IOCCG
International Ocean-Colour Coordinating Group

Working Group on: "Ocean Color observations from the geostationary orbit"

Minutes of the first meeting of the WG,
Hyatt Regency Jeju, Jeju Island, Korea,
November 1st, 2008

Participants, members of he WG:

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Participants, in replacement of members of he WG:

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Excused, members of the WG:

Prakash CHAUHAN	ISRO	India	prakash@sac.isro.gov.in
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Participating as observers:

Pierre-Yves DESCHAMPS	LOA	France	pyd@loa.univ-lille1.fr
Seongick CHO	KORDI	Korea	sicho@kordi.re.kr

9:15 am Start of meeting

David Antoine gave a welcoming address to all participants, and made a presentation reminding what the IOCCG role is in general and what is more particularly the rationale for having set up the working group, and which are the objectives of this group. In particular, it is reminded that an IOCCG report should be published from the work of this WG, with a first draft to be submitted to the IOCCG committee by April of 2009 and a final report to be available tentatively in the fall of 2009.

The content of the provisional agenda is agreed by all participants.

The terms of reference are agreed by all participants; the WG should address the following topics in particular:

- Demonstrating (illustrating) the value of the GEO orbit for ocean color observations (research & operational uses)
- Inventory: some of the most significant past projects, and the existing missions
- Complementarity LEO / GEO
- Complementarity with other GEO missions?
- Common requirements with other GEO missions?
- Specific requirements (different from LEO ?)
- Recommendations (technical & programmatic)

9:45 am Presentation by Antonio Mannino

The largest part of the talk presents a variety of empirical algorithms for the derivation of biogeochemical quantities from ocean color observations (spectral nLw's) in coastal waters (examples from the mid Atlantic bight and the gulf of Maine). This includes the CDOM absorption coefficient, and the dissolved and particulate organic matter concentrations. The algorithms have to be seasonal and regional (too much local variability). It is indicated that the use of neural network is being investigated, because they allow using all available bands instead of a single band ratio (using this unique band ratio, e.g., 490/555, is the main reason for the scatter around the algorithms and their regional and seasonal character).

The second part of the talk is a presentation of the GeoCAPE mission project (geostationary hyperspectral sensor with ~300m resolution).

After the presentation, a discussion starts on the compromise that has to be found in terms of spatial resolution (high spatial resolution can lead to infeasible or prohibitively costly instruments). It is agreed that the radiometric quality and the high revisit are the highest priorities, which should not be compromised by an excessive push towards very high spatial resolution.

10:50 am Coffee break

11:15 am Presentation by Yu-Hwan Ahn

Dr Ahn presents the state of the art of preliminary studies for what could be a "GOCI-2" instrument (i.e., a GOCI follow-on). This instrument would combine observations of the full Earth disk and of more local targets (using pointing mechanisms). The debate is not fixed about whether one or two instruments are needed to fulfill the objectives of such a mission. The band set would be augmented as compared to GOCI.

The interest of having a 709nm band is pointed out by Curt Davis, as well as the importance of including a capability to image the moon in order to track any possible change in the instrument calibration (relative temporal calibration as it is performed for SeaWiFS).

11:50 am Presentation by Seongick CHO

Dr Cho continues Dr Ahn presentation by providing a description of the preliminary design of the GOCI-2 instrument.

A discussion occurs about the necessity of observing the full Earth disk. This can be seen as the combination of a background mission and a more "on-demand" mission allowing tracking of special events identified by the background mission (or even by contemporaneous LEO satellites).

12:10 am Presentation by Anne LIFERMANN

The presentation concerns the CNES perspective on the geostationary observations of ocean color (a phase 0 study is on-going after a proposal was submitted in April 2008 to CNES by the French OC community). The geometry configuration of ocean color observations from a geostationary orbit over Europe are presented, as well as the gain in number of observations as compared to LEO observations.

The option of a geosynchronous orbit, which would improve the ability to observe high latitudes with lower incident angles, is also presented and discussed with the group.

Some results are presented from a CNES study about the respective merits of LEO and GEO observations ("trade off LEO / GEO").

Anne Lifermann said that CNES was interested to get some answers from the WG about the

minimum requirements or acceptable limits in terms of geometry of observation and number of observations per day.

D. Antoine mentions that it's not always feasible to provide such figures, and that the role of the working group is not to define a particular mission. The logic should be similar to the logic adopted when defining radiometric requirements for the present OC sensors; when doing so, very stringent requirements were set up for instance for the noise equivalent radiances (NeΔl), although it was clear that the atmospheric correction errors are much larger than these NeΔl. This approach at least ensures that improvements of the processing and products are always possible and will not be compromised by non-stringent-enough instrument specifications. A similar logic can be adopted for instance for the number of observations per day or the maximum acceptable air mass.

12:50 am Lunch break

2:00 pm Short address by Joji ISHIZAKA

Dr Ishizaka made a short comment about JAXA plans for ocean color observations. There are actually no plans to start a GEO mission in this domain. JAXA presently concentrates its efforts toward the S-GLI mission.

2:10 pm Presentation by Jean-Loup BÉZY

This talk starts with a short reminder about the present and near-future LEO OC missions of ESA (MERIS on ENVISAT and OLCI on Sentinel-3). Then the talk is essentially about the "GeoOCULUS" mission, which is in preparation at ESA (phase 0). This GEO mission would provide optical imagery at high to medium spatial resolution (from 10m to 200m) for applications requiring real-time monitoring or fast response, to observe specific events where and when they occur. The instrument concept is somewhat similar to GOCI, but the whole satellite moves to generate the full scene of observation (instead of moving the mirror only). A few elements are provided about the MTG and Sentinel-4 missions.

Additional bands in the UV have been recurrently proposed for LEO or GEO OC Sensors. JL Bézy warns the WG that this is feasible but carries some technical difficulties.

Finally, questions are expressed about the requirements of the OC community in terms of minimum number of acquisitions per day, maximum acceptable glint signal, pixels size, channels etc....

2:40 pm Presentation by Kevin RUDDICK

Because most of the WG participants have already listen to his presentation during the GOCI PI workshop held during the two days before the IOCCG WG meeting, Dr Ruddick just makes a rapid reminder about the importance of GEO observations for studying the coastal environments, and summarizes the results of a demonstration study he carried out with G. Neukermans about the use of SEVIRI (a sensor on the MSG platform) to map SPM along the Belgium coasts.

2:50 pm Presentation by Xianqiang HE

A comprehensive presentation is made about the requirements for geostationary ocean color observations of the Chinese coastal waters. The requirements include 1 UV and 2 SWIR bands, 1 band for dust detection, no saturation above turbid waters, polarization sensitivity < 2.5%, 100-300m spatial resolution, improved cloud detection schemes as compared to those presently used for LEO observations.

There is no plan now for an OC GEO sensor in China, but the GEO meteorological platforms might be considered.

3:20 pm Coffee break

3:45 pm Presentation by Curt DAVIS

The presentation is about the calibration / validation strategy that could be put in place for GEO ocean color observations. The proposed strategy builds mostly on the SeaWiFS experience. Ideally, it would include a careful pre-launch characterization and calibration, the availability aboard the sensor of calibration devices such as Spectralon plaques to calibrate against the sun, the availability of at least one and ideally several vicarious calibration sites providing high-accuracy marine reflectances in varied environments, and moon imaging capabilities. The possibility to cross-calibrate GEO and LEO sensors is also presented. Such a cross-calibration is far from straightforward, however, if it's intended to be performed at the TOA L1b level (matching geometries are required); it's much easier to conceive the comparison at the level of the geophysical products. The possible use of MERIS and MODIS for such a cross-calibration is presented. It is developed in more details for the HICO sensor.

4:15 pm Presentation by Curt DAVIS, on behalf of Paul DiGIACOMO

This presentation provides the NOAA perspective on geostationary ocean color observations. NOAA has many different monitoring and protection activities in support to policies expressed under various "acts" (e.g., the "coastal zone management act", the "clean water act" etc...). This leads NOAA to ask for improved spatial, spectral and temporal frequency of observations, which is precisely what GEO observations can do.

4:35 End of presentations

4:40 Start of discussion about the TOR and the report content

The report structure and the writing assignments are discussed "on line" using a preliminary report outline prepared before the meeting, and the group progressively arrives to a consensus about these points.

The Report outline and writing assignments are provided here in appendix.

It is agreed that inputs should be sent to chair no later than end of 2008, so a first draft can be circulated among the group by February 2009, and then presented to the annual IOCCG committee meeting in China, 20-22 April 2009.

It is agreed that all the presented material will be put on-line on the IOCCG WG web page.

Another meeting of the WG is not planned for the moment. Members of the WG who are part of IOCCG will have an occasion to meet and, if needed, to work together during the 14th IOCCG committee meeting in China. Another meeting of the entire WG might become necessary in summer or fall of 2009 in order either to finalize the report or to accelerate the writing in case it is not progressing satisfactorily.

D. Antoine closes the meeting by again thanking all members for their active participation, and KORDI for the very helpful and significant support they offered by hosting the working group in Jeju.

5:45 pm End of meeting

APPENDIX: preliminary report outline with writing assignments (in parentheses)

Note 1: a leading author has been identified for each chapter. He is supposed to maintain the momentum by regularly checking that inputs are being prepared for the section in question, and to assemble these inputs into a preliminary version of the chapter (to be transferred to the WG Chair by the end of 2008). He is not supposed to write everything!
Note 2: nothing is frozen with respect to the report structure, headings' titles etc... so any justified change can still be incorporated.

1. Introduction (D. Antoine)

The introduction will remind the rationale for the working group, why & when the OC research community started to considered GEO observations as relevant and other science and programmatic aspects relevant to our work.
Inputs/comments from all members of the working group will be necessary after a first draft is produced by Chair.

2. The case for GEO OC: science questions / applications: examples of possible uses of GEO OC (A. Mannino)
    - Coastal applications: SPM, Monitoring in coastal zones, tidal effects.. (inputs from: K. Ruddick, C. Davis, P. DiGiacomo, P. Chauhan, H. Kobayashi)
    - Inland waters (P. DiGiacomo)
    - Data assimilation (?)
    - Diurnal cycles of ocean properties (D. Antoine)
    - Aerosols (A. Lifermann)
    - Social benefits (P. DiGiacomo)

3. Are requirements of GEO OC different from LEO OC? (C. Davis)
    - Reminder about the general requirements for OC (D. Antoine)
    - Unique requirements for GEO OC? (C. Davis)
    - Requirements / specification in terms of geometry
    - Specific requirements for coastal applications (X. He): spatial, temporal, spectral
    - Specific requirements for global C research (H. Kobayashi)
    - Is the technology advanced enough to answer these requirements? (J.-L. Bézy)

4. Elements of GEO missions characteristics (D. Antoine)
    - Regionally-focused or "global" (i.e., Earth disk) (D. Antoine)
    - Geostationary versus Geosynchronous orbit ? (A. Lifermann, J.-L. Bézy)
    - Can GEO missions be seen as operational missions? (P. DiGiacomo)

5. Calibration requirements and possible strategy for GEO OC (C. Davis)

Inputs from A-Y Ahn and S. Cho on GOCI calibration technique/strategy, and from J.-L. Bézy about techniques used for MERIS

6. "GEO algorithms" specificities / issues (K. Ruddick)
   - BRDF issues / corrections (D. Antoine; ask some material to Z. Lee)
   - Atmospheric corrections issues (or non issues); Y.-A. Ahn (from GOCI experience)
   - Modifications of RT (e.g., spherical): X. He
   - Constraints from th temporal coherency of features? (K. Ruddick)
   - Cloud clearing, daily compositing (X. He)

7. Synergistic aspects (D. Antoine)
   - "comparison" LEO / GEO (A. Lifermann), contribution to the "OC virtual constellation"
   - Complementarity with other GEO missions (e.g., SST)
   - How to build international collaboration with non-global missions? : Sensor pre-launch characterizations / comparisons, sharing algorithms, cal/val techniques ....

8. Recommendations (all)
   - In terms of possible missions
   - In terms of technical requirements
   - In terms of international collaboration

9. Appendix: the situation today (D. Antoine)
   1-2 page(s) summary of today's Agencies' plans for GEO ocean color, in terms of missions plans (if any) or in terms of use of GEO ocean color observations from others.
   - CNES A. Lifermann
   - CNSA X. He
   - ESA J.-L. Bézy
   - ISRO P. Chauhan
   - JAXA H. Kobayashi / J. Ishizaka
   - KORDI Y.-A. Ahn
   - NASA A. Mannino
   - NOAA P. DiGiacomo / C. Davis

   Add a table (appendix) with technical information when it exists

Provisional agenda distributed prior to the meeting:

Working Group on: "Ocean Color observations from the geostationary orbit"

First meeting **AGENDA**, Jeju Island, Korea, November 1st, 2008

9:00 Welcoming and reminder about the role of the WG

9:15 to 12:15 Individual presentations by the working group members.

- David Antoine, LOV, France
  "Potential of ocean color observations from the geostationary orbit; and some elements about the international context for such type of observations"
- Yu-Hwan Ahn, KORDI, Korea
  "Preliminary GOCI-2 Missions & Requirements" (also giving a welcoming address from KORDI)
- Antonio Mannino, NASA/GSFC, USA
  "Development of Carbon Data Products for the Coastal Ocean: Implications for Advanced Ocean Color Sensors"
- Anne Lifermann, CNES, France
  "CNES preparatory activities for GEO Earth observation"
- Jean-Loup Bézy, ESA, The Netherlands
  "The ESA Geo-Oculus mission"
- Kevin Ruddick, MUUM, Belgium
  "Geostationary ocean color: application potential in coastal waters"

12:15 to 13:30 lunch break

13:30 to 14:30 Individual presentations by the working group members, cont'd

- He Xianqiang, Second Institute of Oceanography, SOA, China
  "Specific requirements of GEO orbit ocean color observation for China coastal sea"
- Curt Davis, Oregon State Univ., USA
  "on-orbit calibration and validation of geostationary ocean color sensors"
- Curt Davis, Oregon State Univ., USA (on behalf of Paul DiGiacomo, NOAA, USA)
  "NOAA Perspectives on Geostationary Ocean Color Observations"

14:30 – 15:00 Open discussion on the terms of reference for the working group

15:00 – 15:30 Report structure and content, writing assignments and schedule

15:30 – 16:00 AOB and closing remarks

16:00 End of meeting

ACRONYMS

CDOM	Colored Dissolved Organic Matter
CNES	Centre National d'Etudes Spatiales
CNRS	Centre National de la Recherche Scientifique
CSA	Chinese Space Agency
DOC	Dissolved Organic Carbon
ENVISAT	Environmental Satellite
ESA	European Space Agency
GEO	Used for Geostationary
GeoCAPE	Geostationary Coastal and Air Pollution Events
GOCI	Geostationary Ocean Color Imager
HICO	Hyperspectral Imager for the Coastal Ocean
ISRO	Indian Space Research Organization
JAXA	Japan Aerospace Exploration Agency
KORDI	Korean Ocean Research & Development Institute
LEO	Low-Earth Orbiting
LOV	Laboratoire d'Océanographie de Villefranche
LOA	Laboratoire d'Optique Atmosphérique
MERIS	Medium Resolution Imaging Spectrometer
MTG	Meteosat Third Generation
MUMM	Management Unit of the North Sea Mathematical Models
NASA	National Aeronautics & Space Administration
nLw	Normalized Water-leaving radiance
NOAA	National Oceanographic and Atmospheric Administration
OC	Ocean Color
OLCI	Ocean and Land Color Imager
OSU	Oregon State University
POC	Particulate Organic Matter
SeaWiFS	Sea-viewing Wide Field-of-view Sensor
Sentinel-3	Third series of "sentinel" (ESA satellites)
Sentinel-4	Fourth series of "sentinel" (ESA satellites)
SEVIRI	Spinning Enhanced Visible and Infrared Imager
S-GLI	Second Generation Global Imager
SPM	Suspended Particulate Matter
SWIR	Short Wave Infra Red
TOA	Top of Atmosphere
UV	Ultra Violet