Newsletter of the Climate Variability and Predictability Programme (CLIVAR)

Exchanges

Volume 1, No. 3

August 1996

In this issue

☞ Important note for all subscribers to CLIVAR *EXCHANGES*

Annual Update of the CLIVAR Mailing list :

The International CLIVAR Project Office will update its mailing list once a year beginning in January 1997. Through this effort we would like to minimize the number of duplicates and non-active members in our list. Therefore we kindly ask all subscribers interested in further issues of CLIVAR ***EXCHANGES*** to send the reply form on page 12 via mail, e-mail or fax to the ICPO before **December 31, 1996**. Please note that all members of CLIVAR committees and panels as well as subscribers who have signed up since beginning of this year remain on the list automatically.

News from the CLIVAR Scientific Steering Group

Allyn Clarke (Bedford Inst. Oceanography, Canada),
Kevin Trenberth (NCAR, Boulder, USA),
(CLIVAR SSG co-chairs)

In preparing for the Joint Scientific Committee and CLIVAR SSG meetings this spring, we realized how much the SSG under the leadership of Arnold Gordon had accomplished since 1993. The Scientific Plan was published in August 1995 and has already been reprinted to deal with the demand for copies. Great thanks are due to all those who contributed to this effort. However, the pressure continues as the SSG, at its fifth meeting in June in Sapporo, committed itself to completing an initial Implementation plan for CLIVAR by June 1997. While the Science Plan established the scientific goals, scope and heritage of CLIVAR, the Implementation Plan will define observational, analytical and modelling components and infrastructure that will become CLIVAR. We hope that national and regional governments and agencies will be willing to make funding commitments to these components and that the scientific community joins CLIVAR by writing the proposals and carrying out the programmes by which scientific progress towards our goals will be accomplished.

There is already much CLIVAR-related science and scientific planning underway. At meetings such as the American Meteorological Society's annual meeting last February, sessions on various aspects of climate variability and prediction and coupled climate models showed that there is a large, active, creative and young scientific community interested in this type of science. Before the SSG meeting in Sapporo, Japan, a number of the participants also took part in a workshop sponsored by JAMSTEC (Japan Marine Science and Technology Center) to discuss plans to extend the TOGA TOA mooring array into the western-most equatorial Pacific, the equatorial Indian Ocean and northward in the western Pacific (see also the Summary of the International Workshop of the Pacific Buoy Network in this issue). Regional and national plans are being developed for studies of the American monsoon (PACS), the tropical Atlantic (PIRATA) and the Indian subcontinent. This past year saw the first meetings of both CLIVAR Numerical Experimentation Groups and the Upper Ocean Panel. Over the coming months there will be meetings of the Australian-Asian Monsoon Panel and the CLIVAR/PAGES[1] Working Group as well as workshops on scientific issues related to DecCen climate variability including the coupling of the atmospheric and ocean and modes of variability due to oceanic changes alone. These meetings will all contribute to the creation of a CLIVAR Implementation Plan over the coming months. At its recent meeting the CLIVAR SSG engaged in vigorous debate concerning the scope and the nature of the Implementation Plan. The SSG decided that the implementation of CLIVAR will be an evolutionary process. An initial implementation plan should be developed within the next twelve months; amendments will be issued at irregular intervals to accommodate changes in direction of existing programmes and to add new programmes.

The SSG adopted the following general strategy to guide programme implementation:

- promote continuation of observational and data management activities implemented under TOGA, and the maintenance of those components of the WOCE observing and data management systems that will, if continued, support the scientific objectives of CLIVAR.
- develop a plan that will enable these activities to be reviewed in a timely manner and recommendations for enhancements to be made; these processes to be implemented through standing committees, workshops, assigning rapporteurs and cooperative activities with other WCRP and climate-related programmes.
- establish mechanisms whereby the outcome of these reviews and proposals for new activities can be presented for consideration by national and international scientific programmes.

The SSG adopted guidelines to assist upcoming CLIVAR implementation workshops and panels to contribute to the development of the initial CLIVAR Implementation Plan:

1. The aim must be to go beyond the Science Plan by making concrete proposals for observations, process studies and modelling.
2. A “wish list” of possible projects is not sufficient. Workshop recommendations must aim to contribute towards formulation of a realistic overall programme by:
   - defining project foci
   - setting priorities
   - recommending appropriate timetables and sequence of requirements.
3. In setting priorities, the workshop should take into account:
   - scientific justification and rationale which must relate to the CLIVAR objectives as stated in the Science Plan
   - readiness
   - feasibility, including technical and cost aspects
   - probabilities for multiple payoffs, i.e. formulate hypotheses to provide focus, but design programmes so that even if a specific hypothesis is not supported, there are still substantial gains, for instance, in advancement in understanding, improved models, etc.
   - collaboration with other programmes
   - balance of activities (field programmes, background observations, modelling, empirical studies)
   - contributions to more than one CLIVAR sub-programme (GOALS[2], DecCen and ACC[3]).

The SSG also agreed that wherever possible, CLIVAR would use existing mechanisms to coordinate its observational and data collection, distribution and archiving programmes. The CLIVAR SSG envisages that the Global Climate/Ocean Observing Systems (GCOS/GOOS) will play a major role in the implementation and operation of these aspects of the CLIVAR programme. Close collaboration is being established with other major international climate-related efforts to develop the CLIVAR Implementation Plan. In this issue an article by SSG member Neville Nicholls outlines the relationship between the IPCC and CLIVAR and an article by John Gould (director of the WOCE IPO) suggests ways in which CLIVAR may build on WOCE. Additionally, we invite the readers of this newsletter to regularly visit our home page on the web (address: **http://www.dkrz.de/clivar/hp.html**) to keep track of progress in creating the initial Implementation Plan.

Allyn Clarke, Kevin Trenberth

CLIVAR and the IPCC

Neville Nicholls,
BMRC, Melbourne, Australia

The Second Assessment of Working Group I of the Intergovernmental Panel on Climate Change (referred as IPCC 95) has just been published. An important conclusion of the Assessment, that the “*balance of evidence suggests a discernable human influence on global climate*”, has received extensive media coverage. The many uncertainties identified by IPCC 95 have received much less attention. The three streams of CLIVAR all have important roles in reducing these uncertainties, thereby ensuring that the next IPCC Assessment, probably at the end of the

1. Past Global Changes, IGBP component

2. Global Ocean Atmosphere Land System
3. Anthropogenic Climate Change

century, will be more confident in its pronouncements. The final section of the IPCC 95 "Summary for Policy-makers", a six page document approved word-by-word by 177 delegates from 96 countries at a meeting of Working Group I in Madrid in November 1995, is entitled "*There are still many uncertainties*". The section lists the following as priority topics: estimation of future emissions and biogeochemical cycling (including sources and sinks) of greenhouse gases, aerosols and aerosol precursors and projections of future concentrations and radiative properties; representation of climate processes in models, especially feedbacks associated with clouds, oceans, sea ice and vegetation, in order to improve projections of rates and regional patterns of climate change; systematic collection of long-term instrumental and proxy observations of climate system variables (e.g. solar output, atmospheric energy balance components, hydrological cycles, ocean characteristics and ecosystem changes) for the purposes of model testing, assessment of temporal and regional variability and for detection and attribution studies. Continued study is required to address all these three priority groupings. The first of these priority groupings, with its concentration on emissions, falls in programmes such as the International Geosphere Biosphere Programme (IGBP) and the Global Atmosphere Watch (GAW) of the WMO. The third grouping of priority topics, focusing on observed climate variations, is being handled through the Global Climate Observing System (GCOS), building on existing arrangements such as the World Weather Watch (WWW) of WMO. There is, however, a role for CLIVAR in the development of long-term climate system observations. For instance, the IPCC identified the need for such observations partly because of the need for improved detection and attribution studies. CLIVAR ACC has a role in the design and coordination of such studies, and should, therefore, also be involved in the preparation of the data sets required for detection and attribution studies. Identification of the observing systems most appropriate for climate change detection requires guidance from model experiments and CLIVAR, with its focus on modelling, can provide important advice here. As well, the preparation of high-quality historical climate data sets necessary for detection of change, requires paleoclimatic studies (a joint working group is being established by CLIVAR and the IGBP project on Past Global Changes (PAGES) to assemble detailed information on climate variations over the past 1000 years) or careful studies to remove the many flaws and heterogeneities in instrumental climate data. These flaws arise from changes in instrumentation or location and exposure of instruments, as well as changes in observing practices. It can sometimes be difficult to determine whether apparent changes in a climate variable are real or are due to one of these flaws. A whole variety of approaches, using different data and also involving climate models, may be needed to ascertain the cause of this changed behaviour. So, there is certainly scope for CLIVAR involvement in determining whether such changes are real. CLIVAR could also play a coordinating role in international studies to determine how the climate is changing. For instance, IPCC 95 found that data and analyses were too sparse to decide if, on a global scale, the weather or climate was becoming more extreme. A project has been initiated within GCOS to coordinate country studies on this topic - CLIVAR involvement will strengthen this project, and ensure that its results are useful in climate change detection. CLIVAR involvement with other groups interested in climate change detection, such as the WMO Commission for Climatology (CCl), will facilitate the answering of many of the questions raised in IPCC 95. The rationale here is that the combination of the experience and expertise in data and analysis in the CCl can be combined with the scientific input from CLIVAR, resulting in improved answers for the next IPCC assessment. Probably the main area where CLIVAR can assist IPCC however, is with the second list of priority topics, which focus on model improvement. CLIVAR ACC will lead to improved models, and the use of such improved models in climate change experiments should lead to improved climate change scenarios for IPCC. Some of the projects planned for CLIVAR and of relevance to IPCC are:

- *Model development*
  Progress in understanding in predicting the response of climate to anthropogenic forcing depends on improving coupled ocean atmosphere climate models. This includes the improvement of current parameterisations and the inclusion of new processes (notably

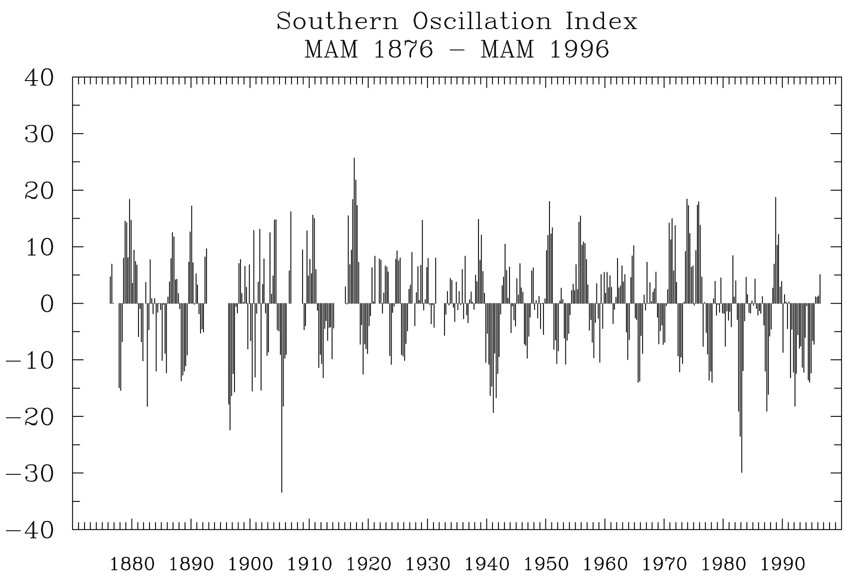


Figure 1 : Seasonal values of the Southern Oscillation Index (SOI). Only seasons where Darwin and Tahiti data are available have been plotted. Negative values generally correspond with El Niño episodes.

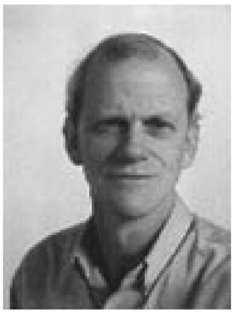
biological and chemical feedbacks). Progress in model development will be continually reviewed to assess model improvements made through numerical experimentation, and to identify areas which require further process studies.

• *Model intercomparison and validation*
The validation of models is essential both in assessing the impact of model development and the credibility of simulations of climate change. A standard approach to model validation is one of the requirements for IPCC assessments. The main activity will be the coupled model intercomparison project (CMIP) in CLIVAR NEG2. The initial stage will be an intercomparison of control simulations. Models will also be run with idealised forcing scenarios to allow the comparison of mechanisms of change in different models. Simulations of the past last hundred years or so will be run to aid the detection and attribution of climate change using, where appropriate, standard forcing data sets.

• *Sensitivity studies*
Although coupled ocean atmosphere models are the main tool for CLIVAR ACC, experiments with component models will be carried out to simplify the identification and analysis of feedback mechanisms. Initial experiments will include:
(a) Experiments with prescribed changes in SST (to identify cloud and other feedbacks)
(b) Equilibrium $2xCO_2$ experiments with mixed layer oceans (to calibrate the sensitivity of atmospheric models used in coupled experiments).

• *Calibration of simple models*
One of the requirements of IPCC is to estimate the climate response to a variety of forcing scenarios. At present, the only practical approach is to use simpler models. These simpler models need to be calibrated against full-scale climate models.

Many of these projects will be incorporated in the CLIVAR Implementation Plan currently being developed. The above has concentrated on what CLIVAR ACC can do for IPCC, but some of IPCC's concerns are relevant across all three of the CLIVAR streams. For instance, IPCC examined how the El Niño - Southern Oscillation might have changed in recent decades. Figure 1 is a time-series of seasonal SOI values. Only seasons with both Darwin and Tahiti data are plotted. The recent (1990-1995) extended period with negative SOI values has attracted much attention. IPCC concluded that this behaviour was "unusual in the context of the last 120 years". Investigation of this unusual behaviour, and exactly how unusual this behaviour is in the longer time frame, will require collaboration across all three CLIVAR streams, GOALS, DecCen, and ACC.



Neville Nicholls is the leader of the Climate Group in the Australian Bureau of Meteorology Research Centre, and is a member of the CLIVAR SSG. He was the Convening Lead Author for Chapter 3, "Observed climate variability and change" in IPCC 95. Neville has a PhD from the University of Melbourne, and an MBA from the Royal Melbourne Institute of Technology. He has published work on the nature, causes, predictability, and impacts of climate variability, especially the El Niño - Southern Oscillation, as well as on observed climate changes.

Ways in which CLIVAR might build on WOCE

John Gould,
WOCE IPO, Empress Dock, Southampton, UK

At the recent CLIVAR SSG in Sapporo John Church (WOCE SSG Co-Chair) and John Gould (WOCE IPO Director) tabled two papers summarising what observations, initiated or maintained under WOCE, might be considered for incorporation in a CLIVAR Implementation Plan and the structure and function of the WOCE data system.

These were presented so that the CLIVAR SSG could consider how elements of WOCE might serve CLIVAR needs. There has been discussion of these documents during and since the Sapporo meeting and revised versions are to be presented at the Villefranche CLIVAR DecCen workshop in November.

The assessment of variability in the ocean has been only one of a number of objectives of WOCE, but much can be gleaned from WOCE observations about decadal-scale ocean variability. The key to learning much more is likely to be continuity between the WOCE 1990-1997 observational phase and the 15 year CLIVAR programme.

The observational paper highlighted a number of subject areas as follows:

• *Meridional heat fluxes* have been or will be computed on a number of trans-basin WOCE sections but little if anything is known from observations about the seasonal and interannual changes in these fluxes. It was suggested therefore that CLIVAR observational strategy for flux determinations should
-focus on zonal sections used in WOCE.
-repeat these sections at intervals in order to determine interannual and longer-period changes in oceanic fluxes.
-build on the experience gained during WOCE to optimise observational techniques. (This particularly in respect of the need to obtain the best possible trans-

port estimates in boundary currents).

- *Water mass modification*
  There are seasonal and interannual changes in the properties and distributions of winter-modified water masses and of the strengths and positions of inter-gyre boundaries. Meridional sections can help to document these changes. During WOCE such sections have been supplemented by intensive surveys of upper ocean properties (e.g. the North Atlantic Vivaldi surveys of 1991 and 1996 which measured upper ocean water-mass properties and transports using a towed undulating Conductivity Temperature Depth instrument (CTD)). CLIVAR might consider incorporating observations that would build on these WOCE observations.

- *Repeated sections* across major current systems and inter-basin channels have been made in WOCE and might be considered for continuation by CLIVAR in order to document interannual and longer period changes in circulation. Western boundary currents are major elements of the global circulation and in mid-latitudes are important in the determination of meridional fluxes. Where direct measurements of transports in these currents exist they should continue.

- Some *time series stations and sections* that had been started many years before, were assimilated into WOCE plans. Many more were recommended by WOCE but were not implemented due to shortage of resources. The recent development of moored profiling CTD systems might relax the present constraint that time series stations and sections must be at locations which are easy to reach and service. However, they would not allow the comprehensive additional observations that add value to, for instance, the Bermuda and Hawaii time series.

- TOGA and WOCE together developed and maintained a global network of high density (eddy resolving) and low density *XBT lines* to document upper ocean thermal structure and to permit estimates of upper ocean heat storage. It is presently envisioned that the low density XBT network will be incorporated in GOOS to the extent that the scientific necessity for the data products continue to be elaborated by WOCE and CLIVAR. The high density lines would need to continue as a research activity under CLIVAR.

- *Upper ocean salinities* are important in defining annual changes in water mass properties and in the longer term in triggering the transition between climate states. The passage of the Great Salinity Anomaly around the N. Atlantic was reconstructed from a wide variety of data sources. Routine measurements of sea surface salinity from the Voluntary Observing Ships (VOS) fleet and from surface drifters would provide a means of observing in greater detail the origins and evolution of such features as the Great Salinity Anomaly. It is therefore recommended that the programme of instrumenting the VOS fleet with salinity sensors should be continued and expanded under CLIVAR. The deployment of surface drifters of the approved TOGA/WOCE design with salinity measuring capability should also be considered by the CLIVAR Upper Ocean Panel.

- The widespread *deployment of subsurface ALACE floats* has been a major element of WOCE. The profiling PALACE derivative is a powerful new tool with which to explore and monitor upper 1500m temperature and salinity structure particularly in remote areas. CLIVAR should consider therefore the deployment of PALACE floats in considerable numbers, in particular, the dominance of mesoscale variability requires a large number of floats to produce stable mean flow statistics needed to assess low frequency variability.

- *Satellite altimetry* has shed light on the variability of *sea level* in the open ocean and CLIVAR and WOCE have jointly pressed for the continuation of Topex-Poseidon-quality altimetric missions. The requirement for in-situ coastal and island sea level measurements however remains as a means of providing continuous long time series of guaranteed quality and as a reference for altimeter missions. Of particular importance as a monitor of variability in ocean circulation

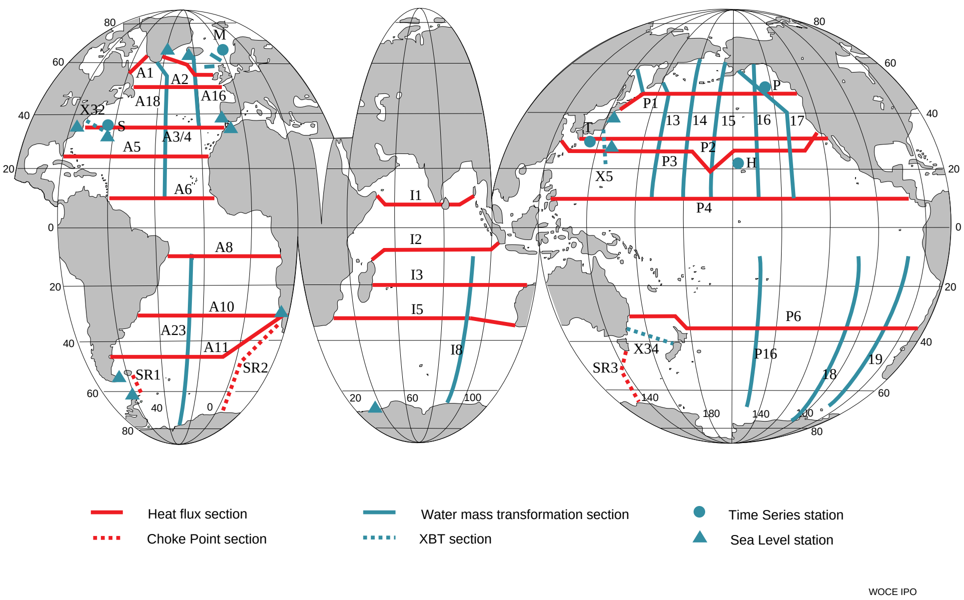


Figure 2: Hydrographic and current monitoring network for CLIVAR as proposed by WOCE.

are sea level measurements at either side of boundary currents and "choke" points, passages with significant throughflow.

Figure 2 shows a possible hydrographic and current monitoring network based on the discussion above.

WOCE has evolved a global network of Data Assembly and Special Analysis centres to deliver data sets of guaranteed quality from WOCE observations. Some elements of that data network are quasi-"operational" in respect of their ability to deliver near real-time data and in having reasonably robust funding. Many other elements operate in a "research" mode. CLIVAR is likely to place a stronger emphasis on the delivery of real-time data than was required by WOCE. At the recent CLIVAR SSG meeting, it was agreed to establish a small ad-hoc panel to review the extent to which elements of the WOCE data system could fulfil the expected requirements of CLIVAR. Since WOCE data will continue to flow for some time past the 1997 end of observations, some joint WOCE-CLIVAR sponsorship may be appropriate.

John Gould

El Niño Definition

Kevin E. Trenberth
National Center for Atmospheric Research
Boulder, CO 80307

The term El Niño originally applied to an annual weak warm ocean current that ran southward along the coast of Peru and Ecuador about Christmas-time (hence Niño, Spanish for 'the boy Christ-child') and only subsequently became associated with the unusually large warmings that occur every few years and change the local and regional ecology. The coastal warming, however, is often associated with a much more extensive anomalous ocean warming to the dateline and it is this Pacific basinscale phenomenon that forms the link with the anomalous global climate patterns. The atmospheric component to 'El Niño' is termed the 'Southern Oscillation'. Scientists often refer to the phenomenon where the atmosphere and ocean collaborate together as ENSO, short for El Niño-Southern Oscillation. However, for the public, the term for the whole phenomena is 'El Niño'. The opposite 'La Niña' ('the girl' in Spanish) phase refers to of a basinscale cooling of the tropical Pacific.

It has been very difficult to precisely define an El Niño. The term has changed meaning, some scientists confine the term to the coastal phenomenon, while others use it to refer to the basin-wide phenomenon, and the public does not draw any distinction. There is considerable confusion, and past attempts to define El Niño have not led to general acceptance. Clearly, the term El Niño covers a diverse range of phenomena. A review of the terminology is given by Aceituno (1992).

Glanz (1996) has put forward a formal definition of El Niño as it should appear in a dictionary :

El Niño ['el nē'nyō], *noun*, [spanish]

1. the Christ Child,
2. the name given by Peruvian sailors to a seasonal, warm southward moving current along the Peruvian coast <la corriente del niño>,
3. name given to the occasional return of unusually warm water in the normally cold water [upwelling] region along the Peruvian coast, disrupting local fish and bird populations,
4. name given to a Pacific basin-wide increase in both sea surface temperatures in the central and/or eastern equatorial Pacific Ocean and in sea level atmospheric pressure in the western Pacific (Southern Oscillation),
5. used interchangeable with ENSO (El Niño - Southern Oscillation) which describes the basinwide (*sic*) changes in air-sea interaction in the equatorial Pacific region,
6. ENSO warm event *synonym* warm event, *antonym* La Niña, [spanish], the young girl; cold event; non - El Niño year; anti - El Niño or anti - ENSO (pejorative); El Viejo ['el vyāhō], *noun*, [spanish], the old man

(from Glantz, 1996).

This definition reflects the multitude of uses for the term but is not quantitative. Attempts to make quantitative definitions, although always by choosing just one of the myraid of possibilities have fallen short of general acceptance. Quinn et al. (1978) provided a list of El Niño events and a measure of event intensity on a scale of 1 to 4 (strong, moderate, weak, and very weak) beginning in 1726. The measures used to define El Niño and its intensity were primarily based on phenomena along the coast of South America and were often qualitative.

In the early 1980s a SCOR[1] Working Group was set up to define El Niño (SCOR, 1983) and the result was the following :

"El Niño is the appearance of anomalously warm water along the coast of Ecuador and Peru as far south as Lima (12˚S). This means a normalized sea surface temperature (SST) anomaly exceeding one standard deviation for at least four consecutive months. This normalized SST anomaly should occur at least at three or five Peruvian coastal stations."

This definition refers just to the event along the South American coast and did not achieve acceptance from the scientific community.

For some time, the focus of much scientific activity related to ENSO has been the Niño-3 region, defined as 5˚N to 5˚S, 150˚W to 90˚W. For instance, the primary ENSO-related quantity predicted by models and verified by observed data has been SST in this region. The Japan Meteorological Agency (JMA) uses the following working

1. Scientific Committee on Oceanic Research

definition for El Niño events. It is an objective procedure and the El Niño periods obtained are quite consistent with the consensus of the ENSO research community.

1. Analyze monthly mean SSTs in 2˚x 2˚ grids.
2. Calculate monthly SST anomalies averaged for the area 4˚N to 4˚S and 150˚W to 90˚W. This is essentially the region known as 'Niño-3'.
3. Find periods during which 5-months running means of the monthly SST-anomalies in the above mentioned area are + 0.5˚C or more for at least six consecutive months. The 5-months running mean of SST anomalies is made in order to smooth out the possible intraseasonal variations in the tropical ocean.

This defines El Niño periods and provides a quantitative measure of the intensity. The results of this technique applied to the Niño-3 data from NOAA are shown in Fig.3.

Kiladis and van Loon (1988) used a standard Southern Oscillation Index (SOI) combined with an SST anomaly index for the eastern tropical Pacific (within 4˚ of the equator from 160˚W to the South American coast) to define an 'event' and required that the SST anomaly be positive for at least three seasons and at least 0.5˚C above the mean, while the SOI must remain negative and below -1.0 for the same duration. They provide a listing of 'warm' and 'cold' events from 1877 to 1982.

In using the SOI, it must be recognized that there are many small-scale and high frequency phenomena in the atmosphere, such as the Madden-Julian Oscillation, that can influence the pressures at stations involved in formulating the SOI, but which do not reflect the Southern Oscillation itself. Accordingly, the SOI should only be used when monthly means are appropriately smoothed (Trenberth 1984, Trenberth and Hoar 1996a).

However, in recent years, it has been apparent that the key region for coupled atmospheric-ocean interactions in ENSO is somewhat farther west (Trenberth and Hoar 1996a). Thus Trenberth and Hoar (1996a) proposed a Niño 3.5 region as the region 120˚W to 180˚, 5˚N to 10˚S, which straddles part of the Niño-3 and Niño-4 regions and extends farther into the Southern Hemisphere as the key region of ENSO. For this region, ENSO events might more appropriately be defined by a threshold of 0.3˚C. This slight shift in the area of SST importance has also been adopted in the Climate Prediction Center of NOAA's National Centers for Environmental Prediction, where they have recently (April 1996) introduced a new SST index called Niño 3.4 for the region 5˚N to 5˚S 170˚W to 129˚W. Similar criteria to the JMA definition could be applied to such a region although a lower threshold would again be appropriate.

Figure 3 shows the five month running mean SST time series for the Niño-3 and 3.5 regions relative to a base period climatology of 1950-79. The somewhat smaller amplitude fluctuations in the 3.5 region are apparent, and the 1951 and 1953 events which qualify under a 0.5˚C threshold for Niño-3, would not qualify for Niño-3.5 unless the threshold is lowered. El Niño events identified using Niño-3 and 0.5˚C threshold include the following years (relative to 1900): 51-52, 53, 57-58, 63-64, 65-66, 68-69-70, 72-73, 76-77, 79-80, 82-83, 86-87-88, 91-92. There are exactly 6 months from August 1979 to January 1980 that exceed the threshold and thus using this technique qualifies 1979-80 as an El Niño event, whereas this period is not normally identified as El Niño from the JMA analyses. This 'event' would be eliminated if a more recent base period were chosen. Also, in both 1993 and at the end of 1994, 5 consecutive months exceed the threshold but not 6. Using instead the Niño-3.5 index and a 0.3˚C threshold has similar results overall. The main changes are that the 1957-58 event extends until April 1959, the 1976-77 event extends to February 1978, 1979-80 again qualifies (although it would not if the higher threshold were used), and the 1991-92 event extends from April 1990 until April 1995 without break although with three more active periods.

Recommendation :

From the standpoint of quantifying El Niño and related phenomena, the definition is still evolving, and in any case needs to recognize the richness of the phenomenon. If a definition is needed, then the one proposed by Glantz should be promulgated although this is not

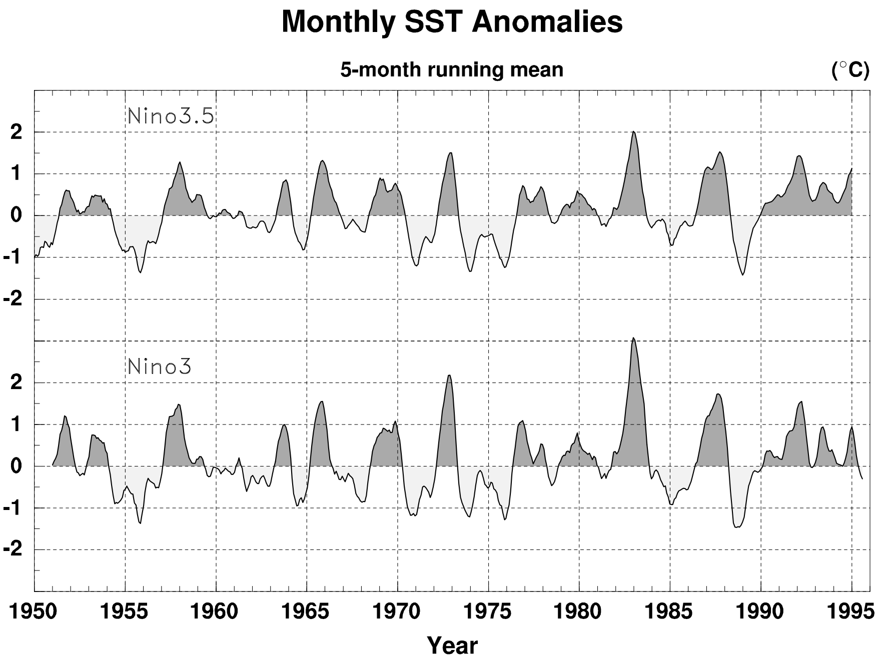


Figure 3: Time series plots of the Niño 3 (lower) and Niño 3.5 SST indices as five month running means using data from NOAA and relative to a base period climatology (1950-79).

quantitative. The JMA definition is suitable for more quantitative purposes in most cases. However, it does not appear at this time to be appropriate for any particular definition to be officially recognized by WCRP or CLIVAR.
Please note that comments on this article are very welcome, preferable by e-mail to: trenbert@ra.cgd.ucar.EDU

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Kevin Trenberth

Euroclivar

Gerbrand Komen,
KNMI, de Bilt, The Netherlands

Euroclivar is a concerted action of the European Union. The objectives of Euroclivar have been presented in earlier newsletters. In essence, Euroclivar is designed to stimulate and help coordinate CLIVAR-related research in Europe. The previous newsletter contained a short report on the first Euroclivar-committee meeting. At that meeting a number of possible European foci had been defined. These have been presented to the CLIVAR SSG meeting in Sapporo and will be discussed further at the next Euroclivar meeting. Later discussions will take place at a number of specialized workshops. In the end the foci will be merged into an initial European CLIVAR Implementation Plan. This note outlines the proposed European CLIVAR foci :

a) *Climate sensitivity and clouds*
The aim is to facilitate the reduction of the uncertainty in estimating the climate sensitivity associated with the representation of clouds. A small workshop is planned for April 1997. Both observationalists and climate modellers will be invited. In addition, the possibility of a more direct relation between CLIVAR and GEWEX is being considered. The initiative for this activity comes from John Mitchell, Lennart Bengtsson and Hervé LeTreut.

b) *Data-assimilation in ocean models*
This focus centers around existing projects, such as AGORA, which aims at the establishment of global data sets; and PROVOST, a seasonal forecasting project, which will need initial ocean conditions for forecasting. Data assimilation in regional seas is also being undertaken. Immediate issues are the preparation of a set of forcing fields, the collection of real-time data from the ship of opportunity programme, and support for the set-up of improved monitoring systems. On the longer term joint data assimilation in coupled atmosphere/ ocean models will become important. Antonio Navarra, David Anderson, David Webb and Jurgen Willebrand are planning a workshop for late’97.

c) *Climate data*
Here the aim is to create datasets that can reveal the magnitude and patterns of variability. A distinction is made between three types of data, namely upper air data (which would need to be reanalysed with a NWP model); surface data from 1750 until present, (so including preindustrial records); and paleo data from tree rings, corals and other sources, with the help of which one may reconstruct time history and patterns over the last 2000 years with annual resolution. The initiative comes from Lennart Bengtsson, Jean-Claude Duplessy and Leif Laursen. A Workshop is planned for late’97.

d) *The North Atlantic Ocean*
This focus would comprise the update and completion of existing datasets (SST, COADS, ice cover history) and their analysis; improved paleoclimatic modelling; and improvement of OGCM’s by better representation of “subgrid” processes; and an observational programme consisting of process studies and a monitoring component. To discuss these issues Euroclivar is co-organizing the forthcoming DecCen Ocean workshop in Villefranche. Fritz Schott and Jean-Claude Duplessy are leading.

e) *The tropical atmosphere/ocean system*
Under this heading four objectives are distinguished:
1. Seasonal and interannual predictability;
2. Studies of the Asian Monsoon;
3. Climate impact of scale interaction; and
4. Tropical Atlantic.

The first two objectives are being pursued in EU-funded projects involving multinational collaborations (PROVOST, part of AGORA and SHIVA). Parts 3 and 4 are not yet funded, but some countries have already expressed interest. The overall programme comprises analyses and reanalyses, modelling, and observations. Pascale Delecluse, David Anderson, Julia Slingo, Antonio Navarra, Serge Paston are planning a workshop for late'97.

f) *Climate models and paleoclimatic data*
Sylvie Joussaume, Jean-Pascal van Ypersele, Jean-Claude Duplessy and John Mitchell intend to invite interested outsiders to scheduled project meetings.

g) *Model improvement and analysis*
There was a strong feeling that model development should be one of the foci. However, time was too short to discuss this topic more thoroughly. Therefore, the discussion of this subject was postponed until the next Euroclivar committee meeting.

This next Euroclivar meeting will take place in St-Lambert-des-Bois, near Paris, September 30 - October 2, 1996. Attendance is by invitation. Suggestions or queries are most welcome. They should be directed to Gerbrand Komen (komen@knmi.nl) or, when they refer to a particular focus, to the persons mentioned above.

G.Komen

Planning for CLIVAR's Programme of Ocean Research

Arnold L. Gordon,
Lamont-Doherty Earth Observatory Palisades, NY, 10964-8000, USA

In developing the CLIVAR Science Plan, the SSG identified a DecCen component dealing with the decadal to century time scales of climate variability, time scales where the ocean role is considered particularly significant. The oceanographic community is now charged with the task of designing and developing a programme of ocean studies related to CLIVAR DecCen objectives for inclusion in the initial CLIVAR Implementation Plan. To encourage broad community involvement in this process, an "Ocean Programme for DecCen Climate Variability" Workshop will be held 28-31 October 1996 in Villefranche-sur-Mer, France.

For the workshop to be successful it is important that scientists who have been invited come prepared to express their views as well as those of their colleagues on the critical issues that should be addressed by CLIVAR. We must foster what I call a "funneling effect", whereby the views of many researchers interested in a particular problem are discussed beforehand and distilled into a single concise statement of objectives, priorities and approaches which can be presented at Villefranche. Also, the national programmes brought to Villefranche should be flexible enough to respond to the synergism that can be derived from an international context provided by a programme like CLIVAR.

A successful CLIVAR depends on what is often referred as a bottom-up or grass-root approach, that is the scientists who will reach for the programme objectives actually plan the programme. I think we are seeing this process at work as our community heads for Villefranche. One example is Euroclivar (see previous article).

Recently I attended the first planning meeting of the United States Ocean CLIVAR (O-CLIVAR) programme. The meeting was held in San Antonio, Texas on June 10-12, 1996, organized by a steering committee chaired by Russ Davis, Scripps Institution for Oceanography. The O-CLIVAR covers the U.S. oceanographic participation in all three CLIVAR components, thereby seeking to offer suggestions for specific ocean-related work that will help meet the plan's scientific objectives across all timescales. This may be considered a step towards better integration of the three components of CLIVAR, as encouraged by the CLIVAR SSG.

Participants of the O-CLIVAR meeting displayed a high level of enthusiasm and I think are well on the way to identifying the key ingredients of a CLIVAR contribution. Many questions on how best to arrange an ocean-related implementation plan arose, and no doubt will be re-visited at the "Villefranche" workshop. O-CLIVAR will bring to the international workshop well-considered proposals, but not plans that are set in concrete.

In the initial introductory session Russ Davis gave background, Allyn Clarke (CLIVAR SSG co-chair) reviewed the status of CLIVAR and I reviewed the plans for the international DecCen Villefranche workshop. The group then broke into three working groups meeting in parallel sessions: Sustained Ocean Measurements, Process Studies and Modelling. Since the San Antonio meeting the working group leaders, working with text from many of the meeting participants, have been formulating a draft plan that will be further reviewed and modified by the national community and then presented to the international community for their consideration in Villefranche.

The Sustained Ocean Measurements group is tasked to design a system for sustained ocean observations to support all three CLIVAR components. This will include routine observations of general utility (XBTs, surface observations, etc.), sustained observations to support specific scientific or prediction needs, and the integration of in situ and satellite observations. The Ocean Modelling group will address ocean modelling research, including ocean general circulation models and their coupling to atmospheric models, data assimilation and prediction models. The Process Studies working group will consider process models and field studies needed to increase the understanding of specific ocean processes and hence to improve climate models and observational networks.

The Villefranche workshop will begin with invited presentations on selected research topics of particular interest to CLIVAR DecCen. Working groups will then be formed to develop proposals for ocean-related elements to be included in an international CLIVAR Implementation Plan. These working groups will focus on three broad areas :

(i) sustained global array of measurements;
(ii) patterns of climate variability; and
(iii) ocean related climate phenomena and processes significant at the decadal to century time scales,

each including observationalists, people involved primarily in data analysis and modellers. The many national and other international plans which are ongoing or developing will be considered, as well as the outcome of the international CLIVAR workshop directed at climate variability produced by large scale atmosphere and ocean interactions which will have been held in Vancouver, Canada on September 4 to 6, 1996.

A.Gordon

Summary of the International Workshop on Pacific Ocean Buoy Network

Masataka Hishida, Ocean Research Department, Japan Marine Science and Technology Center (JAMSTEC), Japan.

The "International Workshop on Ocean Climate Variations from Seasons to Decades with Special Emphasis on Pacific Ocean Buoy Network" was held from 29-31 May 1996, in Mutsu, Aomori-prefecture, Japan, prior to the fifth session of the CLIVAR SSG in Sapporo. The workshop was hosted by the Japan Marine Science and Technology Center (JAMSTEC) and co-sponsored by the Science and Technology Agency of Japan, Mutsu City, the Nippon Foundation, the Oceanographic Society of Japan and the Meteorological Society of Japan. The workshop was convened by Prof. Y. Toba and 35 invited experts from eight countries (Australia, Chinese Taipei, Indonesia, Fiji, Republic of Korea, UK, USA, and Japan) participated.

The purpose of the workshop was to discuss a future international action plan for Japanese activities related to ocean climate research ranging from seasons to decades, and to promote an exchange of ideas prior to the implementation phase of CLIVAR. In particular, a major issue was to discuss JAMSTEC's proposal of a moored-buoy network named Triangle Trans-Ocean Buoy Network (TRITON) for observing oceanic and atmospheric variabilities in the Pacific ocean and its adjacent seas, in cooperation with domestic and foreign agencies and institutions.

The workshop was opened with welcoming speeches by Mr. M. Ishizuka, President of JAMSTEC, and Mr. K. Mamiya, Deputy Director-General, Science and Technology Promotion Bureau of STA. Prof. Toba made introductory remarks which were followed by four keynote speeches. Dr. M. McPhaden reviewed the TAO project and introduced plans for a next generation of ATLAS moorings. Prof. T. Yamagata reviewed the studies on the Kuroshio. Prof. R. Lukas reviewed the studies on the seasonal to decadal variations of the current system in the western Pacific. Mr. M. Hishida introduced the Triangle programme at JAMSTEC; the name reflects the geographical distribution of the proposed buoy array and the three themes: ENSO in the tropical Pacific, Asian Monsoon in the Indian Ocean and decadal scale oceanic variabilities.

The workshop comprised the following sessions:
(1) Surface buoy development plan at JAMSTEC,
(2) National and regional activities,
(3) Studies on ENSO and Monsoon,
(4) Studies on decadal scale oceanic variabilities, and
(5) International cooperation.

In the first session, the status and plan of buoy development at JAMSTEC were reported from the viewpoints of the scientific context, new technological developments and buoy array design. The principal scientific objective of this programme is to understand the detailed ocean circulation and heat transports while directing attention to ENSO, Asian Monsoon and decadal scale oceanic variabilities that influence climate change in the Pacific rim and the whole world.

In the second session, experts from Korea, Indonesia, Chinese Taipei, and Japan reported on their national and regional activities in on ocean / climate studies. A representative from the South Pacific Applied Geoscience Commission (SOPAC) also summarized past research activities in the South Pacific region. In the second and third sessions, there were reports of very interesting observational studies on oceanic variability in the Indian Ocean, the Indonesian archipelago, the South China Sea, and the western Tropical Pacific. The oceanic changes associated with monsoonal forcing in those regions were discussed at some length.

There were several reports on studies using different types of simulation and assimilation models for predicting oceanic anomalies on seasonal, interannual, and ENSO scales. Some reports emphasized utilizing not only surface wind data, but also subsurface temperature data obtained by buoy arrays, to improve the prediction capability.

In the fourth session, statistical studies showed the decadal scale variabilities of the SST and subsurface temperature fields in the Pacific Ocean. It was pointed out that intermediate water may play an important role in decadal scale variability, and that further observational studies should be conducted in the formation area of the intermediate water mass in the North Pacific and its marginal seas.

In the fifth session, the international cooperation programmes of GOOS and CLIVAR were introduced by their respective representatives. Participants recognized that the Pacific Ocean Buoy Network would greatly enhance the prospects for successful implementation of these programmes.

On the last day, a conference statement was adopted. In the statement the participants noted that although understanding of Pacific climate variabilities, such as ENSO events, had advanced significantly during the TOGA/ WOCE period, a major new challenge is to extend our capability to predict ENSO effects in the tropical Pacific to other basins and to higher latitudes. Also, to advance our understanding of Pacific climate variability, further modelling, long-term obser-vations and process studies are needed to relate seasonal-to-decadal variations of the Asian-Australian Monsoon system to variations of the ocean circulation in the western Pacific and Maritime Continent region. The participants recognized that the climate observing system called TAO, deployed in the equatorial Pacific for TOGA, is highly valuable scientifically and contributes to climate predictions, which are very important for society. The present TAO array is maintained by multinational cooperation. Maintenance, expansions and enhancement of such a climate observing system would contribute to the sustainable development of humankind. The participants warmly welcomed and strongly endorsed the project proposed by JAMSTEC/ STA, tentatively named the Triangle Trans-Ocean Buoy Network (TRITON), in the western Pacific and the eastern Indian Ocean where the interaction of the ocean with the Monsoon system is of great practical importance.

The conference statement was reported to the fifth session of the CLIVAR SSG in Sapporo. The SSG participants also welcomed and endorsed the TRITON project proposed by JAMSTEC.

Masataka Hishida

The Global Precipitation Climatology Data Set

Arnold Gruber NOAA/NESDIS E/RA, Washington D.C. 20233, USA, email: agruber@orbit.nesdis.noaa.gov

The GEWEX Global Precipitation Climatology Project (GPCP) Version 1 Combined Precipitation Data Set has been released for public use. The data set provides global, monthly precipitation estimates on a 2.5x2.5 degree latitude-longitude grid for the period July 1987--December 1994. The final product is based on a merger of low-orbit satellite microwave, geo-stationary satellite infrared, and rain gauge data. The release totals 19 products, including the single-source input fields, combination products, and error estimates for the rainfall estimates. The data set includes 20 pages of on-line documentation. The data set is archived at World Data Center A (located at the National Climatic Data Center in Asheville, NC) and can be accessed through the World Wide Web at **http://www.ncdc.noaa.gov/wdcamet.html#GPCP**. Huffman et al. describes the data set and how it was developed.

These data are expected to have wide applicability to validating numerical weather prediction and climate models, providing input for hydrological and water cycle studies, supporting agricultural productivity studies, and diagnosing intra- and inter-annual climatic fluctuations on regional and global scales.

Reference :

Huffman, G.J., R.F. Adler, P. Arkin, A. Chang, R. Ferraro, A. Gruber, J. Janowiak, A. Mc-Nab, B. Rudolf, U. Schneider, 1996: The Global Precipitation Climatology Project (GPCP) Combined Precipitation Data Set, Bulletin of the American Meteorological Society, submitted.

A. Gruber

"SPARC-96" Assembly

David Karoly
Monash University, Clayton VIC 316, Australia

SPARC ("Stratospheric Processes And Their Role in Climate") is an international programme established by WCRP in 1994 with the goal of facilitating research on the relationships between stratospheric processes and their role in climate (both tropospheric and stratospheric).

There are strong links between CLIVAR and SPARC, with CLIVAR looking towards SPARC to understand present stratospheric interactions with climate and to predict the influences that future states of the stratosphere will have on the climate of the troposphere-stratosphere system.

The first General Assembly of SPARC will be held in Melbourne on 2 - 6 December 1996. Sessions on the following themes have been organised:

1. Troposphere-stratosphere GCM's, 2. Stratospheric climatology, 3. Trends in temperature, ozone and water vapour, 4. Gravity wave processes and parameterization, 5. Stratosphere-troposphere transport, 6. Chemistry-climate interaction, 7. UV radiation and its impacts, 8. Other aspects of stratospheric processes.

Prof. Mario Molina, joint recipient of the 1995 Nobel Prize for Chemistry, has accepted an invitation to participate in the Assembly. He will give a public lecture one evening. There are several other scientific activities planned around the Assembly. A short course for graduate students on "Atmospheric Chemistry and Transport" will be held in the week 26-30 November by the CRC for Southern Hemisphere Meteorology at Monash University. A number of short meetings of SPARC Working Groups will also be held around the time of the Assembly.

Preparation for the upcoming Assembly is in full swing. The registration brochure together with other Assembly information were sent out in July to paper authors and others who have expressed interest in participation. For further information, contact Ms Meki Wong, fax +61 3 9905 9689 or sparc96@vortex.shm.monash.edu.au or see the SPARC96 WWW site at **http://www.shm.monash.edu.au/sparc96/sparc96.html**.

David Karoly

CLIVAR Calendar

ICPO can provide further information about the meetings on this calendar.

Date	Meeting	Location	Attendance
Sep. 4 - 6, 1996	CLIVAR DecCen Workshop on the Induction of Dec-Cen Climate Variability by Large-scale Atmosphere - Ocean Interactions	Vancouver, Canada	Limited
Sep. 9 - 11, 1996	CLIVAR NEG-2, 2nd Session	Victoria, BC, Canada	Invitation
Sep. 10 - 13, 1996	*In situ* observations for the Global Observing System	Geneva, Switzerland	Limited
Sep. 27 - 1. Oct. 1996	ICES Annual Science Conference, special WOCE/ JGOFS/CLIVAR Session	Reykjavik, Iceland	Open
Oct. 7 - 11, 1996	First International Conference on EuroGOOS	The Hague, The Netherlands	Open
Oct. 9 - 11, 1996	COARE Flux Group Workshop (Flux 96)	Woods Hole, USA	Limited
Oct. 21 - 25, 1996	CLIVAR Upper Ocean Panel - 2nd Session	Villefranche-sur-Mer, France	Invitation
Oct. 28 - 31, 1996	CLIVAR Ocean Programme for DecCen Climate Variability Workshop	Villefranche-sur-Mer, France	Limited
Nov. 18 - 20, 1996	TAO Implementation Panel Meeting, 5th Session	Goa, India	Invitation
Nov. 20 - 23, 1996	CLIVAR Asian- Australian Monsoon Panel - First Session	Goa, India	Invitation
Nov 18 - 23, 1996	The North Atlantic: Ocean Currents, Climate, Weather and Environment	Kopenhagen, Denmark	Open
Dec 2 - 6, 1996	WCRP/SPARC First Session, General Assembly	Melbourne, Australia	Open
April, 28 - May 2, 1997	CLIVAR SSG-6	Washington DC, USA	Invitation

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Newsletter of the Climate Variability and Predictability Programme (CLIVAR), published by the International CLIVAR Project Office, c/o Max-Planck-Institut für Meteorologie, Bundesstr. 55, D-20146 Hamburg, Germany, Tel.: +49-40-41173-412, Fax.: +49-40-41173-413, e-mail : clivar@clivar.dkrz.de

ISSN No.: 1026 - 0471