

IOCCC Training Course on Inversion Methods in Ocean Colour Remote Sensing

Summary

Time and Venue

The trainings course was held at the "Zündholzfabrik" in Lauenburg/Elbe from Aug. 10-Aug. 14 2009. Lauenburg is located about 60 km east of Hamburg, northern Germany.

Organisation

It was organized by the GKSS Research Center, Institute for Coastal Research.

Organizer: Dr. Roland Doerffer, Secretariat: Doris Schnalke

Lecturers:

Dr. Stewart Bernard, CSIR - NRE, South Africa

Dr. Roland Doerffer, GKSS, Germany

Dr. Mark Dowell, JRC, Italy

Dr. Harald Krawczyk, DLR, Germany

Prof. Zhongping Lee, Mississippi State University, USA

Sponsors:

GKSS Research Centre

JRC Joint Research Centre of the European Union

Gesellschaft zur Förderung des GKSS Forschungszentrums

Participants:

27 Participants from 18 countries including:

Belgium, Brazil, Bulgaria, China, France, Germany, India, Iran, Korea, Kuwait, Portugal, Romania, Russia, South Africa, Spain, Ukraine, UK, USA

Objectives of the Course

The key issue in ocean colour remote sensing is the determination of ocean properties including the concentrations of particulate and dissolved matter and phytoplankton from top of atmosphere reflectance spectra. In optically complex waters, such as the water of most coastal zones, a large number of independent variables influence the water leaving radiance. This large number has to be reduced to a few (partly proxy) components, which can be determined from the reflectance spectrum. Since we try to determine independent (i.e. water constituents, IOPs) from dependent variables (i.e. reflectances in a number of spectral bands) we need special techniques to solve this inversion problem. Furthermore, this type of inversion implies issues, such as uncertainties, ambiguities, out of scope conditions etc.

The objectives of the course was to learn various inversion techniques, their potential and

limitations as well as the basics about forward modelling and the information content of reflectance spectra. Due to time constraints, the course did not include the important topic of atmospheric correction.

For the exercises various data sets derived from SeaBASS and NOMAD including the IOCGG test data set as described in IOCGG Report No. 5 were used. The software used included Excel spreadsheet, Scilab with optimization and artificial neural network packages, and the BEAM-VISAT image processing program. All programs were pre-prepared by the lecturers so that the trainees had to understand and then only to modify the programs according to different tasks.

Topics of the Course (lectures and exercises)

- Bio-optical models
- Forward modelling of reflectance spectra
- Information content of reflectance spectra, principal component analysis
- Uncertainties in data, ambiguities of reflectance spectra
- Data analysis and analytical inversion
- Inversion via algebraic solutions
- Inversion using optimization techniques
- Inversion based on principle component analysis
- Inversion by artificial neural networks
- Determination of out of scope conditions, flagging
- Classification methods
- Reducing variance in model parametrisation
- Influence of in-elastic scattering on inversion algorithms
- Visit of the GKSS Research Centre with short lectures about the coastal research program, afterwards cruise on the Elbe river