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Primary productivity and its variability in the equatorial South China Sea during the northeast monsoon

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Abstract

Near coastal areas of the equatorial South China Sea (SCS) are one of the world's regions with highest primary productivity (phytoplankton growth). Concentrations of phytoplankton in the SCS depend significantly on atmospheric forcings and the oceanic state, in particular during the northeast (winter) monsoon season from November to March. Aided by new ocean-observing satellite data, we present a climatological overview of recent surface atmospheric and oceanic features in the equatorial SCS during the northeast monsoon to identify the dominant air-sea processes influencing and modulating the primary productivity of the region. Measured chlorophyll *a* concentrations are used as a proxy for phytoplankton amounts and the spatial and temporal variations are characterized according to meteorological conditions. Converging northeasterly surface winds support high chlorophyll *a* concentrations along East Malaysia's coastline in conjunction with a continual nutrient supply from the bottom of the continental shelf by vertical mixing. The mixing can be enhanced due to increased turbulence by wind-generated high waves when they approach shallow water from the deep basin during strong cold surges and monsoon disturbances. Intraseasonal variability during the winter monsoon is characterized by a coastal increase of chlorophyll *a* starting in November and peaking in January. A general decrease is observed in March. Interannual variability of chlorophyll *a* concentrations is influenced by ENSO (due to the known modulation of cold surge occurrences), with decreases during El Niño and increases during La Niña in early winter along the shore of East Malaysia. As an example, we discuss an enhanced phytoplankton growth event that occurred due to a typical cold surge-induced Borneo vortex event in January 2010.

1 Introduction

The South China Sea (SCS) lies between the equator and 23° N and extends from 99 to 121° E (Fig. 1). It is a marginal sea of the Pacific Ocean with a total area of around

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