

12. NEW MOORED OBSERVATIONS REVEAL CONTRASTING OXYGEN SEASONALITIES ALONG THE SOUTHERN BENGUELA COAST

On the west coast of South Africa, the southern Benguela Upwelling System (sBUS) experiences seasonal wind-driven upwelling that introduces nutrients to the surface layers, promoting enhanced phytoplankton production and sustaining a diverse ecosystem (Fig. 1). One of the consequences of such enhanced productivity is the development of an oxygen minimum zone (OMZ), where dissolved oxygen (DO) is consumed as organic matter decays. In the sBUS, the OMZ is most pronounced in the bottom waters of St Helena Bay, but also develops elsewhere in nearshore regions along the coast towards the end of the upwelling season.

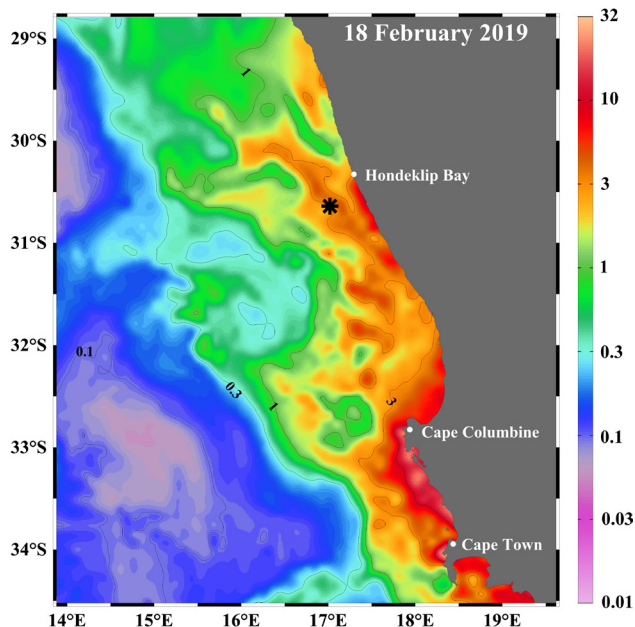


Figure 1. Satellite chlorophyll *a* (mg m^{-3}) for 18 February 2019, illustrating the mooring site (black star).

As part of a German/South African collaborative research project to investigate trophic transfer efficiency in the sBUS, a research cruise was conducted on the German research vessel *RV Meteor* during February 2019. A mooring equipped with a miniDOT sensor (MDO) was deployed at the position 30.64°S and 17.02°E , southwest of Hondeklip Bay (Fig. 1). The MDO measured temperature and DO at a depth of 96 m (ca. 74 m above the sea floor) at 10-minute intervals, for a 20-month period from February 2019 to October 2020 (Fig. 2), when it was recovered during a research cruise on the South African research vessel *RS Algoa*.

Diurnal variability was evident, with DO reaching maxima around 9 am, while minima occurred during the late afternoon. This implies enhanced downward mixing of warm, well-ventilated surface waters, favoured by cooling and reduced stratification in the surface layers during the late afternoon and at night (Fig. 3). DO also showed rapid and dramatic short-term decreases of ca. $100 \mu\text{M}$ over a few days at a time (Fig. 2), due to offshore transport of oxygen-depleted waters from the shallower nearshore area along the coast.

Surprisingly, the seasonal cycle of DO near Hondeklip Bay was marked by minima during winter and maxima in summer (Fig. 3). This seasonality is in contrast to DO seasonality further south in St Helena Bay, where DO minima are usually observed at the end of the upwelling season, with maxima occurring in winter. The opposing seasonal DO cycle, that was observed southwest of Hondeklip Bay (Fig. 3), was likely caused by the more frequent periods of enhanced horizontal mixing that transported oxygen-

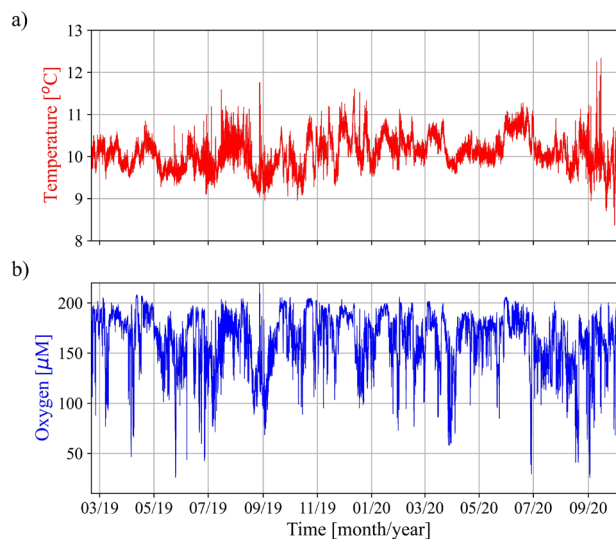


Figure 2. Time series of (a) temperature, and (b) oxygen at the mooring near Hondeklip Bay.

depleted water from the nearshore region to the mooring location, and by the breakdown of the upwelling front, during winter.

It is important to note that the mooring was deployed for a relatively short period, and thus we are unable to make inferences on the reproducibility of this DO seasonal cycle from one year to the next. This stresses the crucial need for continuous, long-term, high temporal resolution observations throughout the sBUS, to adequately capture the variability of environmental conditions that impact the surrounding ecosystem.

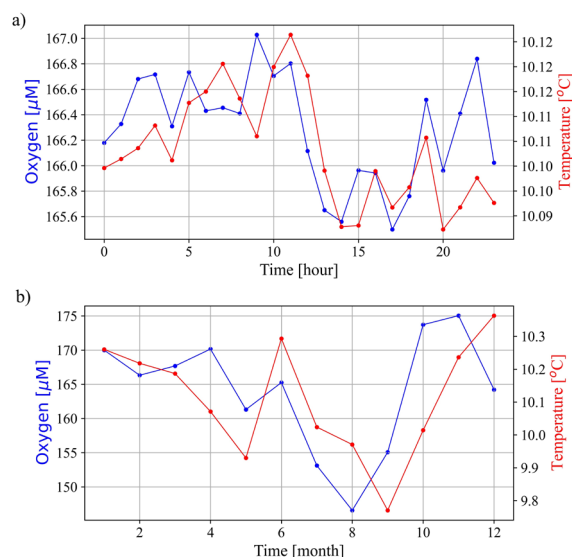


Figure 3. (a) Diurnal, and (b) seasonal variation of oxygen and temperature at the mooring near Hondeklip Bay.

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