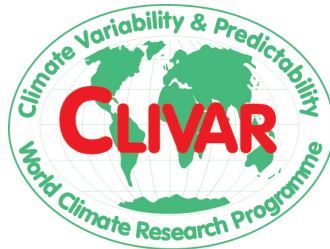


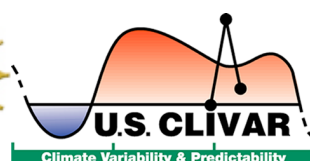


WORLD CLIMATE RESEARCH PROGRAMME



The Climate Variability and Predictability (CLIVAR) Handbook

August 2011



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1 CLIVAR Overview

Climate Variability and Predictability (CLIVAR) is one of the four core projects of the World Climate Research Programme (WCRP). WCRP was established in 1980 under the joint sponsorship of the International Council for Science (ICSU) and the World Meteorological Organisation (WMO), and since 1992 has also been sponsored by the Intergovernmental Oceanographic Commission (IOC) of UNESCO. The main objectives set for WCRP at its inception – which are still valid today – were to determine the predictability of climate and to determine the effect of human activities on climate. A detailed description of WCRP and its other three core projects are available at www.wrcp-climate.org.

CLIVAR was established in 1995. CLIVAR's mission is to facilitate observation analysis and prediction of changes in the Earth's climate system, with a focus on ocean-atmosphere interactions, enabling better understanding of climate variability, predictability, and change, to the benefit of society and the environment in which we live. The objectives of CLIVAR are to:

1. Understand the causes of climate variability on the intra-seasonal to centennial time scales through observation, analysis, and modelling;
2. Improve predictions of climate variability and change associated with both internal and external processes; and
3. Extend the observational climate record through assembly of quality-controlled paleoclimatic and instrumental data sets.

2 Programme Structure

The organisational structure of CLIVAR is summarised in Figure 1.

The Scientific Steering Group (SSG) has oversight over the implementation of CLIVAR and reports to the Joint Scientific Committee (JSC) of the World Climate Research Programme (WCRP).

For efficient implementation, coordination, and management of the CLIVAR programme, several panels and working groups have been established. Some are organised jointly with other WCRP component programmes or in close collaboration with the International Geosphere-Biosphere Programme (IGBP), the Global Climate and Global Ocean Observing Systems, or the Intergovernmental Panel on Climate Change (IPCC) activities.

The CLIVAR SSG continuously reviews the organisational structure of the programme with the aim of eliminating the distinction between the component programmes and combining them into a single CLIVAR programme that has common modelling, observing, and analysis projects.

The International CLIVAR Project Office (ICPO) is responsible for the coordination of both the scientific and administrative aspects of the CLIVAR programme under the oversight of the CLIVAR SSG. The ICPO is supported by the UK's Natural Environmental Research Council (NERC) and the US CLIVAR Office, which receives support from US funding agencies; primarily NASA, NOAA, and NSF.

The Terms of Reference and present membership of each of the CLIVAR panels and working groups are provided in section 3.

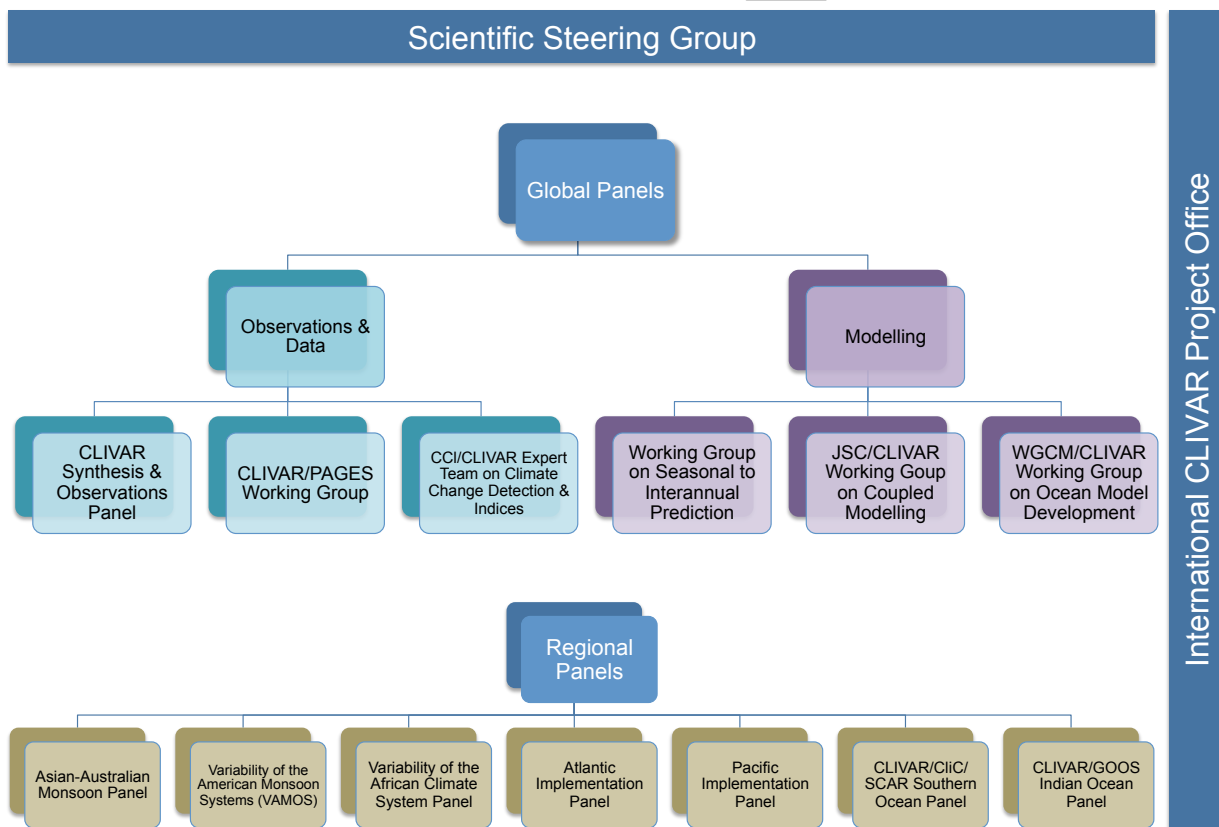


Figure 1: Schematic diagram summarising the current structure of CLIVAR

3 CLIVAR Panels and Working Groups

3.1 Cross-cutting or Global Panels

CLIVAR Scientific Steering Group (SSG)

Terms of Reference

1. To formulate the CLIVAR research programme on climate variability and predictability, based on coupled ocean-atmosphere models, guided by the analysis of observations including paleoclimatic reconstructions, as required to understand the phenomena and predict climate variations.
2. To organise an observing programme that would fulfil the data requirements of CLIVAR, taking into account the development of the operational Global Climate and Global Ocean Observing Systems and possible contributions from national research projects.
3. To provide scientific guidance for the implementation of CLIVAR, using advice of experts and expert groups as necessary.
4. To ensure the exchange and analysis of CLIVAR data and the dissemination of scientific results.
5. To establish scientific liaison with relevant organisations and existing programmes, as appropriate.
6. To advise the Joint Scientific Committee of the World Climate Research Programme of progress achieved in the implementation of CLIVAR and scientific advances in the understanding of climate variability and predictability.

Members

J. Hurrell (co-chair) (12)	NCAR, USA.
M. Visbeck (co-chair) (12)	IFM-GEOMAR, Kiel, Germany
K. Drinkwater (12)	Institute of Marine Research, Bergen, Norway
L. Goddard (11)	Earth Institute at Columbia, USA
S. Gulev (12)	Russian Academy of Sciences, Moscow, Russian Federation
V. Masson-Delmotte (14)	Atomic Energy Commission and Energy Alternatives, France
S. Rintoul (12)	CSIRO, Australia
S. Schubert (12)	NASA Goddard Space Flight Center, USA
D. Wang (12)	Chinese Academy of Sciences, Guangzhou, China

Ex-Officio Members

One chair/co-chair from each CLIVAR panel and working group (with other co-chairs as alternates)

Dr Kevin Trenberth NCAR, Boulder, USA
(chair, GEWEX)

Contact

The group email address for the CLIVAR SSG is clivar-ssg@clivar.org.

The ICPO contact for the CLIVAR SSG is [Dr Bob Molinari](#).

Working Group on Seasonal to Interannual Prediction (WGSIP)

Terms of Reference

1. To develop a programme of numerical experimentation for seasonal to interannual variability and predictability, paying special attention to assessing and improving predictions.
2. To develop appropriate data assimilation, model initialisation and forecasting procedures for seasonal-to-interannual predictions, considering such factors as observing system evaluation, use of ensemble and probabilistic methods and statistical and empirical enhancements, and measures of forecast skill.
3. To advise the CLIVAR SSG on the status of seasonal to interannual forecasting and on the adequacy of the CLIVAR observing system, and to liaise with the JSC/CLIVAR Working Group on Coupled Modelling and the JSC/CAS Working Group on Numerical Experimentation.

Members

B. Kirtman (co-chair) (11)	RSMAS, U. Miami, USA
A. Scaife (co-chair) (13)	UK Met Office, UK
O. Alves (11)	CAWCR, CSIRO, Australia
S. Behera (13)	JAMSTEC, Japan
G. Boer (11)	CCCma, Victoria, Canada
D. DeWitt (09)	IRI, Palisades, USA.
F. Doblas-Reyes (13)	IC3, Spain
H. Douville (13)	METEO, France
A. Kumar (13)	NOAA CPC, USA
W. Landman (11)	CSIR, S. Africa
A. Morse (10)	University of Liverpool, UK
C. Saulo (12)	CIMA, Universidad de Buenos Aires, Argentina
S. Seneviratne (13)	Swiss Federal Institute of Technology Zurich, Switzerland

Contact

The group email address for this panel is clivar-wgsip@clivar.org.

The ICPO contact for CLIVAR WGSIP is [Dr Anna Pirani](#).

JSC/CLIVAR Working Group on Coupled Modelling (WGCM)

The Working Group on Coupled Modelling is a joint group of the Joint Scientific Committee for the WCRP and CLIVAR.

Terms of Reference

1. Review and foster the development of coupled climate models, including organisation of model intercomparisons and utilisation of available instrumental records and paleo-climatic data for model validation and diagnosis of shortcomings.
2. Promote coordinated experimentation with coupled models aiming to understand natural climate variability on decadal to centennial time scales and its predictability, and to predict the response of the climate system to changes in natural and anthropogenic forcing.
3. Promote the development of appropriate data assimilation procedures for coupled models and consider questions related to initialisation.
4. Undertake other modelling activities in support of CLIVAR and WCRP, as requested by the CLIVAR Scientific Steering Group and the JSC.
5. Advise the CLIVAR Scientific Steering Group and the WCRP Joint Scientific Committee on progress in the development and use of global coupled models, and review and coordinate modelling activities as appropriate within CLIVAR and in WCRP as a whole.
6. Maintain close cooperation with the JSC/CAS Working Group on Numerical Experimentation in establishing an integrated approach to climate modelling in WCRP.
7. Liaise as appropriate with IPCC and the Global Analysis, Interpretation and Modelling (GAIM) element of IGBP.

Members

G. Meehl (co-chair) (13)	NCAR, Boulder, USA
S. Bony (co-chair) (13)	LMD/IPSL, France
P. Bracannot (12)	CEA-CNRS, France
V. Eyring (12)	DLR, Institut fuer Physik der Atmosphaere, Wessling, Germany
M. Giorgetta (12)	Max Planck Institute for Meteorology, Germany
A. Hirst (12)	CSIRO, Aspendale, Australia
D. Karoly (12)	University of Oklahoma, USA
M. Kimoto (12)	University of Tokyo, Japan
N. Nakicenovic (12)	IIASA, Austria and Vienna University
B. Wang (12)	State Key Lab. (LASG), China
C. Senior (13)	Hadley Centre, Met Office, UK
N. Mahowald (13)	Cornell University, USA
C. Jones (13)	SMHI, Sweden

Ex-officio Members

CMIP Panel:

R. Stouffer (chair)	NOAA/GFDL, USA
K. Taylor	PCMDI, USA
C. Covey	PCMDI, USA
M. Latif	IFM-GEOMAR, Germany
J. Mitchell	Met Office, UK

G. Flato (member of the WCRP JSC), CCCMa, Canada

Co-chairs, WGOMD, WGNE, AIMES

Contact

The group email address for this panel is clivar-wgcm@clivar.org.

The contact for the JSC/CLIVAR WGCM is [Dr Ghassem Asrar](#), JSC for WCRP.

The ICPO contact for WGCM is [Dr Anna Pirani](#).

DRAFT

CLIVAR/WGCM Working Group on Ocean Model Development (WGOMD)

Terms of Reference

1. To stimulate the development of ocean models for research in climate and related fields, with a focus on decadal and longer timescales at mid- and high-latitudes.
2. To encourage investigations of the effects of model formulation on the results of ocean models, making use of sensitivity studies and intercomparisons.
3. To promote interaction amongst the ocean modelling community and between this and other communities through workshops and other activities.
4. To stimulate the validation of ocean models when used in stand alone mode and as part of a coupled ocean-atmosphere model, using oceanographic data and other methods, and to advise on the observational requirements of such studies.
5. To publicise developments in ocean models amongst the climate modelling community.
6. To collaborate with other activities in areas of overlapping responsibility.
7. To advise on ocean modelling and related issues and to report on its activities to the JSC/CLIVAR WGCM and the CLIVAR Scientific Steering Group.

Members

G. Danabasoglu (12)	NCAR, Boulder, USA
H. Drange (12)	University of Bergen, Bergen, Norway
E. Curchitser (13)	Rutgers University, USA
R. Greatbatch (11)	IFM-GEOMAR, Germany
S. Griffies (13)	Geophysical Fluid Dynamics Lab., NOAA, Princeton, USA
G. Madec (11)	LODYC, France
S. Marsland (12)	CSIRO, Australia
H. Tsujino (11)	Japan Meteorological Agency, Tsukuba, Japan
D. Holland (13)	Courant Institute, NYU, USA
K. Fennel (13)	Dalhousie University, Canada
G. Nurser (13)	National Oceanography Centre, Southampton, UK

Ex Officio Members

R. Gerdes (Clic)	Alfred Wegener Institut für Polar- und Meeresforschung, Bremerhaven, Germany
C. Böning	Leibniz Institut für Meereswissenschaften, Kiel, Germany
E. Chassignet	RSMAS, Miami, USA
A.M. Treguier	Laboratoire de Physique de Océans, IFREMER, France

Contact

The group email address for this panel is clivar-wgcmd@clivar.org.

The ICPO contact for CLIVAR/WGCM WGOMD is [Dr Anna Pirani](#).

CLIVAR Global Synthesis and Observation Panel (GSOP)

Terms of Reference

The CLIVAR Global Synthesis and Observations panel is established to:

1. Develop, promote, and seek to implement strategies for a synthesis of global ocean, atmosphere, and coupled climate information through analysis and reanalysis efforts and through the use of other techniques where appropriate. Initial emphasis will be on global ocean synthesis efforts, building on previous experiences and developments.
2. Be responsible for the definition and fulfilment of CLIVAR's global needs for sustained observations (in collaboration with relevant WMO and IOC bodies, including GCOS, GTOS, GOOS, AOPC and OOPC, and JCOMM), and for the development of a strategy for their evolution/optimisation based on new science and reanalysis insights, and fostering the use of resulting data sets in global synthesis efforts.
3. Promote activities to develop the surface flux data sets required by CLIVAR in liaison with WGNE, global atmospheric reanalysis efforts and the WCRP Working Group on Surface Fluxes.
4. Provide an overview of, and directions to, CLIVAR data management and information activities in collaboration with other WCRP projects and in liaison with CLIVAR-relevant data centres, DACS, and the ICPO.
5. Liaise and collaborate with CLIVAR panels and working groups in identifying the requirements for, and coordinating the development of, an observing system for CLIVAR.

The panel reports to the CLIVAR SSG.

Members

K. Haines (co-Chair) (11)	ESSC, University of Reading, UK
B. Sloyan (co-Chair) (11)	CSIRO, Marine Research, Hobart, Australia
T. Awaji (14)	Kyoto University, Japan
M. Balmaseda (14)	ECMWF, UK
B. Barnier (14)	Laboratoire Ecoulements Geophysiques et Industriels, Grenoble, France
S. Josey (11)	National Oceanography Centre, Southampton UK
T. Lee (14)	Jet Propulsion Laboratory, USA
M. Palmer (14)	Met Office, Hadley Centre, UK
T. Tanhua (11)	Leibniz Institute of Marine Sciences, Kiel, Germany
J. Willis (11)	NASA/JPL California Institute of Technology, USA

Ex-Officio Members

M. McPhaden - chair of the Tropical Moored Buoy Implementation Panel	NOAA/PMEL, Seattle, USA
D. Roemmich - co-chair of the Argo Scripps Institution of Oceanography, La Jolla, USA Steering Team	
U. Send - co-chair of OceanSITES Scripps, La Jolla, USA	

Contact

The group email address for this panel is clivar-gsop@clivar.org.

The ICPO contact for GSOP is [Dr Nico Caltabiano](#).

CLIVAR/PAGES Working Group

Terms of Reference

The PAGES / CLIVAR Working Group will work to:

1. Promote improved high resolution, well-dated, quantitative paleoclimate records with seasonal to interannual resolution, in regions that are of direct relevance to IGBP and WCRP.
2. Formulate and promote, in collaboration with [PAGES](#) and CLIVAR, a programme for analysing and synthesising paleoclimatic data in order to reveal evidence of patterns of variability within the climate system over seasonal to millennial time scales.
3. Promote improved quantitative methods of model-data comparison and evaluation in order to understand the variability present in both the paleoclimatic record and the models.
4. Promote the use of paleoclimate data to examine issues of climate predictability.
5. Coordinate with other modelling activities of relevance to IGBP and WCRP.

Members

G. Schmidt (co-chair) (11)	NASA/Goddard Institute for Space Studies, New York, USA
V. Masson-Delmotte (co-chair) (11)	Lab. de Modelisation d. Climat et de l'Environnement, Gif-sur-Yvette, France
C. Ammann (11)	NCAR, Boulder, USA
J. Beer (11)	EAWAG, Dübendorf, Switzerland
K. Briffa (11)	University of East Anglia, Norwich, UK
K. Cobb (11)	Georgia Institute of Technology, Atlanta, USA
J. Jungclauss	Max Planck Institute for Meteorology, Hamburg, Germany
M. Mann (11)	University of Virginia, Charlottesville, USA
A. Schmittner (12)	Oregon State University, Corvallis, USA
P. Valdes (12)	University of Bristol, Bristol, UK

Contact

The group email address for this panel is clivar-pages@clivar.org.

The ICPO contact for the PAGES/CLIVAR Working Group is [Ms Catherine Beswick](#).

The PAGES contact for the PAGES/CLIVAR Working Group is [Dr Thorsten Kiefer](#).

3.2 Regional Panels

CLIVAR Asian-Australian Monsoon Panel (AAMP)

Terms of Reference: Updated version

1. Evolve and coordinate strategies to increase understanding of climate variability, predictability and predictions of the coupled ocean-atmosphere-land system in the Asian-Australia-Africa monsoon on timescales from intraseasonal to decadal and longer (tie into WGSIP/THORPEX);
2. Promote improvement of model simulations, predictions, and projections of monsoon, especially recognizing the fundamental role of monsoon intraseasonal variability (tie into GCSS/GEWEX, WGCM, WGNE)
3. Contribute to design and implementation of monitoring strategies, including process studies and sustained long term observations, for the Indian Ocean, Western Pacific and surrounding marginal seas and land regions necessary for monitoring and investigating the structure and mechanisms of monsoon variability and change. (into IOP and PP)
4. Co-ordinate and promote interactions among meteorologists, oceanographers and hydrologists in order to foster... (not sure: to recognize coupled nature of the land-ocean-atmosphere nature of the monsoon and to better deliver predictions of monsoon variability including impacts on hydrology)
5. Work in co-operation with other existing and planned regional and multinational programs directed at improving our understanding of the monsoon system, which include investigations on regional weather forecasting, seasonal climate prediction and impacts on human activities.

Members

H. Hendon (co-chair) (12)	BMRC, Melbourne, Australia
K. Sperber (co-chair) (12)	Lawrence Livermore National Laboratory, Livermore, USA
I.S. Kang (12)	Seoul National University, Seoul, Korea
A. Kitoh (12)	Meteorological Research Institute, Japan
M. Lengaigne (14)	National Institute of Oceanography, Goa, India
H. Meinke (12)	Tasmanian Institute of Agricultural Research, University of Tasmania, Australia
M. Rajeevan (12)	National Atmospheric Research Laboratory, Andhra Pradesh, India
A. Turner (12)	University of Reading, UK
G. Vecchi (12)	NOAA/ Geophysical Fluid Dynamics Laboratory, Princeton, USA
B. Wang (12)	University of Hawaii, Honolulu, USA
X. Zeng (12)	University of Arizona, USA
T. Zhou (12)	State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Dynamics, China

Contact

The group email address for this panel is clivar-monsoon@clivar.org.

The ICPO contact for the CLIVAR Asian Australian Monsoon Panel is [Dr Carlos Ereño](#).

CLIVAR/GOOS Indian Ocean Panel (IOP)

The need for high-quality ocean observations is shared by research (CLIVAR) and ocean applications and services (GOOS) and there is a shared conviction that, together, the ocean community should endeavour to establish the basis for a comprehensive ocean observation network and oversee the staged implementation of a sustainable ocean observing system for the Indian Ocean. It is therefore agreed that a panel will be established and supported by CLIVAR and GOOS (through Indian Ocean GOOS and the Perth Office of the IOC) with the following terms of reference.

Terms of Reference

1. Provide scientific and technical oversight for a sustained ocean observing system for the Indian Ocean and Indonesian Throughflow in order to provide ocean observations needed for climate variability research, and to underpin operational ocean applications and services relevant to the region, particularly with regard to ocean-state estimation and climate prediction.
2. Develop, coordinate, and implement a plan for a sustained ocean observing system for the Indian Ocean, to: (a) meet the common requirement of CLIVAR research themes and regional initiatives, particularly those identified by AAMP and VACS and the CLIVAR modelling panels; (b) satisfy the common requirements of GOOS and its modules; and (c) coordinate implementation activities in collaboration with relevant regional and global bodies and IOGOOS and JCOMM in particular.
3. Liaise with relevant research panels of CLIVAR and implementation panels of GOOS and JCOMM and provide a focal point for coordination of ocean observing networks in the region.
4. Report to the CLIVAR SSG through its AAMP and to GOOS through the IOC Perth Office.

Members

W. Yu (co-chair) (13)	First Institute of Oceanography, Qingdao China
Y. Masumoto (co-chair) (12)	FORSGC, JAMSTEC, Tokyo, Japan
M. Feng (12)	CSIRO, Australia
W. Han (14)	University of Colorado, USA
R. Hood (12)	Horn Point Lab. Uni. Maryland, USA
T. Lee (13)	NASA Jet Propulsion Laboratory, Pasadena, USA
C. Magori (14)	Kenya Marine and Fisheries Research Institute, Kenya
M. McPhaden (13)	NOAA, PMEL, Seattle, USA
M. Ravichandran (14)	INCOIS, India
W. de Ruijter (13)	University of Utrecht, NL
T. Shinoda (14)	Naval Research Lab, Stennis USA
D. Sengupta (12)	Indian Institute of Science, India
A. Supangat (14)	National Council on Climate Change, Indonesia
G. Vecchi (13)	NOAA-GFDL, Princeton, USA
J. Vialard (13)	LOCEAN, Paris, France

Ex-Officio Members

G. Meyers (IRF convener)	CSIRO, Hobart, Australia
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Contact

The group email for this panel is clivar-iop@clivar.org.

The ICPO contact for the Indian Ocean Panel is [Dr Nico Caltabiano](#).

Atlantic Implementation Panel

Terms of Reference

1. Recommend and oversee the implementation of observations in the Atlantic Ocean sector and of research on Atlantic climate variability and predictability, in order to meet the objectives outlined in CLIVAR's Science and Initial Implementation Plans, particularly with respect to the Principal Research Areas D1 (NAO), D2 (TAV), D3 (THC), and anthropogenic climate change.
2. Collaborate with JSC/CLIVAR WGCM, WGOMD, and WGSIP in order to contribute to the design of appropriate numerical experiments and to jointly define and implement the requirements for data sets needed to validate and initialise models.
3. Liaise with relevant CLIVAR panels, in particular the Arctic Climate Panel, the Southern Ocean Panel, and the VAMOS and VACS panels to ensure that best use is made of resources from regional research programmes.
4. Liaise with GSOP, OOPC, PIRATA, ARGO, and the IOC-CO2 panel to ensure that CLIVAR benefits from and contributes to GEOSS.
5. Liaise with relevant interdisciplinary SCOR-IGBP groups such as PAGES, GLOBEC, IMBER, and SOLAS, and with regional Atlantic marine ecosystem research programs such as BCLME and GCLME, to ensure that CLIVAR benefits from and provides input to these programmes.
6. Respond to needs from stakeholders and facilitate the transfer of knowledge from science to operations and applications with respect to Atlantic climate variability and predictability issues.
7. Report to the CLIVAR SSG.

Members

L. Terray (co-chair) (12)	CERFACS, Toulouse, France
P. Brandt (co-chair) (13)	IfM-GEOMAR, University of Kiel, Germany
M. Baringer (12)	NOAA/AOML/PHOD Miami, USA
S. Camargo (12)	LDEO Columbia University, USA
P. Chang (12)	Texas A&M University College Station, USA
R. Curry (11)	Woods Hole Oceanography Institution, USA
T. Farrar (13)	Woods Hole Oceanography Institution, USA
B. Hansen (13)	Faroe Marine Research Institute, Faroe Islands
Y. Kushnir (11)	LDEO, Columbia University, USA
M. Mata (12)	FURG Rio Grande, Brazil
M. Rouault (13)	University of Cape Town, South Africa
D. Smith (12)	Hadley Centre, Met Office, UK
A. Treguier (12)	LPO IFREMER Plouzane, France

Ex-Officio Members

A. Koertzing (Carbon Rep.)	IfM-GEOMAR, University of Kiel, Germany
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Contact

The group email address for this panel is clivar-atlantic@clivar.org.

The ICPO contact for the CLIVAR Atlantic Implementation Panel is [Dr Nico Caltabiano](#).

Pacific Implementation Panel

Terms of Reference

1. Oversee and facilitate the implementation of CLIVAR in the Pacific sector in order to meet the objectives outlined in the Science and Initial Implementation Plans, particularly with respect to:
 - Expanding and Improving ENSO predictions;
 - Variability and predictability of the Asian-Australian Monsoon system; and
 - Indo-Pacific Decadal Variability.
 And also on Pacific impacts on:
 - Variability and predictability of the American Monsoon system;
 - Southern Ocean Climate variability; and
 - Climate change prediction/detection and attribution.
2. Develop broad-scale atmospheric sampling plans and processes studies to complement the oceanic observations planned for the Pacific and as an integral component of the strategy to improve atmospheric and coupled models. To work with agencies and nations to sustain broad-scale atmospheric sampling in the Pacific.
3. Coordinate the activities of the Pacific nations, facilitating cooperative efforts and coordinating work within the boundaries of the various nations as well as outside those boundaries. To provide a forum for exchange and discussion of national plans in the Pacific.
4. Organise and conduct workshops that will entrain oceanographers, atmospheric scientists, and other investigators from the Pacific nations, that will lead to formulation of plans for broad-scale sampling and for sampling locations of high interest (such as boundary currents), and will coordinate not only the field activities but also the modelling, empirical, and paleo studies in the Pacific.
5. Collaborate with WCRP WG on Coupled Modelling, the CLIVAR WG on Seasonal-Interannual Prediction and the WG on Ocean Model Development in order to design appropriate numerical experiments. To be aware of the requirements of these groups for data sets needed to validate models.
6. Liaise with the Ocean Observation Panel for Climate (OOPC), with the Joint Commission for Oceanography and Marine Meteorology (JCOMM), with the Atmospheric Observations Panel for Climate (AOPC), and other relevant groups to ensure that CLIVAR benefits from and contributes to observations in GOOS and GCOS.
7. Advise the CLIVAR SSG of progress and obstacles towards successful implementation of CLIVAR in the Pacific.

Members

W. Cai (co-chair) (13)	CSIRO, Div. of Atmospheric Research, Aspendale, Australia
A. Ganachaud (co-chair) (13)	Legos.IRD, Noumea, New Caledonia
M. Collins (14)	University of Exeter, UK
M. Jochum (12)	Ncar, Boulder, USA
M. Lengaigne (12)	LOCEAN, Paris, France
R. Martinez (11)	CIIFEN, Guayquil, Ecuador
F. Molteni (12)	ECMWF, Reading, UK
S. Power (11)	BMRC, Melbourne, Australia
B. Qiu (11)	University of Hawaii, Honolulu, USA
T. Suga (11)	JAMSTEC, Japan
U Takayabu (13)	University of Tokyo, Japan

L. Wu (14)

Ocean University of China, Qingdao, China

Ex-officio Members

M. McPhaden

NOAA/PMEL, Seattle, USA (Tropical Moored Buoy Implementation Panel)

Contact

The group email address for this panel is clivar-pacific@clivar.org.

The ICPO contact for the Pacific Implementation Panel is [Dr Nico Caltabiano](#).

DRAFT

CLIVAR/CliC/SCAR Southern Ocean Panel

Terms of Reference

1. Design a strategy to assess climate variability and predictability of the coupled ocean-atmosphere-ice system in the Southern Ocean region.
2. Engage and interact with the Southern Ocean Observing System (SOOS) programme on Southern Ocean sustained observations and model experiments needed to meet the objectives of CLIVAR, CliC, SOOS and SCAR.
3. Work in concert with relevant CLIVAR panels (e.g. regional panels, numerical experimentation groups), ACSYS/CliC Panels (DMIP, OPP, NEG) and other groups (e.g. Ocean Observation Panel for Climate, Argo Science Team) to integrate Southern Ocean observations with those in neighbouring regions to ensure the objectives of CLIVAR/CliC/SCAR are met and resources are used efficiently.
4. Enhance interaction between the meteorology, oceanography, cryosphere biogeochemistry and paleoclimate communities with an interest in the climate variability of the Southern Ocean region.
5. Serve as a forum for the discussion and communication of scientific advances in the understanding of climate variability and change in the Southern Ocean region.
6. Work with the CLIVAR, CliC, SCAR, SOOS and WCRP Data Council data systems on issues related to distribution and archiving of Southern Ocean observations.
7. Advise the CLIVAR, CliC, SOOS and SCAR SSGs on progress achieved towards implementation.

Members

M. England (co-chair) (12)	University of New South Wales, Australia
K. Speer (co-chair) (11)	Florida State University, Tallahassee, USA
Y. Fukumachi (11)	Hokkaido University, Sapporo, Japan
H. Goosse (11)	Université catholique de Louvain, Louvain-la-Neuve, Belgium
N. Lovenduski (14)	University of Colorado, USA
G. Marshall (13)	British Antarctic Survey, UK
A. Naveira Garabato (11)	National Oceanography Centre, Southampton, UK
S. Rintoul (11)	CSIRO, Hobart, Tasmania, Australia
S. Speich (11)	University of Bretagne Occidentale, Brest, France
D. Thompson (11)	Colorado State University, Fort Collins, USA

Ex Officio Members

A. Orsi	Texas A&M University, College Station, USA (iAZone)
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Contact

The group email address for this panel is clivar-sthnocean@clivar.org.

The ICPO contact for the CLIVAR Southern Ocean Panel is [Ms Catherine Beswick](#).

The ICPO South America contact is [Dr Carlos Ereño](#).

Variability of the American Monsoon Systems (VAMOS) Panel

Terms of Reference

1. Be responsible for the formation of detailed scientific plans and conceptual designs of international projects to investigate the variability and predictability of the American monsoon system in the context of global climate variability and predictability.
2. Promote and coordinate studies of climate change impacts on the American monsoon system as well as studies of adaptation, including the social sciences perspective.
3. Coordinate and promote interactions among atmospheric scientists, environmental scientists, oceanographers and hydrologists, and in general Earth System science researchers from interested nations to work on VAMOS problems.
4. Coordinate, advise and support other CLIVAR and WCRP groups on investigations that need to be carried out to meet VAMOS objectives, and provide the VAMOS products that may be useful to those groups.
5. Work closely and coordinate with other national, regional and international projects and organisations interested in this area of research, e.g. US CLIVAR, the Inter-American Institute for Global Change Research (IAI), the International Research Institute for Climate and Society (IRI), and GEWEX.

Members

E.H. Berbery (co-chair) (12)	University of Maryland, USA
D. Gochis (co-chair) (14)	NCAR RAO, Boulder, Colorado, USA
R. Arritt (14)	Iowa State University, USA
W. E. Baethgen (14)	IRI, Palisades, USA
M. Barreiro (14)	Universidad de la Republica, Uruguay
T. Cavazos (11)	CICESE, Ensenada, Baja California, Mexico
I. Cavalcanti (14)	CPTEC, INPE, Brazil
A. Douglas (14)	Creighton University, USA
B. Kirtman (12)	RSMAS, Miami, USA
A. Montecino (11)	Universidad de Concepcion, Chile
P. Salio (14)	CIMA, Universidad de Buenos Aires, Buenos Aires, Argentina
M. Taylor (14)	University of the West Indies, Jamaica
P. Zuidema (13)	Rosenstiel School of Marine and Atmos. Sciences, University of Miami

Contact

The group email address for this panel is clivar-vamos@clivar.org.

The ICPO contact for the CLIVAR VAMOS Panel is [Dr Carlos Ereño](#).

CLIVAR Variability of the African Climate System (VACS) Panel

Terms of Reference

1. Develop and refine a VACS implementation plan, based on the work of the CAWG and CATT, to diagnose the variability and predictability of African climate and its relationship to the global climate system. This plan should take into account the objectives listed below.
2. Prepare requirements for limited-period and sustained observations in support of the CLIVAR Programme in and around the African continent; establish links with, and present the requirements to, the other major climate-observing programs (e.g. GCOS, WWW, GOOS).
3. Promote and coordinate efforts for evaluations and improvements of model simulations (e.g., AMIP, CMIP, IPCC) for the African region.
4. Promote development of African climate databases and foster access thereto for research purposes in cooperation with projects such as CLICOM, DARE, and INFOCLIMA.
5. Promote the involvement of African scientists within VACS and the use of VACS products in capacity building activities.
6. Develop cooperative investigations with other CLIVAR groups and national, regional, or international research programmes and organisations interested in this area of research.
7. Develop links with programmes and organisations interested in the application of VACS research (e.g. CLIPS and START) and, as far as feasible, integrate requirements of these programmes and organisations into VACS.
8. Execute the VACS implementation plan and measure the success of the plan against stated objectives.
9. Report to the CLIVAR SSG as required on progress and problems in developing and implementing the VACS plan.

Members

R. Washington (co-chair) (13)	School of Geography and the Environment, University of Oxford, Oxford, UK
R. Anyah (13)	University of Connecticut, USA
P. Lamb (13)	University of Oklahoma, USA
F. Semazzi (13)	North Carolina State University, USA
S. Mason (13)	IRI, USA
M. Kadi (14)	ACMAD, Niamey, Niger
J. Mutemi (13)	University of Nairobi, Kenya
A. Tall (13)	Red Cross/Red Crescent Climate Center, and Université Cheikh Anta Diop de Dakar, Senegal
M. Shongwe (13)	Ministry of Tourism & Environmental Affairs, Swaziland
M. Rouault (13)	University of Cape Town, S. Africa

Ex-officio Members

C. Thorncroft (AMMA Liaison)	University of Albany, USA
A. Morse (WGSIP Liaison)	University of Liverpool, UK
Representative of the Drought Monitoring Center (Harare, Zimbabwe)	
Representative of the Agromet Center (Niamey, Niger)	

Contact

The group email address for this panel is clivar-africa@clivar.org.

The ICPO contacts for the CLIVAR VACS Panel are [Dr Nico Caltabiano](#) and [Dr Anna Pirani](#).

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CCI/CLIVAR Expert Team on Climate Change Detection and Indices

Terms of Reference

1. Provide international coordination and help organise collaboration on climate change detection and indices relevant to climate change detection.
2. Further develop and publicise indices and indicators of climate variability and change from the surface and sub-surface ocean to the stratosphere.
3. Encourage the comparison of modelled data and observations perhaps via the development of indices appropriate for both sources of information.
4. Coordinate these and other relevant activities the ET chooses to engage in (such as perhaps observing system experiments that help determine where observations are needed for climate change detection) with other appropriate agencies such as GCOS, CBS, CIMO, CAgM, CHy, IPCC, and START, as well with the joint WCRP JSC/CLIVAR Working Group on Coupled Modelling, the WCRP Observations and Assimilation Panel, and regional associations.
5. Explore, document and make recommendations for addressing the needs for capacity building in each region, pertinent to this topic.
6. Submit reports in accordance with timetables established by the OPAG chair and/or Management Group.

Members

X. Zhang (co-chair) (14)	Climate Research Division, Canada	CLIVAR
A. Klein-Tank (co-chair) (14)	KNMI, The Netherlands	CCI
M. Rusticucci (14)	University of Buenos Aires, Argentina	CCI
B. Trewin (14)	Bureau of Meteorology, Australia	CCI
P. Zhai (14)	China Meteorological Administration, China	CCI
G. Hegerl (14)	University of Edinburgh, UK	CLIVAR
L. Alexander (14)	University of New South Wales, Australia	CLIVAR
F. Zwiers (14)	Environment Canada, Canada	CLIVAR
E. Kent (14)	National Oceanography Centre, Southampton, UK	JCOMM
E. Harrison (14)	University of Washington, USA	JCOMM
E. Lindstrom (14)	NASA, USA	JCOMM
P. Stott (14)	UK Met Office, UK	JCOMM
A. Dai (14)	NCAR, USA	GEWEX

Contact

The group email address for this panel is clivar-etccdi@clivar.org.

The ICPO contact for the CCI/CLIVAR/JCOMM ETCCDI is [Dr Anna Pirani](#).

4 Imperatives for CLIVAR Research

The overall aim of WCRP's strategic framework for 2005-2015 (Coordinated Observation and Prediction of the Earth System, COPES) is to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit, and value to society. To help focus its activities under COPES, WCRP has developed an Implementation Plan for its activities for the period 2010-2015 and a summary of its achievements under COPES to date. These can be downloaded via the following links:

WCRP Implementation Plan 2010-2015: http://wcrp.wmo.int/documents/WCRP_IP_2010_2015.pdf

WCRP 2008-2009 Achievements Report: http://wcrp.wmo.int/documents/WCRP_AR_2008_2009.pdf

At the 16th meeting of the CLIVAR Scientific Steering Group (SSG) in Madrid, May 2009, a preliminary list of CLIVAR imperatives contributing to the implementation of the WCRP-COPES strategy and to the WCRP Implementation Plan was considered. After considerable discussion amongst the SSG members the outcome was the following structure and key topics:

Imperative I - Anthropogenic climate change

Topics: Natural variability versus forced change; Climate sensitivity and feedbacks; Regional phenomena; Extremes.

Imperative II – Decadal variability, predictability and prediction

Topics: Determine predictability; Mechanisms of variability; Role of the oceans including the impact of ocean variations on land, temperature, precipitation, etc.; Adequacy of the observing system; initialisation; Prediction uncertainty; Drought.

Imperative III – Intraseasonal and seasonal predictability and prediction

Topics: Monsoons; El Niño-Southern Oscillation; Tropical Atlantic variability; Madden–Julian Oscillation/intraseasonal variability; Prediction uncertainty.

Imperative IV – Improved atmosphere and ocean components of Earth System Models

Topics: Analysis and evaluation; Climate process teams (process studies).

Imperative V – Data synthesis, analysis, reanalysis and uncertainty

Topics: Ocean; Coupled data assimilation systems.

Imperative VI – Ocean observing system

Topics: Advocacy for sustained observations; Development, implementation, and system design.

Imperative VII – Capacity building

Topical workshops; Summer schools; Expert training.

These imperatives will guide CLIVAR activities over the next several years.

5 CLIVAR Publications

5.1 CLIVAR's Newsletter

CLIVAR produces a newsletter – entitled 'Exchanges' – four times a year. Exchanges provides information on CLIVAR activities, achievements, and issues. The Newsletter is available electronically at the following address:

<http://www.clivar.org/publications/exchanges/exchanges.php>

5.2 Reports and Documents

Various reports and documents are generated by the ICPO staff, including meeting reports, descriptions of CLIVAR projects and summaries of cooperative programmes with other WCRP undertakings. These reports are available electronically at the following address:

<http://www.clivar.org/publications/reports/reports.php>

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6 International CLIVAR Project Office (ICPO)

The CLIVAR Programme is administered by the International CLIVAR Project Office, in consultation with the WCRP Joint Planning Staff Contact.

Contact

International CLIVAR Project Office
National Oceanography Centre, Southampton
University of Southampton Waterfront Campus
Southampton, SO14 3ZH
United Kingdom
tel: +44-23-8059-6777
fax: +44-23-8059-6204
email: icpo@noc.ac.uk

Director

Dr Bob Molinari

email: robert.molinari@noc.ac.uk
tel.: +44-23-8059-6208
fax: +44-23-8059-6204

Staff

Ms Catherine Beswick

email: catherine.beswick@noc.ac.uk

Dr Nico Caltabiano

email: caetano@noc.soton.ac.uk

Dr Carlos Ereño

email: carlos_eren@yahoo.com

Dr Anna Pirani

email: anna.pirani@noc.soton.ac.uk

Mr Matthew Reynolds

email: matthew.reynolds@noc.ac.uk

Mrs Christina Thompson

email: christina.thompson@noc.ac.uk

WCRP Joint Planning Staff Contact

Mrs Valery Detemmerman
c/o World Meteorological Organization
Case Postale No. 2300
CH-1211 Geneva 2
Switzerland
tel.: +41-22-730-8242
fax: +41-22-730-8036
email: vdetemmerman@wmo.int

7 CLIVAR Internet Pages

The CLIVAR Programme has its own homepage on the WWW at the URL-address:

<http://www.clivar.org/>

In addition to finding overviews about the structure and organisation of the CLIVAR programme, you will also find information about recent and planned activities, meetings, conferences, CLIVAR projects, and publications. Links with other sites and programmes interfacing with CLIVAR are also listed. We hope to develop this site to the full potential of the medium in order that you, the interested scientist, can not only read about what others are doing in CLIVAR but can also provide feedback and actively participate in the implementation of the programme.

If you notice errors or have any suggestions regarding the contents of this handbook, please advise:

**International CLIVAR Project Office
National Oceanography Centre
Southampton, SO14 3ZH
United Kingdom**

**tel: +44-23-8059-6777
fax: +44-23-8059-6204
email: icpo@noc.ac.uk**

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