

WCRP REPORT

World Climate Research Programme



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SUMMARY REPORT FROM THE

SECOND SESSION OF THE WCRP OBSERVATION AND ASSIMILATION PANEL (WOAP)

(Ispra, Italy, 28-30 August 2006)

NOVEMBER 2006

WCRP Informal Report N° 22/2006

WCRP Observation and Assimilation Panel (WOAP)

Report from WOAP-2 meeting Ispra 28-30 August 2006

(report dated 6 October 2006, annexes finalized 9 November 2006)

SUMMARY of ACTIONS and RECOMMENDATIONS

Recommendation 1: It was recognized that, if WOAP becomes co-sponsored by GCOS, then the terms of reference for WOAP may need to be revised, and revisions agreed to by the GCOS SC and JSC.

Recommendation 2: WOAP expressed its support to both GCOS and WCRP Secretariat to undertake the necessary actions in order to ensure maintenance of BSRN archive after Prof. Ohmura's retirement

Recommendation 3: WOAP expressed its support for a formal confirmation of the joint sponsorship of TOPC by WCRP.

Recommendation 4: The "CEOS response to GCOS IP" is an important initiative which may impact future GCOS and WOAP activities. WOAP should take part in any further consultation mechanism to be organized on this matter.

Recommendation 5: A letter to CEOS will be prepared by WOAP to complement WCRP strategic views expressed last year, answer CEOS response and stress the issue of the consequences of NPOESS de-scoping for climate observations emphasizing the need for continuity of the climate record. Reprocessing will also be featured. A copy of this letter will also be sent through the GEO channel. Draft to be prepared by M. Manton with the satellite task group and K. Trenberth (to be ready before end of September for consolidation within WOAP), and proposed to go out under the signature of JSC chair. The letter should be copied to many people capable of influencing these matters [*done, cf. appendix 5*].

Recommendation 6: a task group led by G. Sommeria (with M. Manton, T. Koike, M. Rast, R. Juvanon du Vachat) will propose to the panel a message on GEO which will support a joint input by WCRP and GCOS to the 2007-2009 workplan. It will stress the need to use the GCOS IP and follow-on satellite supplement as the main guideline for climate tasks and include a message on funding for climate activities. [*done on 2 October, cf. appendix 6*].

Recommendation 7: WMO WIS should be publicized within the WCRP community, and should be considered by all projects.

Recommendation 8: a task group chaired by N. Mc Farlane will review the status and management of observational data and model output archives, including web sites within WCRP, and will make recommendations for WCRP-wide overarching structure, site contents and data policy (see issues above). It will be composed of one member from each of the core-projects + GCOS, + WMP. Proposed terms of reference are annexed to this report in appendix 7. Time line: membership: 31 Dec 2006; Final report: 31 July 2008).

Recommendation 9: A. Simmons and K. Trenberth will prepare a report article on the atmospheric reanalysis workshop for EOS to publicize benefits and importance of reanalyses,

and outstanding issues, for climate research. [*done 15 September, in press in October, cf. appendix 8*].

Recommendation 10: WOAP endorses the plan for the Third International Reanalysis Conference and recommends support by WCRP and GCOS, as well as from GEO as part of task CI-06-01.

Recommendation 11: a special topic (led by A. Lorenc) is recommended for next WOAP meeting, focusing on the coupled assimilation of atmosphere, ocean, sea-ice, and land surface data as well as issues related to biogeochemistry.

Recommendation 12: A working group will be set up under the auspices of GEO and led by WCRP and GCOS to address the recommendation from the Maryland workshop to form a WG on the issue of “development of improved observational data sets for reanalyses”. Within WOAP, the task group chaired by A. Simmons will refine the TOR derived from Maryland workshop and make recommendations for members (as suggested in the report, from NCDC, NCAR, UKMO, CRU, BoM, JMA, and representatives from WCRP projects, with Steve Worley from NCAR as possible chair), to report to AOPC and WOAP. A.S. will circulate draft TOR and membership to WOAP before the end of October. Support for this group will be solicited from GEO or through GEO as part of CI-06-01 task. However it is expected that the base institutions would fund their own participants and most activity would be carried out by email.

Recommendation 13: Trenberth to contact Susan Solomon on how to take advantage of the lessons learned from AR4. [*Done: reply received, suggesting a workshop in 2008*]

Recommendation 14: the panel supports the Upper Air Network strategy presented by GCOS and urges a first stage in the implementation, by defining some priority steps (starting small, but starting). Additional sensors could be added in a second stage.

Recommendation 15: WOAP recommendations will be available for presentation (if desired by WCRP) by the Chair at the next OCD meeting in Beijing, 7-8 November 2006 and next JSC meeting Zanzibar, last week of March 2007.

Recommendation 16: presentations will be put on WOAP website, password protected [*done*].

REPORT FROM THE MEETING

K.Trenberth opened the session and thanked Alan Belward and his organization, the European Commission Joint Research Centre, for hosting the meeting and providing significant support for the logistics of the meeting and local travel. He also noted the considerable amount of material that had been posted on the WOAP web site (see Appendix 3) as background for the meeting and thanked Catherine Michaut for her help in setting this all up. The agenda is given in Appendix 1 and the participants list in Appendix 2.

1/ Review of past actions and status of the panel:

The chair reviewed the accomplishments of WOAP, related activities over the past year, and outstanding issue for this meeting and longer term, see Appendix 4 for the talking points in detail. The chair summarized the WOAP presentation at JSC, which highlights dataset issues arising from IPCC deliberations and the needs for reprocessing, as well as JSC's recommendations on WOAP.

A major item concerns the status of WOAP, which has been the subject of recent discussions between GCOS and JSC Chairs, following the JSC recommendation to review the respective roles of the joint WCRP-GCOS panels, and to develop a formal link between WOAP and GCOS SC. Improved metrics of success for WOAP are also required.

There is a strong support of the role of WOAP as a coordination panel within WCRP, as a forum to discuss observation and data assimilation questions across projects, and to deal with issues of common interest, including promoting new observational techniques and systems, finding the best balance between in situ and space observations, developing common data management activities, ensure availability of data for assimilation, developing new assimilation techniques ... There was also general agreement that co-sponsorship of WOAP by GCOS would be a positive step, and would help harmonize the work of WCRP with GCOS and the currently co-sponsored panels AOPC and OOPC.

This would confirm the role of WOAP as the preferred channel for the interaction between the two programmes and for the dialogue between GCOS panels and WCRP projects. WOAP would still primarily be a WCRP Panel with GCOS co-sponsorship, similar to what is done for AOPC which is cosponsored by WCRP but has primary support from GCOS.

Recommendation 1: It was recognized that, if WOAP becomes co-sponsored by GCOS, then the terms of reference for WOAP may need to be revised, and revisions agreed to by the GCOS SC and JSC.

J. Shukla provided a summary of WMP's activities and comments on how he sees the complementarity between WMP and WOAP. The question of data assimilation remains central to both panels, and no artificial boundary is ideal. Key questions are still open, for example the coupled atmosphere/ocean data assimilation. WMP and THORPEX are developing a joint plan for advanced global modeling and forecast for weather and climate.

Task groups were formed to help streamline the panel's work, as follows:

1/ Satellite Task Group to deal with item 3: space matters and relation with space agencies.

M. Manton, A. Belward, N. McFarlane, J. Key (e-mail exchanges with W. Rossow)

2/ Reanalyses: recommendations for follow-on actions and joint WG with AOPC on data for reanalysis: A. Simmons, D. Stammer, G. Flato, J. Shukla

3/ Data management: T. Koike, E. Harrison, M. Tjernström, McFarlane

4/ Reprocessing: R. Lawford, J.L. Fellous, A. Lorenc, (W. Rossow by e-mail)

5/ GEO items: G. Sommeria, M. Manton, T. Koike, M. Rast, R..J. du Vachat

Session 2: Coordination with GCOS

D. Goodrich, Director of GCOS, provided an overview of GCOS activities, focusing on follow-up activities to the GCOS Implementation Plan, with in mind a comprehensive “progress report” expected by the UNFCCC Subsidiary Body for Scientific and Technical Advice (SBSTA) in June 2009. Major questions concern the implementation of new parts of the GCOS, and how to build in resiliency in the system (for example where a single-point failure such as NPOESS re-programming does not lead to failure of the whole system). D. Goodrich also introduced the supplemental satellite report to be discussed under session 3.

Reporting to UNFCCC will remain a major GCOS activity, with a likely involvement in the domain of “impacts, vulnerability and adaptation to climate change” (important participation of GCOS at the next SBSTA meeting in November 2006). WCRP does its own reporting to UNFCCC, however the GCOS reports can also be used to vehicle some WOAP messages.

D. Goodrich approved the principle of GCOS co-sponsorship of WOAP including providing staffing of the scientific secretariat for the coming year, under the conditions mentioned above.

A. Simmons, Chair AOPC, presented a summary of AOPC activities. Of particular interest to WOAP was the plan established for the WMO/CGMS Global Space-based Inter-Calibration System (GSICS) with input from the research community. AOPC has established with TOPC a joint Working Group on Land-Surface/Atmosphere Issues to promote the coherent retrieval of surface and atmosphere ECV products. The harmonization and optimization of surface reference networks is a joint concern with TOPC. The situation of BSRN archives, of importance to both GCOS and WCRP is closely followed, and some action is needed in case ETH Zürich cannot ensure the maintenance of this archive after Prof. Ohmura’s retirement. The largest gap in atmospheric measurements relates to tropospheric air quality (atmospheric chemistry). Reanalysis is dealt with later in session 6 and the upper air network in session 8.

E. Harrison, chair of OOPC, presented a summary of OOPC and GOOS activities. A major concern is the sustainability of the advanced ocean observation network developed for research purposes and its evolution towards a real operational observation system. In the interim, this network has to be maintained via research programs, including CLIVAR. Advocacy for ocean observations must include advocacy for system management infrastructure (proposal for Observing Program Support center). Another concern is the decrease of national support to the Volunteer Observing Ship fleet. E. Harrison proposed a workshop on “uncertainty estimation in reconstructed fields”, initiative supported by the panel. Two other specific issues for WOAP are the evolution towards coupled ocean-atmosphere assimilation, and the need for non-physical variables in oceanic areas.

A. Belward, chair of TOPC, presented a summary of TOPC activities and highlighted the role of GCOS IP in focusing efforts on a relatively small number of essential variables (14). The links with research and WCRP are essential for TOPC. A. Henderson-Sellers indicated that the co-sponsoring of TOPC by WCRP will be formalized, a view supported by WOAP. R. Lawford confirmed the importance of this action for GEWEX. Important issues for TOPC are also the maintenance and coordination of ground observation networks, and how to get data such as on lakes and the cryosphere. CEOS is sponsoring workshops on the retrieval of key variables or products, such as albedo, Leaf Area Index (LAI), fraction of Absorbed Photosynthetically Active Radiation (fAPAR). The participation of WCRP scientists is desirable. A specific domain of interaction mainly with GEWEX is the development of soil moisture methodologies and data sets. A. Belward also insisted on the importance of quality control and estimates of uncertainty; issues of importance for all GCOS observations.

Recommendation 2: WOAP expressed its support to both GCOS and WCRP Secretariat to undertake the necessary actions in order to ensure maintenance of BSRN archive after Prof. Ohmura's retirement.

Recommendation 3: WOAP expressed its support for a formal confirmation of the joint sponsorship of TOPC by WCRP.

Session 3: Space matters and relation with space agencies

As an aside from the main meeting, a special presentation was given by B.Pinty on JRC activities, based on papers:

Pinty, B., T. Lavergne, R. E. Dickinson, J.-L. Widlowski, N. Gobron and M. M. Verstraete, 2006: Simplifying the interaction of land surfaces with radiation for relating remote sensing products to climate models, *J. Geophys. Res.*, **111**, doi: 1029/2005JD005952

B. Pinty, B., T. Lavergne, M. Vossbeck, T. Kaminski, O. Aussedat, R.E. Dickinson, N. Gobron, M. Robustelli, M. Taberner, M. Verstraete and J-L. Widlowski: Towards the assimilation of Remote Sensing Products by Climate Models with Updated Land Surface Scheme. [In preparation](#).

A. Simmons presented the report "supplement to GCOS IP on systematic observation requirements for satellite based products" prepared by P. Mason, S. Bojinski, M. Manton and the three GCOS Panel Chairs, with significant input from WCRP. This document was reviewed by the community between April and June and is now being finalized for information at SBSTA. It includes a number of detailed requirements which respond to the needs of the research community for sustained systematic observations, and also notes issues which are still open for new research developments. Jointly with the GCOS IP, it should serve as an important statement of requirements addressed to the satellite agencies and an information tool and reference for WCRP research.

J.L. Fellous presented a first draft of the "CEOS response to the GCOS Implementation Plan" in preparation for COP12 to be presented at next SBSTA in Nairobi (November 2006) through the USA delegation. This document identifies what can be achieved by better coordination of existing capabilities (i.e. reprocessing of past data sets, improvement of data availability for reanalysis...), or in planning future capabilities, as well as improvements that require additional means or mandates beyond the present capacity of space agencies (e. g., transferring systems from research to operational status requires in some cases mandates beyond the present capacity of space agencies). It introduces the concept of "Virtual Constellations", groups of satellites that can work in a coordinated manner to accomplish a specific goal or set of goals.

No reaction from the research community can really be expected before the release of this document, but it could serve as a basis for future joint reflections between CEOS members and the scientific community, and a proper consultation mechanism should be set up for this.

Recommendation 4: The "CEOS response to GCOS IP" is an important initiative which may impact future GCOS and WOAP activities. WOAP should take part in any further consultation mechanism to be organized on this matter.

K. Trenberth presented a short summary of the ASIC3 workshop in May 2006. Its objective was to determine how to achieve the satellite calibration requirements for climate change determined in the Nov 2002 first workshop and published in Ohring et al., BAMS, Sept. 2005. One of the key proposals is a Joint Center for Satellite Calibration. It also supported the concept of a satellite calibration observatory to be developed at the international level. WOAP noted that the GSICS would help to meet the need identified by the ASIC3 meeting.

K.T. presented several items related to the assessed impact of changes in the NPOESS plans as they impact climate observations and continuity of record, including comments by W. Rossow, see Appendix A. This included a draft document based in part on NOAA input and a powerpoint on the status of NPOESS (prepared by A. Heidinger and J. Key) that summarizes the status of NPOESS plans. Comments received by W. Rossow underline the risks of losing the continuity of essential climate records and the urgency of a concerted reaction by the international community.

This was followed by a discussion of the exchange of letters which took place with CEOS in 2005. CEOS's response raised the issues of specific WCRP priorities with respect to GCOS, and of the scientific and societal benefits expected from the additional space observations advocated by the research community. The first issue is to a large extent clarified by the GCOS IP supplement discussed above. The second issue is indeed important to justify WCRP's observational strategy, and a partial response will be given in the letter mentioned below. Key points for a response include:

- 1) We are not inventing new requirements
- 2) We are, however, trying to help establish priorities and to sharpen those:
 - Continuity, continuity, continuity:
 - Needed in any strategy for future
 - Reprocessing and reanalysis of past data
 - Multiple ECVs, land, ocean, atmosphere
 - Calibration, accuracy, benchmarks, in situ
 - Especially at risk now with NPOESS cuts in longer term.
 - Climate variables need to have higher priority

Recommendation 5: A letter to CEOS will be prepared by WOAP to complement WCRP strategic views expressed last year, answer CEOS response and stress the issue of the consequences of NPOESS de-scoping for climate observations emphasizing the need for continuity of the climate record. Reprocessing will also be featured. A copy of this letter will also be sent through the GEO channel. Draft to be prepared by M. Manton with the satellite task group and K. Trenberth (to be ready before end of September for consolidation within WOAP), and proposed to go out under the signature of JSC chair. The letter should be copied to many people capable of influencing these matters.

Session 4: Participation in GEO and IGOS-P

M. Rast presented an update on GEO, focusing on the benefits to be expected by the climate research community from the GEO initiative. GEO is a voluntary process which serves as a coordination mechanism, enables communities and organizations to come together, and provides a platform for political advocacy. The 10-year GEOSS Implementation Plan defines targets for the next 2, 6 and 10 years, in its 9 societal benefit areas. GCOS was central in the definition of the climate tasks, in coordination with WCRP. The 2007-2009 workplan is in preparation, has already received significant input from WCRP and GCOS, and is still open for official comments by member countries and participating organizations (such as WCRP) until 2 October.

G. Sommeria presented a status of the WCRP participation to GEO, stressing the role of WCRP at the various stages in the maturation of the GEO initiative, and specifying the contributions to the present GEO tasks both by WCRP and GCOS. In addition to the climate tasks, there was a significant input from WCRP in the water tasks, through GEWEX and in coordination with the IGOS Water Theme, and in the Architecture and Data tasks with input from CEOP. WCRP is present in the four specialized committees of GEO, Architecture and data, Scientific and Technical (S & T), User's Interface, Capacity building and outreach. It has already provided a provisional

input to the 2007-2009 workplan, which can still be consolidated with the input expected from WOAP. The lack of direct budgetary support by GEO to climate tasks is a drawback and the indirect support obtained through the “GEO labeling” of some projects remains to be tested. The case of the Climate 06-01 task (on reprocessing and reanalysis), is a good test case (it has received a small amount of GEO money to support the reanalysis workshop at ECMWF and a number of partner countries have been identified as potential contributors).

M. Manton, recently appointed to the S & T Committee, raised a few additional questions concerning the way projects or tasks are selected, and how the outcomes will be assessed. It is evident that funds for a GEO activity have to be secured by the named lead organization. He also raised questions about the responsibilities of the lead organizations and the benefits of being listed as partner in a task. There is still some uncertainty about the way the S & T will work and influence the scientific strategy of GEO.

During the discussion, the benefits of the GEO mechanism were further explored. Issues relate to how to get commitments, as having someone named to a task is no guarantee they will do anything. There is still a need to demonstrate how GEO can contribute concretely to the achievement of specific tasks, without providing direct support in terms of manpower or funding. The approach to this question clearly differs from country to country. WCRP and WOAP can indeed provide scientific advice, and attempt to use GEO for advocacy. GEO may help find sponsors. Returns for the scientific community remain to be seen.

As a complement to the GEO discussion, three presentations were made on IGOS themes involving WCRP. R. Lawford presented an update on the Water Cycle theme (IGWCO), for which WMO recently took the lead (contact person W. Grabs). Other main partners are WCRP (GEWEX) and JAXA, and Lawford is chairing the scientific committee. IGWCO is the main proponent for GEO water tasks and many aspects have been taken up by GEO as tasks. J. Key presented an update on the IGOS Cryosphere Theme organized under WCRP leadership (CliC project) recently endorsed by IGOS Partners and largely involved in the preparation of the International Polar Year. The theme report is under preparation and J. Key is Chair of the writing team. The emphasis is on the development of a strategy for cryosphere observations with a large part dedicated to satellite missions. Two important points were raised: the decline of in situ observations, for example the network for lake ice observations is basically disappearing, and the IPY legacy which needs to be preserved with sustained observations. UNFCCC COP is one place to advocate such a requirement for climate observations. A brief update was also provided on the IGOS land theme by A. Belward. In this the focus is on biodiversity, agriculture production, carbon trading linked to forestry (deforestation etc), and land surface processes for climate (land cover and disturbance due to fire).

Recommendation 6: a task group led by G. Sommeria (with M. Manton, T. Koike, M. Rast, R. Juvanon du Vachat) will propose to the panel a message on GEO which will support a joint input by WCRP and GCOS to the 2007-2009 workplan. It will stress the need to use the GCOS IP and follow-on satellite supplement as the main guideline for climate tasks and include a message on funding for climate activities.

Session 5: Data activities

T. Koike reported on the plan for CEOP phase II starting in January 2007, focusing on the data and the scientific management aspects of the project. CEOP Phase II has been approved by JSC in March 2006, subject to a technical review of the science plan by experts from each WCRP project. The science reporting of CEOP is done through GEWEX and WOAP is expected to review the data aspects. The prototype data management system of CEOP is impressive and could be extended to all WCRP projects. It includes Quality Assurance of data, a distributed data function and

cooperative architecture, with interoperability of data. The WOAP Panel needs specialist(s) in data management to cover this issue. Data sharing principles are being developed in GEO. Concerning the core-projects in WCRP, some are proprietary (GHP) and there is not open access to data, therefore a specific effort on implementing the data sharing principles is required within WCRP. CEOP is involved in two new GEO tasks, WA-07-P2 dealing with Satellite Water Measurements, including the implementation of a global water cycle data integration system. The second, DA-07-P4, aims at the design of a broad Earth Observation Data Integration and Analysis System. It has large implications for WCRP as a whole in terms of infrastructure, links to major data centers. It is relevant to both observation and model data.

G. Sommeria presented a summary of the WMO Information System (WIS) prepared by J.M. Rainer (World Weather Watch Dept), which should serve as a general framework for the exchange of global data, operational and research. It is indeed proposed to GEO as a general data system for all its data activities. The concept of Data Collection and Production Center is adapted to some of the large data sets prepared by research projects such as CEOP. An important issue is the development of homogeneous metadata catalogues for international exchange. WCRP is welcome to send an expert to the next CBS Technical Conference on WIS to be held in Seoul 6-8 November 2006. There is also an opening for WCRP projects to become pilot projects under WIS.

Recommendation 7: WMO WIS should be publicized within the WCRP community, and should be considered by all projects.

A matrix on data management (policy, metadata, web sites) in the different projects has been prepared by T. Koike and needs to be thoroughly validated. Comments by GEWEX, CLIVAR, SOLAS, have already been received. This should be followed up on by the data management task team (see below).

There are two distinct issues: the review of the data aspects of CEOP and the general item of DM for WCRP.

The discussion on data management in WCRP projects highlighted the fact that all efforts were developed independently, which also meant solving problems separately without taking advantage of other efforts, and also coming up with answers that may not be compatible across WCRP. A key task is to ensure that projects can take advantage of developments and solutions to problems from other projects. WCRP cannot do data management but can facilitate and coordinate it, and work to minimize duplication of effort. There was discussion of the need to assess the following:

- 1) Is there a problem?
- 2) Observations data and model data
- 3) Redundancy
- 4) Efficiencies
- 5) How research data are archived?
- 6) What is best practice?
- 7) Should there be a WCRP data policy?

Recommendation 8: a task group chaired by N. McFarlane will review the status and management of observational data and model output archives, including web sites within WCRP, and will make recommendations for WCRP-wide overarching structure, site contents and data policy (see issues above). It will be composed of one member from each of the core-projects + GCOS, + WMP. Proposed terms of reference are annexed to this report in Appendix 5. Time line: membership: 31 Dec 2006; Final report: 31 July 2008).

Session 6: Reanalysis in support of climate research

K. Trenberth reported on the Maryland workshop (Sept 2005) on “The development of improved observational data sets for reanalysis: Lessons learned and future directions” with a presentation prepared by S. Uppala. This included specific recommendations for formation of a working group under the auspices of WOAP as discussed below.

A. Simmons reported on the ECMWF workshop held in June 2006 on Atmospheric Reanalysis, under the auspices of WCRP and GCOS, and with financial participation from GEO. The JMA reanalysis (JRA-25) is now completed and will be publicized by an article in the journal of the Japan Meteorological Society. The ECMWF workshop will be publicized through a report in the ECMWF Newsletter. A proposal was to develop that and material from the Maryland workshop as a report for Eos highlighting the need for ongoing reanalysis activities (AS, KT). It can then be used as a basis for getting funds to secure global reanalysis activities.

Recommendation 9: A. Simmons and K. Trenberth will prepare a report article on the atmospheric reanalysis workshop for EOS to publicize benefits and importance of reanalyses for climate research.

D. Stammer presented the plans for the GSOP reanalysis workshop (to be held on 31 August and 1 Sept at ECMWF). It will cover multiple approaches (assimilation, syntheses, ultimately coupled model initialization) with evaluation and intercomparisons on heat balance, water cycle, and sea-level. It will be reported next time, with recommendations to CLIVAR and WOAP.

The plan for the organization and scientific agenda of a Third International Reanalysis conference, to be hosted by University of Tokyo (28 Jan 2007 to 1 Feb 2008), was presented by T. Koike. Support is being solicited from GEO, WCRP, GCOS and WMO.

Recommendation 10: WOAP endorses the plan for the Third International Reanalysis Conference and recommends support by WCRP and GCOS, as well as from GEO as part of task CI-06-01.

A. Lorenc summarized data assimilation activities in WGNE in relation with WOAP. Following the report on “Data assimilation” he led in 2005, further action is required from WOAP, in order to make progress in Earth System prediction.

Recommendation 11: a special topic (led by A. Lorenc) is recommended for next WOAP meeting, focusing on the coupled assimilation of atmosphere, ocean, sea-ice, and land surface data as well as issues related to biogeochemistry. One focus could be “seamless” prediction and the need for initialization of coupled models.

A general discussion on reanalysis matters, and in particular the recommendation to form a working group on reanalysis data, was conducted by K. Trenberth, with participation from project representatives and led to the following recommendation:

Recommendation 12: A working group will be set up under the auspices of GEO and led by WCRP and GCOS to address the recommendation from the Maryland workshop to form a WG on the issue of “development of improved observational data sets for reanalyses”. Within WOAP, the task group chaired by A. Simmons will refine the TOR derived from Maryland workshop and make recommendations for members (as suggested in the report, from NCDC, NCAR, UKMO, CRU, BoM, JMA, and representatives from WCRP projects, with Steve Worley from NCAR as possible chair), to report to AOPC and WOAP. A.S. will circulate draft TOR and membership to WOAP before the end of October. Support for this

group will be solicited from GEO or through GEO as part of CL-06-01 task. However it is expected that the base institutions would fund their own participants and most activity would be carried out by email.

Session 7: Reprocessing

Each project provided some input in response to the letter by K. Trenberth asking for a report (see online material in appendix 1) on the status of global, long-term data sets and plans for their re-processing (CLIVAR, GEWEX, SPARC, CliC and the Working Group on Surface Fluxes). The paper by Landsea et al. and its “critique” related to the need for reprocessing of satellite data to produce improved information on properties of tropical cyclones was also presented by K.T. This is a topic presently debated in the community, and should be kept in mind as part of any reprocessing effort.

G. Sommeria presented the conclusions of a summary paper prepared by G. Duchossois and advocating the need for systematic re-processing of the global data sets. It summarizes the status of this already on-going activity and the main deficiencies and obstacles for successful achievement: resources (funding and man power), availability and quality of data/metadata, lack of coordinated approach involving agencies and the scientific community. Such an activity should be considered as an integral part of the process of creating a climate data record (cf. Principles for Re-processing Climate Data Records). A detailed presentation of the variables concerned is already made in the GCOS IP satellite supplement. A stepwise approach was proposed by G. Duchossois within the GEO framework, but the panel felt that the connection with the GCOS Implementation Plan was insufficient. The GEO Work Plan for 2006 includes a task (CL-06-01) with a reprocessing workshop in 2007, but this was not endorsed by WOAP, and relevant activities to be pursued in the 2007-2009 WP.

The discussion covered the on-going activities in this domain, some of them not covered in the above reports such as those related to land surface properties. The general need for reprocessing of many datasets arose in the AR4 report but is not documented there. There is an advantage to deal with all ECV together across the domains. Some distinction has to be made between reprocessing of level 1 data (done by space agencies) and level 2 where scientists are involved, and the needs are different in the various domains of the climate system. It appeared in the discussion that a large part of the arguments developed here are already available in the GCOS IP satellite supplement and in the CEOS response under preparation. There is also some coordination needed with the GSICS initiative mentioned above under session 2. What may be missing is a synthetic view with messages for science and space agency managers.

After the discussion, it seemed that the needs for reprocessing is an important element of the “CEOS response to the GCOS IP” and relevant follow up activities. Some aspects will also be dealt with by the working group on “improved observational data sets for reanalyses”. **The need for reprocessing should be featured as part of the letter to CEOS, mentioned in session 3.**

Recommendation 14: Trenberth to contact Susan Solomon on how to take advantage of the lessons learned from AR4. In this case the question is, given that IPCC does not do research and there is little or nothing in the IPCC report on research needs, how can WCRP take advantage of the experience garnered by IPCC authors (who are members of the WCRP and IGBP communities) during AR4? The suggestion is, of course, that somehow IPCC and WCRP should pick all of the brains of AR4 authors and capture the experience and lessons from AR4 with regard to making a case for further research, for example relevant to WOAP: the development of improved and more complete datasets, so that in AR5 the problems will be diminished.

Session 8: Reflection on WCRP and GCOS observation strategy

As an introduction to this item, D. Goodrich presented the conclusions of two recent GCOS/NOAA meetings on a reference radio-sonde network. An AOPC working group chaired by P. Thorne has been established on the subject and a draft report is available. It proposes an observing system architecture going from the GCOS Upper Air Network (161 stations) to a Benchmark Network (10 stations) through an Upper Air Reference Network (30-40 stations). There is a phased implementation proposed, building on existing sites. The final goal is to define and implement a GRUAN (GCOS Reference Upper Air Network), using a higher quality Benchmark Network as ultimate reference. This strategy is advocated as the way to build resiliency in the climate observation system (observations with absolute accuracy and baseline character). Calibration issues are critical, in order to avoid break in record for example from satellite systems. New satellite missions with high resolution GPS positioning, such as the "COSMIC" constellation are also promising in this regard, but do not replace a high quality in situ network. This report when finalized will be presented to GCOS Steering Committee, CIMO Management Group and the relevant CBS Expert Team.

It was noted that the strategy for timing the launches of the radiosondes remained to be agreed (there would be disadvantages of not having a synoptic time of launch in terms of creating an independent climate record. Moreover, it is difficult to collocate a sounding in time with a satellite overpass as the sounding takes 2 hours to complete). This network is a key part of building resilience in the climate system so that there are some observations that approach absolute accuracy and baseline character. It relates to calibration issues and ways to overcome a possible break in record. However there ought to be a process to examine what makes sense in terms of consolidating disparate networks, like GUAN, aeronet, ozonesonde, BSRN etc.

Recommendation 15: the panel supports the Upper Air Network strategy presented by GCOS and urges a first stage in the implementation, by defining some priority steps (starting small, but starting). Additional sensors could be added in a second stage.

A general discussion was held on the importance of a coordinated approach to climate reference networks, to be advocated both by GCOS and WCRP. A recommendation on this issue will be included in the recommendation to GEO for CI-06-02 task.

In the closing session, Task group leaders summarized briefly their preliminary conclusions, to be drafted for e-mail consultation within WOAP (deadline 20 September for GEO, 30 September for the others) and these were reviewed, as given above.

The Chair asked for feedback on the meeting and proposals for next year's agenda. Possible venues are Melbourne in December 2007, or Japan after or before Reanalysis Conference (28 Jan-3 Feb 2008), other proposals welcome. It is desirable to meet in conjunction with another activity to enrich participation and offset costs. WCRP Director indicated after the meeting that no financial support for WOAP was available in 2007, therefore recommended the Jan-Feb 2008 proposal.

Recommendation 16: WOAP recommendations will be available for presentation (if desired by WCRP) by the Chair at the next OCD meeting in Beijing, 7-8 November 2006 and next JSC meeting Zanzibar, last week of March 2007.

Recommendation 17: presentations will be put on WOAP website, password protected.

Appendix 1: Agenda of WOAP II meeting

Second WCRP Observations and Assimilation Panel (WOAP) Meeting

JRC ISPRA, 28-30 August 2006
BUILDING 44- ROOM 038

Documents indicated by * are posted on the site:

<http://copes.ipsl.jussieu.fr/Organization/COPESStructure/WGOA.html>

Day 1: Monday, 28 August 2006

0830: Assemble

0900: Start

Session 1: WOAP, where are we, where do we go?

1.1- Purpose of the meeting, summary of actions since last meeting (K. Trenberth).
Reference documents: report from WOAP1, WOAP report on GCOS*, Reanalysis in support of climate research*, WCRP views on Earth Observation missions*, CEOS response to WCRP*, CEOP and WCRP*, Data Assimilation activity within WCRP* 1/2hour*

0930

1.2- Report on WCRP JSC and place of WOAP within WCRP:

- Overview by *K. Trenberth*
- Comments on interface with WMP (*Shukla*).

Reference papers: WOAP report to JSC plus K. Trenberth powerpoint*. 1hour*

1.3- Formation of task groups for this meeting: cf. proposal for task groups in appendix

1030- 11.00 Break

Session 2: Coordination with GCOS

2.1- GCOS: update on GCOS activities, focusing on participation of WCRP to GCOS IP, Joint GCOS-WOAP actions under way or required (D. Goodrich, A. Simmons, E. Harrison, A. Belward).

Reference papers: GCOS and OOPC reports to JSC, GCOS IP (cf. GCOS site), 1 hour*

Session 3: Space matters and relation with space agencies

3.1- GCOS satellite observation supplement (A. Simmons, E. Harrison, A. Belward)

*Reference paper: Supplement to GCOS IP on systematic observation requirements for satellite based products**

1230- 14.00 Lunch

PRESENTATION on JRC ACTIVITIES (B. Pinty) _ hour

3.2- CEOS paper in response to GCOS IP: Presentation by J.L. Fellous, discussion on WCRP's and GCOS' involvement (including participation to GEO task CI-06.02) and future actions in this domain

*Reference papers: draft of "CEOS response to the GCOS implementation Plan, a report to COP-12"(not available yet), ASIC³ (Achieving Satellite Instrument Calibration for Climate Change) Workshop Summary: May 6-18, 2006**

1 hour

1530-1600 Break

3.3- Observation requirements for climate, analysis of changes in NPOESS plans (K. Trenberth). Reference papers: discussion of impact of changes with regard to NPOESS on climate*, NPOESS re-baseline impacts: current status (Bill Rossow)* _ hour

**3.4- Follow up to last year's letter to CEOS, preparation of response to questions raised last year: specific WCRP priorities w/r to GCOS, scientific (and societal?) benefits from additional space observations: discussion lead by K. Trenberth
Input expected from Bill Rossow?**

**Possible actions for WOAP on items 3.3 and 3.4 and recommendations to WCRP and GCOS on how to address this major issue: discussion lead by K. Trenberth
Home Work: small task group to consider draft letter response that factors in all above**

1.5 hour

1800 END of DAY 1

Day 2

0830

Session 4: Participation in GEO and IGOS-P

4.1- GEO: update on 2006 workplan activities, focused on actions directly related to WOAP, review of draft 2007-2009 workplan

- GEO update by *M. Rast*
- Status of participation of WCRP in GEO (*G. Sommeria*)
- Comments by *M. Manton*

Reference papers: report on GEO for joint WCRP/IGBP session, draft GEO 2007-2009 workplan**
_ hour

4.2- Involvement of WCRP and GCOS in GEO tasks, how to feed in and benefit from GEO, message for GEO (*M.Manton, K.Trenberth*) _ hour

4.3- Update on the IGOS Water theme (*R.Lawford*) _ hour

4.4 - Update on the IGOS Cryosphere theme (*J.Key*) _ hour

4.5 - Discussion _ hour

10.30- 11.00 Break

Session 5: Data activities

5.1- Report on data activities of CEOP (*T. Koike*), how to extend them to WCRP? Follow up on the CEOP Task Group report from last year. _ hour

5.2- Update on WMO information system (*G. Sommeria*), discussion on relevance to WCRP _ hour

5.3- Data management activities (*T. Koike* and task group)

Review of existing WCRP web structure and sites, and recommendations for WCRP-wide over-arching structure, site contents and data policy. _ hour

12.30 14.00 LUNCH

5.4 Follow up on all aspects of this, recommendations on what WCRP should do on websites wrt data management, and wrt policy. WCRP cannot do data management but can facilitate and coordinate it, and work to minimize duplication of effort.

Reference doc: Xls spreadsheet: WCRP data map (*T.Koike*)* _ hour

Session 6: Reanalyses

6.1- Report from the Workshop on “The Development of Improved Observational Data Sets for Reanalysis: Lessons learned and future directions” 28-29 September 2005, Maryland, USA* and recommendations for WOAP actions (*K. Trenberth*)

6.2- Report from June ECMWF workshop and discussion of follow-up actions (*A. Simmons*)
Total: 1hour

15.30- 16.00 BREAK

6.3 - Plans for the GSOP ocean reanalysis workshop (*D. Stammer*)

6.4 - Preparation for reanalysis conference in Japan funding needs and role of GEO and WOAP (*T. Koike*)

6.5 - AOPC meeting related outcomes (*A. Simmons*)

6.6 - WGNE activities (*A. Lorenc*) and follow up actions from the assimilation paper

6.7 - Update from all projects on data assimilation activities (*all project rep*)

6.8 - Discussion on (i) data for reanalysis and possible formation of WG (with GCOS), and (ii) overall status of reanalyses plans and projects and how it is possible to support and coordinate (role of WCRP and funding issues)

Total: 2 hours

Reference papers: report of "data sets for reanalysis" workshop, ECMWF/GEO workshop on atmospheric reanalysis*, agenda for CLIVAR/GODAE workshop*, CLIVAR/GODAE Global synthesis evaluation framework*, outline of third international reanalysis conference**

18.00 END of DAY 2 DINNER HOSTED by IES

Day 3

0830

Session 7: Reprocessing

7.1 - Report summarizing the status with regard to activities related to reprocessing, including variables suitable for reprocessing (need, readiness), activities definitely planned, and funding and commitments already obtained and required. Endorsement of reprocessing principles (*G. Duchossois, presented by G. Sommeria*). Additional comments by project reps.

7.2 - Role of WOAP and how WCRP should or could package this to make it more visible and fundable, including a possible synthesis to be proposed to agencies

1030- 11.00 BREAK

7.3 - Charging task group to follow through and general discussion on recommendations (lead by *K. Trenberth*)

Reference papers: Letter and reprocessing principles from K. Trenberth, Project reports*, Landsea paper on trends in tropical cyclones and critique*, excerpt from Seaflux report*, voluntary observing ships (Kent et al)*, Guidelines for evaluation of Air-sea flux data sets*, note on reprocessing of climate data (G. Duchossois)* 2 1/2 hour*

1130

Session 8: Reflection on WCRP observation strategy

(IN SITU NETWORKS, LONGER TERM SPACE PRIORITIES)

8.1- Main issues: introduction by *K. Trenberth*

A key issue is the low priority being given to climate and continuity, and how to make noises in appropriate places to upgrade both in situ networks and satellite missions. (prepare a set of questions for this item?)

8.2- report on the May GCOS/NOAA meeting on reference radiosonde network, Reference doc: GCOS/NOAA Reference Upper Air Network meeting report* *D. Goodrich*

8.3- reports by task groups formed during meeting

12.30-14.00 LUNCH

8.4- actions by GCOS panels, (*GCOS panel chairs*)

8.5- role of WOAP (*K. Trenberth* lead)

Other Business

- IPY
- Next meeting
- OCD meeting in Beijing
- JSC meeting

Close of the meeting: around 4 P.M.

Appendix:

PROPOSAL FOR TASK GROUPS for this meeting

1/ Satellite Task Group to deal with item 3: space matters and relation with space agencies. Prepare draft response of WCRP to CEOS and others, clarify WCRP views and concerns wrt NPOESS plans...

M. Manton, A. Belward, N. McFarlane, J. Key (e-mail exchanges with W. Rossow)

2/ Reanalyses: recommendations for follow-on actions and joint WG with GCOS on data for reanalysis:

A. Simmons, D. Stammer, G. Flato, J. Shukla

3/ Data management:

N. McFarlane, T. Koike, E. Harrison, M. Tjernström

4/ Reprocessing:

R. Lawford, J.L. Fellous, A. Lorenc, (W. Rossow by e-mail)

5/ GEO items:

G. Sommeria, M. Manton, T. Koike, M. Rast, R. Juvanon du Vachat

Appendix 2: List of participants

- Chair:** **Kevin Trenberth**
National Center for Atmospheric Research (NCAR)
trenbert@ucar.edu
- Scientific Officer:** **Gilles Sommeria**
GCOS Secretariat
GSommeria@wmo.int
- Scientific Secretary:** **Régis Juvanon du Vachat**
Météo-France
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- Ex-officio:** **J. Shukla** (Chair modeling panel)
George Mason University
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- CliC:** **Jeffrey Key**
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- CLIVAR:** **Detlef Stammer**
University of Hamburg
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- GEWEX:** **William Rossow** replaced by **R. Lawford (D. IGPO, gewex@gewex.org)**
NASA Goddard Institute for Space Studies
wrossow@giss.nasa.gov
- SPARC:** **Bill Randel** replaced by **N. Mc Farlane (D. SPARC Office, norm.mcfarlane@ec.gc.ca)**
National Center for Atmospheric Research (NCAR)
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- WGCM:** **Greg Flato**
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greg.flato@ec.gc.ca
- WGNE:** **Andrew Lorenc**
UK Met Office
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- (WGSF):** **Elizabeth Kent** not available
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- CEOP** **Toshio Koike**
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- AOPC:** **Adrian Simmons**
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TOPC: **Alan Belward**
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IGBP: **Michael Tjernström**
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CEOS-SIT: **Jean-Louis Fellous**
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Nominated expert: **Mike Manton**
michael.manton@sci.monash.edu.au

Michael Rast (representing GEO, mrast@geosec.org)
Ann Henderson-Sellers (D/WCRP, ahenderson-sellers@wmo.int)
David Goodrich (D/GCOS, dgoodrich@wmo.int)
Bernard Pinty (JRC, bernard.pinty@jrc.it)
Michel Verstraete (JRC, michel.verstraete@jrc.it)

Appendix 3: Documents available for the meeting

- [Agenda WOAP2 revised August 24, 2006 \(.doc format\)](#) - [\(.pdf format\)](#)
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- **Session 1 - WOAP, where are we, where do we go?**
 - [Report from the WOAP-1 Meeting \(.doc format\)](#) - [\(.pdf format\)](#)
 - [WOAP Report on GCOS \(.doc format\)](#)
 - [Reanalysis in support of climate research](#)
 - [WCRP views on Earth Observation missions \(.pdf format\)](#)
 - [CEOS response to WCRP \(.pdf format\)](#)
 - [CEOP and WCRP \(.doc format\)](#)
 - [Data Assimilation Activity within WCRP](#)
 - [Report to JSC XXVII, March 2006 \(.doc format\)](#)
 - [Observations and their analysis for WCRP/COPE5 \(.ppt format, 4.2 Mbytes\)](#)
 - **Session 2 - Coordination with GCOS**
 - [GCOS report to JSC \(.doc format\)](#)
 - [OOPC report to JSC \(.doc format\)](#)
 - **Session 3 - Space matters and relation with space agencies**
 - [Supplement to GCOS IP on systematic observation requirements for satellite based products \(.doc format\)](#)
 - [ASIC³ Workshop Summary \(.doc format\)](#)
 - [Discussion of impacts of changes in plans with regard to NPOESS on climate \(.doc format\)](#)
 - [NPOESS Re-baseline Impacts: Current Status \(.doc format\)](#)
 - **Session 4 - Participation in GEO**
 - [Report on GEO for joint WCRP/IGBP session \(.doc format\)](#)
 - [Draft GEO 2007-2009 workplan \(.pdf format\)](#)
 - **Session 5 - Data activities**
 - [WCRP Data Map \(.xls format - .pdf format\)](#)
 - [WMO Information System \(.doc format\)](#) (posted August 25, 2006)
 - **Session 6 - Reanalysis**
 - [Report of the Workshop on "The Development of Improved Observational Data Sets for Reanalysis: Lessons learned and Future Directions \(.doc format\)](#)
 - [ECMWF/GEO Workshop on Atmospheric Reanalysis, ECMWF, 19-22 June 2006 \(.doc format\)](#)
 - [Agenda of CLIVAR/GODAE Meeting \(.doc format\)](#) (posted August 24, 2006)
 - [CLIVAR/GODAE Global Synthesis Evaluation Framework \(.doc format\)](#) (posted August 24, 2006)
 - [Outline of third international reanalysis conference \(.doc format\)](#)
 - **Session 7 - Reprocessing**
 - [Letter from K. Trenberth \(.doc format\)](#)
 - [Principles for Re-Processing Climate Data Records \(.doc format\)](#)
 - [CliC reprocessing efforts \(.doc format\)](#)
 - [GEWEX report to WOAP2006: Status of global, long-term datasets and plans for their reprocessing \(.doc format\)](#)
 - [The SPARC Data Center - brief overview and summary of current data holdings \(.doc format\)](#)

- WCRP Working Group on Surface Fluxes (WGSF) Requirements for Datasets and Reprocessing of Marine Data ([.doc format](#))
- CLIVAR Global Datasets and Reprocessing Activities ([.doc format](#))
- Can We Detect Trends in Extreme Tropical Cyclones? ([.pdf format](#))
- Critique of "Can We Detect Trends in Tropical Cyclones?" ([.pdf format](#))
- Exerpt from seaflux report ([.doc format](#))
- Voluntary observing ships ([.pdf format](#)) (posted August 24, 2006)
- Guidelines for evaluation of air-sea flux datasets ([.pdf format](#)) (posted August 24, 2006)
- Reprocessing of climate data ([.doc format](#)) (posted August 24, 2006)
- **Session 8 - WCRP Observation Strategy**
 - GCOS Reference Upper Air Network: Justification, requirements, and siting and instrumentation options ([.doc format](#))

Appendix 4: Commentary of issues put forward by the Chair at the opening of the meeting

WOAP: Under COPEs, in order to develop a strategy for WCRP, it was regarded as essential to have an observations, analysis and assimilation oversight panel, WOAP, that is complementary to WMP. This helps establish a framework for comprehensive activities in WCRP.

WOAP is not intended to duplicate GCOS, which is more operationally oriented and which does not focus as much on the analysis phase, but to complement it. Paraphrased TOR:

- Identify climate **observational requirements**
- Help **optimize** observations
- Act as a **focal point** for WCRP interactions with other groups
- Promote and coordinate **analysis, reprocessing, reanalysis and assimilation**
- Promote and coordinate **information and data management** activities, including web sites.

Promoting the needed research in all areas related to observations for climate, e.g.,

- to optimize the observing system,
- to help make observational choices with limited funds,
- to balance in situ vs satellite
- to get maximum value from observations,
- to develop new analytical techniques,
- to develop new diagnosis techniques and new products, and
- to promote reprocessing and reanalysis to improve climate data records.
- to promote comprehensive assessment of the state of the climate system
- to promote archival of research observations

We also have the mandate to promote and enhance data management activities in WCRP.

And we act as a focal point for contacts with other organizations such as GCOS, GEOSS, CEOS, IPCC, etc. wrt observations.

Should we be doing more on some of these, or other items?

- At JSC: WOAP has been charged with oversight of observational and analysis activities related to all projects and especially task groups as they wind up.
- Also CEOP data management activities are to be reviewed by WOAP.

Why should we have WOAP?

When you come to a WOAP meeting, do you feel like it is a burden or a chore? Or do you look forward to it because you learn something and get to promote something of use to you or your project? If not the latter, how can we make it so?

How do we judge the success, or otherwise of WOAP?

At the last JSC the issue was raised about metrics for WCRP activities. I am opposed to simple metrics as they can distort activities to try to get a good score. However, there ought to be an assessment of value and achievements. What have we accomplished and are the accomplishments of value?

How should we operate? This Panel is a panel of people who are already members of other WGs. Everyone is a volunteer. I plan on working everyone at the meeting and with some, but limited homework, through use of task groups. Do we need some standing subgroups? Spin off workshops?

An achievement is to have a meeting, given shortages of resources. We really ought to have several invited guests present (e.g., Bruce Wielicki, Tom Karl...)

Some Achievements

1) We drafted a **letter to CEOS** about climate concerns of WCRP. It was a good letter and probably should have been distributed much more widely: to many program managers (e.g. NOAA: Jack Kelly, Greg Withee, Tom Karl, Rick Spinrad (was Rick Rosen), Chet Koblinsky; NASA: Jack Kaye...). Those concerns have been exacerbated by recent events: the cancellations in NPOESS. Also GOES is in similar trouble. The responses we got from CEOS were quite unsatisfactory and clearly show a need for continuing education and pressure on the officials who have influence in setting satellite priorities to meet the climate needs. One major task for us is to continue with this in the light of the recent developments.

2) We had a good discussion on **reanalysis** and set up the ECMWF workshop, which went very well, and we will have a report that highlights the progress and outstanding issues: and there are many. We also made the suggestion to Japan to hold the next reanalysis conference, and that is proceeding. Report follows later. But much more is to be done.

Data assimilation is a key charge for this committee that is not dealt with by GCOS. We wrote some short documents that are on the web site, with good links and which can be used to make the case for reanalysis. What about assimilation?

3) We have established some principles for **reprocessing**, that are posted on the web site, and begun to assess the needs and how to promote these. In IPCC it is clear that the need is high.

Need to follow up with IPCC on needs for obs and data: UNFCCC and SBSTA informs UNFCCC about obs needs. Research needs assessed at SBSTA : overhead, burden, worth it. Contact Susan about IPCC input to this.

4) We reviewed **CEOP** and made some concrete proposals for changes which have been partly implemented.

5) We have established a presence and credibility so that WOAP has been invited to quite a few fora and I have given half a dozen or more presentations that have generally been well received and opened eyes (NRC/CRC, Obs reanal workshop in MD, Eumetsat (Nuremberg), WMP, ASIC3, JSC, Ref Sonde mtg, ECMWF Reanal wkshp).

6) Misc. others: data management, web sites, GEO interactions.

Appendix 5: joint GCOS/WCRP letter to CEOS (prepared by WOAP)

USA

30 October 2006

Ms Barbara J. Ryan
Chair, Committee on Earth Observation Satellites
Associate Director for Geography
U.S. Geological Survey
12201 Sunrise Valley Drive MS-102
Reston, VA 20192

Dear Ms Ryan,

We are writing to continue the dialogue between CEOS and the World Climate Research Programme (WCRP) started in 2005 with letters signed by Colin Hicks and Peter Lemke and the ongoing discourse between CEOS and the Global Climate Observing System (GCOS). WCRP agrees that the GCOS Implementation Plan (GIP) and the follow-on Systematic Observation Requirements for Satellite-based Products for Climate supplement (GCOS-107) provide a basis for the evolution of the global observing systems for climate. Both WCRP and GCOS greatly appreciate the work of CEOS to develop a response to the GIP over the last year (Satellite Observations of the Climate System; the CEOS Response to the GCOS-107). The complementary and mutually supporting roles of satellite and in situ observations is well emphasized in the CEOS response. WCRP and GCOS wish to stress further some aspects of the priorities from the perspective of research, especially that feeding into the need for long-term reliable climate records for many purposes, including understanding climate variability and change and any future assessments by bodies such as IPCC. Climate change research requires accurate detection of small changes over a long period of time. As a result, instrument accuracy and stability requirements and/or satellite mission operation practices need to be stringent. It is also clear that the primary imperatives for all essential climate variables are to maintain global homogeneity and time continuity of existing records.

The CEOS response raises very important issues that require international consideration and action. Many measurements of essential climate variables are taken through research missions with limited lifetimes, and so there is a need for strategies that lead to sustained support for these measurements. The response also emphasizes the need for greater attention to calibration and validation across agencies and missions, in addition to careful quality control processes within each mission. WCRP and GCOS endorse those sentiments.

Some of the difficulties in establishing and maintaining climate observations from space are currently being highlighted by the de-scoping of NPOESS, in which climate observations have been seriously compromised. The difficulties with NPOESS are very public, but similar issues arise in other missions that comprise both measurements for climate and measurements for real-time application such as numerical weather prediction. While many climate instruments have demonstrated high levels of stability, they generally lack the absolute accuracy or calibration required to overcome climate record data gaps. Because there is so much interannual to decadal variability in our climate system, data record gaps seriously degrade the ability to detect climate change and to constrain forcings and feedbacks in the climate system. Improved calibration, absolute accuracy, and benchmarks (including in situ observations) can help in this process.

However, unless revised plans compensate for the anticipated shortcomings in climate observations, gaps in several key climate data records (some that go back almost 30 years) are highly likely. An especially urgent issue is the potential gap in Earth Radiation Budget measurements, which include the monitoring of the solar radiation and which can be considered to be the most fundamental observations of the climate system. WCRP and GCOS assert that our ability to address critical climate issues, with profound societal implications, will be strongly limited unless observation of climate variables is given higher priority. We urge that this be done.

The continuing problems in establishing and maintaining global measurements of essential climate variables highlight the need for formal international coordination of these measurements across agencies and missions, in liaison with user groups from the climate community. Coordination is especially important in the design phase of missions (so that consistency and continuity can be maintained) and in the calibration and validation processes (so that spatially and temporally consistent data can be collected). Both of these aspects are identified in the CEOS response through the virtual constellation concept and the Global Space-based Inter-Calibration System (GSICS). Particularly in relation to GSICS, it was encouraging to note the proposal for greater cooperation between CEOS and the Coordination Group on Meteorological Satellites (CGMS).

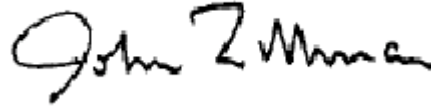
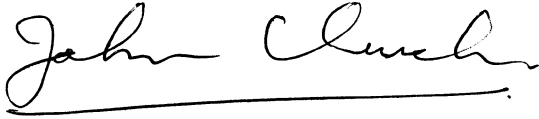
WCRP and GCOS wish to emphasize, once again, that a key part of the overall strategy in creating climate data records, is the need to have a vibrant program of reprocessing of past data (as is highlighted in the GIP and the satellite requirements supplement for many variables) and reanalysis of all the data into global fields. The Fourth Assessment Report of the IPCC, due out early in 2007, is likely to highlight shortcomings in many climate records, especially those from space. But those studies and related research have also demonstrated the potential for improvements in the records. Identified problems and new algorithms and cross calibration techniques suggest that major improvements could be realized through reprocessing past satellite records. WCRP has posted a set of guidelines on when and whether it is appropriate to carry out reprocessing (see Annex 1). A recent example that has come to the fore is the need to improve the information on tropical cyclones and how they may have changed in intensity, size, duration, and character.

An ad hoc or piecemeal approach, variable by variable and/or agency by agency, is not always the most efficient way to proceed. Resources are required to build and sustain the teams needed to carry out the much needed research. Further, it is recognized that there is a need to differentiate between level-1 data, for which the responsibility for data management and reprocessing rests almost entirely with the space agencies, and level-2 and level-3 data, whose production and subsequent reprocessing involves other scientists to a degree that varies from product to product. There are also special needs for each domain (atmosphere, ocean, terrestrial) that have to be taken into account. Once again, coordination among the major space agencies is highly desirable.

Experience with recent reanalyses, such as the ECMWF ERA-40, also suggests that major advances would accrue to the global climate record, and ultimately improve substantially the analysis of atmospheric circulation and climate in the next IPCC assessment. The WCRP and GCOS consider that these activities should be ongoing, as changes in the observing system and improvements in processing will continue. Building an internationally coordinated climate data base, along with appropriate metadata, for reanalysis is a part of the need, and preliminary plans are underway within WCRP and GCOS to set up a working group, probably through GEO, to address this issue. Although reprocessing is identified in the CEOS response (e.g., actions C-15 and C-19), it should receive more prominence and requires coordination across agencies. WCRP and GCOS urge that priority be given to establishing a systematic program of reprocessing past data.

The WCRP and GCOS would welcome the opportunity to continue to work with CEOS and CGMS to assist in the implementation of the processes and systems outlined in the CEOS response to the GIP. As international programs, WCRP and GCOS are able to foster international cooperation, coordination and consensus-building, which are critical elements of the implementation strategies outlined in the CEOS response.

Yours sincerely,



Dr John Church, Chair
World Climate Research Programme
Joint Scientific Committee

Dr John Zillman, Chair
Global Climate Observing System
Steering Committee

cc: CEOS members and associates
Co-chairs and Director GEO, Director GCOS, Director WMO Space Programme, Director WCRP
NASA: Jack Kaye, NOAA: Richard Spinrad, John J. Kelly, Chester Koblinsky, US Climate Research Committee: Antonio Busalacchi

Appendix 6: Joint GCOS/WCRP comments on GEO 2007-2009 workplan, 2 October 2006 (prepared by WCRP Observation and Assimilation Panel)

This text should be considered as a complement to responses sent earlier by GCOS and WCRP on version1 of the plan. It may not address specific points that each programme is willing to raise independently.

As clearly stated in the GEO 10-year Implementation Plan, the GCOS Implementation Plan should serve as the general basis for GEO tasks in the climate societal benefit area. This Plan (recently complemented by a document especially dedicated to the satellite-based observations), which has been initially prepared in response to UNFCCC requirements, is now considered by the various international bodies dealing with climate observations as a commonly agreed basis for actions in this domain. Without going back to the detailed justification, nicely presented in the GEO 10-year IP, it would be useful to refer in the 2007-2009 workplan to the GCOS IP as the backbone for the various climate tasks. In order to ease the “convergence” policy of GEO, we see three main long-term tasks which could cover basically all aspects: “Sustained reprocessing and reanalysis of the climate record” (follow-up of CI-06-01), an enlargement of CI-06-02 to “Key climate observations in response to GCOS IP”, and the proposed CI-07-P1 new task “Seamless Weather and Climate Prediction System” (joint proposal by THORPEX and WCRP).

In CI-06-01, we would propose to replace “initiation” by “development”, which is more appropriate at the 2-3 year time-scale, and also highlight the importance of maintaining data records which have already started. In CI-06-02, we would wish to underline the need for both the development of a coordinated response from space agencies (as already on-going) and a coordinated reinforcement of the observing systems in the “atmospheric”, “oceanic” and “terrestrial domains”. This would mean a progressive convergence of CI-02, 03, 05 and 06 into a joint long-term task, involving of course the major observing systems, which are WMO/GOS, WMO/GAW, WHYCOS, GOOS and GTOS. We see an important role for GEO in advocating this major undertaking at the political level, in relaying concerns of the GCOS and WCRP communities for gaps identified in the various systems (e.g. continuity and calibration issues in data records and satellite programmes, deficiencies and coordination of in situ networks, including the establishment of a global upper-air reference network), and in encouraging joint meetings between providers of in situ and space data. In the presentation of CI-07-P1, we would suggest replacing “high-resolution global and regional data assimilation” by “coupled atmosphere/ocean data assimilation”.

In addition to the climate tasks mentioned above, the Panel was informed of the interest of CEOP in two new tasks, WA-07-P2 (Satellite Water Measurements) and DA-07-P4 (Data Integration and Analysis System). The first one is of general interest to GEWEX and to CliC. In the second one, it is expected that CEOP can serve as a demonstration system of general benefit to the research and application communities. The panel's view is to support CEOP contribution in those two tasks, under WCRP's umbrella.

The panel has also examined the new proposed US-07-P2 task (Millennium development goals) and sees this task as having the potential to promote the use of climate products and climate forecast products to support development goals, as advocated in the long-term objectives of both GCOS and WCRP. It recommends a declaration of interest from GCOS and WCRP in this task, without involving specific resources at this stage.

It is understood that the GEO Secretariat has limited resources for the direct support of activities. The support received from GEO for the ECMWF workshop on reanalyses as part of C1-06-01 was much appreciated. With respect to future GEO planning, we would like to emphasize that GCOS and WCRP do not have the resources to implement the additional activities associated with GEO tasks. We understand that GEO may provide indirect support by promoting climate activities to potential partners. However, it is important that GEO is seen by the overall community to be directly supporting some specific tasks in each societal benefit area. This need is especially important for the climate societal benefit area which provides vital information for a number of other domains covered by GEO.

Appendix 7: Task force on data management in the WCRP, proposed terms of reference

Tasks

1. The task force will review the status and management of observational data and model output archives within the WCRP core projects to ascertain:
 - (a) The current status of archived data and model output (what? where? purpose?).
 - (b) The degree of accessibility and ease of access to archived material.
 - (c) The degree of redundancy in the archived material either within the WCRP or between WCRP and other archives (e.g. major data centers).
 - (d) Anticipated future archiving of observational data/model output
 - (e) Possible need for and ways to facilitate coordination of data archiving and management in the WCRP
 - (f) Possible future resources needed for data archiving and management
2. The task force will report to WOAP and make recommendations as to possible actions that may be taken.

Composition: One member from each of the core projects, WOAP, and WMP.

Time lines: - Membership: December 31, 2006

- Final report: July 31, 2008.

Appendix 8: report article for EOS

Atmospheric reanalyses: Conclusions from a workshop highlighting future needs

ECMWF, 19-22 June 2006

Adrian Simmons, Kevin E Trenberth and Sakari Uppala

Over the past decade, reanalyses of multi-decadal series of past observations, produced using modern versions of the data assimilation systems developed for numerical weather prediction (NWP), have become established as an important and widely utilised resource for the study of atmospheric and oceanic processes and predictability. Reanalyses are also being used increasingly in a wide range of applications that require a record of the state of either the atmosphere or its underlying land and ocean surfaces. Whilst high-resolution operational NWP systems continue to provide good quality analyses for timely study of recent conditions, including climatic extremes, changes made to improve the operational systems introduce inhomogeneities in time series of operational analyses that limit their utility for studies of longer-term climate variability and change. Lower-resolution reanalyses produced using an up-to-date data assimilation system provide products for all but the last few years that are generally superior to those available from the archives of past operational products. The reanalysis products are by design more suitable than their operational counterparts for use in studies of longer-term variability in climate, although they remain susceptible to changes in the observing system that can make accurate depiction of long-term trends problematic.

Recent European Centre for Medium-Range Weather Forecasts (ECMWF) reanalyses (ERA) have exploited the substantial advances made in the ECMWF forecasting system and technical infrastructure since operations began at the Centre in 1979. The ERA-40 reanalysis project (1957-2002) was launched in 1998 and production was completed in 2003. To review progress since then and address future reanalysis requirements, a Workshop on Atmospheric Reanalysis was held at ECMWF from 19 to 22 June 2006. Funding was provided by ECMWF and the Group on Earth Observations (GEO), and the programme for the meeting was developed by ECMWF in liaison with the World Climate Research Programme (WCRP) Observation and Assimilation Panel (WOAP) and the Global Climate Observing System (GCOS)/WCRP Atmospheric Observation Panel for Climate (AOPC). The workshop considered the status of and plans for global reanalysis in Europe, Japan, and North America, and discussed the work needed to prepare for a new generation of improved multi-decadal global reanalyses to succeed ERA-40, the new Japanese reanalysis from 1979 to 2004 (JRA-25) and the earlier U.S. National Centers for Environmental Prediction (NCEP) reanalyses. Conclusions of recent related workshops were reviewed, in particular one that had focussed on the development of improved observational data sets for reanalysis, and one on bias estimation and correction in data assimilation.

User views expressed at the workshop confirmed the need for improved climate products, especially as regards the representation of moist processes, surface fluxes, the southern hemisphere in the pre-satellite era, constituent transport and low-frequency variability and trends. More generally, users require good documentation of reanalysis systems and their performance, measures of expected accuracy or uncertainty, continuation of reanalyses in near real time, capability to access reanalysis data assimilation systems to perform observing-system experiments and involvement in the planning of new reanalyses through User Advisory Groups.

Many user needs can be met by reanalyses for the recent decades for which there is good upper-air data coverage by satellites or at least radiosonde data. The possibility of extending reanalysis to cover earlier periods when only surface observations are available in reasonable numbers

(e.g., from the 1850s to the 1930s) is nevertheless of interest, and has been explored in two pilot studies comparing analyses with good coverage of satellite data and other upper-air data with analyses using only surface-pressure observations. It was shown that both ensemble Kalman filter and four-dimensional variational (4D-Var) approaches are capable of providing realistic analyses in the troposphere based on surface data only, provided that, in the case of 4D-Var, the background error statistics are adapted to reflect the state of the reduced observing system rather than today's data-rich system.

Instead of being viewed as a one-off effort, reanalysis has come to be seen as an iterative process, where developments in modeling, data-analysis techniques and computing power are allied with new data-rescue efforts and data and experience from earlier reanalyses to produce successive reanalyses of increasing quality. For application in climate studies, it is especially important that the process is organised and executed in such a way as to ensure that each new generation of reanalysis accounts increasingly well for changes in the global observing system.

Many observations, whether made for weather or climate purposes, are potentially useful in reanalysis provided that adequate metadata exist concerning their quality and how they were made. It should be an expectation that all data should be taken, recorded, and archived in ways that enable future reanalysis. To that end it is essential to have an ongoing data stewardship and management activity that is sufficiently well supported to collect and protect these valuable measures of the past climate. Such an activity should be international and distributed, but at the same time with a central directory that tracks and brings quality assurance to the process. The data include not only the raw observations that are to be input to new reanalyses (or other types of climate study), but also metadata on observation quality provided by previous use of these observations in reanalysis. Data are also required on the so-called forcings of the atmosphere, including the solar output, atmospheric composition, sea surface temperatures and surface land conditions. As reanalyses develop to encompass land surface model assimilation and ocean and sea ice analyses, the list of variables will expand. Closely related activities should routinely explore and document effects of changes in the observing system such as the deployment of new satellite platforms. This can be done both through observing system experiments and through analysis of the statistics of data usage by assimilation systems.

In addition, new generations of extended atmospheric reanalyses should exploit possibilities not open to daily operational weather prediction. A reanalysis system can, for example, be designed to make use of observations taken over a period after the analysis time as well as before. Utilization of the available observational information may be improved by lengthening the time window of the data assimilation in a so-called "weak-constraint" 4D-Var system. In such a system, the longer time window and an allowance for model error reduce dependence on the specification of background error statistics that are not easy to estimate and that vary with changes in the observing system. New approaches for handling observational and model biases within data assimilation systems also show promise for use in reanalysis. Although considerable investment is being made in underlying developments in data assimilation, such as presented at the workshop, the investment is being made primarily for application in NWP. Realization of the potential of these developments for reanalysis requires some additional investment to ensure good performance in long-term assimilation of data from the evolving observing system. Reanalysis for climate application cannot rely entirely on use of an off-the-shelf NWP system, however tried and tested in operational use with today's observing system.

Although much of the scientific and technical infrastructure developed for weather forecasting can nevertheless be exploited, reanalyses remain large and demanding undertakings. They require multi-institutional collaboration to acquire not only the many types of daily data to be ingested but also the necessary boundary forcing fields and specifications of atmospheric composition. Product continuity has to be maximized, involving the homogenization of input observations in addition to the bias handling built into the assimilation system itself. The production phase of a reanalysis typically runs over several years to a tight timetable that may be dictated by funding constraints or

availability of computing resources, and requires intensive monitoring to ensure satisfactory scientific and technical performance. Documentation, data services and user support are needed long after production is complete.

Because of the complexity and duration of these tasks, the potential for improved reanalysis cannot be realized without appropriate long-term organization, funding and international collaboration. Such an activity is an essential part of a global climate observing system.

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