SPREP
South Pacific Regional Environment Programme

Workshop on the Year 2000 Problem

Implications for Meteorological Services

Honolulu, Hawaii

8–10 November 1998

World Meteorological Organization

US NOAA National Weather Service

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Meeting Report

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Contents

Acronyms

AFTN	Aeronautical Fixed Telecommunication Network
AFTN/MET	Meteorological component of AFTN
AES	Atmosphere Environmental Service (Canada)
ANZ	Australia and New Zealand
ARM	Atmospheric Radiation Measurement Program (US)
ASOS	Automated Surface Observing System
ATCW	Australian Tropical Cyclone Workstation
AusAID	Australian Agency for International Development
AWIPS	Advanced Weather Interactive Processing System
AWS	Automated Weather Station
BUFR	Binary Universal Form for the Representation of Meteorological Data
CAAF	Civil Aviation Authority of Fiji
CBS	Commission for Basic Systems
CIMS	Cook Islands Meteorological Service
CLICOM	Climate Computing
CNMI	Commonwealth of Northern Mariana Islands
CSU/DSU	Channel service unit/data service unit
DCP	Data Collection Platform
DIFAX	Digital Facsimile
DOE	Department of Energy (US)
ECMWF	European Centre for Medium-range Weather Forecasting
EMWIN	Emergency Managers Weather Information Network
EU	European Union
EU CWSUP	European Union Cyclone Warning System Upgrade Project
FAA	Federal Aviation Administration
FMS	Fiji Meteorological Service
FSM	Federated States of Micronesia
FTP	File Transfer Protocol
FTS	Federal Telecommunications System
GMS	Geostationary Meteorological Satellite
GOES 10	Geostationary Orbital Environmental Satellite
GPS sondes	Geographic Positioning Satellite radiosondes
GRIB	Gridded Binary
GTS	Global Telecommunications System
HF radio	High frequency radio
ICAO	International Civil Aviation Organization
IGYCAG	Informal Global Y2K Coordination Action Group (ICAO)
INMARSAT	International Maritime Satellite
IP	Internet Provider
ISDN	Integrated Services Digital Network
MAPSO	Microcomputer-aided Paperless Surface Observing
McIDAS	Main Computer Interactive Data Access System
MicroArt	Microcomputer Automatic Radiotheodolite
NEXRAD	Next Generation Weather Radar
NIST	National Institute of Standards (US)
NMHS	National Meteorological and Hydrological Service
NMC	National Meteorological Centre
NMS	National Meteorological Service
NOAA	National Oceanic and Atmospheric Administration (US)
NZODA	New Zealand Official Development Assistance
PCs	Personal computers
PEACESAT	Pan-Pacific Education and Communication Experiments by Satellite

PNG	Papua New Guinea
POC	Point of Contact
PRH	Pacific Regional Headquarters (US NWS)
PRONET	Pacific Region Operations Network
PTT	Power, water, telecommunications
RTH	Regional Telecommunication Hub
SATCOM	Satellite communications
SIDS	Small Island Developing State
SIMS	Solomon Islands Meteorological Service
SOPAC	South Pacific Applied Geoscience Commission
SPREP	South Pacific Regional Environment Programme
TCP/IP	Transmission Control Protocol/Internet Protocol
TELCO	Telecommunication Companies
UNDP	United Nations Development Programme
UPS	Uninterrupted Power System
US NCEP	United States National Centers for Environmental Prediction
US NWS	United States National Weather Service
UTC	Universal Time
VCP	Voluntary Cooperation Programme
VMS	Vanuatu Meteorological Service
WAFS	World Area Forecasting System
WEFAX	Weather Facsimile satellite programme
WMO	World Meteorological Organization
WMO RA-V	WMO Regional Association V (covering the South West Pacific)
WMO VCP	WMO Voluntary Cooperation Programme
WSO	Weather Service Office (FSM)
WSR88-D	Weather Surveillance Radar 1988 Doppler
Y2K	Year 2000

Editor's note: In the interests of producing this report in a timely manner, we have had to include some acronyms for which the authors have not provided full information. Our apologies.

Executive summary and recommendations

Having met in Honolulu, Hawaii, from 8 to 10 November 1998, participants of the Workshop on the Year 2000 Problem *have agreed to the following summary and recommendations which are directed towards government decision makers and relevant organisations.*

There are slightly over 400 days left before the date change to the year 2000 (Y2K). Therefore, there has been a realisation within the World Meteorological Organization, the South Pacific Regional Environment Programme (SPREP), and many other organisations that, given the widespread use of computers that support meteorological operations, it is imperative that computer systems affected by the Y2K problem (e.g. hardware, software, communications, infrastructure) be Y2K compliant. The problem is not restricted to the meteorological equipment for any one nation. Given the interconnectivity of today's networks and systems, it is vital that any National Meteorological and Hydrological Service (NMHS) coordinate with vendors of expendable items and services, the infrastructure of the state (e.g. telecommunications, power and water) and with neighbouring countries to ensure that there is a sharing of information on Y2K to ensure compliance, in a timely manner, from all these sectors.

In summary, the Y2K problem stems from an old practice in computer systems architecture that was used to save memory space in the days when computer memory was a very scarce and expensive resource. In order to save memory, only the last two digits of a year were used to depict and process that information (e.g. 1998 was processed as 98). The problem with the year 2000 is that, if not fixed, the two-digit value of '00' could be interpreted as the year 1900 rather than the year 2000. This presents a number of problems that range from computers shutting down to data being inadvertently purged due to automated archiving. Although the full extent of the Y2K problem may never be fully known, good management practice dictates that measures be taken to ensure that the impact on operations is minimised by having a Y2K programme in place that stresses an inventory of computer-based systems, renovation, testing, and constant diligence to ensure that the problems are known and are solved effectively. As in any good management practice, contingency plans must also be in place to take care of any problems that are somehow overlooked or undetected.

The recognition of the Y2K problem and its possible effects on meteorological operations, along with recommendations to help mitigate the problem, were the centrepiece of this workshop. A number of presentations were made that focused on the Y2K problem itself. Various organisations such as the US National Weather Service, World Meteorological Organization (WMO), Meteorological Service of New Zealand, Federal Aviation Administration, and Hawaii State Civil Defense presented what they were doing about the problem. Following that, three working groups were established — (1) observing systems, (2) telecommunications and (3) data processing — in order to come up with practical recommendations that could be used by the members of SPREP to help mitigate the Y2K problem in each member's NMHS.

The following recommendations and actions were generated and adopted by the workshop participants:

1. Explore opportunities with the WMO, SPREP and the European Union Cyclone Warning System Upgrade Project (EU CWSUP) for securing funds to assist NMHSs in mitigation efforts for the Y2K problem.
2. Form a task team consisting of members from or arranged by the WMO, US National Weather Service, New Zealand Meteorological Service and the SPREP Secretariat to provide special assistance to SPREP members requiring assistance in mitigating the Y2K problem.
3. Encourage members to exchange information with other parts of their government and with other NMHSs to raise awareness and maintain diligence in tackling and solving the Y2K problem.
4. Members are encouraged to perform a detailed inventory of their hardware, software and communications interfaces and provide it to the SPREP Secretariat as well as the new WMO sub-regional office based at SPREP headquarters in Samoa. This inventory will not only focus the members

on the required actions for Y2K, but will also provide an inventory of telecommunications capabilities that will assist the SPREP Y2K task team noted in action No. 2. This would also be useful in deciding where scarce resources should be applied in order to ensure at least minimal Y2K compliance after 31 December 1999.

5. Although it is not a low-cost solution, a recommendation was made that one Y2K contingency to be considered in the Pacific would be to upgrade some key World Area Forecasting System (WAFS) sites from one-way receive to two-way receive/transmit stations to allow for the uninterrupted transmission of raw meteorological data. In order to start this process, a formal recommendation from SPREP should be forwarded to WMO stating that the upgrade of the WAFS Pacific Ocean Region satellite facility in Yacoult, Washington, to two-way capability would be a good Y2K contingency. From that, the WMO would have to make a formal request to the United States for such an upgrade. Details (e.g. costs, procedures) will need to be worked out to determine if such an upgrade is feasible.

6. The survey of Y2K status (see Annex 7) accomplished just prior to (and during) the Honolulu Y2K Workshop needs to be kept up to date as work progresses towards full Y2K compliance in the SPREP member countries. SPREP member countries are urged to keep their status under review and provide frequent updates of the information and data to the SPREP Secretariat. WMO members are reminded that the WMO Secretariat needs to be kept informed as to their Y2K status.

7. SPREP member countries should check and evaluate not only their meteorological systems, but consult with their providers of power, water, telecommunications (PTT); providers of consumables, expendables and spare parts; providers of fuel; and customers to ensure they are Y2K compliant. This will help ensure uninterrupted service within the NMHSs and to those served.

8. SPREP member countries are urged to consult the WMO website (http://www.wmo.ch and its Y2K pages) to see what the latest information and guidance is.

9. Because there could be a disruption of supplies in early 2000, it may be prudent to ensure that a full allowance of consumables, expendables and spare parts are on hand by mid-December 1999.

10. Tests of systems, consultation with manufacturers, etc. should be completed as high-priority actions. For example, in Annex 1, the telecommunications group identified a number of systems and has listed a number of recommendations and actions that SPREP members should accomplish. SPREP members are urged to complete these items by early 1999 — at the latest, by 31 March 1999.

11. As a result of discussions during the Y2K Workshop in Honolulu, it became apparent that it would be useful (in deciding where scarce resources should be applied in order to ensure at least minimal critical Y2K compliant telecommunications services after 31 December 1999 as well as working out alternative or contingency routing of data and products) to have a condensed inventory of available telecommunications systems in each SPREP country. It is recommended that the SPREP Secretariat, as a priority action, compile the information necessary to complete the table shown in Annex 5, including systems which are not listed.

1. Workshop opening and administrative remarks

The WMO/SPREP/United States National Oceanic and Atmospheric Administration (US NOAA) National Weather Service (NWS) workshop on the year 2000 (Y2K) problem opened at the Heliconia Conference Room, Double Tree Hotel, Honolulu, Hawaii, at 8.00 am on 9 November 1998. Mr Penehuro Lefale, SPREP Representative, called the meeting into session. He welcomed the participants and noted the importance of the year 2000 problem and its potential impacts on National Meteorological Services (NMSs) in the Pacific region. He wished the participants a successful meeting and an enjoyable stay in Honolulu.

Mr Al-Majed, Director of the WMO South West Pacific and South East Asia, welcomed the participants on behalf of Professor G.O.P Obasi, Secretary General, and mentioned that WMO was pleased to co-sponsor the workshop. He expressed its deep appreciation to SPREP, US NOAA NWS, Pacific Region, Honolulu, Hawaii, United States Department of Energy Atmospheric Radiation Measurement Program (US DOE ARM), Bureau of Meteorology Australia, the French Meteorological Service (Meteo France) and the Meteorological Service of New Zealand (NZ MetService) for co-sponsoring the workshop. He noted that the WMO Secretariat had organised several meetings and workshops in different regions of the world to monitor the progress of NMSs response to the Y2K problem and had developed strategies to assist NMSs with their Y2K activities. He informed the workshop that the latest information collected from NMSs had been provided via the WMO home page on the World Wide Web. He wished the workshop success.

Mr Richard Hagemeyerx Director, US NOAA NWS, Pacific Region, welcomed the participants to Honolulu. He noted that the year 2000 problem was an extraordinary challenge for NMSs and urged each member to do their best so systems would be fully compliant by the year 2000. He wished participants a pleasant stay in Honolulu.

The workshop was attended by 28 participants from 19 members of WMO/SPREP and 11 resource people and observers from regional and international organisations. The list of participants in the sessions and workshop and the capacities in which they attended is given in Annex 3.

2. Introduction and overview of the year 2000 (Y2K) problem

Mr Howard Diamond provided a general overview of the Y2K problem by making a presentation provided by Dr Robert Brammer of the TASC Company of Redding, Massachusetts. Dr Brammer is a senior Vice-President of TASC and a well-known expert regarding the Y2K problem. The presentation provided a common baseline of information of the extent of the Y2K problem so that all attendees started with the same information regarding what things need to be looked at for Y2K as we get nearer to the actual date switchover. A number of the impacts, considerations and planning activities necessary to consider in Y2K were discussed in the presentation. In brief, the following areas were discussed: (1) the nature of the technical problem; (2) Y2K as a management and business problem more than just a technical problem; (3) some specific examples where Y2K might be a problem (e.g. infrastructure, internal systems, products and services); (4) risk mitigation and contingency planning; (5) definition of Y2K compliance; and (6) how to proceed from here. A copy of the full briefing, including slides, was given to each SPREP member to assist them in their work.

Mr John Lincoln presented an analysis of the Y2K problem from the WMO perspective. The key question is: Are the computer-based systems in your National Meteorological and Hydrological Service (NMHS) year 2000 compliant?

It must be emphasised that individual countries survey their computer-based systems and make necessary upgrades and develop contingency plans. The WMO has received inputs from 108 of the 185 WMO member countries. That means almost 42% of the countries have not responded after repeated requests for information regarding Y2K compliancy in their NMHS.

Letters were sent to some 200 manufacturers of meteorological and hydrological equipment, instruments and computers. Only 60 have responded, with 35 reporting their systems fully Y2K compliant.

He provided a checklist and summary of actions for NMHSs to follow to ensure Y2K compliance. The status of Y2K compliance for NMHSs and manufacturers is found on the WMO Web site in the Y2K page under the World Weather Watch (http://www.wmo.ch). Y2K is obviously a challenge, but it is also an opportunity to upgrade outdated systems. A copy of the full briefing, including slides, was given to each SPREP member to assist them in their work.

A summary table (see Annex 2) was prepared to show the Y2K compliance status of the SPREP countries.

Mr Diamond provided a briefing of his activities as the US NWS Y2K end-to-end test manager. In this presentation he gave an overview of the Y2K phases and schedules for compliance being done by the US NWS, the definition of Y2K mission-critical systems, the unique nature of weather data products related to the fact that weather products do not use year or month information in the transmission headers of products, the details of US NWS end-to-end testing, and a display and explanation of the US NWS Y2K home page at http://www.osol.x3.nws.noaa.gov/y2k. Mr Diamond indicated that the US NWS's mission-critical systems are all Y2K compliant and that full implementation is on schedule for 31 March 1999. As for the nature of dates in weather products, all weather products have a transmission header format of DDHHHH where the DD represents the two-digit day of the month and the HHHH represents the four digit Universal Time (UTC) hour of the day. For a small subset of products (e.g. buoy, climate, gridded binary (GRIB), binary universal form for the representation of meteorological date (BUFR)) there is some year information embedded in the body of the products. These dates need to be taken into consideration for any data processing. As for BUFR and GRIB data, the WMO has standardised the representation of the year 2000 (century 20 and year 100) and the year 2001 (century 21 and year 1). It was noted that the US National Center for Environmental Prediction has generated test Y2K data for those data types that have them. This data is available on the NWS Y2K home page as well as via File Transfer Protocol (FTP) at the server at the Internet Provider (IP) address: 140.90.193.214. The end-to-end testing is intended to build on previous compliance testing (the NWS definition of Y2K compliance was distributed) and is the final demonstration to ensure uninterrupted data exchange with all customers. Three scenarios will be used in the end-to-end testing: (1) the leap day scenario (28–29 February 2000);

(2) the 1999–2000 switchover (31 December 1999–1 January 2000); and (3) if data are available the 2000–2001 switchover from 31 December 2000 to 1 January 2001. End-to-end testing will be done between the US NWS and the US Navy, US Air Force, Canada Atmosphere Environmental Service (AES), the United Kingdom Meteorological Office and some private US weather vendors. A copy of the full briefing, including slides, was given to each SPREP member to assist them in their work.

Mr Garry Clarke, NZ MetService, provided a report on the MetService's efforts regarding Y2K assistance to Pacific island countries' National Meteorological Services as part of the New Zealand Official Development Assistance (NZODA). The methodology used, progress made and problems encountered were presented to the meeting, together with the process required for Pacific Island countries requiring assistance from NZODA.

Mr Joe Morgan of the US Federal Aviation Administration (FAA) made a presentation on the activities of the FAA as it relates to Y2K and aviation. Mr Morgan is the director of the FAA's International Y2K Office and indicated that his office was hard at work coordinating with the other countries on ensuring the safety of passengers by pursuing and coordinating the Y2K compliance of air traffic control and avionics systems. The majority of US passengers fly to six countries (United Kingdom, Canada, Japan, the Bahamas, the Dominican Republic and Mexico) and, although the FAA has focused most intently on these nations, it continues to coordinate with all 185 member states under the auspices of the International Civil Aviation Organization (ICAO). The ICAO interfaces with the WMO through the membership of Howard Diamond from the US National Weather Service who serves as the weather representative to the ICAO's Informal Global Y2K Coordination Action Group (IGYCAG). A copy of the full briefing, including slides, was given to each SPREP member to assist them in their work.

Mr Roy Price, the Vice-Director of the Hawaii State Civil Defense Agency, gave a very interesting briefing on the unique aspects of Y2K as it relates to the insular state nature of Hawaii (as with all SPREP members) where all supplies (e.g. food, fuel, medicine) depend on air and/or water shipments. If Y2K becomes a problem for shipping companies, then insular states should have contingencies in place to stockpile key supplies to avert any critical shortages. Mr Price stressed that the members of SPREP should go back to their countries and inform others, particularly the emergency management community, of the urgency of Y2K contingency planning and how important this is. Unlike other disasters, such as hurricanes and earthquakes, where Hawaii can look to the mainland for support, Y2K is a problem that affects everyone and, therefore, external help may not be available. Therefore, it is incumbent on all states, particularly those insular states in the Pacific, to be prepared in case Y2K causes disruptions to the populace.

Mr Diamond gave a presentation on what the US NWS is doing for Y2K contingency planning in the area of telecommunications. The US NWS, like many other organisations, has realised that telecommunications is an external area of risk that must be considered. Although telecommunications companies at all levels indicate that a dial tone will be available on 1 January 2000 and that calls should go through, the problem with Y2K and telecommunications companies is in the administrative and support functions (e.g. billing, service orders, alarm monitoring) which, if not ready, could cause telecommunications problems anywhere from 1 to 2 months after the Y2K switchover date itself. The US NWS methodology (handed out for all participants) is predicated on preparing contingencies on a local, national and international basis. Examples of contingencies include increasing the use of Emergency Managers Weather Information Network (EMWIN) receivers, expanding the content of the NOAA Weather Wire Service satellite broadcast data stream, and investigating the possible expansion of the WAFS broadcast from one-way to two-way in areas such as the Pacific. Although the WAFS upgrade to two-way is only at discussion stage, a more descriptive action item is delineated in the Annex to the Group 2 report in Annex 1. The intent of this contingency planning is to be as prepared as possible, while realising that any contingency cannot mimic operations 100% but rather at some lower level that provides the most critical minimal service that can be provided until any possible infrastructure Y2K problems are solved. A copy of the methodology for this contingency planning was given to each SPREP member to assist them in their work.

3. Reports by participants on the status of systems in their NMHS

3.1 American Samoa

The Government of American Samoa is very much involved in upgrading all its systems to be Y2K compliant well before 1 January 2000. The Governor has designated certain government agencies to spearhead efforts to ensure full Y2K compliance of all local government systems by mid-1999.

The Weather Service Office at Pago Pago is part of the US National Weather Service and, as such, all its systems will be Y2K compliant by 31 March 1999. The latest inventory of all the computers in the Pago Pago office showed that 75 per cent of all personal computers (PCs) must be upgraded to be made Y2K compliant. These PCs are currently used as follows:

- 1 × 486 PC to download model data
- 2 × 486 PCs for MAPSO (Microcomputer-aided Paperless Surface Observing) system (1 is for backup)
- 2 × 486 PCs for upper air (1 is for backup)
- 2 × 486 PCs for Aeronautical Fixed Telecommunication Network (AFTN) (1 is for backup)
- 2 × 486 PCs for administrative purposes

All the above systems will be replaced and/or upgraded to be Y2K compliant in the near future.

3.2 Australia

The Australian Bureau of Meteorology started its planning for Y2K compliance in the late 1980s and a taskforce was finally established in 1996. All Bureau line managers are now held responsible for the system under their control. Reports by the task team are widely distributed to staff via the Bureau's intranet. All systems are to be tested for Y2K compliance and modified, upgraded or replaced (if not compliant) by 30 June 1999.

Phases of the plan

Phase 0: Compile inventory (completed in February 1998)
Phase 1: Scoping (vendor compliance, contingency, cost estimation)
Phase 2: Conversion/upgrade/replacement strategies, testing criteria
Phase 3: Testing (using test server, etc.)
Phase 4: Complete implementation by 30 June 1999

Progress

- NEC-SX4 super-computer compliant
- Found drivers to X.25 (Network Management System and old Cisco routers) non-compliant; changeover to Transmission Control Protocol/ Internet Protocol (TCP/IP) in progress
- Computer Message Switching System compliant
- Web servers compliant
- AXI/AXM radiofacsimile systems to be tested
- Real-time database compliant, but tests on decoders continuing
- Geostationary Meteorological Satellite (GMS) satellite ingest, processing, dissemination and archival systems compliant but Main Computer Interactive Data Access System (McIDAS) needs upgrading before compliant
- Bureau regional computing systems need replacement

Greatest concerns

- Dependence on communication links to external agencies for data collection exchange and product delivery
- Detection and rectification of embedded systems
- Failure of operational system caused by power outage
- Slippage in replacement programme

3.3 Cook Islands

The Cook Islands Meteorological Service (CIMS) has undergone some testing for Y2K compliance for all the computers in the Service. Only 20 per cent of the systems are known to be compliant. The task now is to see if the non-compliant systems need to be upgraded or replaced. As most of the PCs in the service are either 386 or 486, there is a better chance of these being replaced, but we will have to await for a certain project to be identified and then implemented.

Non-mission-critical

Some clients like Air New Zealand and the domestic airline Air Rarotonga have their own Y2K compliance strategies, and have requested the CIMS to provide them with compliance approval of some sort regarding some of the equipment that contribute to the products they receive from the CIMS. This equipment is as follows:

- vaisala anemometer
- radar
- photocopier
- facsimile
- Weather facsimile satellite programme (WEFAX)
- airconditioners
- Australia and New Zealand (ANZ) standard workshop and requirements.

The CIMS does not have an action plan to cater for this issue of the Y2K problem. The Service does, however, realise the problem and is concerned about the issue and would like to implement whatever is required to ensure that the service is maintained throughout the critical period of the switchover from the 20th to the 21st century. The CIMS has recently received some equipment from donor agencies that would contribute to the objectives of WMO. This has to be checked for Y2K compliance and should also be recognised as of importance to the Cook Islands.

Initiatives

The Meteorological Service of New Zealand Ltd has provided assistance to the CIMS through an NZODA project whereby the International Operations Manager, Mr Garry Clarke, visited the Cook Islands for management purposes. During this visit, Mr Clarke conducted a Y2K compliance test where he found that only 20 per cent of the PCs in the CIMS are compliant. The software on these systems has yet to be tested. Mr Clarke will return to the Cook Islands in the very near future to conduct more tests.

3.4 Federated States of Micronesia

The Federated States of Micronesia (FSM) Weather Service Offices (WSOs) are funded by the US government through the compact of free association — all the WSO programmes and operations are similar to the US first-order stations. All the existing computers, hardware and software have been inventoried and are Y2K compliant — by the NOAA, NWS, Pacific Region Staff. However, all the MAPSO and MicroArt (Microcomputer Automatic Radiotheodolite) computers will be replaced with the Y2K upgraded new computers.

The AFTN/Met System is being used for the transmissions of weather data and receipts of forecasts and warnings. The AFTN/Met System is owned by the FAA and NWS Pacific Region Headquarters (PRH) will check on Y2K compliance with the FAA.

The FSM Telecommunication Corporation will be contacted for Y2K compliance after this workshop.

The utility corporation of each of the FSM States which provides electric power and water will be contacted for Y2K compliance.

The managers of Weather Service Offices in each State will make every effort to contact vendors and companies to ensure that Y2K-compliant systems are in place to avoid disruption of essential operations.

3.5 Fiji

A Y2K project is already under way. A report indicating the current status regarding the Y2K compliance at Fiji Meteorological Service (FMS) was presented.

- FMS went through a major change in technology in April of this year with the assistance of the Japanese Government. Equipment supplied under this project was tendered for with a clause ensuring Y2K compliance. Most of the equipment used operationally was supplied under this project. Note that, in some cases, although the hardware is compliant, there is still a need to apply patches to operating systems on which these run. FMS is in the process of identifying and upgrading these.
- Under the Japanese project, software applications used operationally were also provided with the same clause. The Australian Bureau of Meteorology provided the bulk of the software purchased. They have had a Y2K project since 1996, and have put a lot of effort into making their applications compliant. A team of people from the Bureau will be coming at the end of the cyclone season in April to confirm the compliance of these applications and apply any further patches if needed.
- A small portion of the applications was purchased from the NZ MetService which has already applied the necessary patches to make its software compliant.

FMS has, in addition to the above, developed an action plan to try to eliminate areas of potential risk to its day-to-day operations and ability to carry out its responsibilities.

Even with all the precautions taken, FMS still is in no position to guarantee a fully operational service at the turn of the century. The main reason for this is the dependence of FMS on external sources to provide it with information and to disseminate its own products and information. As it has no control over such agencies, FMS can be susceptible to problems. Examples of these include:

- FMS needs reliable data lines and telephone services to receive and transmit information. This service depends on companies such as Telecom Fiji, Fintel Fiji and Telstra Australia. FMS will not be in a position to guarantee a reliable service without all these companies being operationally active.
- FMS relies on the Australian Bureau of Meteorology and Met Service of New Zealand to switch data from the Global Telecommunications System (GTS) and AFTN to us. They are two of the major switching centres in our part of the world. Without the information they provide there will be insufficient data to prepare products.
- FMS relies on the Civil Aviation Authority of Fiji (CAAF) AFTN switching system to route AFTN met data to us and from us.
- The data transmitted from FMS automatic weather stations are received by the Japanese GMS-5 satellite, which is then transmitted via the GTS from the Japan Meteorological Agency and is received via our leased lines from Melbourne.
- FMS relies on satellite imagery from several external sources (GMS-5, Geostationary Orbital Environmental Satellite (GOES 10), NOAA 12 and NOAA 14), and cannot guarantee the compliance of these sources.

Fiji is making the best possible effort to ensure Y2K compliance of all its systems and to ensure that its services are uninterrupted as we cross over to the new millennium.

3.6 French Polynesia

Mission-critical processes have been identified and systems inventory undertaken with assistance of Meteo France. Problem areas have been identified and Y2K assurances from vendors/ service providers have been provided.

3.7 Guam

Assurance has been given by US NOAA NWS in Honolulu that Automated Surface Observing System (ASOS), Weather Surveillance Radar 1988–Doppler (WSR88–D), upper air, Advanced Weather Interactive Processing System (AWIPS) with build 4.2 installed, Console Replacement System and NOAA Weather Radio System are Y2K compliant. Telecommunications may be a significant problem for Guam and Micronesia. Areas which could be affected are telephone and fax which are the primary dissemination systems for forecasts and warnings to Guam and Commonwealth of the Northern Mariana Islands (CNMI), NOAA Weather Radio from Replacement System to transmitter and receiving long-line data. The primary means of transmitting forecasts and warnings to Micronesia is the AFTN system. AFTN/MET (a replacement for AFTN) is being installed in Guam and Micronesia and will tie into the FAA's NADIN II system in Hawaii. The FAA will need to verify that their portion of the AFTN/MET system is Y2K compliant.

National Weather Service Office Guam will review all local software (such as Microsoft Excel) on its computers and workstations to assess if they are Y2K compliant. All computers were assessed to determine Y2K compliance. Hardware that is not Y2K compliant will, if necessary, be replaced with new equipment.

3.8 Republic of Kiribati, Tonga and Tuvalu

Mission-critical processes have been identified and systems inventory undertaken with assistance of Met Service of New Zealand. Problem areas are being investigated and Y2K assurances from vendors/service providers are yet to be actioned.

3.9 Republic of the Marshall Islands

Mission-critical processes have been identified and systems inventory undertaken with assistance of US NOAA NWS Pacific Region in Honolulu. Problem areas are being investigated and Y2K assurances from vendors/service providers are yet to be actioned.

3.10 Nauru

The government is aware of the problem and has sought assistance to solve the problem. Telecommunications is a major concern and Nauru is fully participating in regional telecommunications meetings to identify solutions.

3.11 New Caledonia

Mission-critical processes have been identified and systems inventory undertaken with assistance of Meteo France. Problem areas are being investigated and Y2K assurances from vendors/ service providers are yet to be actioned.

3.12 New Zealand

Y2K problem was recognised early; mission-critical processes were identified; and systems inventory undertaken. A Y2K coordinator was appointed. Projects have been developed to correct problems. Y2K compliance statements have been requested from vendors/service providers. Met Service of New Zealand Ltd Y2K compliance statement has been published on www.met.co.nz home page. Many systems/ processes are already Y2K compliant. Full compliance is planned for 30 June 1999.

3.13 Niue

A short report has been completed and forwarded from Niue Meteorological Service with regards to computer systems we use in our office relating to the Y2K problem. Hardware and software have been checked and tested by Mr Garry Clarke from Met Service of New Zealand during his visit in August 1998. As required by the World Meteorological Organization, computers in the Niue Meteorological Service were checked and are Y2K compliant.

3.14 Republic of Palau

There is no set-up to overcome Y2K issues. The Republic depends on the US NOAA NWS Pacific Region in Honolulu to assist with efforts to ensure compliance.

3.15 Papua New Guinea

Papua New Guinea (PNG) has been aware of the Y2K problem since 1997. However, very little had been done until early 1998 when various committees were set up within government and non-government bodies to assess and report on the situation.

The PNG National Weather Service, after receiving a circular/questionnaire from WMO, responded to the questionnaire and thereby knew what items/systems were and were not Y2K compliant.

Our point of contact for the Y2K problem is Mr Moyap Kilepak.

The PNG NWS does not have a mini-computer system but has numerous PCs ranging from 386s, 486s to Pentiums. As most of our latest PCs are new, they have been tested and are Y2K compliant. Old PCs have been recommended for replacement. Software has also been tested and most is Y2K compliant.

Observation systems

- Surface — most are manually done
- Upper-air wind — manual
- Upper-air wind/temp — Manus (ARM) Geographic Positioning Satellite radiosondes (GPS sondes) yet to be checked for Y2K compliance
- Radiation observations — ARM, Manus, yet to be checked by ARM/PNG NWS
- Satellite (QFAX) observations/systems — yet to check
- No action as yet regarding vendors of supplies and meteorological equipment/instruments.

Telecommunication systems

- Global Telecommunications System (GTS) — computer hardware is Y2K compliant
- AFTN — office of civil aviation will ensure that this is compliant
- High frequency (HF) radio — Y2K compliant
- Phones/faxes — Telikom PNG to ensure they are compliant
- Email and Internet — computer hardware is compliant and Telikom (PNG) to ensure that system runs

Data processing and weather forecasting

- Climate Computing (CLICOM) — computer hardware is Y2K compliant; yet to check with version of CLICOM software
- QFAX satellite data processing — computer hardware is okay; software yet to be tested
- Weather analysis and forecasting —manually done
- Australian Tropical Cyclone Workstation (ATCW) — computer hardware and software are Y2K compliant

3.16 Samoa

The Samoan Government has been involved extensively in the Y2K problem. Mid-year, the Visitors Bureau, in preparation for the new

millennium, ceremoniously installed a new year 2000 arch digital clock at the entrance to the government building. It was followed by a National Workshop to discuss the Y2K problem.

From this workshop, a National Y2K Problem Committee was established. As a result, the Meteorological Services benefited from an inventory and testing of computer hardware, and efforts are under way to upgrade the airline systems as well.

Through the Institutional Strengthening and the Management Project (which provided the framework for this initiative), an enormous facelift of Treasury, Water Authority, Public Service Commission and Public Works systems is taking place to ensure they are Y2K compliant.

3.17 Solomon Islands

The Solomon Islands Meteorological Service (SIMS) sees the Y2K problem to be a critical issue that will affect operations of the service as it approaches the next millenium.

SIMS has yet to establish formal awareness programmes to make the issue known nationwide. Also, it has yet to do a test and an inventory of PCs and other operational systems for Y2K compliance.

However, once the issue is well understood, steps will be taken to tackle the initial problems and build on that.

3.18 United States of America

Mr Howard Diamond reported in the morning session on the NWS's efforts on a national level with Y2K testing and associated telecommunications contingency planning. In short, all NWS national-level systems are Y2K compliant and will be fully implemented as such by 31 March 1999. This includes full Y2K compliance for the Regional Telecommunication Hub (RTH) Washington system (NWS Telecommunication Gateway). For the NWS Pacific Region, all nationally supported systems such as the Next Generation Weather Radar (NEXRAD), Automated Surface Observing System (ASOS), Microcomputer-aided Paperless Surface Observing (MAPSO) system, and Advanced Weather Interactive Processing System (AWIPS) at build 4.2 are Y2K compliant. As the delegates from Guam and the Federated States of Micronesia reported on our efforts on their various Y2K areas, we have surveyed our computers and tested them. The US Pacific Region will be upgrading and/or replacing hardware as required. Here in the Honolulu office, the Pacific Region Operations Network (PRONET), which is a hybrid of a system developed by the NWS Alaska Region, has been upgraded with the latest Hewlett-Packard Y2K-compliant version operating system software. The PRONET system has also been tested with test Y2K data and no problems have arisen to date.

3.19 Vanuatu

The Vanuatu Meteorological Service (VMS) did a preliminary inventory of computer systems and submitted this to WMO. It also designated a point of contact. An action plan was also developed to overcome Y2K issues. NMS needs assistance from donors to assist the Service overcome Y2K problems. Vanuatu wanted to see computer-based equipment provided under donor projects, such as QFAX equipment upgraded or replaced in order to be Y2K compliant. It requested WMO, SPREP and the EU (European Union) Cyclone Warning System upgrade project to explore opportunities for securing funding to assist NMHSs in the region.

4. Summary of conclusions and recommendations

On behalf of Discussion Group 1 which covered *observing systems*, Garry Clarke (Meteorological Service of New Zealand Ltd) presented the findings of his group.

Observing systems were classified as follows: manual, automated and databases. The problems that were noted for all of these centred around the possibility of the following:

- loss of or unreliable power
- loss of or unreliable communications
- failure of other infrastructure
- loss of GPS navigation for upper air
- loss of archived data due to automated date purging which proves unreliable due to Y2K problem
- loss of data that seriously affects local forecasts and/or global or regional models.

A number of proposed solutions were documented that focused on good business practice contingency planning. The key factor here was the exchange of information, testing and getting information from vendors. Urgent action required was targeted for completion by 30 June 1999. Resources to accomplish this should rely on both internal and external expertise, along with resources available on Internet Web sites from the WMO, manufacturers and vendors. Where Internet access is not available, hard copies of information should be sought. Where financial or expert assistance is required, members should first apply to their own governments, then to the WMO Voluntary Cooperation Programme (VCP), the United Nations Development Programme (UNDP), or to other development assistance entities. This needs to be done as soon as possible.

On behalf of Discussion Group 2 which covered *telecommunications*, John Lincoln (WMO Consultant) presented the findings of his group.

It was pointed out that the WMO GTS (Global Telecommunications System) and other meteorological telecommunications circuits are the keystone to satisfactory operations of individual National Meteorological and Hydrological Services as well as the meteorological and hydrological community of the world as a whole. Therefore, it was felt that an all-out effort should be made to ensure that all segments of the meteorological telecommunications system in the Pacific, including the GTS and the individual low-speed circuits within and between countries, should operate without interruption as we move from 1999 to 2000. In other words, the goal of the WMO and its member countries as well as the SPREP countries between now and 31 December 1999 should be to ensure that the GTS as well as all other supporting circuits are fully Y2K compliant (in this case defined as 'no decrease in or loss of raw data or products flow') on 1 January 2000 and thereafter.

It was noted that there is little flexibility in the time schedules if there is any hope of being ready for the transition from 31 December 1999 to 1 January 2000, i.e. *time is of the essence.* The approach was to identify as many segments as possible of the telecommunications system supporting the meteorological services in the WMO's Regional Association V, covering the South West Pacific (WMO RA-V) in general, and specifically the SPREP countries. From this list, an analysis was done on whether the segments are Y2K compliant and, if not, the steps to be taken to rectify the problem and any associated recommendations were formulated. The specific systems identified and the solutions and recommendations are contained in the section on Discussion Group 2 in Annex 1.

On behalf of Discussion Group 3 which covered *data processing and forecasting systems*, Edward Young (US National Weather Service, Pacific Region Headquarters) presented the findings of his group.

In the Pacific, the primary data processing and forecasting centre activities are performed by the United States, New Zealand, Australia, the French territories and Fiji. The Y2K efforts in these states are well in hand. Countries were classified into one of four categories regarding data processing:

1. those with independently developed data processing and forecast display systems
2. those with a subset of data processing and forecast display systems donated by donor countries

3. those with some data processing and forecast display system capability (e.g. QFAX, EMWIN, WAFS, CLICOM)
4. those with limited data processing and forecast display systems capabilities (e.g. QFAX, EMWIN, CLICOM).

Data processing and forecasting systems were then classified into nine general categories:

A. numerical weather prediction products
B. meteorological and tsunami warning and advisories
C. meteorological workstation display systems
D. backup procedures
E. satellite processing
F. radar processing
G. climate processing
H. tropical cyclone tracking
I. hydrological processing.

Annex 1: Reports of the three discussion groups

Discussion Group 1: Observing systems

Task

Identify potential Y2K-related problems, propose solutions and formulate recommendations.

Definition of scope for discussion

The scope should include a risk analysis and planning discussion focusing on:

- an inventory of computer-based systems and Y2K compliance status (if known)
- solutions for non-compliant systems (modifications vs replacement)
- identification of resources to effect solutions.

Manually observed observations

- Considered surface, upper-air, analogue radar, ship and aircraft reports.
- Noted some instruments require electric power, and fully manual observations are becoming increasingly rare, being entered into a computer for quality control, coding and onward transmission to the NMHSs.
- All upper-air systems in the region depend on computers, and the return to a manual computer flight would be impossible with current resources. Only visual pilot balloon flights could be undertaken if the computer systems failed.

Automatically observed observations

- Considered surface, upper-air, ship and aircraft reports, as well as drifting and fixed buoys, sea-level automated weather stations (AWSs), digital radar, profilers, and satellite observations.
- Noted most systems depend on electrical supply and communications systems that are computer-controlled. Also noted some codes used contain year fields.

Databases of observations

- Noted that the hardware and software used in these systems may not be Y2K compliant.
- Also noted potential problems associated with automatic archiving and purging of old data.

Problems identified

- Loss of or unreliable power supplies.
- Loss of or unreliable communications systems (internal, external, public and private).
- Failure of other infrastructure (building systems, access, security, etc).
- Vendors/service providers unable to deliver consumables, etc., used for observing systems.
- Loss of GPS navigation for upper-air systems.
- Failure or partial loss of computer systems, either hardware or software (commercial, donated, locally developed or developed by other members).
- Archiving/automatic purging of old data issues, e.g. file names may contain two-digit years and, in a worse-case scenario, if systems did not roll over to the year 2000 but reset to a historic date, then possibly all data could be purged.
- Loss of data seriously affects local forecasting capability and integrity of regional and global models.

Solutions

- *Loss of or unreliable power.* Dependent on suppliers. Seek Y2K compliance reassurance. Be specific about requirements. Ensure contingency planning, e.g. standby generators, batteries, Uninterrupted Power System (UPS), power filters.
- *Loss of or unreliable communications.* Dependent on suppliers. Seek Y2K compliance reassurance. Be specific about requirements. Ensure contingency planning uses alternative communications systems, including radio systems.
- *Failure of other infrastructure.* Check and test with local experts.
- *Vendors/service providers unable to deliver.* Dependent on suppliers. Seek Y2K compliance reassurance. Be specific about requirements. Ensure contingency planning, e.g. inventory of requirements. Maybe increase stockholding.
- *Loss of GPS navigation.* Seek Y2K compliance reassurance from vendors. Older GPS systems are non-compliant and will need replacing.
- *Failure or partial loss of computer systems, either hardware or software.* Seek Y2K compliance reassurance from vendors. Be specific about requirements. Test, upgrade or replace as necessary. Members who are using the same hardware/software should coordinate to reduce cost by sharing expenses.

- *Archiving/automatic purging of old data issues.* Seek Y2K compliance reassurance from vendors. Be specific about requirements. Test, upgrade or replace as necessary. Members who are using the same software should coordinate to reduce cost by sharing expenses.
- *Develop a formal mechanism* for a regional solution to Y2K observing system issues. Urgent action is required, targeted at a completion date of 30 June 1999.
- *Encourage and support exchange of information* and experience internationally.
- *Prioritise actions* — firstly, upper-air; secondly, automatically observed observations; finally, manually observed observations.

Resources

- Use both internal and external expertise. Check with other members for possible solutions or resource persons to use.
- Members with Internet access should use the Y2K resources available on sites developed by WMO, NMHS, hardware and software vendors, manufacturers and developers. Others should seek hard copies of available information.
- Where financial or expert assistance is required, members should apply firstly to their own governments, then to WMO VCP, or to other development assistance agencies active in the region such as UNDP, AusAID, EU, NZODA. *This should be done as soon as possible.* In order to assist WMO members, blank VCP forms and filled-in samples were provided.

Discussion Group 2: Telecommunications

Membership

Arona Ngari (Cook Islands); John Miller (Guam); Criden Appi (Nauru); Sebastian Chen (New Caledonia); Paea Havea (Tonga); Terry Ganzel (USA); Colin Schulz (SPREP Consultant); with John Lincoln (WMO Consultant) as the coordinator-facilitator.

Tasks

The tasks assigned were: (1) identify problems, (2) propose solutions, and (3) formulate recommendations.

Discussion

Keeping in mind that the WMO GTS (Global Telecommunications System) is the keystone to satisfactory operations of individual National Meteorological and Hydrological Services as well as the meteorological and hydrological community of the world as a whole, it was felt that an all-out effort should be made to ensure that all segments of the meteorological telecommunications system in the Pacific, including the GTS and individual low-speed circuits within countries, should operate without interruption as we change from 1999 to 2000. In other words, the goal of the WMO and its member countries as well as the SPREP member countries and territories between now and 31 December 1999 should be to ensure that the GTS as well as all other supporting circuits are fully Y2K compliant (in this case defined as 'no decrease in or loss of raw data or products flow') on 1 January 2000 and thereafter.

It was noted that there is little flexibility in the time schedules if there is any hope of being ready for the transition from 31 December 1999 to 1 January 2000, i.e. time is of the essence. The approach was to identify as many segments of the telecommunications system supporting the meteorological services in WMO RA-V (RA-V is the WMO Regional Association V which covers the 'Southwest Pacific') in general, and specifically the SPREP member countries and territories. From this list, an analysis was done as to whether the segments are Y2K compliant and, if not, the steps to be taken to rectify the problem and any associated recommendations were formulated.

Findings

Note: In each case below, the paragraphs are: 2.x.1 — the identification of the problem; 2.x.2 — the proposed solution(s); 2.x.3 — the specific recommendation.

Data collection platfoms (DCPs)

2.1.1 Although DCPs are not yet used extensively in the Pacific, they are expected to be used in the near future. DCPs are associated with automatic weather stations (AWSs), radiosonde ground equipment, etc. It is essential that any DCPs introduced in the Pacific area are Y2K compliant.

2.1.2. Contracts for any DCPs procured for installation in the Pacific should be certified as Y2K compliant.

2.1.3 It is recommended that DCPs or any other new systems installed in the Pacific area be certified by the manufacturer as Y2K compliant.

Aeronautical Fixed Telecommunication Network (AFTN)

2.2.1 The AFTN is key to the flow of meteorological data in the Pacific and may not be

fully Y2K compliant. The meteorological portion of AFTN known as AFTN/MET is an X.25 protocol communication system. Although the X.25 protocol itself is not affected by the Y2K problem, the assurance of Y2K compliance for X.25 depends on the communications processors and routers that drive and send the data on the AFTN/MET network. There is no one global organisation that manages AFTN; it is the responsibility of each State with an AFTN drop to ensure the compliance of their routers and servers. Certification of Y2K compliance is required for this key network for ensuring flow of key aviation meteorological data in the Pacific.

2.2.2 The US FAA (Federal Aviation Administration) administers the NADIN II communication facility in Hawaii (at Diamond Head) which is the communications facility that collects AFTN/MET data from the Pacific area and routes it to RTH Washington. The FAA states that they are still investigating the Y2K compliance of the NADIN II facility. The United States is encouraged to provide assurance as soon as possible regarding Y2K compliance for that portion of the AFTN under their control. Users of the AFTN should check their receiving and transmitting segments of the AFTN to ensure Y2K compliance.

2.2.3 All users of the AFTN should check for Y2K compliance themselves or with their appropriate civil aviation authority which, in many cases, controls the configuration of the AFTN service in a country. Should there be problems, Ed Young of NWS PRH should be notified at edward.young@noaa.gov with a copy to Howard Diamond of US NWS Headquarters at howard.diamond@noaa.gov Note that the International Civil Aviation Organization's (ICAO) Informal Global Y2K Coordination Action Group is investigating the possibility of an alternative Y2K contingency network to AFTN. However, any information that ICAO can get on current AFTN Y2K compliance would be very helpful.

Satellite communications (SATCOM)

2.3.1 There may be failures of circuits on 1 January 2000 which cannot be restored quickly.

2.3.2 SATCOM (satellite communications) such as International Maritime Satellite (INMARSAT) should be considered by WMO as backup for circuits that may fail on 1 January 2000. Also, it may be appropriate for individual countries to consider DCPs for the uplinks of outgoing data and the EMWIN for incoming data and products for the alternative routing of data and products. Technical advice and information for the DCP and EMWIN alternatives could be requested from the United States.

2.3.3 Contingency plans should include the possible use of such capabilities as INMARSAT to ensure receipt and transmission of critical data should other circuits fail on 1 January 2000.

Radio facsimile broadcasts

2.4.1 It is believed that radio fax broadcasts (Guam, Honolulu, Australia and New Zealand) are generally Y2K compliant. One possible exception in some systems may be timers on receivers.

2.4.2 Because these fax systems are likely to be Y2K compliant, tests should be run on the timers to ensure that they will work or can be bypassed to ensure that these systems will work on 1 January 2000 and beyond.

2.4.3 Run tests to ensure that radio fax broadcasts will work reliably after 31 December 1999.

Public fax (dial-up)

2.5.1 Because these tend to be computer-generated, there could be problems with continuous operation after 31 December 1999.

2.5.2 Tests should be run to ensure these systems will work properly effective from 1 January 2000.

2.5.3 These tests should be comprehensive and, should they fail, contact with manufacturers should be made as soon as possible to ensure that a fix is effected before 1 July 1999.

Power, water, telecommunications (PTT)

2.6.1 It is possible that some of the PTTs (and Telecommunication Companies — TELCOs — as appropriate) in RA-V will not be completely Y2K compliant.

2.6.2 Since many of the circuits depend on PTT routing, it is essential that end-to-end tests be run to ensure full circuit availability and operation after 31 December 1999. The tests should differentiate between 'switched services' and dedicated circuits.

2.6.3 Contact with serving PTTs should be effected immediately to enable full end-to-end testing to be accomplished by early 1999 to determine if there are any problems. The tests and discussions with PTTs should determine whether any problems revealed will mean that the circuit(s) in question will not work at all from 1 January 2000 or that the problem can be worked around. Contingency plans should be formulated accordingly.

Satellite telecommunications tracking data

2.7.1 Computer controls of programmed tracking of telecommunications satellites may have problems with the Y2K problem.

2.7.2 Tests of tracking systems should be accomplished as soon as possible. This should include discussions with manufacturers of the equipment and software and tests involving the operator of the satellite systems.

2.7.3 Complete tests should be scheduled by 1 February 1999.

Email and Internet

2.8.1 Email and the Internet are becoming key to the flow of essential meteorological data in some cases. Should there be a failure of these, critical data could be lost — both transmission of raw observation data (roughly half of the SPREP member countries and territories depend on email to transmit both their surface and upper-air observations) as well as receipt of products by user meteorological services.

2.8.2 The end equipment and software should be tested, and checks with the servers (whether through the PTTs or commercial servers) should be done to ensure that the total system will work reliably after 31 December 1999. It was noted that not all countries have access to the Internet, but may have email capability.

2.8.3 Tests and liaison with servers should be effected by 1 March 1999.

Modems

2.9.1 Although most modems are considered to be Y2K compliant, there could be problems with the CSU/DSU (channel service unit/data service unit).

2.9.2 Users should check with their PTTs to ensure there will not be a problem with the CSU/DSUs.

2.9.3 This should be part of the overall liaison with PTTs to ensure these as well as other potential problems under the control of PTTs are tested (and, if necessary, corrected) early in 1999.

Communications software

2.10.1 It must be assumed that there are potential Y2K compliance problems with telecommunications software (both operating system and applications software).

2.10.2 For example, anyone using PROCOMM software should check it carefully for Y2K compliance. Version 2.01 for DOS has been found to be non-compliant, whereas PROCOMM version 3.0 for Windows is Y2K compliant.

2.10.3 Software tests should be done as early as possible, and at least by the end of January 1999. This may have to include liaison with manufacturers to see what the fix may be.

EMWIN

2.11.1 The EMWIN system is Y2K compliant. However, the only possible portion of the system that requires a contingency is the telecommunications link between the EMWIN control centre in Silver Spring, Maryland, and the satellite uplink facility in Wallops Island, Virginia.

2.11.2 The primary and secondary telecommunication links are Federal Telecommunications System (FTS) communications, of which Y2K compliance for the lines has been assured.

2.11.3 In order to demonstrate due diligence in Y2K planning, the United States is exploring the possibility of installing a satellite link between Silver Spring and Wallops Island as a third-level backup contingency. A decision on this satellite link, based on the availability of funding, should be made in early 1999.

WAFS/STAR4

2.12.1 It is known that the 486-based computers are *not* Y2K compliant. The Pentium-based systems are Y2K compliant.

2.12.2 The United States will replace those 486-based computers and the associated software which they originally sponsored. Mr Diamond will check to see if there are others which need to be upgraded.

France should upgrade the unit at Wallis & Futuna to ensure Y2K compliance.

2.12.3 It has been suggested that a reasonable Y2K contingency in the Pacific would be to upgrade some key WAFS sites from one-way receive to two-way receive/ transmit stations to allow for the uninterrupted transmission of raw meteorological data. In order to start this process, a formal recommendation from SPREP needs to be forwarded to WMO stating that the upgrade of the WAFS Pacific Ocean Region satellite facility in Yacoult, Washington, to two-way capability would be a good Y2K contingency. From that, the WMO would have to make a formal request to the United States requesting such an upgrade. Details (e.g. costs, procedures) will need to be worked out to determine if such an upgrade is feasible.

HF radio

2.13.1 HF radio is considered Y2K compliant.

2.13.2 Countries with HF radio capability should consider this in their contingency planning. Many SPREP and RA-V countries have HF radios that could be used. These should be tested.

2.13.3 Contingency planning should include tests of HF radios to see how they could be used as backup or replacement (even if temporary) for circuits which may fail due to non-Y2K compliance.

Routers

2.14.1 Routers may not all be Y2K compliant.

2.14.2 They should be tested and upgraded as necessary. *Note:* The X.25 protocol is okay with respect to Y2K compliance.

2.14.3 The testing should be accomplished as soon as possible.

RTH and GTS

2.15.1 From briefings by the Australian and New Zealand representatives (and the WMO Y2K Web page), the two RTHs in RA-V should be Y2K compliant. The GTS circuits may not all be Y2K compliant.

2.15.2 All countries in RA-V and SPREP should run end-to-end tests in conjunction with the two operators of the RTHs in the Pacific to ensure that these critical circuits will operate satisfactorily after 31 December 1999.

2.15.3 Australia and New Zealand should take the lead in scheduling and running tests of the distribution and collection of data and products by their RTHs. These tests should be accomplished by early 1999.

Transmission of ship weather observations

2.16.1 About 70 per cent of the earth is covered by oceans and seas. The ship weather reports from this extensive portion of the earth are extremely important to meteorology. This is especially true in the Pacific. Because the ship observations are largely taken by privately owned commercial ships, and the transmission of these ship reports is over various means of telecommunications outside the GTS, it is important that these ship reports flow uninterruptedly after 31 December 1999.

2.16.2 Liaison by the WMO and SPREP member countries and territories with the ministry responsible for maritime affairs should be undertaken at an early date to ensure that the methods and techniques used to obtain observations, especially those taken by automated means, are Y2K compliant. Further, the various telecommunications methods used to transmit these observations should be checked through the appropriate telecommunications authorities to ensure they are Y2K compliant.

2.16.3 The WMO and SPREP members should liaise with the appropriate maritime and telecommunications authorities in their respective countries to ensure that the Y2K problem has been taken into account and that ship observations and surface and upper air reports will flow uninterruptedly after 31 December 1999. Countries operating a ship-visit programme should include in the checklist a query as to whether the ships being visited have weather observation systems and whether telecommunications systems on which the observations are transmitted are Y2K compliant. Tests may be appropriate.

PEACESAT

2.17.1 PEACESAT (Pan-Pacific Education and Communication Experiments by Satellite) may offer a reliable backup capability that is Y2K compliant.

2.17.2 SPREP countries should consider the possibility of including PEACESAT capability as an emergency backup capability.

2.17.3 Plans should include this possibility.

Attachment to Discussion Group 2

Note: The following points (following the format in the main report) are from the Prague Y2K workshop — they raise other points that should be taken into consideration by RA-V and SPREP member countries and territories.

1. There may be a need for temporary resources and capability during the transition period and first few days (or possibly longer) of the year 2000 as a result of the loss of capability for the transmission of data, e.g. some PTTs may have problems in meeting the needs of NMHSs in the first hours or even days of the year 2000.

   Members should look for other temporary resources (e.g. military telecommunications capability) with which to meet any temporary needs in the early days of the year 2000. Also, RTHs should envisage the possibility of failure of leased lines. Dial-up communications lines between two RTHs, e.g. with Integrated Services Digital Network (ISDN), should be ready for use.

   One way to meet temporary needs for circuits or broadcasts would be to negotiate with the military of the member countries. This would provide a temporary capability for contingency planning at little or no extra cost and would fulfill the military telecommunications requirements to exercise their capabilities under unusual circumstances.

2. It is essential that new replacement systems be procured that exactly meet the requirements of the member countries.

   An outline should be prepared for countries engaged in procuring new Y2K-compliant systems so that their requirements, now and in the future, will be met. The procurement of new systems should carefully analyse the required technology of the computers and software as well as the connecting circuit requirements.

   The WMO Secretariat should develop an outline to guide member countries through the development of requirements, generation of specifications and procurement of new Y2K-compliant systems.

3. There is a requirement to simulate the Y2K situation in a standard or set way in order for the exercise or test of RTHs and telecommunications circuits as they will be after 1 January 2000.

   Develop a set of 'standards' for RTH and circuit tests in order to ensure that tests and exercises under post-31 December 1999 conditions are orderly and standardised.

   Commission for Basic Systems (CBS) to develop a set of 'standards' for RTH and circuit tests in order to ensure that tests and exercises under post-31 December 1999 conditions are orderly and standardised. These 'standards' should be made available to all WMO members by posting on the WMO Web page not later than 15 November 1999 in order to ensure the tests outlined in the previous paragraph are realistic and under controlled conditions.

4. Different telecommunications protocols operate to different standards and requirements.

   Develop standards and draft requirements to ensure that the proper and most effective telecommunications protocols are specified when ordering message-switching systems and circuitry on which data will be transmitted.

   CBS(Ext.) to develop, by 30 November 1998, standards and draft requirements to ensure that the proper and most effective telecommunications protocols are specified when ordering message-switching systems and circuitry on which data will be transmitted.

5. The recommended sequence of testing needs to be established.

   The sequence for testing should, where possible, be in the following order: (a) hardware, (b) operating system, (c) telecommunications links and (d) applications software. (*Note:* The last two may, in some instances, be reversed.)

   The sequence for testing should be endorsed by CBS(Ext.).

6. The various protocols, e.g. TCP/IP, X.25, have different characteristics and may present unique problems in handling the Y2K problem on different operating systems.

   Communications elements, e.g. CISCO routers, are also Y2K sensitive, so the actual software version has to be verified as Y2K compliant.

   It is also possible that other communication elements use software which could be Y2K sensitive. Therefore, attention should be paid to this factor. An alert to this potential problem should be included on the WMO Web Y2K page.

7. The migration of one level or version of an operating system to another in order to make the system Y2K compliant must include all levels of authorised licences.

   Members should check carefully with the vendor(s) to ensure that all licences, e.g. compilers, software tools, display utilities, graphics packages, are available in the upgraded configuration.

The WMO Secretariat should include this information on the Y2K page of the WMO Web site.

8. For RTH and other levels of telecommunications testing, not all member countries have the necessary backup or alternate systems with which to run tests.

   It must be recognised that all testing will not be at the same level of involvement and may only be possible for short periods of time.

   CBS(Ext.) must recognise the various capabilities of RTHs and National Meteorological Centres (NMCs) and leave the details to the RTHs and/or NMCs between which tests are to be accomplished. It should also be recognised that bilateral tests are probably the most effective.

9. The test dates for tests or exercises of the operating system(s) should probably include or be after 29 February 2000 to ensure that the leap year of 2000 will be accommodated.

   Operating system test dates starting on 28 February 2000 and including at least a few days of March 2000 would probably give the most comprehensive test results.

   CBS(Ext.) should endorse test dates starting 28 February 2000 and including the early part of March 2000.

10. There are different levels of capability for the various RTHs and exactly the same level of testing is not practical for all RTHs.

    Larger, more capable RTHs are encouraged to provide advice, assistance, etc. to the less capable RTHs for the tests and transition to the year 2000.

    This should be discussed and negotiated on a bilateral basis between RTHs.

11. Because of the uniqueness and special requirements within the GTS and especially the RTHs, there needs to be a separate venue for the exchange of ideas and lessons learned.

    A method of exchange of information needs to be established.

    The WMO Secretariat should establish a separate page within the WMO Y2K Web site for the posting of lessons learned, ideas, etc. with emphasis on the GTS, RTHs, etc.

12. From information available, it is not clear that all PTTs and power management have developed plans to ensure the management facility and their network(s) will be Y2K compliant.

    Close liaison and discussions between NMHSs and their respective PTTs and power companies needs to be established as soon as possible, if it is not already done.

    CBS(Ext.) should encourage NMHSs to establish contact with their PTTs and power companies to ensure realistic tests and that, in fact, the circuits assigned to the exchange of meteorological and hydrological data will flow uninterruptedly beyond 31 December 1999.

13. There may be a need for full manning and expertise to be available over the days before and especially after 1 January 2000 to handle unforseen contingencies.

    NMHSs should be prepared for full manning in the days immediately before and after 1 January 2000.

    CBS(Ext.) should endorse this guidance.

Discussion group 3: Data processing and forecasting systems

Leader

Edward Young

Membership

Dr Ven Tsui (Australia); Mr Akira J. Suzuki (Federated States of Micronesia); Mr Galen Joel (Federated States of Micronesia); Mr Bernard Aten (Federated States of Micronesia); Mr Rajendra Prasad (Fiji); Mr Hirao Kloulchad (Republic of Palau); Mr James Nako (Papua New Guinea); Mr Ausetalia Titimaea (Samoa); Ms Hilia Vavae (Tuvalu); Mr David Scott (South Pacific Applied Geoscience Commission — SOPAC, Suva, Fiji); Mr Penehuro Lefale (SPREP)

Problems

With the exception of Australia, New Zealand, the United States and the French territories, which already have well-developed plans for solving Y2K problems within their countries, including their RTHs, and to a lesser extent Fiji, data processing requirements for the small island states are more concerned with the flow of meteorological data to and from each country to support their meteorological analysis and forecasting systems. Thus, a dependency on the communications systems of each country is a Y2K problem if the national telecommunications provider is not Y2K compliant.

Countries were classified into four categories:

1. countries with independently developed data processing and forecast display systems
2. countries with a subset of data processing and forecast display systems donated by donor countries
3. countries with some data processing and forecast display systems capability (QFAX, EMWIN, WAFS, CLICOM)
4. countries with limited data processing and forecast display systems capability (QFAX, EMWIN, CLICOM).

A. Numerical weather prediction products for model and data products

- Originating NWP centres
- Melbourne
- Darwin
- European Centre for Medium-range Weather Forecasting (ECMWF)
- United States National Centers for Environmental Prediction (US NCEP)
- Monterey
- Bracknell

Need to ensure primary communications capability to receive guidance are Y2K compliant. Need to ensure backup communications methods are provided to continue receiving NWP guidance products.

B. Meteorological and tsunami warnings and advisories

NMHSs require transmission and reception capabilities for meteorological and tsunami warnings and advisories, and meteorological and tidal data supporting this responsibility, which should be checked for Y2K compliance.

- Many SIDS (Small Island Developing States) NMHSs are now taking on responsibility for disseminating and issuing of national tsunami warnings.
- Many SIDS NMHSs also have sea-level monitoring stations, which are used operationally.
- Some countries have seismic data that is not disseminated in real time in support of the tsunami programme, and may require Y2K checks.

C. Meteorological workstation display systems

The following are critical meteorological display systems used operationally in most NMHSs, and can should be checked for Y2K compliance:

- Digital facsimile (DIFAX)
- Digital Atmosphere
- EMWIN
- WEFAX
- WAFS
- Radiofax
- Internet
- Digicora-Vaisala upper-air observing system, on 486 Windows 3.X PCs.

D. Backup procedures

Backup procedures are required for uplink and downlink of critical meteorological/hydrological products to support NMHSs, through the following dissemination systems:

- PEACESAT
- EMWIN
- WEFAX
- Internet
- DCP
- WAFS (*Note:* Explore two-way system for selected WAFS sites in the Pacific)
- Radiofax
- HF packet radio/radio — use packet radio to transmit products to neighbouring packet radio site for re-transmission, uplink, etc.

E. Satellite reception/data processing

- GMS — GMS/MTSAT (conversion to digital broadcast)
- GOES
- Polar Orbiting
- FY2

F. Radar data processing/dissemination

G. Climate data processing/dissemination

- CLICOM
  Y2K-compliant software
  Y2K-compliant hardware (PC)
- Spreadsheets (Microsoft Excel, etc.)

H. Tropical cyclone tracking software

- ATCW — Australia-hosted software resident on older 486s. Need to replace PCs. Reinstall Y2K CD-ROM-compliant version.
- ATCF Jr. — U.S. Navy software provided to Micronesia, resident on older 486s. Need to certify Y2K software compliance and hardware compliance.
- CREX Code development for tropical cyclone trajectory forecasts (check with JMA, who developed the experimental CREX code)

I. Hydrological data

- Critical hydrological data (telemetered rain gauge data, river gauge data) in use in some Pacific Island countries require Y2K compliance checks.
- Non-critical hydrological data processing software may not be Y2K compliant.

Annex 2: Summary of SPREP countries/territories reporting Y2K status

Country/Territory	Y2K programme A.2	Inventory A.4	POC A.6	Predict OK 31/12/99 A.7
American Samoa**	Yes	Yes	Yes	Yes
Australia*	Yes	Yes	Yes	Yes
Cook Islands*	Yes	Yes	Yes	Yes
Federated States of Micronesia (FSM)*	No	Planned	Yes	Yes
Fiji*	Yes	Yes	Yes	Yes
France*#	Yes	Yes	Yes	Yes
French Polynesia**	Yes	Yes	Yes	Yes
Guam**	Yes	Yes	Yes	Yes
Kiribati	Planned	Yes	Yes	Yes
Marshall Islands	Yes	Yes	Yes	Yes
Nauru	Yes	No	No	No
New Caledonia**	Yes	Yes	Yes	Yes
New Zealand*	Yes	Yes	Yes	Yes
Niue*	Planned	Planned	Yes	Planned
Northern Mariana Islands**#	Yes	Yes	Yes	Yes
Palau	Yes	Yes	Yes	Yes
Papua New Guinea*	Planned	Yes	Yes	Yes
Pitcairn** #				
Samoa*	Yes	Yes	Yes	Yes
Solomon Islands*	No	No	Yes	Yes (Need help from WMO)
Tokelau**#	Yes	Yes	Yes	Yes
Tonga*	Yes	Yes	Yes	Yes
Tuvalu	Planned	Planned	Yes	Yes
USA*	Yes	Yes	Yes	Yes (31/03/99 is the deadline)
Vanuatu*	Yes	Yes	Yes	Planned
Wallis & Futuna**	Yes	Yes	Yes	Yes

* WMO members
** WMO membership comes through France, New Zealand or the United States
# Not represented at Honolulu

Annex 3: List of participants

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Annex 4: Agenda

Day 1: Sunday, 8 November 1998

12.00 noon to 6.00 pm	Arrival and registration
7.00 to 9.00 pm	Pre-workshop meeting of resource people

Day 2: Monday, 9 November 1998

8.00 am	Welcome, opening and administrative remarks (Mr E. Al-Majed, WMO, Mr R. Hagemeyer, US NOAA/NWS, Mr P. Lefale (SPREP))
8.30 am	Introduction and overview of the Y2K problem (Mr H. Diamond, US NOAA NWS)
9.15 am	Y2K problem from the WMO perspective (Mr J. Lincoln, WMO Consultant)
10.00 am	Break
10.15 am	Y2K end-to-end testing in the NWS (Mr H. Diamond)
11.00 am	Report from New Zealand Meteorological Service on their efforts to provide Y2K assistance to Pacific Island countries Met Services (Mr G. Clarke, Met Service of New Zealand Ltd)
11.30 am	Y2K and aviation (Mr J. Morgan, Federal Aviation Administration (FAA))
12.00 noon	Lunch
1.00 pm	Y2K for emergency management in the State of Hawaii (Mr R. Price, State of Hawaii Emergency Management)
1.30 pm	Y2K telecommunications contingency planning (Mr H. Diamond)
2.15 pm	Brief reports by participants on the status of systems in their NMHS
3.15 pm	Break
3.30 pm	Formation of discussion groups (*Note*: Discussion groups are expected to: (a) identify problems; (b) propose solutions; and (c) formulate recommendations. Inherent in the discussions will be a risk analysis and planning discussion focusing on: (1) an inventory of computer-based systems and Y2K compliance status (if known); (2) solutions for non-compliant systems (modification vs replacement); and (3) identification of resources to effect solutions. Group 1: Observing systems (Leader — Mr G. Clarke) Group 2: Telecommunications (Leader — Mr J. Lincoln) Group 3: Data processing, forecasting systems (Leader — Mr E. Young)
6.30 pm	Adjourn

Day 3: Tuesday, 10 November 1998

8.00 am	Continuation of discussion groups
9.45 am	Break
10.00 am	Plenary presentation of results from discussion groups • Analysis of the potential impact of the Y2K problem • Inventory of computer-based systems and Y2K compliance status • Solutions for non-compliant systems (modification vs replacement) • Identification of resources to effect solutions
12.00 noon	Lunch
1.00 pm	Continuation of plenary discussions
3.00 pm	Break
3.15 pm	Development of a schedule for resolving problems
4.15 pm	Regional response team for resolving problems (RESET Team)
5.00 pm	Preparation of a brief summary of actions and recommendations
6.00 pm	Wrap-up and discussion of how to proceed and follow-up
6.30 pm	Closure of the workshop

Annex 5: NOAA year 2000 compliance definition

Meaning of NOAA year 2000 compliance

The purpose of this document is to provide a definition for NOAA systems that are year 2000 compliant. Throughout the industry, the term 'year 2000 compliant' remains ambiguous and ill-defined. To avoid confusion with less precise descriptions of year 2000 compliance, NOAA will use the term 'NOAA year 2000 compliant' to identify systems which meet our definition. This document may evolve over time as we learn more about year 2000 requirements and testing.

NOAA year 2000 compliant

To be 'NOAA year 2000 compliant', NOAA systems must be reviewed to confirm that they store, process (including sorting and performing mathematical operations), input and output data containing date information correctly regardless of whether the data contains dates before, on or after 1 January 2000.

Techniques

Dates before, on or after 1 January 2000 may be interpreted and stored using either *compliant* or *windowing* techniques. A system termed 'NOAA year 2000 compliant' means that the *compliant* technique was used. However, compliance by *windowing* may be used in circumstances where compliance by the *compliant* technique is impractical, or where *windowing* is required to meet specific external interface requirements. If the *windowing* technique is used, it must be specifically documented in the system description. *Compliant* and *windowing* have the following definitions:

- *Compliant:* All dates are stored, processed, input and output in formats that preserve century, decade and year information.
- *Windowing:* Dates are stored, input and output in a format that preserves only decade and year information, but they are processed through a sliding window calculation. For example, if the year is 00 to 60, add 2000, and if the year is 61 to 99, add 1900. There is no industry standard for the cutoff date used in such calculations, and therefore interfaces may not work correctly between programmes or systems using different conventions. Any NOAA system achieving compliance through *windowing* must clearly document the cutoff date and any other necessary information relating to the bridging calculation used.

Leap year

The year 2000 itself must be correctly processed as a leap year, i.e. the two days following 28 February 2000 must properly be interpreted as Tuesday, 29 February 2000, and Wednesday, 1 March 2000.

Display

When possible, any output or display of a date should use a four-digit year (YYYY). However, if two-digit display of a date is required and does not cause confusion, the year field may be displayed as two digits.

Firmware and hardware

Any firmware, hardware or networking component in 'NOAA year 2000 compliant' systems must process dates in accordance with the requirements in this document.

System integration

Certification of 'NOAA year 2000 compliance' extends only to the specific system configuration tested, and does not include other software, firmware or hardware components which may be used in conjunction with the tested configuration. For NOAA system configurations consisting of multiple components to be considered 'NOAA year 2000 compliant', each constituent component, regardless of source, must be 'NOAA year 2000 compliant' in accordance with this document, and the system as a whole must be tested for compliance. Constituent components include all software (including operating systems, programmes, packages and utilities), firmware, hardware, networking components and peripherals provided by NOAA as part of the configuration.

Year 2000 system compliance requirements

The following questions must be answered as indicated (i.e. either 'yes' or 'no') or marked N/A (not applicable) for any NOAA system to be identified as 'NOAA year 2000 compliant'. Any deviations from these responses must be specifically documented. Although not required, it is highly recommended that 'Test Assertions for Date and Time Functions' by Gary Fisher of NIST be used for testing date and time functions. The latest version of this document may be viewed at http://www.nist.gov/y2k/datetest.htm.

Date manipulation questions		**N/A**	**No**	**Yes**
Does the system:				
1.	use December 31, 1999, as a regular end of year without special meaning?			✓
2.	treat September 9, 1999, as a regular day with no special meaning?			✓
3.	do any of the following date field manipulations?		✓	
4.	– 99 indicates last record		✓	
5.	– 00 to indicate a null record		✓	
6.	– 99 and 00 default values		✓	
7.	– special interpretations of 00		✓	
8.	– hard coded 19 in 4-digit year field		✓	
9.	– separate manipulations of century digits		✓	
10.	include any licence date expiries associated with the end of 1999?		✓	
11.	use dates in name constructions?		✓	
12.	mix date data and control information in commands or flags which are interpreted as one or the other depending on their values?		✓	
13.	use a date as part of the key of an indexed file?		✓	

Year and century questions		N/A	No	Yes
Does the system:				
1.	recognise 2000 as a leap year?			✓
2.	allow itself to be set to any date after 12/31/1999 including 02/29/2000?			✓
3.	indicate the correct day, date and time when the following test is performed? With the date set to 12/31/1999, power the system off and then back on when the time will be in 1/1/2000.			✓
4.	indicate the correct day, date, and time when the following test is performed? With the date set to some time after 1/1/2000, power the system off and back on.			✓
5.	display the date correctly as 2/29/2000 when the following test is performed? With the date set to 2/28/2000, power the system off, and then back on when the next day has been reached.			✓
6.	treat December 31, 1999, as a Friday?			✓
7.	treat January 1, 2000, as a Saturday?			✓
8.	treat February 29, 2000, as a Tuesday?			✓
9.	treat December 7, 2000, as a Thursday?			✓
10.	treat December 31, 2000, as a Sunday?			✓
11.	treat January 1, 2001, as a Monday?			✓
12.	treat March 1, 2000, as a Wednesday?			✓
13.	treat February 28, 2001, as a Wednesday?			✓
14.	treat March 1, 2001, as a Thursday?			✓

Database access and storage questions		N/A	No	Yes
Does the system:				
1.	code all years as in a manner that preserves century, decade and year information?			✓
2.	correctly perform all of the following manipulations across the century boundary?			✓
3.	– computations of time spans, due dates, etc.			✓
4.	– sorting of data			✓
5.	– selections based on key fields			✓
6.	– selections based on non-key fields			✓

Operating system and application questions		N/A	No	Yes
Does the system:				
1.	display the year as an unambiguous value with a minimum of two digits?			✓
2.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set to today's date?			✓
3.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set to 1/1/2000?			✓
4.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set after 1/1/2000?			✓
5.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set to 12/31/1999?			✓
6.	correctly process dates with the system clock set to 12/31/1999 and processing allowed to continue across the century boundary?			✓
7.	correctly handle date comparisons where one date is not greater than 12/31/1999 and the other date is not less than 1/1/2000?			✓
8.	use a sliding window for year calculations?		✓	
9.	contain a date format that does not preserve century information?		✓	
10.	create and/or store data in files or log files or, generate reports that do not preserve century information in date fields?		✓	
11.	use a 32-bit incrementing signed value for date and time?		✓	
12.	correctly set and maintain the century digits in the real-time clock; if the system uses AT-class PCs (286 to Pentiums and clones), does the operating system or your system software correctly set and maintain the century digits in the real-time clock?			✓
13.	correctly handle all time-interval calculations based on the century transition — both looking back into the past, and looking forward into the future?			✓
14.	correctly handle future time-interval calculations that span the century transition?			✓
15.	if required, correctly handle date and time-interval calculations based on the use of data previously stored by the system or previous versions of the system?			✓
16.	Is the system formally tested for year 2000 compliance?			✓

Annex 6: Meteorological telecommunications systems in SPREP member countries and territories

Country/Territory	WAFS/STAR4 Send Receive	AFTN Send Receive	EMWIN Send Receive	
American Samoa**				
Australia*				
Cook Islands*				
Federated States of Micronesia (FSM)*				
Fiji*				
France*				
French Polynesia**				
Guam**				
Kiribati				
Marshall Islands				
Nauru				
New Caledonia**				
New Zealand*				
Niue*				
Northern Mariana Islands**				
Palau				
Papua New Guinea*				
Pitcairn**				
Samoa*				
Solomon Islands*				
Tokelau**				
Tonga*				
Tuvalu				
USA*				
Vanuatu*				
Wallis & Futuna**				

* WMO members
** WMO membership comes through France, New Zealand or the United States

Annex 7: Year 2000 compliance survey

Survey response from:

.....

NMHS POINT OF CONTACT AND COUNTRY

A. General/organisation

		Please tick your response			
		Yes	**No**	**Planned**	**N/A**
1.	Does your National Meteorological and Hydrological Service (NMHS) consider the year 2000 problem to be a critical issue affecting meteorological operations that needs immediate attention in order to be resolved before 31 December 1999?				
2.	Does your NMHS have an awareness of the year 2000 problem and has it established programmes to ensure that electrical power, communications, transportation, water and emergency services will not be affected as 1 January 2000 approaches?				
3.	Has your NMHS established a formal year 2000 programme to cover meteorological operations?				
4.	If your NMHS has a formal year 2000 programme, have you developed an inventory of meteorological systems or computer-related systems (e.g. PCs, telecomms switching computers, fax machines, radiosonde systems, automatic weather systems, workstations)?				
5.	If your NMHS has a formal year 2000 programme, is it taking into account the Y2K impact on its meteorological operations of the following:				
	(a) Information systems				
	(b) Internal and external telephone and communications systems and PTT				
	(c) Electrical power supplies				
	(d) Water				
	(e) Fuel				
	(f) Equipment suppliers and service providers				
	(g) Emergency services?				
6.	Is there a dedicated programme manager or contact person for the NMHS year 2000 programme? If yes, please provide: (a) full name: (b) address: (c) telephone no.: (d) fax no.: (e) email address:				
7.	Do you believe that your NMHS's meteorological systems will be adequately prepared on 31 December 1999?				

8.	Does your NMHS have, or is it working on, specific year 2000 operational contingency plans?				
9.	Do your neighbouring countries' NMHSs have formal meteorological year 2000 programmes?				
10.	What standard for year 2000 compliance is being used by your NMHS?				
11.	Have you contacted manufacturers of your computer systems hardware and operating systems to determine if they are Y2K compliant?				
12.	Have you contacted the developers of your computer systems applications software to determine if it is Y2K compliant?				
13.	From any tests, enquiries, etc. so far, have you learned things that would be useful to other NMHSs? If so, please provide a short summary:				
14.	Depending on what you have learned so far (from manufacturers, other NMHSs, WMO, etc.), have you determined which computer-based systems must be replaced, upgraded, etc.? *Note:* The following could be sub-items: (a) If any must be replaced or upgraded, have you determined the cost involved? (b) If so, have you budgeted the necessary funds for 1998 or 1999 with which to accomplish the necessary procurement of replacement systems or the upgrading of systems? (c) If you do not have essential funds, have you considered contacting UNDP, WMO (VCP), etc. for possible funding assistance?				
15.	Do you have any comments on the year 2000 problem? Please list.				

B. Year 2000 programme status

The headings in points 16 to 27 below represent key elements of a year 2000 programme. Please indicate your level of confidence against each element listed by circling a number from 1 to 4, as per the following criteria. If an element does not apply, please indicate that by circling N/A.

1. High level of confidence, full compliance programme in place with defined objectives and milestones.
2. Medium level of confidence, full compliance programme being developed but not yet in place.
3. Low level of confidence, no programme in place, but recognise the need to create programme as a matter of priority.
4. Low level of confidence, do not have a programme in place, and no plans exist to create one.

	Element	**Criteria**				
16.	Systems and applications	1	2	3	4	N/A
17.	Networks (domestic)	1	2	3	4	N/A
18.	Networks (domestic, interconnect)	1	2	3	4	N/A
19.	Networks (international), including GTS connection to RTH(s) serving you	1	2	3	4	N/A
20.	Networks (telex)	1	2	3	4	N/A
21.	Internet and email access	1	2	3	4	N/A
22.	Products and services	1	2	3	4	N/A
23.	Communication to customers	1	2	3	4	N/A
24.	Communication to suppliers	1	2	3	4	N/A
25.	Supplier relationships	1	2	3	4	N/A
26.	Integration testing (end-to-end)	1	2	3	4	N/A
27.	Contingency planning*	1	2	3	4	N/A
28.	Indicate your planned Y2K compliance date					

* For contingency planning in question B27, consider such things as the alternative routing of circuits, ensuring that key personnel are available from the critical period of 26 December 1999 to 15 January 2000, etc.

Annex 3: List of participants

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Annex 4: Agenda

Day 1: Sunday, 8 November 1998

12.00 noon to 6.00 pm	Arrival and registration
7.00 to 9.00 pm	Pre-workshop meeting of resource people

Day 2: Monday, 9 November 1998

8.00 am	Welcome, opening and administrative remarks (Mr E. Al-Majed, WMO, Mr R. Hagemeyer, US NOAA/NWS, Mr P. Lefale (SPREP))
8.30 am	Introduction and overview of the Y2K problem (Mr H. Diamond, US NOAA NWS)
9.15 am	Y2K problem from the WMO perspective (Mr J. Lincoln, WMO Consultant)
10.00 am	Break
10.15 am	Y2K end-to-end testing in the NWS (Mr H. Diamond)
11.00 am	Report from New Zealand Meteorological Service on their efforts to provide Y2K assistance to Pacific Island countries Met Services (Mr G. Clarke, Met Service of New Zealand Ltd)
11.30 am	Y2K and aviation (Mr J. Morgan, Federal Aviation Administration (FAA))
12.00 noon	Lunch
1.00 pm	Y2K for emergency management in the State of Hawaii (Mr R. Price, State of Hawaii Emergency Management)
1.30 pm	Y2K telecommunications contingency planning (Mr H. Diamond)
2.15 pm	Brief reports by participants on the status of systems in their NMHS
3.15 pm	Break
3.30 pm	Formation of discussion groups (*Note*: Discussion groups are expected to: (a) identify problems; (b) propose solutions; and (c) formulate recommendations. Inherent in the discussions will be a risk analysis and planning discussion focusing on: (1) an inventory of computer-based systems and Y2K compliance status (if known); (2) solutions for non-compliant systems (modification vs replacement); and (3) identification of resources to effect solutions. Group 1: Observing systems (Leader — Mr G. Clarke) Group 2: Telecommunications (Leader — Mr J. Lincoln) Group 3: Data processing, forecasting systems (Leader — Mr E. Young)
6.30 pm	Adjourn

Day 3: Tuesday, 10 November 1998

8.00 am	Continuation of discussion groups
9.45 am	Break
10.00 am	Plenary presentation of results from discussion groups • Analysis of the potential impact of the Y2K problem • Inventory of computer-based systems and Y2K compliance status • Solutions for non-compliant systems (modification vs replacement) • Identification of resources to effect solutions
12.00 noon	Lunch
1.00 pm	Continuation of plenary discussions
3.00 pm	Break
3.15 pm	Development of a schedule for resolving problems
4.15 pm	Regional response team for resolving problems (RESET Team)
5.00 pm	Preparation of a brief summary of actions and recommendations
6.00 pm	Wrap-up and discussion of how to proceed and follow-up
6.30 pm	Closure of the workshop

Annex 5: NOAA year 2000 compliance definition

Meaning of NOAA year 2000 compliance

The purpose of this document is to provide a definition for NOAA systems that are year 2000 compliant. Throughout the industry, the term 'year 2000 compliant' remains ambiguous and ill-defined. To avoid confusion with less precise descriptions of year 2000 compliance, NOAA will use the term 'NOAA year 2000 compliant' to identify systems which meet our definition. This document may evolve over time as we learn more about year 2000 requirements and testing.

NOAA year 2000 compliant

To be 'NOAA year 2000 compliant', NOAA systems must be reviewed to confirm that they store, process (including sorting and performing mathematical operations), input and output data containing date information correctly regardless of whether the data contains dates before, on or after 1 January 2000.

Techniques

Dates before, on or after 1 January 2000 may be interpreted and stored using either *compliant* or *windowing* techniques. A system termed 'NOAA year 2000 compliant' means that the *compliant* technique was used. However, compliance by *windowing* may be used in circumstances where compliance by the *compliant* technique is impractical, or where *windowing* is required to meet specific external interface requirements. If the *windowing* technique is used, it must be specifically documented in the system description. *Compliant* and *windowing* have the following definitions:

- *Compliant:* All dates are stored, processed, input and output in formats that preserve century, decade and year information.
- *Windowing:* Dates are stored, input and output in a format that preserves only decade and year information, but they are processed through a sliding window calculation. For example, if the year is 00 to 60, add 2000, and if the year is 61 to 99, add 1900. There is no industry standard for the cutoff date used in such calculations, and therefore interfaces may not work correctly between programmes or systems using different conventions. Any NOAA system achieving compliance through *windowing* must clearly document the cutoff date and any other necessary information relating to the bridging calculation used.

Leap year

The year 2000 itself must be correctly processed as a leap year, i.e. the two days following 28 February 2000 must properly be interpreted as Tuesday, 29 February 2000, and Wednesday, 1 March 2000.

Display

When possible, any output or display of a date should use a four-digit year (YYYY). However, if two-digit display of a date is required and does not cause confusion, the year field may be displayed as two digits.

Firmware and hardware

Any firmware, hardware or networking component in 'NOAA year 2000 compliant' systems must process dates in accordance with the requirements in this document.

System integration

Certification of 'NOAA year 2000 compliance' extends only to the specific system configuration tested, and does not include other software, firmware or hardware components which may be used in conjunction with the tested configuration. For NOAA system configurations consisting of multiple components to be considered 'NOAA year 2000 compliant', each constituent component, regardless of source, must be 'NOAA year 2000 compliant' in accordance with this document, and the system as a whole must be tested for compliance. Constituent components include all software (including operating systems, programmes, packages and utilities), firmware, hardware, networking components and peripherals provided by NOAA as part of the configuration.

Year 2000 system compliance requirements

The following questions must be answered as indicated (i.e. either 'yes' or 'no') or marked N/A (not applicable) for any NOAA system to be identified as 'NOAA year 2000 compliant'. Any deviations from these responses must be specifically documented. Although not required, it is highly recommended that 'Test Assertions for Date and Time Functions' by Gary Fisher of NIST be used for testing date and time functions. The latest version of this document may be viewed at http://www.nist.gov/y2k/datetest.htm.

	Date manipulation questions	**N/A**	**No**	**Yes**
Does the system:				
1.	use December 31, 1999, as a regular end of year without special meaning?			✓
2.	treat September 9, 1999, as a regular day with no special meaning?			✓
3.	do any of the following date field manipulations?		✓	
4.	– 99 indicates last record		✓	
5.	– 00 to indicate a null record		✓	
6.	– 99 and 00 default values		✓	
7.	– special interpretations of 00		✓	
8.	– hard coded 19 in 4-digit year field		✓	
9.	– separate manipulations of century digits		✓	
10.	include any licence date expiries associated with the end of 1999?		✓	
11.	use dates in name constructions?		✓	
12.	mix date data and control information in commands or flags which are interpreted as one or the other depending on their values?		✓	
13.	use a date as part of the key of an indexed file?		✓	

Year and century questions		N/A	No	Yes
Does the system:				
1.	recognise 2000 as a leap year?			✓
2.	allow itself to be set to any date after 12/31/1999 including 02/29/2000?			✓
3.	indicate the correct day, date and time when the following test is performed? With the date set to 12/31/1999, power the system off and then back on when the time will be in 1/1/2000.			✓
4.	indicate the correct day, date, and time when the following test is performed? With the date set to some time after 1/1/2000, power the system off and back on.			✓
5.	display the date correctly as 2/29/2000 when the following test is performed? With the date set to 2/28/2000, power the system off, and then back on when the next day has been reached.			✓
6.	treat December 31, 1999, as a Friday?			✓
7.	treat January 1, 2000, as a Saturday?			✓
8.	treat February 29, 2000, as a Tuesday?			✓
9.	treat December 7, 2000, as a Thursday?			✓
10.	treat December 31, 2000, as a Sunday?			✓
11.	treat January 1, 2001, as a Monday?			✓
12.	treat March 1, 2000, as a Wednesday?			✓
13.	treat February 28, 2001, as a Wednesday?			✓
14.	treat March 1, 2001, as a Thursday?			✓

Database access and storage questions		N/A	No	Yes
Does the system:				
1.	code all years as in a manner that preserves century, decade and year information?			✓
2.	correctly perform all of the following manipulations across the century boundary?			✓
3.	– computations of time spans, due dates, etc.			✓
4.	– sorting of data			✓
5.	– selections based on key fields			✓
6.	– selections based on non-key fields			✓

Operating system and application questions		N/A	No	Yes
Does the system:				
1.	display the year as an unambiguous value with a minimum of two digits?			✓
2.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set to today's date?			✓
3.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set to 1/1/2000?			✓
4.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set after 1/1/2000?			✓
5.	correctly handle data with dates before 1/1/2000, on 1/1/2000 and after 1/1/2000 with the system clock set to 12/31/1999?			✓
6.	correctly process dates with the system clock set to 12/31/1999 and processing allowed to continue across the century boundary?			✓
7.	correctly handle date comparisons where one date is not greater than 12/31/1999 and the other date is not less than 1/1/2000?			✓
8.	use a sliding window for year calculations?		✓	
9.	contain a date format that does not preserve century information?		✓	
10.	create and/or store data in files or log files or, generate reports that do not preserve century information in date fields?		✓	
11.	use a 32-bit incrementing signed value for date and time?		✓	
12.	correctly set and maintain the century digits in the real-time clock; if the system uses AT-class PCs (286 to Pentiums and clones), does the operating system or your system software correctly set and maintain the century digits in the real-time clock?			✓
13.	correctly handle all time-interval calculations based on the century transition — both looking back into the past, and looking forward into the future?			✓
14.	correctly handle future time-interval calculations that span the century transition?			✓
15.	if required, correctly handle date and time-interval calculations based on the use of data previously stored by the system or previous versions of the system?			✓
16.	Is the system formally tested for year 2000 compliance?			✓

Annex 6: Meteorological telecommunications systems in SPREP member countries and territories

Country/Territory	WAFS/STAR4 Send Receive	AFTN Send Receive	EMWIN Send Receive	
American Samoa**				
Australia*				
Cook Islands*				
Federated States of Micronesia (FSM)*				
Fiji*				
France*				
French Polynesia**				
Guam**				
Kiribati				
Marshall Islands				
Nauru				
New Caledonia**				
New Zealand*				
Niue*				
Northern Mariana Islands**				
Palau				
Papua New Guinea*				
Pitcairn**				
Samoa*				
Solomon Islands*				
Tokelau**				
Tonga*				
Tuvalu				
USA*				
Vanuatu*				
Wallis & Futuna**				

* WMO members
** WMO membership comes through France, New Zealand, United Kingdom or the United States

Annex 7: Year 2000 compliance survey

Survey response from:

.....

NMHS POINT OF CONTACT AND COUNTRY

A. General/organisation

		Please tick your response			
		Yes	**No**	**Planned**	**N/A**
1.	Does your National Meteorological and Hydrological Service (NMHS) consider the year 2000 problem to be a critical issue affecting meteorological operations that needs immediate attention in order to be resolved before 31 December 1999?				
2.	Does your NMHS have an awareness of the year 2000 problem and has it established programmes to ensure that electrical power, communications, transportation, water and emergency services will not be affected as 1 January 2000 approaches?				
3.	Has your NMHS established a formal year 2000 programme to cover meteorological operations?				
4.	If your NMHS has a formal year 2000 programme, have you developed an inventory of meteorological systems or computer-related systems (e.g. PCs, telecomms switching computers, fax machines, radiosonde systems, automatic weather systems, workstations)?				
5.	If your NMHS has a formal year 2000 programme, is it taking into account the Y2K impact on its meteorological operations of the following:				
	(a) Information systems				
	(b) Internal and external telephone and communications systems and PTT				
	(c) Electrical power supplies				
	(d) Water				
	(e) Fuel				
	(f) Equipment suppliers and service providers				
	(g) Emergency services?				
6.	Is there a dedicated programme manager or contact person for the NMHS year 2000 programme? If yes, please provide: (a) full name: (b) address: (c) telephone no.: (d) fax no.: (e) email address:				
7.	Do you believe that your NMHS's meteorological systems will be adequately prepared on 31 December 1999?				

8.	Does your NMHS have, or is it working on, specific year 2000 operational contingency plans?				
9.	Do your neighbouring countries' NMHSs have formal meteorological year 2000 programmes?				
10.	What standard for year 2000 compliance is being used by your NMHS?				
11.	Have you contacted manufacturers of your computer systems hardware and operating systems to determine if they are Y2K compliant?				
12.	Have you contacted the developers of your computer systems applications software to determine if it is Y2K compliant?				
13.	From any tests, enquiries, etc. so far, have you learned things that would be useful to other NMHSs? If so, please provide a short summary:				
14.	Depending on what you have learned so far (from manufacturers, other NMHSs, WMO, etc.), have you determined which computer-based systems must be replaced, upgraded, etc.? *Note:* The following could be sub-items: (a) If any must be replaced or upgraded, have you determined the cost involved? (b) If so, have you budgeted the necessary funds for 1998 or 1999 with which to accomplish the necessary procurement of replacement systems or the upgrading of systems? (c) If you do not have essential funds, have you considered contacting UNDP, WMO (VCP), etc. for possible funding assistance?				
15.	Do you have any comments on the year 2000 problem? Please list.				

B. Year 2000 programme status

The headings in points 16 to 27 below represent key elements of a year 2000 programme. Please indicate your level of confidence against each element listed by circling a number from 1 to 4, as per the following criteria. If an element does not apply, please indicate that by circling N/A.

1. High level of confidence, full compliance programme in place with defined objectives and milestones.
2. Medium level of confidence, full compliance programme being developed but not yet in place.
3. Low level of confidence, no programme in place, but recognise the need to create programme as a matter of priority.
4. Low level of confidence, do not have a programme in place, and no plans exist to create one.

	Element	**Criteria**				
16.	Systems and applications	1	2	3	4	N/A
17.	Networks (domestic)	1	2	3	4	N/A
18.	Networks (domestic, interconnect)	1	2	3	4	N/A
19.	Networks (international), including GTS connection to RTH(s) serving you	1	2	3	4	N/A
20.	Networks (telex)	1	2	3	4	N/A
21.	Internet and email access	1	2	3	4	N/A
22.	Products and services	1	2	3	4	N/A
23.	Communication to customers	1	2	3	4	N/A
24.	Communication to suppliers	1	2	3	4	N/A
25.	Supplier relationships	1	2	3	4	N/A
26.	Integration testing (end-to-end)	1	2	3	4	N/A
27.	Contingency planning*	1	2	3	4	N/A
28.	Indicate your planned Y2K compliance date					

* For contingency planning in question B27, consider such things as the alternative routing of circuits, ensuring that key personnel are available from the critical period of 26 December 1999 to 15 January 2000, etc.