Report on IOCCG training course on

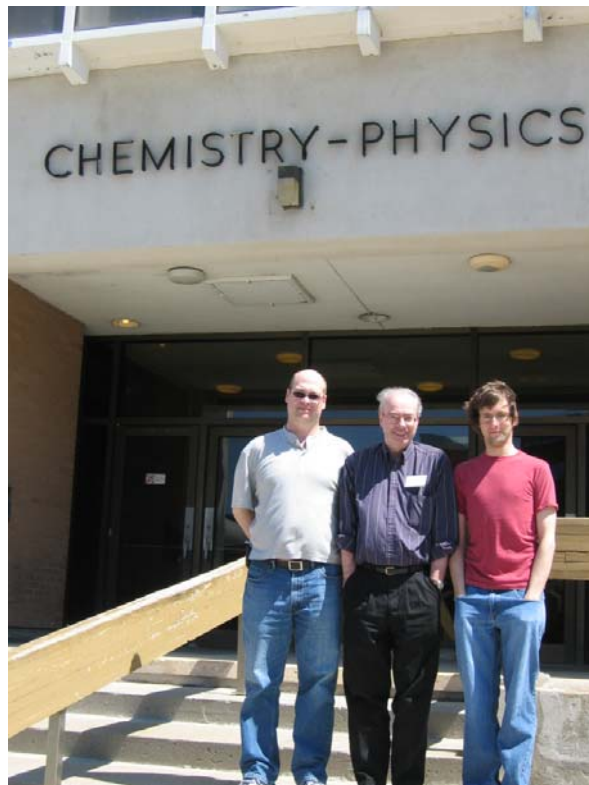**Analysis and Applications of Satellite-derived Ocean-Colour Data**

Memorial University, St. John's, Newfoundland, 7-11 May 2007

By Venetia Stuart

Introduction

The Canadian Space Agency funded an intensive (1-week) ocean-colour training course which was organized and coordinated by the International Ocean Colour Coordinating Group (IOCCG). CSA has been supporting the IOCCG under the Government-Related Initiatives Programs (GRIP) since 2004. CSA's main interest in ocean-colour research is to enable operational end-users to exploit the large amount of ocean-colour data available to support programs for fisheries management, ecosystem protection, coastal zone management, and climate change. IOCCG and POGO were also supporters of the course.

The training course was conducted in the computer lab of the department of Physics and Physical Oceanography at Memorial University. The computing facilities were excellent and we received outstanding support from the computing personnel including Brent Payne, Kevin Layman, Dave House and Greg Starkes, for which we are most grateful.

Computer consultants Brent Payne, Kevin Layman and Dave House (absent Greg Starkes)

A total of 19 students attended the course including 16 from across Canada and 3 overseas students (China, France and Portugal) - see Appendix I for list of course participants. The students had diverse backgrounds and expertise and included a core of M.Sc and Ph.D. students as well as graduate students and researchers wanting to gain more experience in the field of ocean colour. Several students received scholarships from the IOCCG to attend the course.

IOCCG training course participants - St. John's Newfoundland

Programme

The aim of the training course was to provide the participants with a basic understanding of the principles underlying remote-sensing techniques of ocean colour, plus the experience and confidence to implement such techniques. Accordingly, the course included a series of morning lectures presented by local and international experts (see list below), as well as afternoon hands-on practical sessions, co-ordinated by Dr. Emmanuel Devred (see Appendix II for course schedule). Lectures covered a range of topics from marine optics, phytoplankton pigments and calibration/validation to primary production, remote sensing of PFTs and statistical analysis. Many of the ocean-colour applications demonstrated were relevant to the waters off Newfoundland.

Teaching Staff

Emmanuel Devred (course coordinator) - Bedford Institute of Oceanography, Canada
Frédéric Mélin   - Joint Research Centre (EU), Italy
Tim Moore   - University of New Hampshire, USA
Trevor Platt   - Bedford Institute of Oceanography, NS, Canada
Shubha Sathyendranath   - POGO, NS, Canada
Marie-Hélène Forget   - Bedford Institute of Oceanography, NS,Canada
Venetia Stuart   - IOCCG Project Office, NS, Canada

Jim Helbig   - NW Atlantic Fisheries Centre, NL, Canada
Gary Borstad   - Borstad Associates, BC, Canada

During the afternoon practical session the students broke up into five separate groups, depending on their interests and previous experience. Each group gave a short presentation at the end of the week to demonstrate what they had learned. The quality of these presentations was excellent and clearly reflected the knowledge acquired and the enthusiasm and effort put in by the students.

Group 1 focussed on basic processing of ocean-colour data using SeaDAS - they carried out a number of satellite vs. *in situ* comparisons for their project. Carla Caverhill prepared the material for this group, but unfortunately she was unable to attend at the last minute. Group 2 set out to quantify the effects of atmospheric correction on remotely-sensed ocean colour data, and also compared satellite-derived nLw with field data (Bermuda, Adriatic) as well as validation against Aeronet data. Group 3 examined the inversion of *in situ* reflectance to retrieve marine-constituent IOPs, while Group 4 gained experience in the computation of primary production. Group 5 used the NOMAD dataset to develop a regional algorithm for the North Atlantic and compared the results statistically with the global OC4 algorithm. They concluded that the global OC4 algorithm tended to overestimate the chlorophyll concentration in the Gulf of St Lawrence and Scotian Shelf areas.

Course Evaluation

Students were given a course evaluation sheet to complete at the end of the course. The overall consensus was that the students learned a lot in a short space of time, the course was well run and also presented a great opportunity for participants to network with specialists in the field. Many students would have like an extra day or two to complete their projects, and several requested a follow-up course.

On the last evening, many of the students took part in a traditional Newfoundland "Screech-in" and became honorary Newfoundlanders after kissing a cod fish!

Emmanuel Devred kissing the cod fish

Conclusions

The IOCCG is meeting a real need by helping to build capacity in remote sensing of ocean-colour in Canada and elsewhere. The training course also provided a forum for future collaboration between students and scientists of the region. The large number of applications received (over two thirds of all applicants had to be turned away) indicate the real need for this type of training for scientists from Canada and other countries.

The success of the training course can be attributed to the dedicated team of lecturers, the excellent computing facilities and the interest and motivation displayed by the students. We thank the Canadian Space Agency for providing the funds to carry out the training course, as well as the staff at Memorial University for their outstanding support.

Appendix I

IOCCG Training Course Participants
7-11 May 2007, St. John's, Newfoundland, Canada

Name	Country	Email
Anderson, M. Robin	Newfoundland, Canada	andersonro@dfo-mpo.gc.ca
Ben Mustapha, Selima	Quebec, Canada	selima.ben.mustapha@usherbrooke.ca
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Appendix II

Lecture Schedule –IOCCG Training Course (7-11 May 2007, Newfoundland)

Time	Monday 7 May	Tuesday 8 May	Wednesday 9 May	Thursday 10 May	Friday11 May
09h00 - 09h45	▪ 09h00 - Welcome **Brad de Young, Jim Helbig** ▪ 09h15 – Week outline **Emmanuel Devred** ▪ 09h30 – Student introductions, ▪ logistics	Atmospheric correction **Frédéric Mélin**	Calibration, validation **Frédéric Mélin**	Introduction to radiative transfer and OC algorithms **Shubha Sathyendranath**	Remote sensing of PFTs **Emmanuel Devred**
09h45 - 10h30	Ocean colour resources in Canada **Venetia Stuart**	Phytoplankton pigments **Venetia Stuart**	Modelling primary production (I) **Trevor Platt**	Online analysis tools for Canadian waters **Gary Borstad**	Statistical analysis on OC4 data **Tim Moore**
	Break (30 min)	Break (15 min)	Break (15 min)	Break (15 min)	Break (15 min)
10h45 - 11h30	Introduction to marine optics (I) **Emmanuel Devred**	Introduction to marine optics (II) **Shubha Sathyendranath**	Primary production and community structure **Marie-Hélène Forget**	Ecological indicators **Trevor Platt**	Student project preparation
11h30 - 12h15	Ocean colour satellites and sensors **Frédéric Mélin**	Variability in phytoplankton optical properties **Shubha Sathyendranath**	Modelling primary production (II) **Trevor Platt**	Ecosystem identification **Emmanuel Devred**	
12h15 - 13h30	Lunch	Lunch	Lunch	Lunch	Lunch

Afternoon Practical Sessions

	Monday 7 May	Tuesday 8 May	Wednesday 9 May	Thursday 10 May	Friday 11 May
13h30-15h15	• Introduction to SeaDAS - **Emmanuel Devred** • Processing L1 to L2 data - **Frédéric Mélin** • OC applications -**Emmanuel Devred**	• Advanced processing / Giovanni - **Tim Moore** • Primary Production – **Trevor Platt, Marie-Hélène Forget**	Group Projects	Group Projects	Student Group Presentations (~30 min each)
15 min	**Break**	**Break**	**Break**	**Break**	**Break**
15h30 – 17h30	Group Projects	Group Projects	Group Projects	Group Projects	Group Presentations

Group Projects

Students were assigned to one of the following five groups to work on mini- projects during the afternoon practical sessions. Each group was expected to give a short presentation at the end of the week (Friday afternoon).

Group 1: Basic processing of ocean-colour data (Group leader – Jim Helbig/ Heidi Maass): Time series and *in situ* comparisons.
Students: Robin Anderson, Melissa Rohde, Marie Lionard, Suzanne Roy

Group 2: Atmospheric correction (Group leader - Frédéric Mélin): Impact of atmospheric correction procedure on chlorophyll concentration retrieval.
Students: Jennifer O'Neill, Daniel Ricard, Sélima Ben Mustapha, Pedro Pina

Group 3: Ocean colour applications/ regional algorithms (Group leader - Emmanuel Devred): Development of local algorithms to retrieve Chl concentration.
Students: Joannie Ferland, Lucile Duforet, Yongsheng Wu, Heidi Maass

Group 4: Primary production (Group leaders – Trevor Platt, Marie-Hélène Forget): Computation of primary production: regional example.
Students: Gary Maillet, Bai Yan, Liuming Hu

Group 5: Advanced processing of ocean colour data (Group leader - Tim Moore): Impact of different algorithms on Chl retrieval, use of LOCUS etc.
Students: Alexander Smith, Darryl Williams, Jeff Higdon, Gary L. Bugden