
Ocean Technology Group
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# Ocean Colour Remote Sensing of Flood Plumes in the Great Barrier Reef

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ABSTRACT

The objective of the research reported in this thesis was to develop a technique to monitor the dynamics of sediments and nutrients entering the coastal ocean with river plumes associated with high intensity low frequency events (e.g. floods), using ocean colour remote sensing. To achieve this objective, an inverse bio-optical model was developed, based on analytical and empirical relationships between concentrations of optically significant substances and remote sensing of water-leaving radiance. The model determines concentrations of water-colouring substances such as chlorophyll, suspended sediments, and coloured dissolved organic matter, as well as the values of optical parameters using water-leaving radiances derived from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS). To solve atmospheric correction in coastal waters, the aerosol type over clear waters is transferred to adjacent turbid water pixels.

The vicinity of the Herbert River, central Great Barrier Reef zone, Australia, was used as a case study for the application of the algorithm developed. The satellite ocean colour technique was successfully validated using sea-truth measurements of water-colouring constituents acquired in the area during various seasons throughout 2002-2004. A high correlation between chlorophyll and dissolved organic matter was found in the coastal waters of the region, and when the bio-optical model was constrained to make chlorophyll a function of dissolved organic matter, the relationship between in situ and satellite-derived data was substantially improved. With reliable retrieval of the major water-colouring constituents, the technique was subsequently applied to study fluxes of particulate and dissolved organic and inorganic matter following a flood event in the Herbert River during the austral summer of 1999.

Extensive field observations covering a seasonal flood in the Herbert River in February 2004 revealed high sediment and nutrient exports from the river to the adjacent coastal waters during the flood event. Due to rapid settling, the bulk of the sediment-rich influx was deposited close inshore, while the majority of nutrients exported from the river were consumed by phytoplankton in a relatively small area of the coastal ocean. With the help of ocean colour remote sensing, it was demonstrated that river-borne sediments and nutrients discharged by a typical flood in the Herbert River are mostly precipitated or consumed within the first 20 km from the coast and therefore are unlikely to reach and possibly affect the mid-shelf coral reefs of this section of the Great Barrier Reef lagoon.

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