

# Surface SPM concentration in Taiwan Strait during summer and winter monsoon

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The Taiwan Strait, situated in the East China Sea between Taiwan and China is shallow, relatively turbid and characterized by strong tidal currents and a winter and a summer monsoon season, (Jan *et al.*, 2002; Chen and Wang, 2006; Liao *et al.*, 2008). During winter winds are generally blowing from the NE and the hydrodynamics are characterised by the China coastal current that flows towards the SW following the China Coast and a weak Kuroshio branch current along the west coast of Taiwan that flows towards the north. During summer the weather pattern changes, the winds are blowing from the south and the warm water from the South China Sea current is advected into the Strait. The changes in weather pattern influences rainfall and thus river run-off. The riverine discharge in Taiwan during flood season often carries huge amounts of fine-grained sediments into the Strait that are rapidly dispersed in the sea (Dadson *et al.*, 2005; Liu *et al.*, 2006; Chien *et al.*, 2011). These sediment inputs occur during the short time periods of heavy rains often associated with typhoons. Variations in SPM concentration are typically caused by resuspension, mixing, settling and deposition of fine-grained sediments, by advection due to subtidal flows and by the input of fine-grained sediments through river run-off. The aim of the study is to use images from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite, in order to investigate how local sediment sources together with the seasonality in wind, oceanographic currents and waves influence the SPM dynamics in Taiwan Strait.

In total 4094 MODIS images, covering the period between July 2002 and September 2013, have been processed from Level 1A to Level 2, using the SeaDAS software. Images were collocated on a common rectangular grid using nearest neighbor resampling, and multiple overpasses combined to a single daily composite (Vanhellemont *et al.*, 2011; Vanhellemont and Ruddick, 2011). Surface SPM concentration is then retrieved from remote sensing reflectance at the MODIS band centered at wavelength 667nm, using the algorithm of Nechad *et al.* (2010). Finally, Level 2 processing flags, (Patt *et al.*, 2003) are used to mask out the land and cloud pixels and any bad quality pixels. The SPM concentration data together with wind, wave and current data from numerical models (Yu *et al.*, 2014) have been used to reconstruct the SPM dynamics. The data have been ensemble averaged according to winter and summer monsoon weather type. The use of atmospheric circulation patterns to describe different situations has proven to be very useful in climate and oceanographic studies (Demuzere *et al.*, 2009; Fettweis *et al.*, 2012). Each weather type has a distinct distribution of surface SPM concentrations, which is explained by differences in hydrodynamics, river run-off and wave conditions (see Fig. 1). During the summer monsoon season (June-September) the winds are blowing from the south and warm water with low SPM concentration is entering the Strait from the South China Sea. Higher SPM concentrations are found along the coasts and in the shallow areas of the Strait. These high turbidity areas are generated by local resuspension and by the river runoff. During winter (November-March) the NE winds are stronger. The SPM concentration is higher, which is due to higher waves and thus a higher resuspension, but also due to the higher import of SPM from the Chinese coastal Current into the Strait. The mixing of ocean water with low SPM concentration and coastal waters with high SPM concentration by wind stress is clearly visible in some images where eddies are visible. The results shed new light on the surface SPM concentration variability on seasonal and monthly time scales and allowed to better understand the large scale geographical variability of high turbidity zones in Taiwan Strait induced by meteorological and climatological variations using remote sensing data.

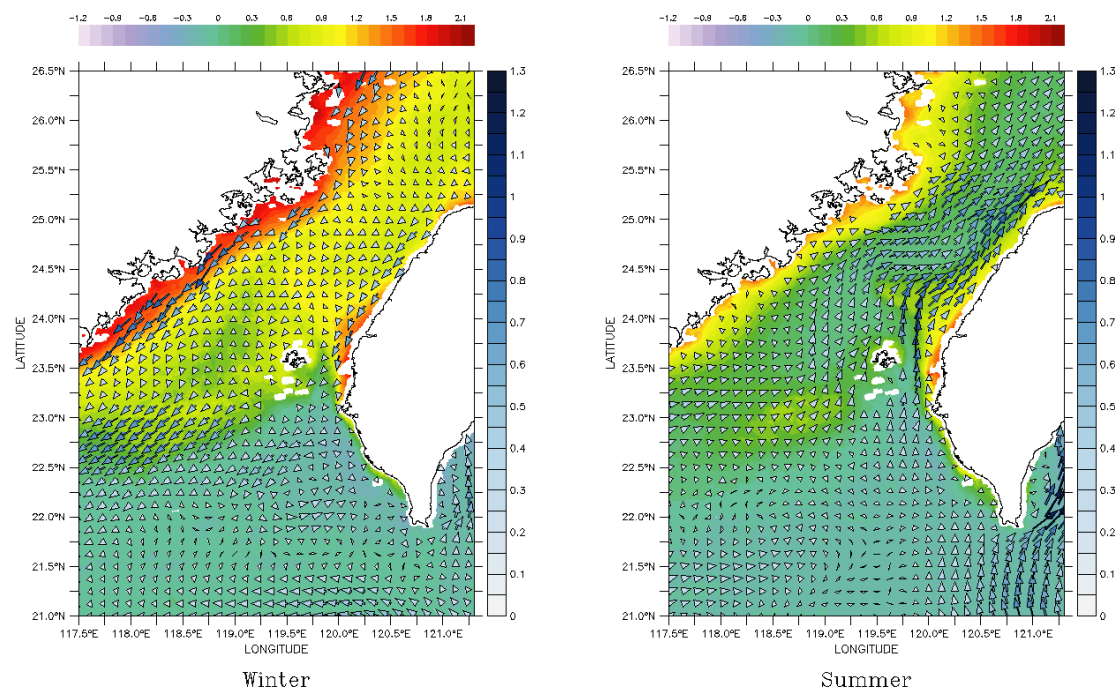


Fig. 1. Winter and summer averaged surface SPM concentration (in log [mg/L]) together with residual current pattern [m/s].

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