CSI (Colour Scene Investigation): from operations to applications

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Outline

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• The role of ocean colour in operational systems

• Ocean colour data assimilation

• End-user requirements

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What is the value of assimilating ocean colour in an operational system like this?
Emergent ocean colour applications

Research Push

Biological Data Assimilation of Ocean Colour in an Operational Framework

GlobColour

ESA CCI OC

1st Jan 2003

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-2  -1.5  -1  -0.5  0  0.5  log10(mg/m³)
Impact of data assimilation

**log\textsubscript{10}(chlorophyll) error**  
North Atlantic

Global pCO\textsubscript{2} RMS error versus in situ obs

![Graph showing the impact of data assimilation](graph.png)
Air-sea CO$_2$ flux (delayed mode assimilation)

Tropical Pacific mean

Monthly mean CO2 FLX - Tropical Pacific - 5.02159

No assimilation
GlobColour assimilation
Takahashi climatology

Multivariate ENSO index sourced from: http://www.esrl.noaa.gov/psd/enso/mei/
/WGOOF/ HOOKING UP DATA USERS WITH DATA

ICES Working Group on Operational Oceanographic Products for Fisheries and the Environment.

ICES Insight Sept 2010.
Responses from fisheries managers (commercially exploited species and ecosystems)

Oceanographic data products requested by the ICES community of marine researchers, in order of importance.

- Temperature
- Transport & currents
- Salinity
- Primary Production
- Zooplankton
- Mesoscale features
  - Chlorophyll
  - Nutrients
  - Oxygen
  - Ichthyoplankton transport
- Timing of algal blooms
- Light & suspended matter
- Turbulence
- CO₂/pH
- Pollution dispersion
- Ice cover
- Wave height
- Bed stress

0%  20%  40%  60%  80%

Percentage of users requesting oceanographic products

Delivery of data products
- Data access. Data should be free and operationally available to all. Registration prior to data access should be avoided.
- Time scale. Two-thirds of users highlighted monthly average data as important. All other time-scales were requested by less than 30% of users.
- Data type. More than 90% of ICES users requested access to historical data. This forms a stark contrast to the move in operational oceanography to develop forecast, nowcast, and real-time systems.
- Data updates. Regular on an annual basis: quarterly and monthly updates were also requested by a large proportion of users.
- Data format. An overwhelming majority requested that data values be available for download in ASCII format. Graphical outputs were seen as a good way to characterize the data, but the users wanted access to data that they could manipulate.
- Meta data. Users want a description of the methodology accompanying the data.

Berx et al. (2010)

http://groupsites.ices.dk/sites/wgoofe
Ocean Colour Requirements?

(Modellers: chl, PFTs, SPM, IOPs, K_{d_{490}}, CARBON)

(WGOOFE users: PP, chl, phenology, SPM)

Uninterrupted, long-term provision of data in a timely manner in order to understand and differentiate natural variability from climate trends.

Validation against *in situ* data and across biogeochemical regions. Large biases in the merged product corrected by *in situ* data

Sustainability in product delivery is key as significant investment is required to use the data.
Opportunities for improvement

• Research *push versus user pull*.

• *Lack* the truly operational *exploitation* by “real” as opposed to “research” users: a potential problem, which may jeopardise future missions.

• *Value* of ocean colour data has not been fully capitalised on, despite its potential:
  • Data assimilation, model assessment, initialisation and development.
  • Monitoring (e.g. OSE) and future-proofing climate services and predictions.

• Ocean colour community has to pause and reflect:
  • How is the community is today? How should it be in the future?
  • Lessons to be learnt from the GHRSSST model?
Thank you!
Research Push vs. User Pull (daily, seasonal, decadal)

Observed and modeled bio-optical, bioluminescent, and physical properties during a coastal upwelling event in Monterey Bay, California.

Igor Shulman, Mark A. Moline, Bradley Penta, Stephanie Anderson, Matthew Oliver, and Steven H. D. Haddock

JGR, VOL.116, 2011

ESM models - Projecting the future

European GMES Marine Core Service
www.myocean.eu.org