WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

MEETING OF THE LEAD CENTRES ON
VERIFICATION FOR LONG-RANGE FORECASTS

FINAL REPORT

MONTREAL, CANADA, 1-5 DECEMBER 2003

DISCLAIMER

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

MEETING OF THE LEAD CENTRES ON VERIFICATION FOR LONG-RANGE FORECASTS

Montreal, Canada, 1-5 December 2003

EXECUTIVE SUMMARY

At the kind invitation of Canada, the meeting of the Lead Centres on seasonal and long-range forecast verification was held at the Canadian Meteorological Centre (CMC) in Montreal, Canada, 1-5 December 2003. Six experts (from CMC-Canada (2), Melbourne, NCEP (NOOA), IRI (USA) and ECMWF) and the secretariat representative participated in the meeting. The main purpose of the meeting was to review the role of the Lead Centres in the exchange of seasonal and long-range forecast verification results as specified in the Standardised Verification System (SVS) for Long-Range Forecasts (LRF) defined in the WMO Manual on the Global Data-Processing System. The meeting remained focused on the particular issues related to the establishment and functioning of the Lead Centre web site and concentrated on the development of a system to help RCCs and NMHSs assessing the skill of long-range forecast products from verification data. The goal was to help the RCCs and NMHSs to have a tool for improving the long-range forecasts delivered to the public.

The meeting reviewed the progress made so far in the implementation of the SVSLRF. It was noted that only BOM, CMC, JMA and ECMWF were displaying SVSLRF verification results. It was found that JMA had the most comprehensive system and should be congratulated for its achievements in implementing the SVSLRF system.

The meeting recommended that:

- The MSSS and its three-term decomposition should be displayed after post-processing (bias correction, variance normalisation).

- The error bar calculation should take into account the spatial dependence of grid point values.

- The ROC score (area under the ROC curve) should be calculated as the area under a fitted curve through the ROC points. The meeting recognised that the accuracy of the ROC score could be improved with the use of a fitted curve instead of a straight line between the ROC points.

- All Global Producing Centres (GPCs) producing long-range forecasts with statistical models are welcome to participate in the SVSLRF verification.

- The SVSLRF expert team develops and maintains a list of official global producing centres.

The meeting reviewed the role of the Lead Centres and detailed some of their functions. The Lead Centre will develop and maintain the SVSLRF web site. The meeting agreed that there should be only one web site for SVSLRF. This web site will be located at the WMC Melbourne. The Lead Centre will provide access to verification datasets on the SVSLRF web site. The verification

datasets will be in GRIB1 format. They will be translated to GRIB2 format when the encoder/decoder becomes widely available. The RSMC Montreal will take the responsibility for preparing the verification datasets. These will be updated on the SVSLRF web site on a yearly basis provided that new data is made available. The choice of the verification datasets will be revised as new datasets become available and as recommended by the SVSLRF expert team. The Lead Centre will develop and provide specifications defining the format of the data to be sent to the Lead Centre for graphics preparation. There is no need to specify standards for graphics to be sent to the SVSLRF web site because all graphics will be generated by the Lead Centre.

The Lead Centre will ensure that clear and concise information explaining the verification scores, graphics and data is available and maintained up-to-date on the SVSLRF web site. Also, links to the participating GPCs will be listed on the SVSLRF web site. The Lead Centre will consult with the GPCs to make sure that the verification data is correctly displayed before making available their verification results on the SVSLRF web site. The Lead Centre will provide and maintain software to calculate the verification scores. The development of the software will be the responsibility of the RSMC Montreal. The software code will be available on the SVSLRF web site. Once the SVSLRF web site is operational, the Lead Centre will provide progress reports every two years to CBS, prior to its meetings. The meeting recommended that the SVSLRF web site be password protected in order to reduce the traffic load. The password will be given to all those that request access to the SVSLRF web site.

The meeting recommended also that long-range forecast verification be discussed at the Workshop of Global Producers of Seasonal to Inter-Annual Forecasts planned in 2005. This workshop should involved the GPCs, the Lead Centre, representatives of RCCs and NMHSs and consequently it is recommended that the workshop be called : “Workshop on Production and Verification of Seasonal to Inter-Annual Forecasts”.

REPORT OF MEETING OF THE LEAD CENTRES ON VERIFICATION FOR LONG-RANGE FORECASTS

Montreal, Canada, 1-5 December 2003

1. OPENING OF THE MEETING

1.1. At the kind invitation of Canada, the meeting of the Lead Centres on seasonal and long-range forecast verification was held at the Canadian Meteorological Centre (CMC) in Montreal, Canada, 1-5 December 2003. Mr. Richard Verret opened the meeting and welcomed the participants. He outlined the work expected of the meeting.

1.2. It was recalled that the main purpose of the meeting was to review the role of the Lead Centres in the exchange of seasonal and long-range forecast verification results as specified in the Standardised Verification System (SVS) for Long-Range Forecasts (LRF) defined in the WMO Manual on the Global Data-Processing System (GDPS), Volume I and to lay down basic specifications of the web site that will be used as a mean to achieve this exchange of verification results. The work of the meeting should remain focused on the particular issues related to the establishment and functioning of the Lead Centre web site. The main outcome of the meeting should be the implementation of an efficient Lead Centre web site.

1.3. Mr. Joël Martellet from the WMO Secretariat thanked Canada for organising the meeting. He emphasised the fact that the meeting does not have to be involved in research discussions on verification, but rather ought to concentrate on the development of a system to help RCCs and NMHSs assessing the skill of long-range forecast products from verification data. He wished that the meeting will help the RCCs and NMHSs to have a tool for improving the long-range forecasts delivered to the public.

2. ORGANIZATION OF THE MEETING

2.1. The agreed agenda of the meeting is given in Appendix I. Items 1, 2 and 3 of the agenda were dealt with on day one of the meeting. Items 4 and 6 of the agenda were dealt with on day 2, thus leaving two to three days to work on agenda item 5, the latter one constituting the main goal of the meeting.

2.2. The meeting agreed on its working arrangements. There were seven participants as listed in Appendix II.

3. REVIEW PROGRESS IN THE USE OF THE STANDARDIZED VERIFICATION SYSTEM (SVS) FOR LONG-RANGE FORECASTS (LRF) AND CURRENT AVAILABILITY IN PROVIDING END-USERS SERVICES

3.1. Background

3.1.1. The WMO Commission for Basic Systems (CBS), at its extraordinary session in Cairns, Australia, 4-12 December 2002, noted with appreciation that a few major centres have successfully implemented or are in the process of implementing the Standard Verification System for Long-range Forecasts (SVSLRF) and had agreed to make the results available.

3.1.2. The Commission recognised also that there was still considerable work to be done in the commencement of implementation of a standardised verification scheme for long-range forecasts. The Commission considered and adopted the revised specifications for the Standard Verification System for Long-range Forecasts as new attachments II.8 and II.9 to the Manual on the Global Data-Processing System, Volume I. These revised specifications were as proposed at the meeting of the expert team to develop a verification system for long-range forecasts, held in Montreal, Canada, 22-26 April 2002.

3.2. Current status

3.2.1. The meeting noted the following progress made so far in the implementation of the SVSLRF. Emphasis was put on surface temperature anomaly (T2m) and precipitation anomaly (Pcpn) forecast verification. The following table gives the URL addresses where the SVSLRF verification results that were looked at are available.

Japan Meteorological Agency (JMA, Japan)	http://okdk.kishou.go.jp/products/model/index.html
Canadian Meteorological Centre (CMC, Canada)	http://www.cmc.ec.gc.ca/~cmcdev/saisons/lrfsvs/lrfsvs_results.html login: svs password: oui
European Centre for Medium range Weather Forecasts (ECMWF)	http://www.ecmwf.int/products/forecasts/d/charts/seasonal/verification/
Bureau of Meteorology (BOM, Australia)	http://www.bom.gov.au/reguser/by_user/bomw0278/lrfvs/ login: bomw0278 password: MaNd98ed

3.2.2. Level 1 (aggregated verification, reference to paragraph 3.1.1 of Attachment II.9 to the Manual on the Global Data-Processing System, Volume I). A check mark indicates compliancy with the SVSLRF:

	MSSS		ROC curves		ROC areas		Reliability		Frequency	
	T2m	Pcpn	T2m	Pcpn	T2m	Pcpn	T2m	Pcpn	T2m	Pcpn
JMA	√	√	√	√	√	√	√	√	√	√
CMC	√	√	√	√	√	√	√	√	√	√
ECMWF	√	√	√	√	√	√				
BOM					√	√				

3.2.3. Level 2 (grid point verification, reference to paragraph 3.1.2 of Attachment II.9 to the Manual on the Global Data-Processing System, Volume I). A check mark indicates compliancy with the SVSLRF:

	MSSS		MSSS 3 terms		ROC area	
	T2m	Pcpn	T2m	Pcpn	T2m	Pcpn
JMA	√	√	√	√	√	√
CMC	√	√	√	√	√	√
ECMWF	√	√	√	√	√	√
BOM						

3.2.4. Level 3 (contingency tables, reference to paragraph 3.1.3 of Attachment II.9 to the Manual on the Global Data-Processing System, Volume I). A check mark indicates compliancy with the SVSLRF:

	3 by 3 contingency tables		ROC reliability tables	
	T2m	Pcpn	T2m	Pcpn
JMA	√	√	√	√
CMC				
ECMWF				
BOM				

3.2.5. The meeting also noted:

- The JMA produces SVSLRF verification results for T2m and Pcpn as well as mean sea level pressure, 500 hPa geopotential heights and for 850 hPa temperatures. The hit rate, false alarm rate and Hanssen and Kuipers score for 3 by 3 contingency tables are available. The verification data sets used are: CRU data (Jones et al, 2001) for T2m and Climate Prediction Centre merged analysis of precipitation (CMAP) (Xie and Arkin, 1997) for Pcpn. The mean sea level pressure, 500 hPa geopotential heights and 850 hPa temperatures are verified against the ECMWF ERA-15 and JMA Global analyses. The JMA was congratulated for its achievements in implementing the SVSLRF system.

- The CMC provides reliability diagrams with error bars. The reliability diagrams also include the reliability of deterministic forecasts. The Hanssen and Kuipers score at grid points is available. The verification data set is the CRU data (New et al, 1999; 2000) both for T2m and Pcpn.

- The ECMWF produces SVSLRF verification results for T2m and Pcpn as well as mean sea level pressure, 500 hPa geopotential heights, 850 hPa temperatures and Sea Surface Temperatures. The correlation displayed is the anomaly correlation coefficient. The ranked probability skill score (RPSS) at grid points is also available. The verification data set is a combination of ERA-40 and ECMWF operational analyses. GPCP (Huffman et al, 1997) data is used to verify Pcpn.

- The BOM mostly follows the specifications established at the very first meeting of the expert team to develop a verification system for long-range forecasts that was held at the

ECMWF 16-20 August 1999. The SVSLRF has been revised extensively at the second meeting of the team in Montreal 22-26 April 2002. BOM presents the percent correct and the Hanssen and Kuipers score at grid points. It also presents the root mean square error, the root mean square error skill score and the Hanssen and Kuipers score as bulk numbers for the deterministic forecasts. Two by two contingency tables are also available.

- Other than these four centres (JMA, ECMWF, BOM and CMC) the meeting did not find any other SVSLRF verification results. Appendix III lists the known Global Producing Centres (GPCs). Many of these centres have performed long-range forecast verification internally but these results are not made available on the web. The meeting encourages these centres to make their verification results available on the web.

3.2.6. The meeting recommended that:

- The MSSS and its three-term decomposition should be displayed after post-processing (bias correction, variance normalisation). The ECMWF and CMC both show MSSS decomposition terms before post-processing while the MSSS displayed is calculated after post-processing. Verification before post-processing has value for developers and modelers but sot no much for users and therefore should not be displayed as part of the SVSLRF since the SVSLRF is intended for RCCs and NMHSs. The post-processed terms should normally be close to zero for the bias and close to one for the ratio of variances.

- The error bar calculation should take into account the spatial dependence of grid point values.

- The ROC score (area under the ROC curve) should be calculated as the area under a fitted curve through the ROC points. Although the trapezoidal method to calculate the ROC score is valid, the meeting recognised that the accuracy of the ROC score could be improved with the use of a fitted curve instead of a straight line between the ROC points.

- GPCs producing long-range forecasts with statistical models are welcome to participate in the SVSLRF verification.

4. DISCUSSION ON THE IMPLEMENTATION OF THE LEAD CENTER ROLE, WITH PARTICULAR EMPHASIS ON EFFECTIVE COMMUNICATION OF THE VERIFICATION INFORMATION TO ASSIST NMHSs AND RCCs IN USING THE GLOBAL-SCALE PRODUCTS IN PROVIDING END-USER SERVICES

4.1. Background

4.1.1. The meeting noted that the Commission for Basic Systems endorsed the continuing need for a Lead Centre. It acknowledged the work done in WMC Melbourne so far and encouraged the Centre to continue to develop its capabilities. However, the Commission also considered that, in those early stages of the implementation of an operational verification system, it would be beneficial if one or two other centres could assume such a role also. The Commission accepted the offer of Canada and designated RSMC Montreal as a co-lead centre for verification of long-range forecasts.

4.1.2. The meeting of the expert team to develop a verification system for long-range forecasts considered that potential users of verification information would be best served by consistent presentation of the results on a single web site. This would provide a convenient means of assimilating the information on the various prediction systems. It was suggested at that meeting that, in the short term, this could be achieved by the processing at a single centre of digital versions of the verification information. In the longer term, and based on experience, guidelines could be developed for standardised presentation of the information on distributed web sites.

4.1.3. Consequently it was concluded that the need for a Lead Centre role was greater than previously envisaged.

4.1.4. The meeting of the expert team to develop a verification system for long-range forecasts held in Montreal 22-26 April 2002 proposed that the role of a Lead Centre be as follows:

4.1.4.1. Create and maintain a web site to provide access to the LRF verification information.

4.1.4.2. Work toward: (i) Producing monthly verification data sets in common format on 2.5º x 2.5º grid where appropriate and (ii) Developing guidelines for the presentation of verification information including guidelines for consistent graphical displays.

4.1.4.3. Liaise with other groups involved in verification (e.g. WGSIP, COLA etc.) on the effectiveness of the current standardised verification system (SVS) and identify areas for future development and improvement.

4.1.4.4. Provide periodic reports to CBS and other relevant Commissions assessing the effectiveness of the SVS.

4.1.5. It is important to clarify terminology at this point. Thereafter in this document, the term "Lead Centre" refers to both co-lead centres (WMC Melbourne and RSMC Montreal) together. Also, the web site to be developed and maintained by the two co-lead centres is designated as the "SVSLRF web site".

4.2. Lead Centre role

4.2.1. The meeting was in general agreement with the role of the Lead Centre as previously defined by the SVSLRF expert team at its meeting in Montreal in April 2002.

4.2.2. The role of the Lead Centre is to facilitate the availability of information to assess the skill of long-range forecasts but not to provide a direct inter-comparison between the GPCs' models.

4.2.3. The Lead Centre will develop and maintain the SVSLRF web site. The meeting agreed that there should be only one web site for SVSLRF. This web site will be located at the WMC Melbourne. There is no need for a mirror site but the SVSLRF web site and all associated datasets should be securely archived. The WMC Melbourne will develop the structure of the SVSLRF web site (HTML code, etc.).

4.2.4. The Lead Centre will provide access to verification datasets on the SVSLRF web site. The verification datasets will be in GRIB1 format. They will be translated to GRIB2 format when the encoder/decoder becomes widely available. The RSMC Montreal will take the responsibility for preparing the verification datasets. These will be updated on the SVSLRF web site on a yearly basis provided that new data is made available. The choice of the verification datasets will be revised as new datasets become available and as recommended by the SVSLRF expert team.

4.2.5. The Lead Centre will develop and provide specifications defining the format of the data to be sent to the Lead Centre for graphics preparation. There is no need to specify standards for graphics to be sent to the SVSLRF web site because all graphics will be generated by the Lead Centre. The WMC Melbourne will develop the infrastructure to generate all graphics posted on the SVSLRF web site.

4.2.6. The Lead Centre will have the responsibility to make available the digital verification information as specified at levels 1, 2 and 3 in Attachment II.9 of the Manual on GDPS.

4.2.7. The Lead Centre will ensure that clear and concise information explaining the verification scores, graphics and data is available and maintained up-to-date on the SVSLRF web site. The production of this documentation will be shared between the two co-lead centres. Also, links to the participating GPCs will be listed on the SVSLRF web site. The content of the documentation and information on interpretation and use of the verification data will be determined in consultation with the SVSLRF expert team.

4.2.8. The Lead Centre will consult with the GPCs to make sure that the verification data is correctly displayed before making available their verification results on the SVSLRF web site.

4.2.9. The Lead Centre will ensure that the verification results placed on the SVSLRF web site comes from officially recognised global producing centres with operational guidance commitments. The meeting recommended that the SVSLRF expert team develops and maintains a list of official global producing centres. The list in Appendix III can be used as a starting point.

4.2.10. The Lead Centre will provide and maintain software to calculate the verification scores. The development of the software will be the responsibility of the RSMC Montreal. The software code will be available on the SVSLRF web site. It will be coded in FORTRAN language. However, it is recognised that the use of this software is not mandatory.

4.2.11. The Lead Centre will publicise the SVSLRF web site to other organisations involved in verification (such as WGSIP, COLA etc.) and establish contacts in order to receive feedback and facilitate discussion for further development and improvement.

4.2.12. Once the SVSLRF web site is operational, the Lead Centre will provide progress reports every two years to CBS, prior to its meetings.

5. DEVELOPMENT OF THE LEAD CENTRE WEB SITES

5.1. Background

5.1.1. The meeting of the expert team to develop a verification system for long-range forecasts held in Montreal in April 2002 recommended that the web site will:

5.1.1.1. Provide access to standardised software for calculating scoring information (ROC curves, areas, contingency table scores, hit rates…).

5.1.1.2. Preferably, provide consistent graphical displays of the verification results from participating centres through processing of digital versions of the results; alternatively, contain links to the verification information held on the web sites of participating centres.

5.1.1.3. Contain relevant documentation and links to the web sites of global-scale producing centres.

5.1.1.4. Provide some means for the collection of feedback from NMHSs and RCCs on the usefulness of the verification information.

5.1.1.5. Contain information and, preferably, provide access to available verification data sets.

5.2. Recommendations

5.2.1. The meeting was in general agreement with the basic specifications for the SVSLRF web site established by the SVSLRF expert team at its meeting in Montreal in April 2002.

5.2.2. Technical and practical details of the functioning of the web site:

5.2.2.1. The meeting recommended that the SVSLRF web site be password protected in order to reduce the traffic load. The password will be given to all those that request access to the SVSLRF web site.

5.2.2.2. The SVSLRF web site will be as streamlined as possible, without any sophisticated and complex HTML page formatting. This is required to speed up access to the site as much as possible.

5.2.2.3. A structured database will be developed to store digital verification results. This activity will be under the responsibility of the WMC Melbourne.

5.2.2.4. There will be a standard for file naming and data format. The verification results file naming convention will be unique for each participating GPC, season, lead time, scores, etc. This activity will be under the responsibility of the WMC Melbourne.

5.2.2.5. There will be a disclaimer on the SVSLRF web site stating that the quality of the verification information displayed on the site is the responsibility of the GPCs. The Lead Centre

does not accept responsibility for the way in which the verification results available on the SVSLRF web site are used.

5.2.2.6. All graphics will be produced by the Lead Centre in a consistent fashion, with a consistent colour bar to facilitate interpretation of the results. This activity will be under the responsibility of the WMC Melbourne.

5.2.2.7. The home page on the SVSLRF web site will display a text explaining the role of the SVSLRF initiative. The home page will provide access to the verification results, to a documentation page, to a disclaimer and to a user's manual explaining how to use the site. It will also have a link to the WMO web site. Appendix IV outlines the proposed basic structure of the SVSLRF home page.

5.2.2.8. The documentation page on the SVSLRF web site will provide access to: (i) the list of participating GPCs, (ii) information on each participating GPC's forecast system(s) with links to each participating GPC's web site, (iii) a description of the role of the Lead Centre and purpose of the SVSLRF web site, (iv) the SVSLRF specifications, (v) the definition of the scores, how they are calculated, their interpretation including access to software for their calculation, and (vi) the verification data sets including the downloading functionality. Appendix V outlines the proposed basic structure of the SVSLRF documentation page.

5.2.2.9. The verification page will provide access to the verification results. Users will have to select the GPC, parameter for which verification is required, type of forecasts (deterministic or probabilistic), score to be displayed, season and lead time. Once all the selections are made, the page will display the verification results requested. The page will also display a window giving a short summary of the GPC's forecast system that is being verified with a link to that GPC web site. The verification page will offer the functionality to download the digital data. Appendix VI outlines the proposed basic structure of the SVSLRF verification page.

5.2.2.10. Each GPC's logo will be used where appropriate, upon approval by the GPCs.

5.2.2.11. The meeting agreed that standard formats have to be developed for the participating GPCs to send digital verification results to the SVSLRF web site. Formats are required to send data to generate the scores on a grid, for ROC diagrams, reliability diagrams and frequency histograms and for contingency tables at grid points. The meeting agrees that further discussion is required to come up with the required formats.

5.2.2.12. It is recognised that it will be impossible to test the SVSLRF web site on all possible web browsers. The SVSLRF web site will be coded in such a way that it should work with any browser that allows frames and javascript. A disclaimer to that effect will be placed on the SVSLRF web site.

5.2.2.13. It is required that the WMO web site maintains a hypertext link to the SVSLRF web site and vice-versa.

5.2.3. Establishing links to producing centres:

5.2.3.1. The Lead Centre will ensure that appropriate hypertext links to participating GPCs are available on the SVSLRF web site.

5.2.3.2. Standards and guidelines for the display of information to provide consistent graphical displays:

5.2.3.3. All graphics will be generated by the Lead Centre and posted on the SVSLRF web site in a consistent fashion.

5.2.4. Links to supporting documentation:

5.2.4.1. The Lead Centre will ensure that there will be links to all documentation, as previously discussed above (see paragraphs 4.2.7 and 5.2.2.8).

5.2.5. Availability of software to calculate scores:

5.2.5.1. The Lead Centre will develop the software to calculate the core SVSLRF verification scores and ensure that it is available on the SVSLRF web site for downloading, as previously discussed above (see paragraphs 4.2.10 and 5.2.2.8).

5.2.6. Information on verification data sets:

5.2.5.2. The verification data sets as specified by the SVSLRF expert team will be made available in GRIB1 format on the SVSLRF web site for downloading. Associated documentation will also be made available, as previously discussed above (see paragraphs 4.2.4 and 5.2.2.8).

6. RECOMMENDATIONS TO THE VERIFICATION TEAM ON UPDATES TO OPERATIONAL PRACTICES IN LIGHT OF EXPERIENCE SO FAR AND MAKE SUGGESTIONS ON MEANS OF OBTAINING COMMENTS FROM NMHSs AND RCCs ON THE USEFULNESS OF THE VERIFICATION INFORMATION

6.1. Recommendations

6.1.1. The meeting recognised that error bars are more informative than significance levels for RCCs and NMHSs. It is thus recommended to put more emphasis on error bars in the SVSLRF specifications (Attachment II.9 to the Manual on the Global Data-Processing System, Volume I) as opposed to significance levels. The meeting also recommended that the error bar calculation should take into account the spatial dependence of grid point values.

6.1.2. The accuracy of ROC scores could be improved with the use of a fitted curve instead of a straight line between the points on the ROC curve. The meeting thus recommended that fitting

curves through the ROC points be mandatory. The SVSLRF expert team should decide upon one standard curve fitting technique.

6.1.3. The meeting recommended that attachments II.8 and II.9 in the manual on GDPS be revised and unified. Attachment II.8 could be converted into an executive summary of attachment II.9. In doing so, care should be taken to clearly specify what is part of the core verification system and what is not. A chapter on the role of the Lead Centre should be added.

6.1.4. The meeting recommended that the real time verification is the responsibility of the producing centres and that real time scores will not be posted on the SVSLRF web site.

6.1.5. The meeting recommended that the definition of ENSO years in paragraph 7 of attachment II.9 to the Manual on GDPS should be removed. This table should be displayed on the SVSLRF web site. It is recommended that the SVSLRF expert team reviews and updates the list of ENSO years.

6.1.6. The meeting recommended that the SVSLRF expert team revises the choice of the official verification datasets. It is recommended to restrict the verification datasets to one per parameter and the choice of datasets be periodically revised. It is recommended that the detailed table of section 4.1 of attachment II.9 to the Manual on GDPS be removed.

6.1.7. The meeting invited the SVSLRF expert team to be more precise on the prescription of the cross-validation procedure (number of years skipped, etc.).

6.1.8. It is recommended that attachment II.9 to the manual on GDPS clearly states that producing centres have to send new hindcast verification results as soon as their forecast system is changed.

6.1.9. It is recommended that the calculation of the Gerrity scores be clarified.

6.1.10. It is recommended that the sentence “The lead centre will take responsibility for defining a common format for displaying the verification scores” in paragraph 5 of Attachment II.9 to the Manual on GDPS be deleted. This sentence is the only one in the Attachment II.9 that refers to the Lead Centre. Further more there is no need for a common format for graphics (see paragraphs 4.2.5 and 5.2.2.6).

6.1.11. It is recommended that long-range forecast verification be discussed at the Workshop of Global Producers of Seasonal to Inter-Annual Forecasts planned in 2005. This workshop should involved the GPCs, the Lead Centre, representatives of RCCs and NMHSs and consequently it is recommended that the workshop be called : “Workshop on Production and Verification of Seasonal to Inter-Annual Forecasts”.

6.1.12. It is recommended that the WMO secretariat sends a letter to GPCs to invite them to submit their verification results to the SVSLRF web site once the latter one is ready. Information on the format of the data to be sent will be included. Information also has to be sent to RCCs and NMHSs on the role of the Lead Centre. This has to be done prior to the next meeting of the SVSLRF expert team planned in the second half of 2004.

6.1.13. The meeting recommended that the WMO secretariat requests RCCs and NMHSs for feedback one year after the launch of the SVSLRF web site. A questionnaire will be developed and processed by the Lead Centre.

7. CLOSURE OF THE MEETING

7.1.1. The meeting was closed at 5:00 PM on Wednesday December 3 2003. Dr. Andrew Watkins stayed over for further discussions between the two co-lead centres and to finalise the report.

8. REFERENCES

Huffman, G. J., F. A. Robert, P. Arkin, A. Chang, R. Ferraro, A. Gruber, J. Janowiak, A. McNab, B. Rudolf, and U. Schneider, 1997: The Global Precipitation Climatology Project (GPCP) Combined Precipitation Dataset. Bulletin of the American Meteorological Society: Vol. 78, No. 1, 5–20.

Jones, P.D., T. J. Osborn, K. R. Briffa, C. K. Folland, B. Horton, L. V. Alexander, D. E. Parker, and N. A Rayner, 2001: Adjusting for sampling density in grid-box land and ocean surface temperature time series. J. Geophys. Res. 106, 3371-3380.

New, M., M. Hulme, and P. D. Jones, 1999: Representing twentieth century space-time climate variability. Part 1: development of a 1961-90 mean monthly terrestrial climatology. Journal of Climate 12, 829-856

New, M., M. Hulme, and P. D. Jones, 2000: Representing twentieth century space-time climate variability. Part 2: development of 1901-96 monthly grids of terrestrial surface climate. Journal of Climate 13, 2217-2238

Xie, P. and P. A. Arkin, 1997: Global Precipitation: A 17-year monthly analysis based on gauge observations, satellite estimates, and numerical model outputs, Bulletin of the American Meteorological Society, 78, 2539-2558.

APPENDIX I

Agenda

1. OPENING OF THE MEETING

2. ORGANIZATION OF THE MEETING

   2.1 Adoption of the agenda

   2.2 Other organizational questions

3. REVIEW PROGRESS IN THE USE OF THE STANDARDISED VERTIFICATION SYSTEM (SVS) FOR LONG-RANGE FORECASTS AND CURRENT AVAILABILITY OF INFORMATION FROM THE SVS.

4. DISCUSS THE IMPLEMENTATION OF THE LEAD CENTRE ROLE, WITH PARTICULAR EMPHASIS ON EFFECTIVE COMMUNICATION OF THE VERIFICATION INFORMATION TO ASSIST NMHSs AND RCCs IN USING THE GLOBAL-SCALE PRODUCTS IN PROVIDING END-USER SERVICES.

5. DISCUSS THE DEVELOPMENT OF THE LEAD CENTRE WEB SITES INCLUDING:

. technical and practical details of the functioning of the web site

. establishing links to producing centres

. standards and guidelines for the display of information to provide consistent graphical displays

. links to supporting documentation

. availability of software to calculate scores

. information on verification data sets

6. RECOMMEND TO THE VERIFICATION TEAM UPDATES TO OPERATIONAL PRACTICES IN LIGHT OF EXPERIENCE SO FAR AND MAKE SUGGESTIONS ON MEANS OF OBTAINING COMMENTS FROM NMHSs and RCCs ON THE USEFULNESS OF THE VERIFICATION INFORMATION .

7. CLOSURE OF THE MEETING

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APPENDIX II

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APPENDIX III

List of known long-range forecasts Global Producing Centres (GPCs)

(as of December 2003)

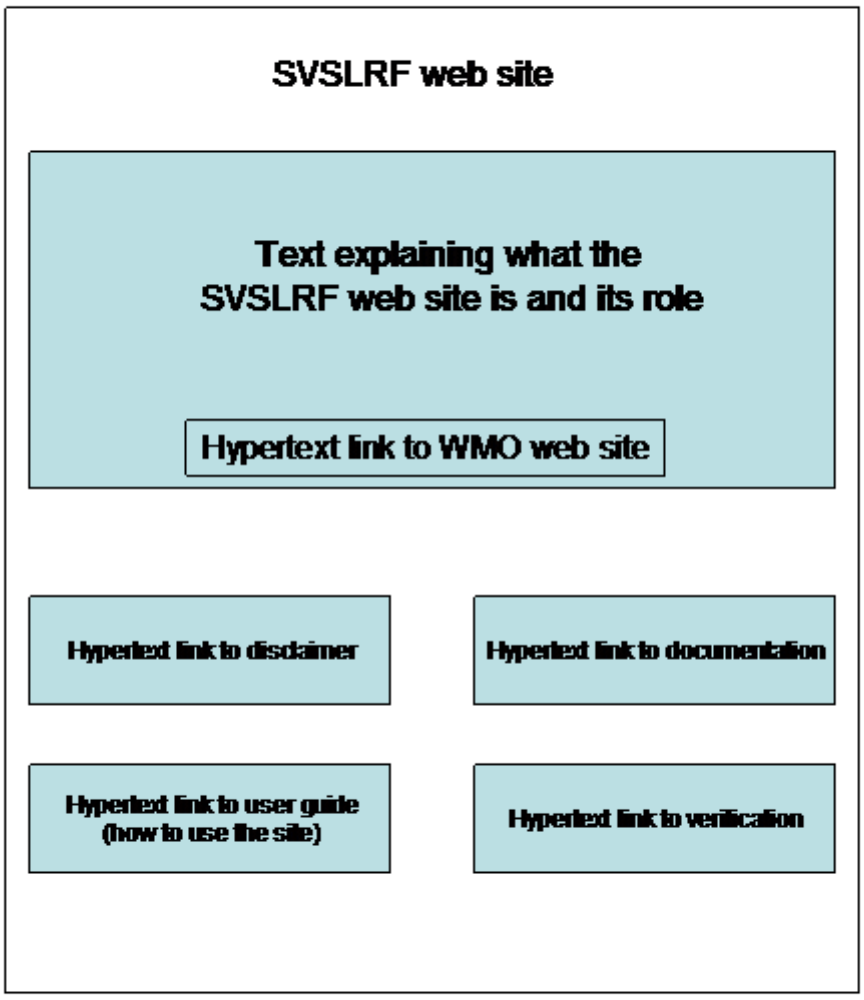
Centre	Model	No. of members	Range	Initial conditions
ECMWF	T95L40, coupled	40	6 months	5 ocean analyses with SST perturbations + Stop
IRI	multimodel: t.b.d.	>30	6 months	LAF
Beijing	T63L16 coupled	8	Season	LAF
Bracknell	2.5° res. 19 lev.	9	4 months and	Six-hour LAF
	2.5° res. 19 lev.	9	2 years	Six-hour LAF
Lima	CCM3 Coupled,	12	6 months	Perturbed SST
Melbourne	T47L17 Coupled(ACOML)	30	8 months	LAF
Montreal	T63L23, T32L10	12	100 days	24 hour LAF, two models
Pretoria	GM (COLA) T30L28	–	8 months	
Sao Paulo INPE/CPTEC	T62L28	25	6 months	Random OP
Seoul	T106L21	20	130 days	BGM
	T106L21	20	7 months	BGM
Tokyo	T63L40	31	120/210 days	SV
	GM coupled (AGCM/OGCM) T63L21	31	18 months	SV
Toulouse	GM ARPEGE-Climat T63L31	10	129 days	LAF
Washington	T62L28	20	7 months	BGM

Centres producing global long-range products

GM = Global Model
LAM = Limited Area Model (resolution coarser or equal to 36 km
MSM = Meso Scale Model (resolution finer than 36 km)
Perturbation technique for ensemble prediction systems:
SV = Singular Vectors, BGM = Breeding of Growing Modes, LAF = Lagged Average Forecasts, StoP=Stochastic Physics, OP=Observation Perturbations

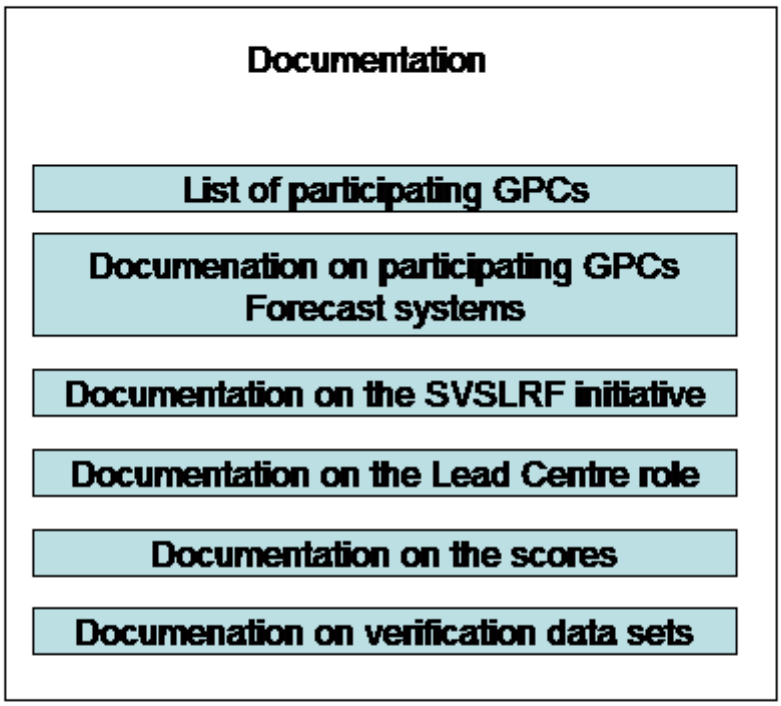
APPENDIX IV

Appendix to paragraph 5.2.2.7.



APPENDIX V

Appendix to paragraph 5.2.2.8.



APPENDIX VI

Appendix to paragraph 5.2.2.9.