of Sindala and Sharma, both of which are characterised by substantially higher surface Chl-a concentrations than the other areas examined.

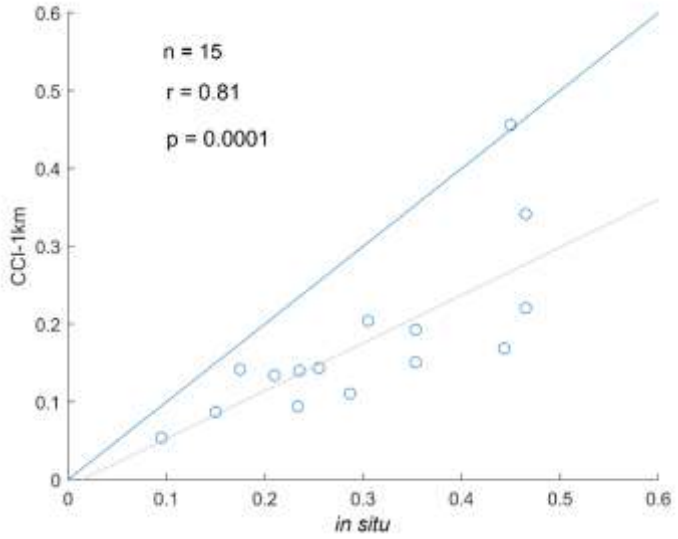

Figure S3. Comparison between satellite derived Chl-a and *in situ* observations. Both axes share the same units (mg m^{-3}). In total, 15 match-ups were formed while using the mean values from 5 points (center and the 4 points surrounding it) in the satellite-derived dataset.

Accuracy of Sea Surface Temperatures

The surface temperatures in the lagoons, Sindala and Sharma, are lower than the open waters in NEOM (Figure 5; Table S1). This may be explained by the shallow bathymetry of the areas, which makes them more susceptible to atmospheric forcing. *In situ* measurements taken during November 2017, despite being limited to a few stations inside the lagoons, are in agreement with the model temperature outputs used in this study. *In situ* temperature measurements were also taken below surface waters up to 75 m depth, when possible, and may be provided upon request.

Table S1. SST (°C), from *in situ* measurements, during November 2017 in several stations around NEOM.

Station	Open	Sharma	Sindala
1	26.33	25.90	21.97
2	26.56	25.68	24.37
3	26.60	25.91	
4	26.65	25.80	
5	26.86		
6	26.74		
7	27.22		
Mean	**26.71**	**25.82**	**23.17**

Mixed Layer Depth in NEOM

Model outputs were also used to calculate the seasonal Mixed Layer Depth (MLD) in NEOM (Figure S4). The results correlate with the satellite-derived Chl-a observations (Figure 2). During winter, a deeper MLD (>80 m) in the open waters provides more nutrients to the surface, while in summer the strong stratification (MLD <20 m) has an opposite effect. The transition periods are also clear in spring and autumn, when the MLD is decreasing or increasing respectively. The Gulf of Aqaba, however, appears to have a deeper MLD in comparison to the southern waters of NEOM throughout the year, and may explain the slightly higher surface Chl-a values observed there (Figure 3).

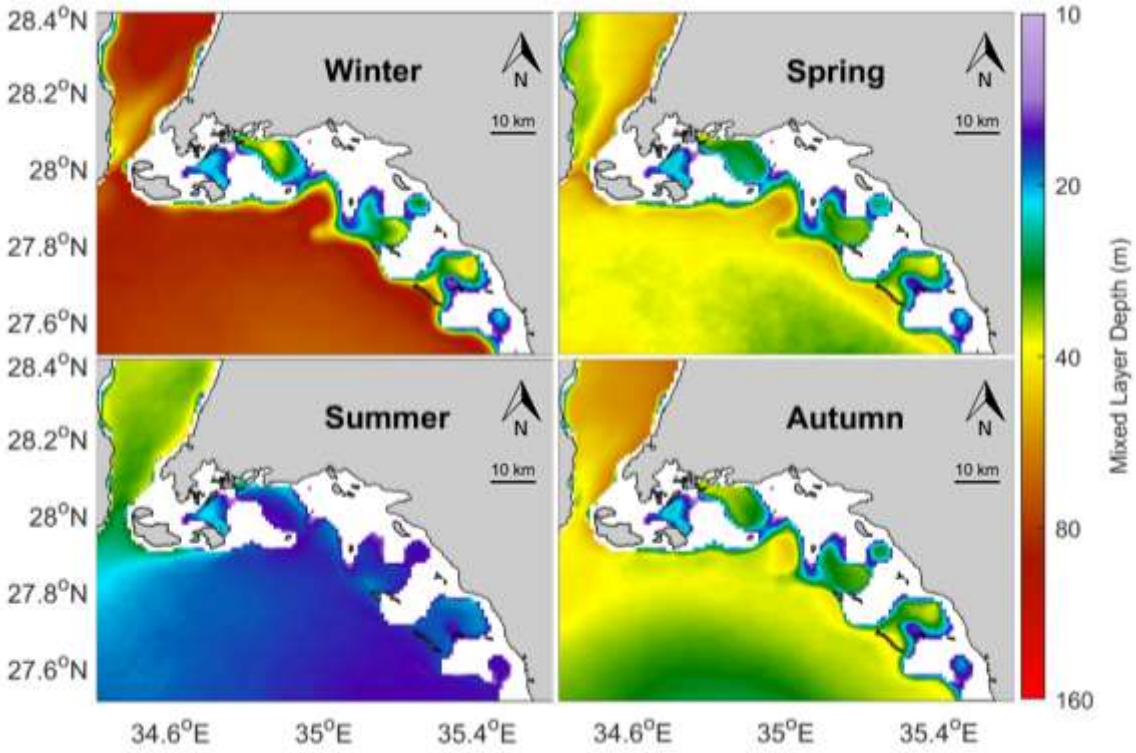

Figure S4. Mean MLD in NEOM during each season. White areas include coral reefs and other shallow habitats, which cannot be assigned any MLD values.