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PHYSICAL CHARACTERISTICS OF BRUNEI BAY

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INTRODUCTION

Brunei Bay, located in Borneo East Malaysia, is a semi-enclosed bay with a width of ~40 km and a maximum depth of approximately <40 m within the bay. It was connected with Labuan at the north, Brunei Darussalam at the west, Weston, Sabah at the east and Lawas, Sarawak at the south. The open ocean that interacts with the Brunei Bay is south-eastern of South China Sea (SCS). The bay is connected to the SCS through adjacent continental shelf and the deep continental slope (~2000 m depth) at ~100 km from the bay. Brunei Bay is expected to have similar physical characteristics to SCS and, as every feature in oceanographic nature of SCS is subjected to seasonal monsoon system (Saadon *et al.,* 1997). Some previous studies suggested that the entire system of SCS is under the influence of northeast (NE) monsoon (Nov – Feb) and a southwest (SW) monsoon (June – September) (Wyrtki, 1961; Hu *et al.,* 2000; Akhir, 2012). Other than the seasonal effects, a system in a bay also experiences local variations similar to an estuarine system where it acts as an arm of the sea, where the tide meets and mixes with fresh water runoff from the land, rivers and rain from the atmosphere.

In 2013, Lawas coastline, located at the south of Brunei Bay was proposed to be gazetted into a Marine Protected Area because the area was known to support various marine ecosystems including endangered species. However, little is known on the physical characteristics of sea water in Brunei Bay or indeed many other parameters. There are a few studies done at the shelf outside the Brunei Bay that might have relationship with the physical characteristics in Brunei Bay.

By using 55 conductivity, temperature and depth (CTD) casts, cruises in July 2009 combined with five Argo profiling floats, Arsad & Akhir (2013) had described the water masses distributions in the surrounding seas near Sabah (northern Borneo). In their study, they had found similar water masses as found in SCS (Rojana-anawat

et al., 2000; Dippner *et al.*, 2011; Roseli *et al.*, 2015) which suggests a connection between SCS in West Malaysia and SCS in East Malaysia. In additional, a recent study by Yan *et al.* (2015) has found the existence of winter coastal upwelling along the shelf of Borneo coastline. The low sea surface temperature (SST), higher chlorophyll-a (chl-a) and favourable upwelling winds observed from satellite and in-situ data showed that this upwelling forms in December and matures in January which is similar to the sampling period discussed. During this time, the currents moved south-westward along the Borneo coastline and were believed to bring different water masses to the Brunei Bay.

Study on physical characteristics in Brunei Bay is vital because any activities occurring in the sea is mainly affected by physical process, directly and indirectly. Therefore, this study was designed with the main objective to develop knowledge of the physical characteristics in the Brunei Bay by describing the water characteristics and its circulation.

MATERIALS AND METHODS

In this study, the field data collections were conducted in two different times, June 2013 (SW monsoon) and January 2014 (NE monsoon), by INOS, UMT crews under the Marine Environmental Processes (MEP) of HICoE project. Both samplings were conducted at similar stations. Figure 1 shows the stations involved in both samplings at the Brunei Bay. There were 34 stations within 6 transects (T1 – T6).

During the first sampling (June 2013), the equipment used to collect water parameters (temperature, salinity, dissolved oxygen (DO) and pH) was HT6. Due to some limitation in using the HT6 during the first sampling (it did not collect data at every 1m depth), Seabird 19v2 CTD was used in the next sampling (January 2014) collecting similar parameters. The CTD was cast from the shipboard to the bottom with 4 Hz sampling rate. The data collected by CTD were self-recorded into the installed program in the connected device. The data were then binned into 1 m depth which is more comprehensive than HT6 data. Sontek acoustic doppler current profiler (ADCP) was used to collect currents speed and direction. ADCP used here is the 3 beam mounted vessel ADCP with frequency of 0.5 kHz that can go approximately to 150 m depth. Ocean Data View (ODV) software by Schlitzer (2012) was used in the data processing for both samplings. In this study, Data-Interpolating Variational Analysis (DIVA) gridding in ODV were selected to be used as the interpolation method in the data visualization.