Validation of CoastColour L2W products in the St. Lawrence estuary (Canada)

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Pêches et Océans Canada

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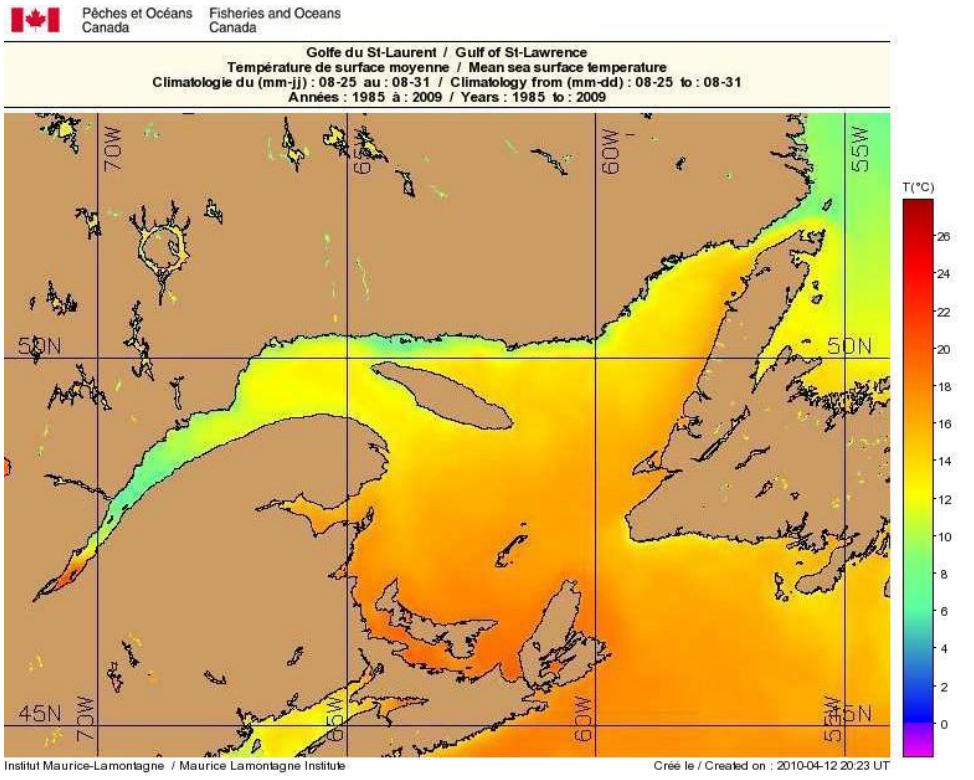
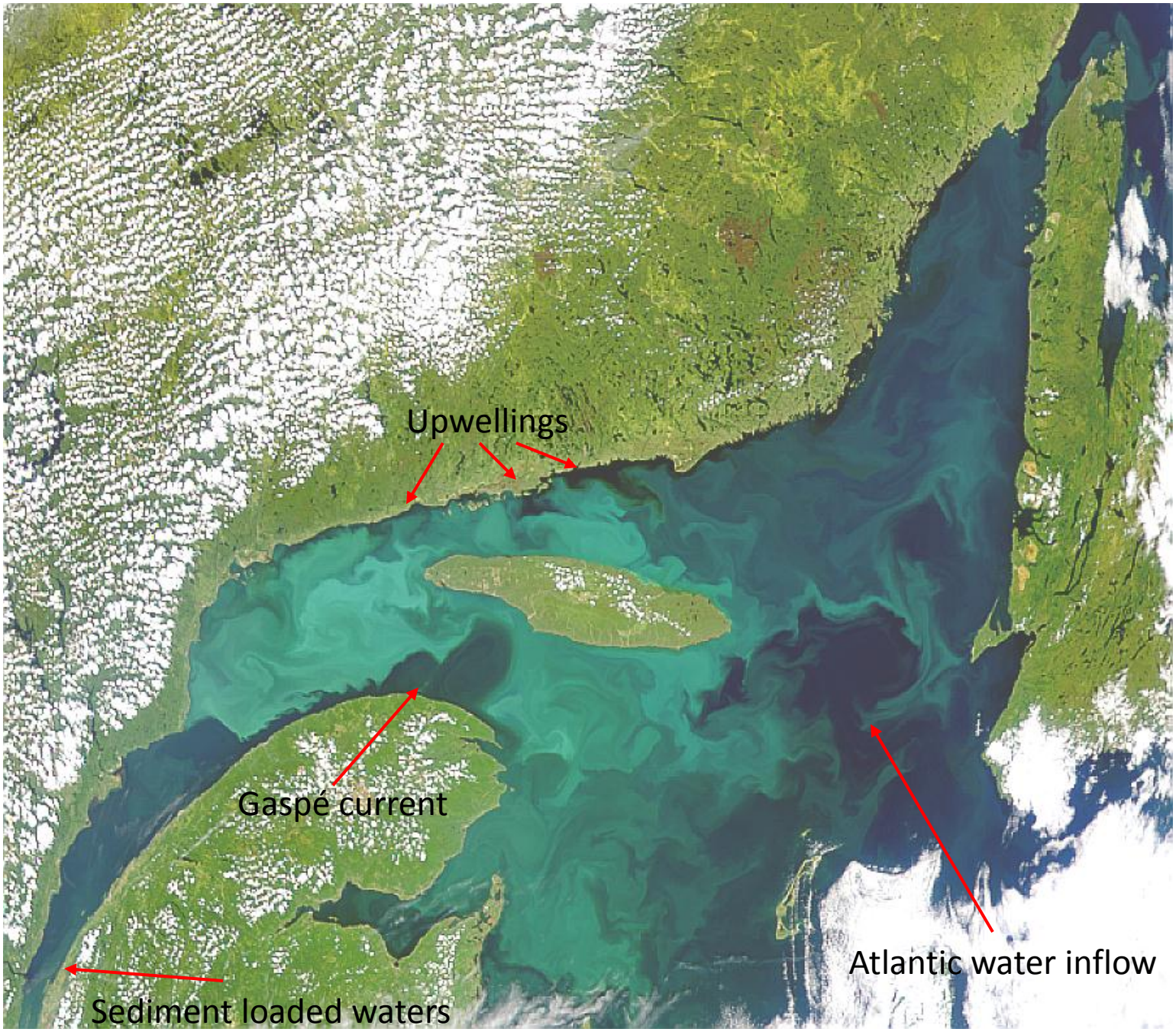
Cartel

Centre d'applications et de recherches en télédétection

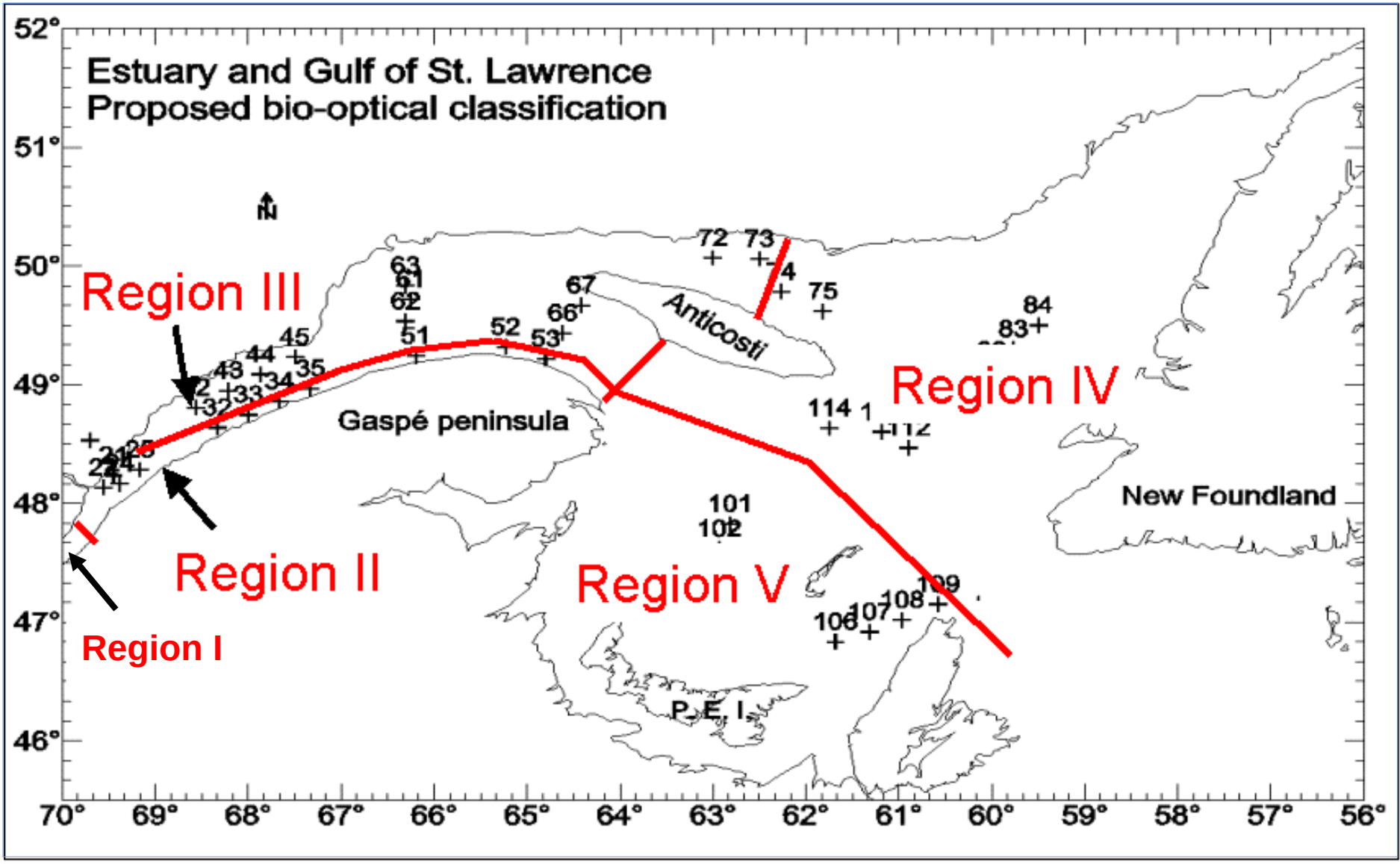
INTRODUCTION

- St. Lawrence estuary is a complex ecosystem
- Strong seasonal cycle
- Large tides
- Large freshwater flux (18 000 m^3 s^{-1})





SeaWiFS image on August 20, 1999



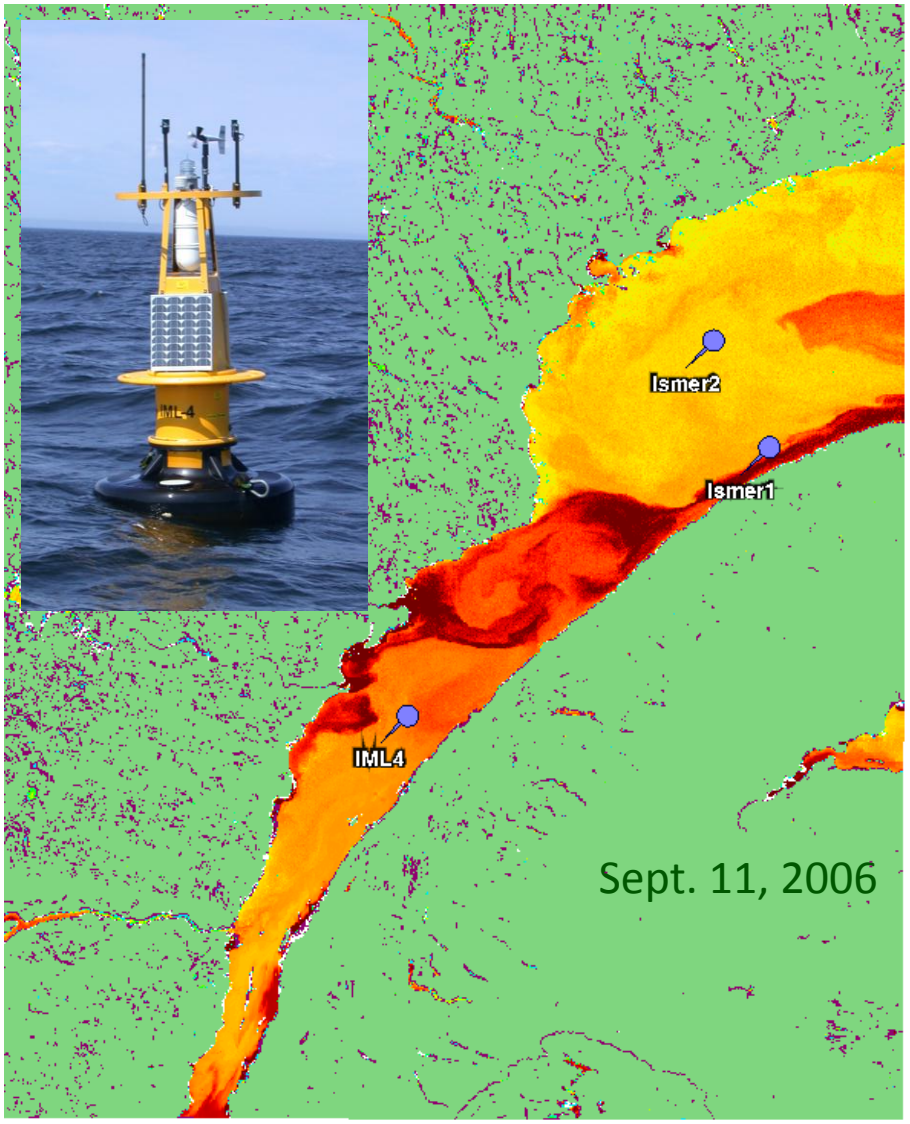
Optically classified regions of the Estuary and Gulf St. Lawrence. Regions I and II are always characterized as Case 2 waters, whereas Regions III and V switch between Case 1 and Case 2, and Region IV is always Case 1

OBJECTIVE

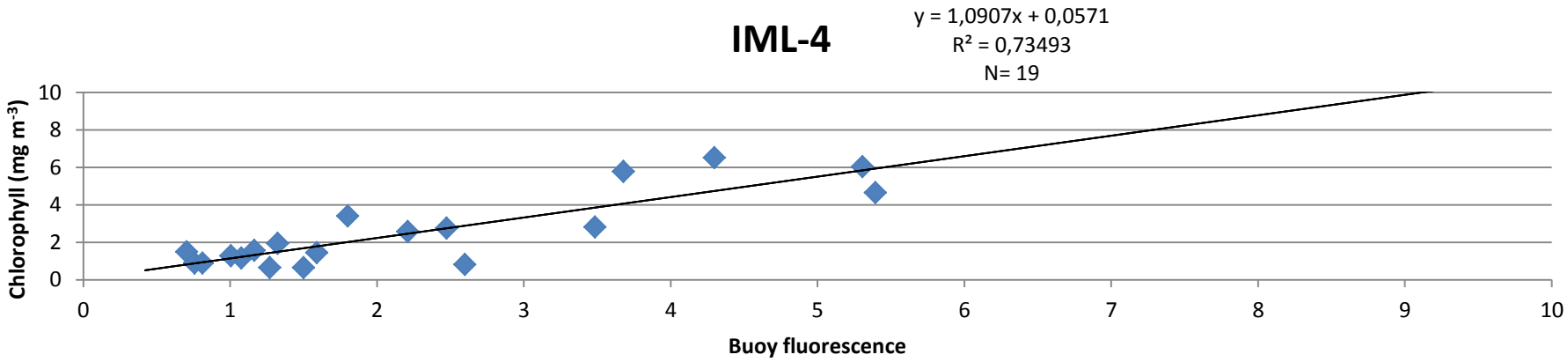
- Validate MERIS chlorophyll concentration products as part of the CoastColour project
- Work done in the St. Lawrence estuary (Acadia region, site 5)

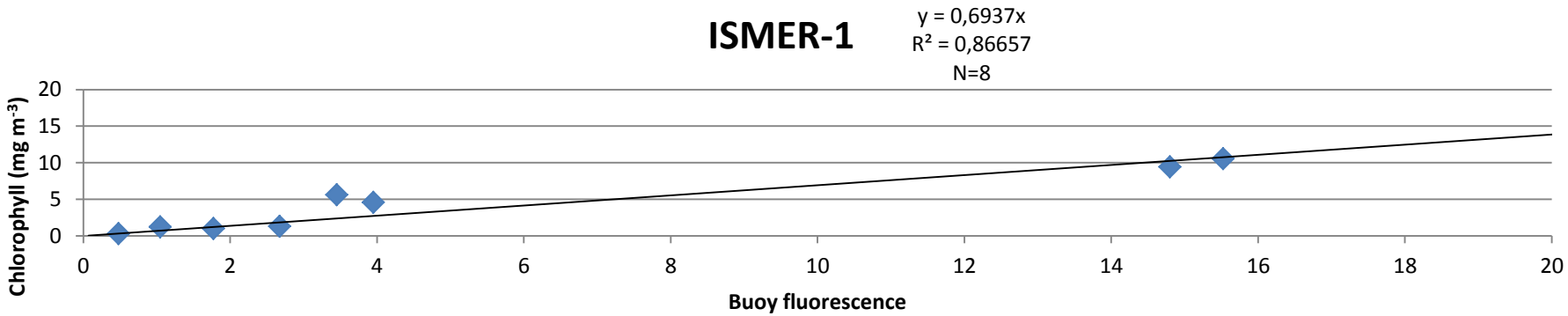
METHODOLOGY

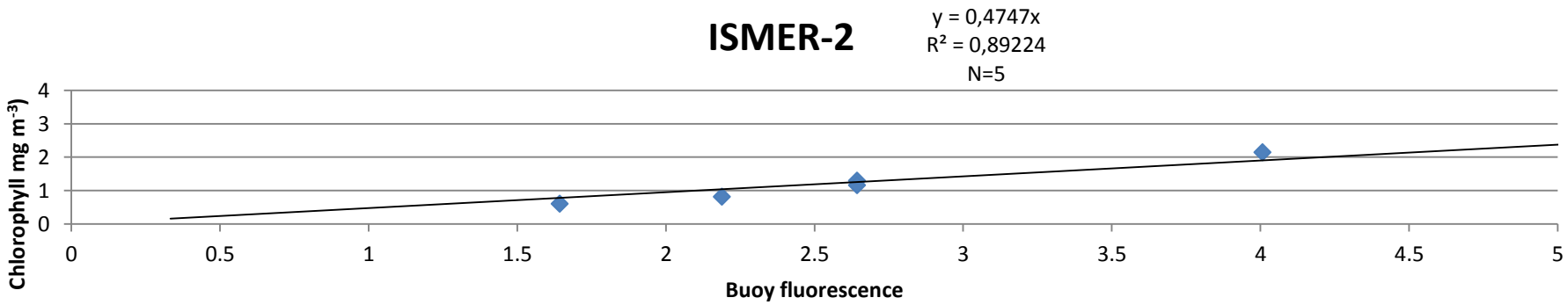
- Use of data from oceanographic buoys network
- Only one within 10 km of land (adjacency effect?)
- Chl fluorescence sensor
- Protected by bromine
- 15 min. sampling rate
- May-October
- Find matchups with 2006 MERIS level 2W dataset
- 89 images provided, 13 usable
  May: 2, July: 2, Sept: 6, Oct.: 2
- Check for cloud proximity
- Use Visat 4.9



FLUORESCENCE CALIBRATION

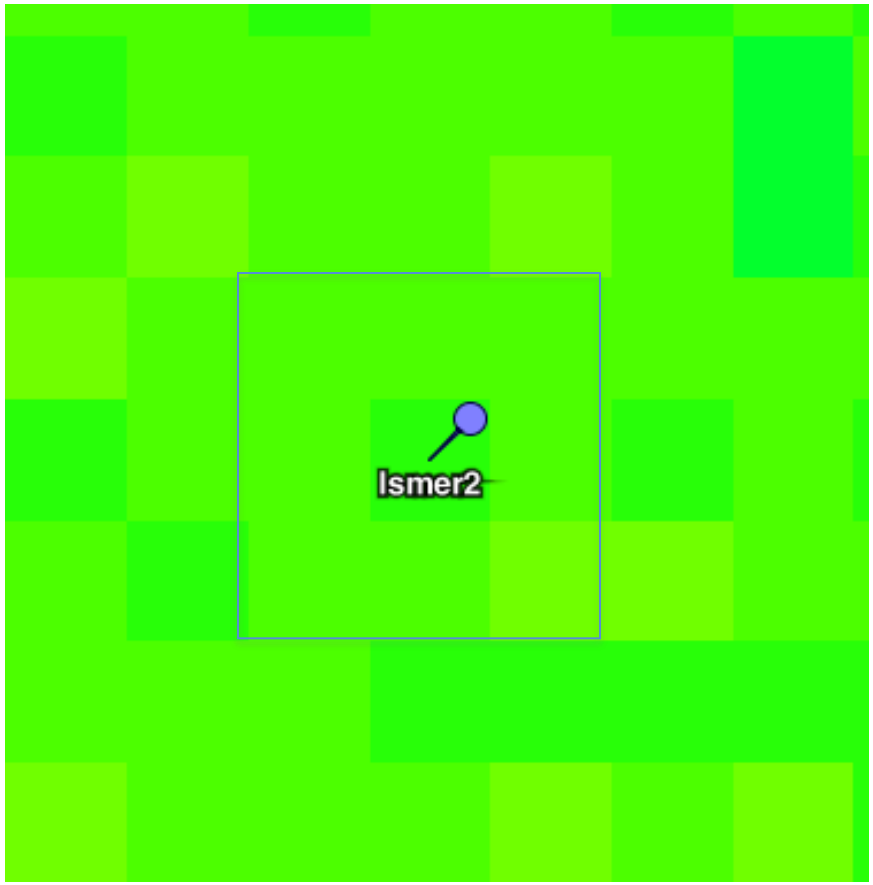


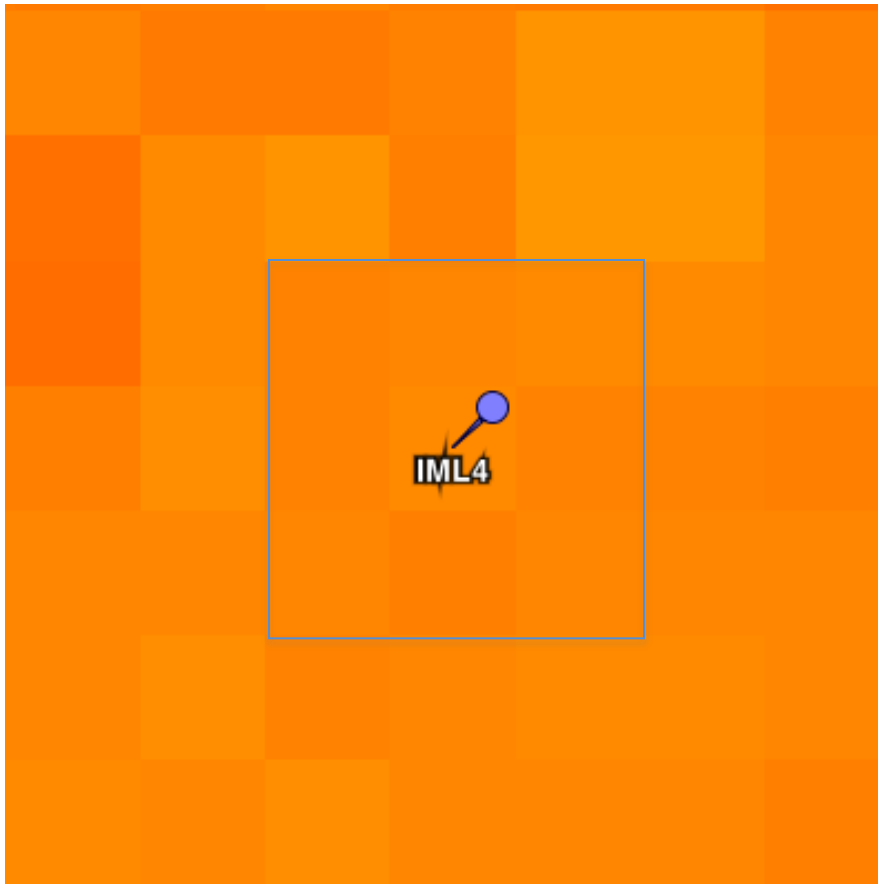




Satellite data extraction

- Mean of 3x3 matrix around buoy location
- No cloud close to buoy location





RESULTS

Chl a range [0,26-4,24]

LOCATION	APD (%)	Bias (%)	RMS (mg m^{-3})
ESTUARY (IML4) (n=6)	305	305	14
GASPÉ (Ismer1) (N=8)	436	419	7,25
GYRE (Ismer2)(N =10)	172	165	1,48
TOTAL (N=24)	293	285	8,21

Seasonal distribution

Season	APD (%)	Bias (%)	RMS (mg m^{-3})
Spring/summer (N=6)	141	117	15,13
Fall (N=18)	344	340	10,15

The search for a new regional algorithm

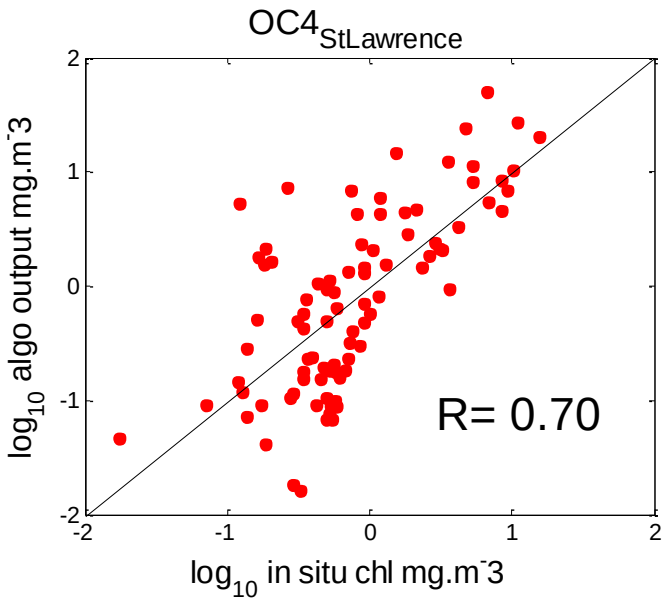
(Based on 1997-2001 cruises*)

- 90 SPMR profiles
- Coincident CDOM [0,04-0,90 m^{-1}], Chl_a [0,02-15,6 mg m^{-3}], SPM [0,19-8,92 g m^{-3}]measurements
- Coverage of both type I and II waters
- Empirical approach taken

* Larouche, Pierre (2000). “Results from the 2nd St. Lawrence Estuary and Gulf SeaWiFS Validation Cruise”, Sixth International Conference on remote Sensing for Marine and coastal Environments, Charleston, South Carolina, 1-3 May 2000.

OC4 adaptation

Adapted coefficients = [0.007, -4.79, 12.11, -36.09, 88.78]



APD = 218% vs 293% for L2W

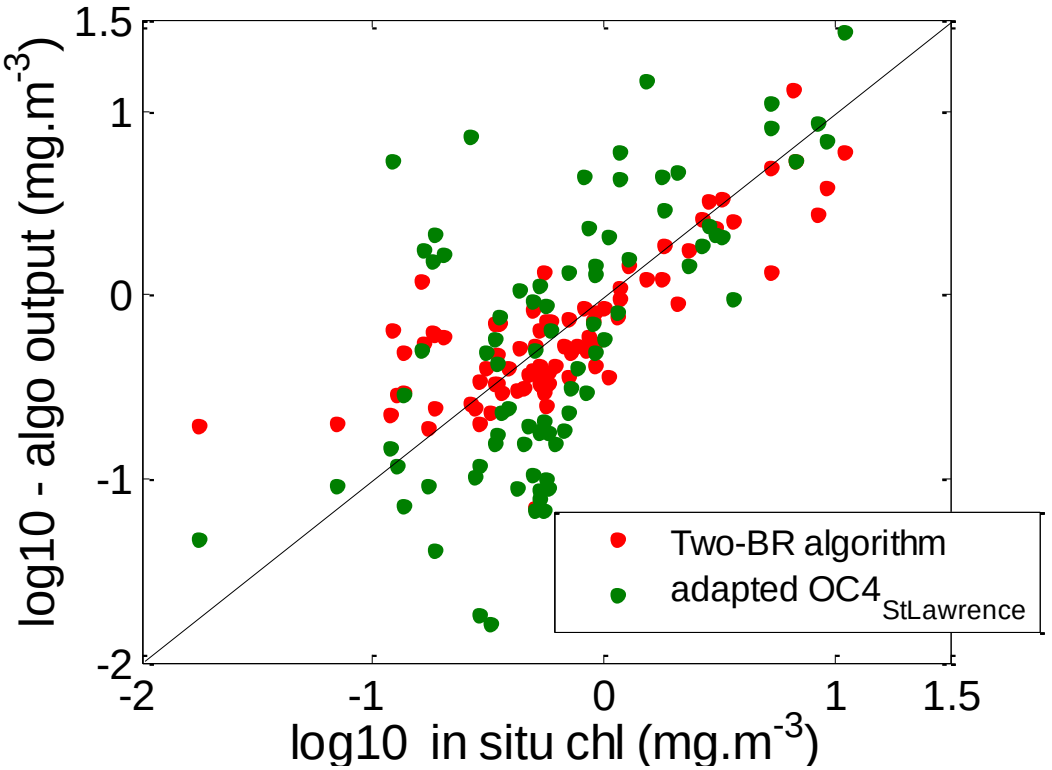
NEW ALGORITHM

- Tried other approaches to improve performance in Case II waters using empirical algorithms
- Tested hundreds of variations
- New algorithm decorelating the Chl-a and the CDOM signal using 2 band-ratios *

2BR CHL_a = 10**[1.839*(log10(R_{RS}412/RRS555))-(7.893*(log10(R_{RS}510/R_{RS}555)))+0.586]

*Yayla, M. , N.T. O'Neill, P. Larouche and S. Çizmeli, *CDOM signal competition with chl in the Estuary and Gulf of St. Lawrence : potential of multiple band-ratio alternatives* (In preparation).

Performances of adapted OC4 and 2BR algorithms on the development dataset



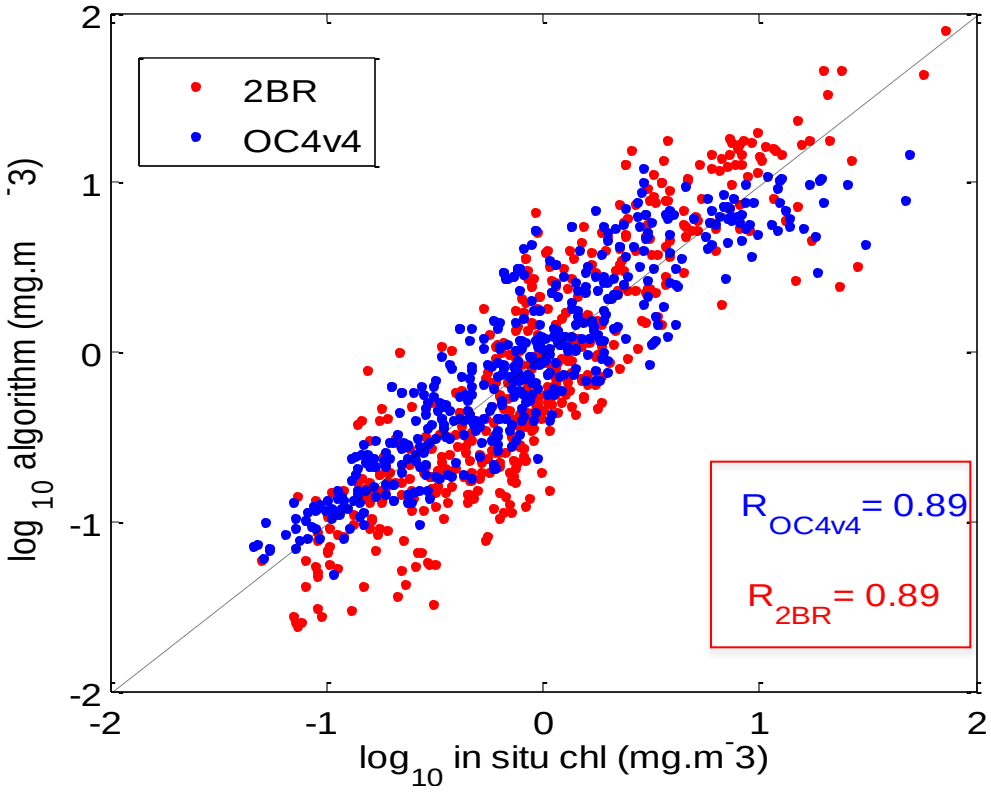
APD of 74% vs 218 for OC4SL

APPLICATION (VALIDATION) OF 2BR ALGORITHM ON MERIS-BUOY DATA MATCHUPS

LOCATION	2BR ERROR	MERIS L2W
ESTUARY	**147**	305
GASPÉ	**182**	435
GULF	**66**	172
TOTAL	**127**	293

APD (%)

GLOBAL VALIDATION OF 2BR ALGORITHM USING NOMAD DATASET



Validation subsample: Stations with complete chl (both fluorimetric and HPLC) , L_w and E_s (411, 443, 490, 510, 555nm) data. No other data filtering is applied (N=482).

OC4v4 : 55% vs 2BR: 68 %

CONCLUSION

- MERIS level 2W chl a products do not appear to be of good quality in the St. Lawrence estuary and Gulf
- This possibly result from the original NN training data set
- Even though errors are still high, an empirical algorithm based on 2 band-ratios appears to deliver better quality estimates of chl_a in this complex ecosystem
- More validation data will be added with time and MERIS product data availability
- Interesting to test 2BR with other datasets (CoastColour)

Acknowledgements

- Canadian Space Agency
- National Science and Engineering Research Council
- Dept. Fisheries and Oceans Canada
- ESA (CoastColour)