# Priorities for OCR-VC Implementation

M.Dowell (EC/JRC), P. Bontempi (NASA), H. Murakami (JAXA)

Contributions from IOCCG (V. Stuart & D. Antoine - Chair)

# Accomplishments in Q1 2010

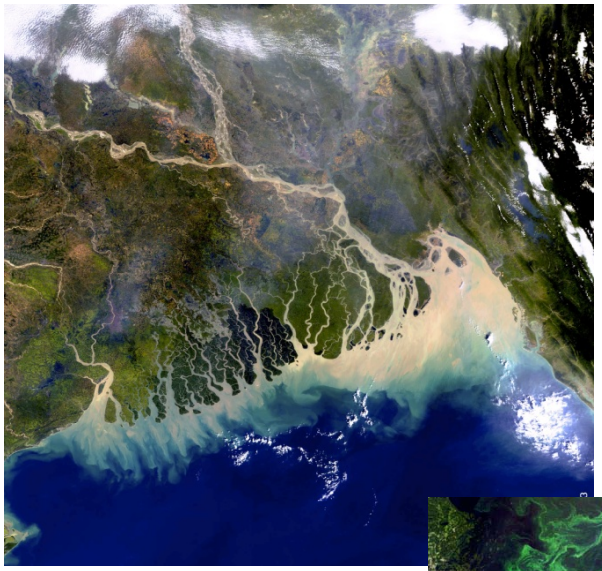
1. 1 Day OCR-VC discussion during annual IOCCG meeting (January 2010) – almost all adhering Agencies present.
   - Prioritization discussion (see later)
2. OCR-VC provided edits to GCOSIP10 text on OCR ECV
3. OCR-VC participated to Climate formulation group discussion (February 2010)
   - OCR-VC available to undertake a pilot study for ECV implementation

# Priorities Identified

1. Inter-agency OCR ECV implementation strategy and subsequent execution of this strategy
2. Concerted inter-agency effort on activities relating to sensor inter-comparison and uncertainty assessment of datasets required for ECV generation.

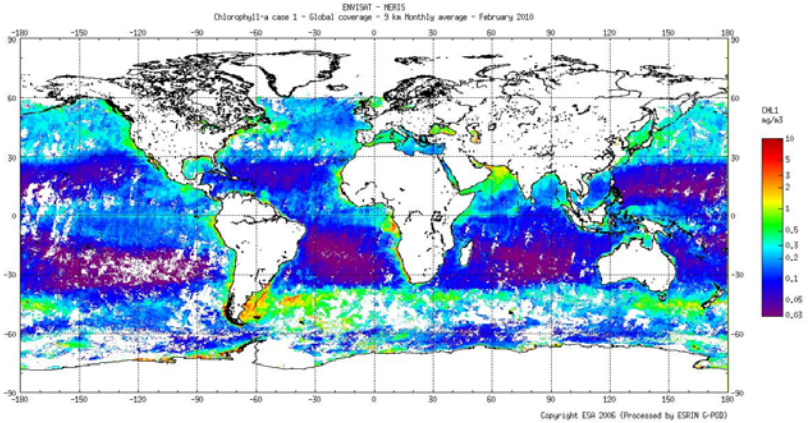
# Additional priorities

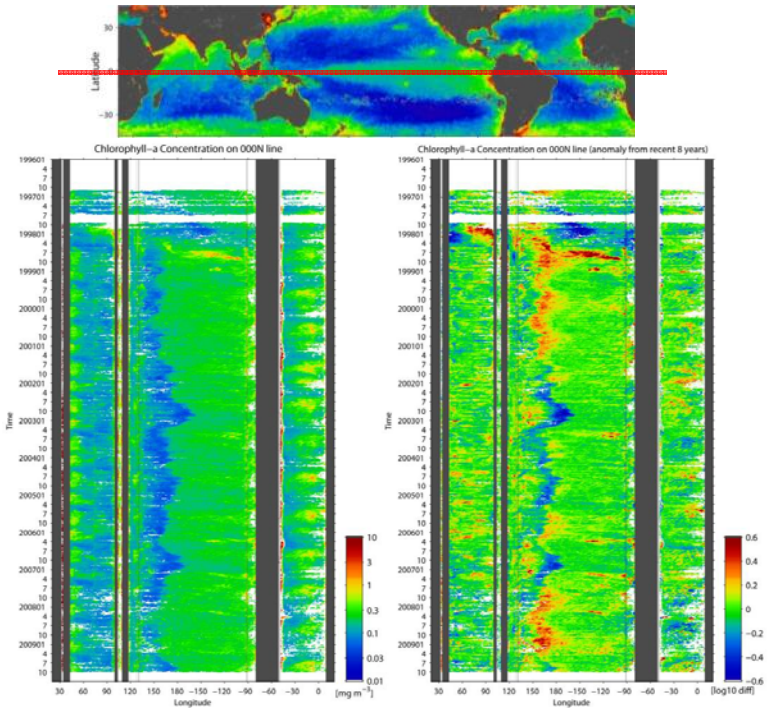
- At January meeting it was recognised that other activities in OCR-VC Implementation
  - Example: better coordination of plans for future geostationary mission across agencies
- However, first priorities given to topics that require multi-agency efforts immediately



# OCR ECV Implementation

- Monitor the accuracy of the the individual sensors
- Identify the difference between (the nLws) the currently orbiting sensors
- Monitoring the continued stability of the OCR ECV time-series.
- There has been various prototype (fix-term research projects) on data merging (e.g. REASoN -> MEASURES/Giovanni, GlobColour).
- The are also projects which are about to start which specifically address the GCOS requirement i.e. the ESA Climate change initiative
- Resources required:
  - International interagency science team to monitor accuracy or ECV
  - Linked to IOCCG



# OCR ECV – preliminary gap analysis

# [Handout of table]

| | | | Global Spatial Resolution (km) target (breakthrough, min.) | Repetitivity Cycle (d) target (breakthrough, min.) | Accuracy (%) target (breakthrough, min.) | Accuracy (%) *see footnote | Delay of Availability (d) target (breakthrough, min.) | Source of accuracy data | Notes on accuracy data |
|---|---|---|---|---|---|---|---|---|---|
| **GCOS Requirements (incl. CEOS response** | | | **1 (5,100)** | **1 (1.5, 3)** | **5 (8.5, 25)** | | **1 (1.5, 3)** | | |
| **Sensor** | **Agency** | **Lifetime** | **Spatial Resolution (km)** | **Repetitivity Cycle (d)** | **Relative % Diff.** | **Absolute % diff.** | **Delay of Availability (d)** | **Source** | **Notes** |
| **CZCS** | NASA | 1978–1986 | 0.825 km at nadir | No global coverage | | Lwn(443) 12.8%<br>Lwn(520) 19.9%<br>Lwn(550) 23.9% | | http://seabass.gsfc.n | From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data |
| **MOS** | DLR | 1996–2004 | 0.5 km at nadir | No global coverage | | | | | |
| **OCTS** | JAXA | 1996–1997 | 4 km | 3 d | | Lwn(443) 140.8%<br>Lwn(490) 82.0%<br>Lwn(520) 162.1%<br>Lwn(565) 108.1% | | http://seabass.gsfc.n | From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data |
| **SeaWiFS** | NASA | 1997–Date | 4 km/9 km | 2 d | *ρw*(443) -0.3%<br>*ρw*(490) -3.2%<br>*ρw*(510) -4.8%<br>*ρw*(550) -9.9% | Lwn(443) 20.1%<br>Lwn(490) 16.5%<br>Lwn(510) 15.2%<br>Lwn(555) 17.6% | 6 h – 14 d<br>(depending on licence type) | http://seabass.gsfc.n | **Abs. % Lwn:** From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data<br>Rel. % ***ρw*:** From Antoine - http://www.obs-vlfr.fr/Boussole/html/publications/pubs/Antoine-etal-JGR2008-2007JC004472.pdf |
| **POLDER** | CNES | 1996–1997 | 6 km | 1 d (quasi global) | | | | | |
| **MODIS-TERRA** | NASA | 1999–Date | 4 km/9 km | 1–2 d | | Lwn(443) 20.9%<br>Lwn(488) 15.8%<br>Lwn(531) 15.0%<br>Lwn(551) 14.4% | | http://seabass.gsfc.n | **Version: 0 Ocean Color Processing - VERY PRELIMINARY RESULTS!**<br>From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data |
| **OCM** | ISRO | 1999–Date | 4 km | 2 d | | | | http://drs.nio.org/drs/bitstream/2264/543/1/Proc_Spie_6404_42.pdf | |
| **OSMI** | KARI | 1999–2008 | 0.85 km at nadir | 2–3 d | | | | | |
| **MERIS** | ESA | 2002–Date | 4.6 km/9 km | 3 d | *ρw*(443) 31.6%<br>*ρw*(490) 15.8%<br>*ρw*(510) 21.5%<br>*ρw*(560) 21.3% | *ρw*(442.5) 30%<br>*ρw*(490) 20%<br>*ρw*(510) 21%<br>*ρw*(560) 23% | 1d | http://dup.esrin.esa.i | **Abs.% *ρw*:** 6 years of Case 1 matchups – CoastColour Meeting 19–20 March 2009 (M. Bouvet ESA)<br>**Rel % *ρw*:** From Antoine– http://www.obs-vlfr.fr/Boussole/html/publications/pubs/Antoine-etal-JGR2008-2007JC004472.pdf |
| **MODIS-AQUA** | NASA | 2002–Date | 4 km/9 km | 1–2 d | *ρw*(443) -1.5%<br>*ρw*(488) -4.7%<br>*ρw*(551) -12.4% | Lwn(443) 24.3%<br>Lwn(488) 20.2%<br>Lwn(531) 15.5%<br>Lwn(551) 15.5% | NRT Stream 6 h<br>Refined Products 1–3 d | http://seabass.gsfc.n | **Abs.%: Lwn:** From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data<br>**Rel % *ρw*:** From Antoine– http://www.obs-vlfr.fr/Boussole/html/publications/pubs/Antoine-etal-JGR2008-2007JC004472.pdf |
| **COCTS (HY-1A)** | CNSA | 2002–2004 | 1.1 km | 7 d | | | | | |
| **GLI** | JAXA | 2003–2003 | 9 km (L3) / 1 km (L2) | 2-3 d | | Lwn(380) 16% Max<br>Lwn(443) 18% Max<br>Lwn(490) 16% Max<br>Lwn(520) 19% Max<br>Lwn(565) 30% Max | NRT Stream 4 h<br>Refined Products 1-7 d | MOBY, PRR, TriOS, SIMBAD-A incl. CalCOFI..<br>(Not public open but some are distributed from data-sources) | **Median of Abs.%: Lwn**: From Murakami et. al., 2006, Validation of ADEOS-II GLI Ocean Color Products Using In-Situ Observations, http://www.terrapub.co.jp/journals/JO/pdf/6203/62030373.pdf |
| **POLDER-2** | CNES | 2003–2003 | 6 km | 1 d (quasi global) | | | | | |
| **Parasol** | CNES | 2004–present | 6 km | 1 d | | | | | |
| **COCTS (HY-1B)** | CNSA | 2007–Date | 1.1 km | 7 d | | | | | |
| **OCM-2** | ISRO | 2009–Date | 4 km | 2 d | | | | | |
| **GOCI** | KARI | to be launched | 0.5 km not global | hourly | | | | | |
| **VIIRS (NPP)** | NOOA/NASA | to be launched | 0.74 | 1 d | | | | | |
| **HY-1 C,D** | CNSA | to be launched | ? | ? | | | | | |
| **OCLI (Sent 3A)** | ESA | to be launched | 0.26 | 2 d | | | | | |
| **VIIRS (NPOESS** | NOOA/NASA | to be launched | 0.74 | 1 d | | | | | |
| **SGLI** | JAXA | to be launched | | | | | | | |

**** Ocean colour radiances are used to produce a wide range of products e.g. chl, PAR, Kd, AOT, TSM, POC, primary production etc.***

# OCR ECV – preliminary gap analysis

# [Handout of table]

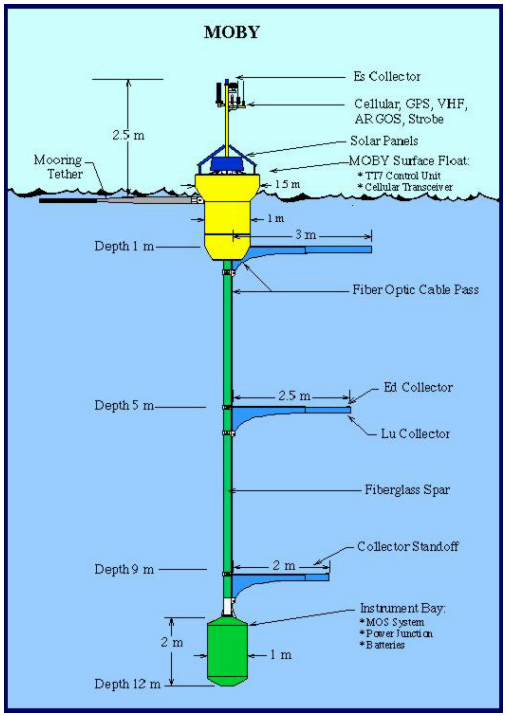
| | | | Global Spatial Resolution (km) | Repetitivity Cycle (d) | Accuracy (%) | Accuracy (%) | Delay of Availability (d) | Source of accuracy data | Notes on accuracy data |
|---|---|---|---|---|---|---|---|---|---|
| | | | target (breakthrough, min.) | target (breakthrough, min.) | target (breakthrough, min.) | *see footnote | target (breakthrough, min.) | | |
| **GCOS Requirements (incl. CEOS response** | | | 1 (5,100) | 1 (1.5, 3) | 5 (8.5, 25) | 5 (8.5, 25) | 1 (1.5, 3) | | |
| **Sensor** | **Agency** | **Lifetime** | **Spatial Resolution (km)** | **Repetitivity Cycle (d)** | **Absolute % diff.** | **Relative % Diff.** | **Delay of Availability (d)** | **Source** | **Notes** |
| **CZCS** | NASA | 1978–1986 | 0.825 km at nadir | No global coverage | Lwn(443) 12.8%<br>Lwn(520) 19.9%<br>Lwn(550) 23.9% | | | http://seabass.gsfc.nasa.gov/seabasscgi/validation.cgi | From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data |
| **MOS** | DLR | 1996–2004 | 0.5 km at nadir | No global coverage | | | | | |
| **OCTS** | JAXA | 1996–1997 | 4 km | 3 d | Lwn(443) 140.8%<br>Lwn(490) 82.0%<br>Lwn(520) 162.1%<br>Lwn(565) 108.1% | | | http://seabass.gsfc.nasa.gov/seabasscgi/validation.cgi | From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data |
| **SeaWiFS** | NASA | 1997–Date | 4 km/9 km | 2 d | Lwn(443) 20.1%<br>Lwn(490) 16.5%<br>Lwn(510) 15.2%<br>Lwn(555) 17.6% | *pw*(443) -0.3%<br>*pw*(490) -3.2%<br>*pw*(510) -4.8%<br>*pw*(550) -9.9% | 6 h – 14 d<br>(depending on licence type) | http://seabass.gsfc.nasa.gov/seabasscgi/validation.cgi | **Abs. % Lwn:** From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data<br>Rel. % ***pw*:** From Antoine - http://www.obs-vlfr.fr/Boussole/html/publications/pubs/Antoine-etal-JGR2008-2007JC004472.pdf |
| **POLDER** | CNES | 1996–1997 | 6 km | 1 d (quasi global) | | | | | |
| **MODIS-TERRA** | NASA | 1999–Date | 4 km/9 km | 1–2 d | Lwn(443) 20.9%<br>Lwn(488) 15.8%<br>Lwn(531) 15.0%<br>Lwn(551) 14.4% | | | http://seabass.gsfc.nasa.gov/seabasscgi/validation.cgi | **Version: 0 Ocean Color Processing - VERY PRELIMINARY RESULTS!**<br>From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data |
| **OCM** | ISRO | 1999–Date | 4 km | 2 d | | | | http://drs.nio.org/drs/bitstream/2264/543/1/Proc_Spie_6404_42.pdf | |
| **OSMI** | KARI | 1999–2008 | 0.85 km at nadir | 2–3 d | | | | | |
| **MERIS** | ESA | 2002–Date | 4.6 km/9 km | 3 d | *pw*(442.5) 30%<br>*pw*(490) 20%<br>*pw*(510) 21%<br>*pw*(560) 23% | *pw*(443) 31.6%<br>*pw*(490) 15.8%<br>*pw*(510) 21.5%<br>*pw*(560) 21.3% | 1d | http://dup.esrin.esa.int/files/news/CoastColour_Bouvet.pdf | **Abs.% *pw*:** 6 years of Case 1 matchups – CoastColour Meeting 19–20 March 2009 (M. Bouvet ESA)<br>**Rel % *pw*:** From Antoine– http://www.obs-vlfr.fr/Boussole/html/publications/pubs/Antoine-etal-JGR2008-2007JC004472.pdf |
| **MODIS-AQUA** | NASA | 2002–Date | 4 km/9 km | 1–2 d | Lwn(443) 24.3%<br>Lwn(488) 20.2%<br>Lwn(531) 15.5%<br>Lwn(551) 15.5% | *pw*(443) -1.5%<br>*pw*(488) -4.7%<br>*pw*(551) -12.4% | NRT Stream 6 h<br>Refined Products 1–3 d | http://seabass.gsfc.nasa.gov/seabasscgi/validation.cgi | **Abs.%: Lwn:** From SeaBASS analysis – Absolute % diff. Satellite vs *in situ* data<br>**Rel % *pw*:** From Antoine– http://www.obs-vlfr.fr/Boussole/html/publications/pubs/Antoine-etal-JGR2008-2007JC004472.pdf |
| **COCTS (HY-1A)** | CNSA | 2002–2004 | 1.1 km | 7 d | | | | | |
| **GLI** | JAXA | 2003–2003 | 9 km (L3) / 1 km (L2) | 2-3 d | Lwn(380) 16% Max<br>Lwn(443) 18% Max<br>Lwn(490) 16% Max<br>Lwn(520) 19% Max<br>Lwn(565) 30% Max | | NRT Stream 4 h<br>Refined Products 1-7 d | MOBY, PRR, TriOS, SIMBAD-A incl. CalCOFI..<br>(Not public open but some are distributed from data-sources) | **Median of Abs.%: Lwn**: From Murakami et. al., 2006, Validation of ADEOS-II GLI Ocean Color Products Using In-Situ Observations, http://www.terrapub.co.jp/journals/JO/pdf/6203/62030373.pdf |
| **POLDER-2** | CNES | 2003–2003 | 6 km | 1 d (quasi global) | | | | | |
| **Parasol** | CNES | 2004–present | 6 km | 1 d | | | | | |
| **COCTS (HY-1B)** | CNSA | 2007–Date | 1.1 km | 7 d | | | | | |
| **OCM-2** | ISRO | 2009–Date | 4 km | 2 d | | | | | |
| **GOCI** | KARI | to be launched | 0.5 km not global | hourly | | | | | |
| **VIIRS (NPP)** | NOOA/NASA | to be launched | 0.74 | 1 d | | | | | |
| **HY-1 C,D** | CNSA | to be launched | ? | ? | | | | | |
| **OCLI (Sent 3A)** | ESA | to be launched | 0.26 | 2 d | | | | | |
| **VIIRS (NPOESS** | NOOA/NASA | to be launched | 0.74 | 1 d | | | | | |
| **SGLI** | JAXA | to be launched | | | | | | | |

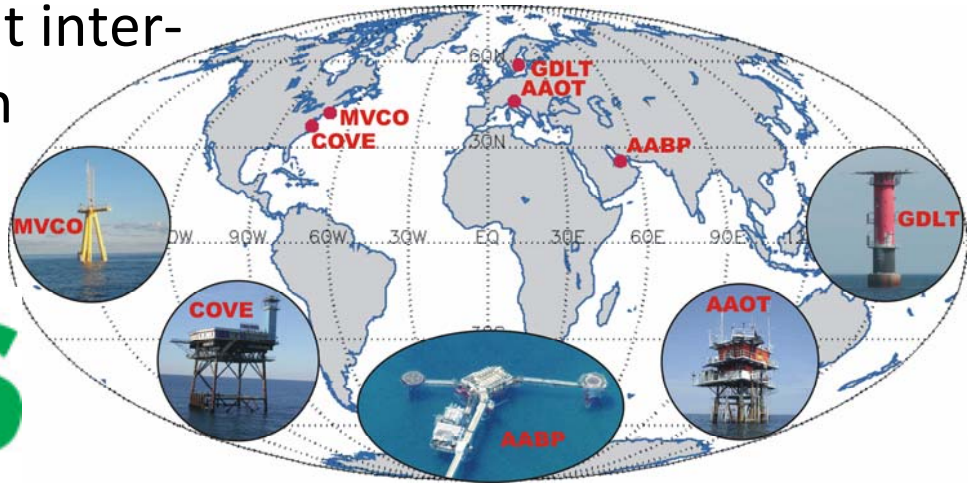
**** Ocean colour radiances are used to produce a wide range of products e.g. chl, PAR, Kd, AOT, TSM, POC, primary production etc.***

# INSITU-OCR

International Network for Sensor InTercomparison and Uncertainty assessment for Ocean Colour Radiometry

- sensor inter-comparison
- product validation
- Investigate vicarious calibration approaches
- algorithm parameterization
- instrument inter-calibration



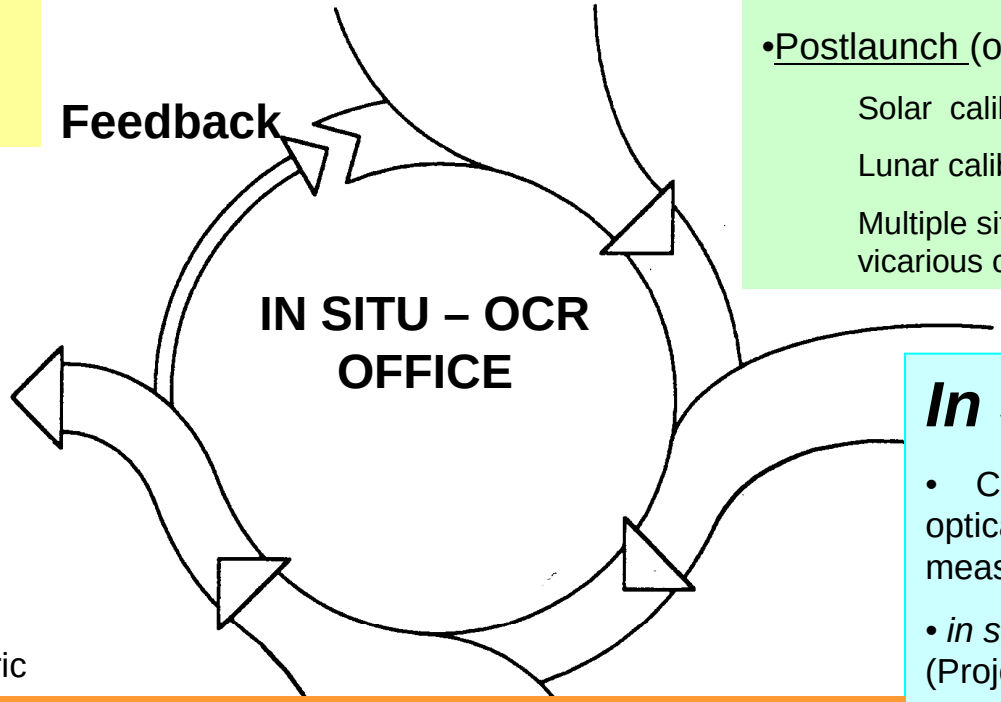
# Satellite Data from Calibrated Sensors (2010)

## Mission Feedback

- Science community input
- Comparison with other appropriate products
- New Mission
- Protocol development

## Calibration Strategy

- Prelaunch
  - Lab. characterization & calibration (NIST traceable)
  - Solar calibration (transfer-to-orbit)
- Postlaunch (operational adjustments)
  - Solar calibration (daily)
  - Lunar calibration (monthly)
  - Multiple sites $L_{wn}$ time series for vicarious calibration – ISRO, MOBY C




## Improved Products &Algorithms

- Reprocessing due to improvements in calibration, masks, binning schemes, product compatibilities, etc.
- New products from bio-geochemical fields, atmospheric fields, etc.
- Data distribution interface

## *In Situ* Data

- Collection of required bio-optical and atmospheric measurements (SIMB II PIs)
- *in situ* instrument calibration (Project round robin NIST-traceable, IOPs, AOPs)
- Data collection following NASA Ocean Optics protocols
- Archive of calibrated QC *in situ* data (SeaBASS)
- Calibrated instrument pool
- Development of new instrumentation

## Product & Algorithm Validation

- Atmospheric & bio-optical algorithm validation and development (SIMBIOS PIs and project staff)
- Match-up analysis via Aeronet OC sites, satellite QC, time series evaluation, Bio-Argo etc.
- **Earth System/Climate Model data assimilation**

## SeaDAS, BEAM….

- Satellite data processing software (ACE, OCM-2, MERIS, OLCI, SGLI, GOCI, …..)

# Discussions with CEOS WGs

- WGCV
  - Strong interaction in planning INSITU-OCR
  - Planned joint meeting with IVOS subgroup in October 2010
- SEO
  - Discussion on gap analysis
- WGISS
  - Planning for a central OCR data portal
- WGEdu
  - IOCCG training courses
  - OCR curriculum & alumni tracing

# Proposed OCR-VC Actions for CEOS Response to GCOS IP

1. Ox1 – Implementation of the Ocean Colour Radiometry Virtual Constellation
2. Ox2 – Facilitate implementation of the Ocean Colour Radiometry ECV
3. Ox3 – Define and Implement an Integrated Network for Sensor InTercomparison and Uncertainty Assessment for Ocean Colour Radiometry (INSITU-OCR))

# Upcoming Activities/Events

1. Oceans from Space 2010 (April 2010):
   - Town Hall Session, introducing OCR-VC ambitions to the community
   - IOCCG Executive Committee side-session to formulate initial plan for INSITU-OCR
2. IOCCG Level 1 requirements WG workshop from 20-21 April in Washington, D.C. This will further refine requirements for the OCR-VC observations.
3. Complete gap analysis for OCR-ECV
4. WGCV/IVOS Conference (October 2010)
   - Building OCR-VC INSITU-OCR components
   - Dedicated session ½-1day to highlight OCR-VC activities to IVOS community (particularly INSITU-OCR)

# Conclusion

1. Prioritisation exercise:
   a) Provides effective mean of advancing with concrete aspects of OCR-VC implementation
   b) In next 6-8 months we will identify clear
2. At the point we will return with concrete recommendations to SIT, incl. resource estimates for inter-agency aspects