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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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## CONTENTS

<b>Chapter 1. SETTING THE PROBLEM</b>	<b>1</b>
1.1. Great Barrier Reef health status	3
1.2. Effects of nutrient and sediment on corals	3
1.3. Human alterations to river discharge	7
1.4. Need to monitor	7
1.5. Satellite remote sensing	9
1.6. Study area	10
1.7. Research questions and objectives of the study	13
1.8. Thesis structure	14
<b>Chapter 2. BIO-OPTICAL MODEL</b>	<b>15</b>
2.1. HISTORICAL OVERVIEW OF BIO-OPTICAL MODELLING	17
2.1.1. Forward and inverse problems in ocean optics	17
2.1.2. Algorithm evolution	18
2.1.3. Semi-analytical inverse models of case II waters	20
2.1.4. Future of bio-optical modelling	22
2.2. BIO-OPTICAL MODEL DESCRIPTION	23
2.2.1. SeaWiFS water-leaving radiance	23
2.2.2. Apparent and inherent optical properties	24
2.2.3. Absorption of phytoplankton	27
2.2.4. Backscatter of phytoplankton	28
2.2.5. Coloured dissolved organic matter	29
2.2.6. Inherent optical properties of suspended sediments	31
2.2.7. Bottom reflection	34
2.2.8. Assumptions of the model	35
2.2.9. Inversion of the bio-optical model	38
2.3. MODEL SENSITIVITY	41
2.3.1. Coastal ocean scenarios	41
2.3.2. Forward model sensitivity to water colouring constituents	42
2.3.3. Forward model sensitivity to model parameters	43
2.3.4. Inverse model sensitivity to input water-leaving radiance	46
<b>Chapter 3. MODEL APPLICABILITY</b>	<b>51</b>
3.1. DATA COLLECTION	53
3.1.1. Field trip overview	53
3.1.2. Methodology	54
3.1.3. Implications for remote sensing	66
3.2. MODEL VALIDATION	75
3.2.1. SeaWiFS atmospheric correction background	75
3.2.2. Atmospheric correction modification procedure	78
3.2.3. Application of modified atmospheric correction to validation stations	79
3.2.4. Validation analysis	84

3.3. APPLICATION OF THE OCEAN COLOUR REMOTE SENSING TECHNIQUE TO A FLOOD EVENT IN THE HERBERT RIVER	95
3.3.1. Flood plumes	95
3.3.2. 1999 flood event	96
3.3.3. Conclusion	102
<b>Chapter 4. BEYOND SEAWIFS</b>	107
4.1. FLOOD-MEDIATED TRANSPORT FROM THE HERBERT RIVER TO THE COASTAL OCEAN	109
4.1.1. Introduction	109
4.1.2. Data overview	110
4.1.3. Herbert River hydraulic regimes	114
4.1.4. Discharge rate versus water properties relationships	116
4.1.5. Sediment dynamics in the coastal ocean	117
4.1.6. Sediment and nutrient export	120
4.1.7. Conclusion	121
<b>Chapter 5. CONCLUSIONS</b>	123
5.1. MAJOR FINDINGS OF THE PRESENT STUDY	125
5.1.1. Research question 1: Is satellite remote sensing suitable for studying flood plumes?	125
5.1.2. Research question 2: Can SeaWiFS be used in coastal waters?	126
5.1.3. Research question 3: What is the fate of biogeochemical substances of Herbert River plumes in the coastal ocean?	126
5.1.4. Research question 4: Do riverine sediments and nutrients reach coral reefs?	128
5.2. ISSUES RAISED BY THE PRESENT STUDY	129
5.3. WHERE TO GO NEXT	132
5.3.1. MERIS potential	132
5.3.2. Numerical modelling	133
5.3.3. Linking science and management	134
5.4. SUMMARY	135
REFERENCES	137
<b>APPENDICES</b>	151
APPENDIX 1. List of abbreviations	153
APPENDIX 2. List of symbols	155
APPENDIX 3. Lucinda experiment plan, 8-21 February 2004	157
APPENDIX 4. Field data for expeditions in the Lucinda region in 2002-2004	163
APPENDIX 5. Atmospheric correction modification procedure	185