Report of the IOCCG Essential Climate Variable (ECV) Task Team

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Charge to the Committee: How to produce basin to global scale ECV/CDR time series of ocean color products (specifically L_w and derived products) for climate-related studies.

Climate Data Record (CDR) is a time series of measurements of sufficient length, consistency, and continuity to determine climate variability and change.   From U.S. National Academy of Sciences report.

ECV is the "measurement" (see above), but ECV and CDR seem to be used interchangeably.

International Efforts to Produce Time Series

NASA-GSFC is producing L_w and Chl time series involving multiple sensors (SeaWiFS, Aqua, Terra and MERIS).

MEaSUREs (NASA-funded) uses the GSM model to calculate inherent optical properties (IOPs) from SeaWiFS, Aqua and MERIS data.

GLOBColour is also using GCM model to produce a time series of merged data from SeaWiFS, Aqua and MERIS data at 4.6km resolution.

ESA's CCI program is producing a time series based on SeaWiFS, Aqua and MERIS data (F. Melin's talk).

Uncertainties

CCI project uses Longhurst approach to partition the global ocean into bio-optical provinces.

- Uses validation data assigned to each province to calculate errors. Bias (mean absolute relative difference) depends on province.
- POLYMER atmospheric correction algorithm for MERIS – maybe for other sensors in the future.

MEaSUREs and GlobColour determine uncertainty at each pixel from the covariance matrix used in the fitting technique. They test and validate these uncertainty estimates using *in situ* data from the NOMAD data set.

Data Merging Discussion

Are there advantages for merging data from multiple sensors versus concatenating data sets to produce long time series? Yes, for daily. Some argue not to merge for ECVs (which average over longer periods e.g. monthly).

Some argue that merged products convolve algorithm and instrument differences and sampling biases; understanding the differences will be challenging. Concatenation may be preferred for the multi-mission record.

General agreement on an approach that would incorporate weighting based on uncertainties while merging.

CEOS's target for L_w and **Chl** stability are 0.5% **and 3% per decade**, respectively.

Chl trends in 5 global, biogeochemical models run for 1998-2012 and 1998-2027 show that mean trends in **Chl** are of the order ~ **0.1-0.5% per decade**.
     Thus, reaching the CEOS Chl stability target (we're not there yet!) may not be adequate to resolve decadal trends in Chl.

Results also show monthly resolution is insufficient to characterize seasonal cycle of phytoplankton, and also insufficient to detect long-term trends in phytoplankton phenology, and its change.

Monthly resolution cannot resolve bloom initiation or duration.

GHRSST science team meets once per year and consists of those who represent agency-funded projects involved in producing products from SST measurements (satellite and *in situ*).

Has adopted a "common product assessment approach", not a common processing approach.

To be certified as a CDR, GHRSST has defined a number of characteristics for each record. CDRs are L2P data products which include uncertainties by scan line.

GHRSST has an accuracy statistic objective over a certain spatial scale. Should OCR ECVs do something smilar, e.g for the Longhurst provice scale?

Next Steps

Common scheme to map Longhurst provinces onto larger areas such oligo, meso and eutrophic waters.

Groups will all compare Globcolour/MEASURES, CCI and NASA products. NASA will make all the data available to participants. Compare products from same sensor produced by different methods, as well as compare products from different sensors produced using the same methodology.

Standard metrics for comparisons include correlation (two units: reflectance and as well as mean difference) and Taylor diagrams to compare trend variability.

Use CCI method for band shift.