World Meteorological Organization
Organisation météorologique mondiale

Secrétariat
7 bis, avenue de la Paix – Case postale 2300 – CH 1211 Genève 2 – Suisse
Tél.: +41 (0) 22 730 81 11 – Fax: +41 (0) 22 730 81 81
wmo@wmo.int – www.wmo.int

Weather • Climate • Water
Temps • Climat • Eau

Our ref.: WDS/DPFS/GDPFS-NWP/2014 GENEVA, 8 June 2015

Annexes: 2 (available in English only)

Subject: Annual WMO Technical Progress Report on the Global Data-Processing and Forecasting System (GDPFS) and related Research Activities on Numerical Weather Prediction (NWP) for 2014.

Action required: To submit your contribution for the Annual WMO Technical Progress Report on the GDPFS and related Research Activities on NWP for 2014, by **1 August 2015.**

Dear Sir/Madam,

The Annual WMO Technical Progress Report on the Global Data-processing and Forecasting System (GDPFS), combined with the report on related Research Activities on Numerical Weather Prediction (NWP), hereafter referred to as the "Report", serves as one way of updating Members on the rapidly evolving and emerging facilities, research and applications being implemented at GDPFS Centres as requirements and technology advance. The Report provides to operational experts and researchers, information on the status in GDPFS Centres related to the (1) installation and updating of operational equipment and related facilities, including weather analysis-forecasting and NWP systems, and their specialized systems for specific applications; and (2) their research and development efforts in the area of understanding meteorological processes, and continuous developments in numerical models and techniques for supporting operational forecasting. Additionally, a comprehensive review based on all the reports received plays an important function in ensuring WMO's understanding of, and continuing attention to the state of the operation of the GDPFS at its global, regional and national levels.

In this context, I am pleased to inform you that the 2013 reports submitted by Members have been collected and compiled, along with those of previous years (Annex I), on the WMO Website at:
http://www.wmo.int/pages/prog/www/DPFS/ProgressReports/2013/GDPFS-NWP-2013.html

To: Permanent Representatives (or Directors of Meteorological or Hydrometeorological Services) of Members of WMO (PR-6850)
Director, ECMWF
Director, ACMAD

cc: Presidents and vice-presidents of the Commissions for Atmospheric Sciences and for Basic Systems
Members of CAS Management Group
Members of CAS Joint Scientific Committee of OPAG-WWRP
OPAG-WWRP Working Groups
Members, CBS Management Group and CBS/OPAG on DPFS
Points of Contact, RSMCs for Environmental Emergency Response and/or Backtracking
(for information)

Members are now invited to prepare and submit to the WMO Secretariat their contributions to the Report for the year 2014. To facilitate the provision of relevant information related to activities at your GDPFS Centre and/or its collaboration in a Consortium, spanning from nowcasting to extended- and long-range forecasting, as well as specialized NWP/post-processing applications (e.g. for ocean waves, storm surge, sea ice, marine pollution transport and weathering, tropical cyclones, air pollution transport and dispersion, solar ultraviolet (UV) radiation, air quality forecasting, smoke, sand and dust, etc.), a template in the form of the Report's Table of Contents (Annex II) has been prepared and made available on the WMO website at:

http://www.wmo.int/pages/prog/www/DPS/documents/TEMPLATE_2014.doc

I should be grateful if you could kindly arrange for the completion of your contribution to the Report for 2014, **in electronic form only**, and send it at your earliest convenience, but preferably **not later than 1 August 2015** to the WMO Secretariat by e-mail (dpfsmail@wmo.int), preferably in MS Word or other compatible formats, attention to: Ms Pascale Gomez.

I would like to thank you for your continuous support and contribution to this Report, and strongly encourage those Members who have not contributed, or have not updated their respective reports for several years, to do so for the benefit of all WMO Members.

Yours faithfully,

(J. Lengoasa)
for the Secretary-General

Annex I

Annual WMO Technical Progress Reports on the GDPFS and related Research Activities on NWP (for 2013, or latest report year)

ECMWF (2013)

Algeria (2013)

Argentina (2013)

Armenia (2011)

Australia (2010)

Austria (2010)

Belarus (2012)

Belgium (2008)

Bolivia (2010)

Bosnia and Herzegovina (2008)

Botswana (2010)

Brazil (2010)

Bulgaria (2006)

Canada (2013)

Chile (2008)

China (2013)

Côte d'Ivoire (2004)

Croatia (2011)

Cyprus (2013)

Kyrgyzstan (2004)

Latvia (2013)

Lithuania (2012)

Madagascar (2008)

Malaysia (2011)

Montenegro (2008)

Morocco (2006)

Mozambique (2010)

Netherlands (2010)

New Zealand (2011)

Oman (2011)

Pakistan (2012)

Panama (2005)

Peru (2007)

Poland (2012)

Portugal (2011)

Qatar (2012)

Republic of Korea (2013)

Romania (2013)

Czech Republic (2013)

Denmark (2010)

Ecuador (2008)

Egypt (2013)

Estonia (2008)

Fiji (2010)

Finland (2012)

France (2013)

Georgia (2004)

Germany (2013)

Greece (2013)

Hong Kong, China (2013)

Hungary (2013)

India (2011)

Indonesia (2009)

Iran, Islamic Republic of (2006)

Ireland (2013)

Israel (2012)

Italy (2011)

Japan (2013)

Kazakhstan (2012)

Kenya (2013)

Russian Federation - English (2011)

Russian Federation - Russian (2011)

Saudi Arabia (2008)

Serbia (2013)

Singapore (2012)

Slovakia (2012)

Slovenia (2012)

Spain (2013)

Sri Lanka (2010)

Sweden (2013)

Switzerland (2013)

Tanzania (2012)

Thailand (2012)

The former Yugoslav Republic of Macedonia (2010)

Tunisia (2003)

Turkey (2009)

United Kingdom of Great Britain and Northern Ireland (2013)

United Republic of Tanzania (2009)

United States of America (2013)

Uruguay (2008)

Uzbekistan (2013)

W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N
==========

ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM (GDPFS) INCLUDING NUMERICAL WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2014

TABLE OF CONTENTS

4.3.2 Model

4.3.2.1 In operation
4.3.2.2 Research performed in this field

4.3.3 Operationally available NWP products

4.3.4 Operational techniques for application of NWP products (MOS, PPM, KF, Expert Systems, etc..)

4.3.4.1 In operation
4.3.4.2 Research performed in this field

4.3.5 Ensemble Prediction System (Number of members, initial state, perturbation method, model(s) and number of models used, perturbation of physics, post-processing: calculation of indices, clustering)

4.3.5.1 In operation
4.3.5.2 Research performed in this field
4.3.5.3 Operationally available EPS products

4.4 Nowcasting and Very Short-range Forecasting Systems (0-12 hrs)

4.4.1 Nowcasting system

4.4.1.1 In operation
4.4.1.2 Research performed in this field

Note: please also complete the CBS/PWS questionnaire on Nowcasting Systems and Services, 2014)

4.4.2 Models for Very Short-range Forecasting Systems

4.4.2.1 In operation
4.4.2.2 Research performed in this field

4.5 Specialized numerical predictions (on sea waves, storm surge, sea ice, marine pollution transport and weathering, tropical cyclones, air pollution transport and dispersion, solar ultraviolet (UV) radiation, air quality forecasting, smoke, sand and dust, etc.)

4.5.1 Assimilation of specific data, analysis and initialization (where applicable)

4.5.1.1 In operation
4.5.1.2 Research performed in this field

4.5.2 Specific models (as appropriate related to 4.5)

4.5.2.1 In operation
4.5.2.2 Research performed in this field

4.5.3 Specific products operationally available

4.5.4 Operational techniques for application of specialized numerical prediction products (MOS, PPM, KF, Expert Systems, etc.) (as appropriate related to 4.5)

4.2.4.1 In operation
4.2.4.2 Research performed in this field

4.5.5 Probabilistic predictions (where applicable)

4.5.5.1 In operation
4.5.5.2 Research performed in this field
4.5.5.3 Operationally available probabilistic prediction products

4.6 Extended range forecasts (10 days to 30 days) (Models, Ensemble, Methodology)

4.6.1 In operation

EXPLANATORY NOTES

to the suggested contents of Annual Joint WMO Technical Progress Report on the Global Data-Processing and Forecasting System (GDPFS) and Numerical Weather Prediction (NWP) Research Activities

The WMO progress report will be jointly compiled annually by the WDS and AREP Departments of the WMO Secretariat on the basis of contributions from WMO Members and/or GDPFS centres.

The publication will begin with an introduction prepared by the WMO Secretariat explaining the major purposes of the publication with the appropriate references.

Each individual contribution should contain appropriate parts of the following items.

1. Summary of highlights. This should reflect the major changes in the data-processing and forecasting system during the last year.

2. Equipment in use at the centre. This paragraph should contain information on the major data-processing units, especially in the large centres. Here and in the following paragraphs the information for the first national contribution to the Progress Report should be given in a complete form to avoid too many references. In the next contribution, the information can be restricted to the indication of major changes during the year being reported on.

3. Data and products from GTS in use. It is suggested that only the bulletin headings with the basic information (SYNOP, SHIP, TEMP, SATEM etc.) and the types of products (GRID, GRIB, facsimile charts etc.) received through the GTS or other means and used at the centre will be indicated in this paragraph. The daily statistics for each type of bulletin and the product should be included, if such statistics are available. For example, SYNOP-500, TEM-600, GRID-20.

4. Forecasting system. There are several aspects of this system since some centres run several models which have different approaches to the data assimilation, use different numerical techniques and so on. Consequently, this paragraph is divided into several sub paragraphs.

4.1 ***System run schedule***. It is suggested that the general structure of a prognostic system should be described in the paragraph with an indication of models in operational use, including those for specialized applications, the run schedule and the forecast ranges.

4.2-4.6 These sub-paragraphs are a series of similarly structured texts describing different operational sub-systems of a numerical weather forecasting system: Medium-range forecasting (section 4.2); Short-range forecasting (section 4.3); Nowcasting and very-short-range forecasting (section 4.4), Specialized numerical predictions for various sector specific applications, including sea waves, storm surge, sea ice, marine pollution transport and weathering, tropical cyclones, air pollution transport and dispersion, solar ultraviolet (UV) radiation, air quality forecasting, smoke, sand and dust, etc. (section 4.5), extended-range forecasting (section 4.6) and long-range forecasting (section 4.7). Each sub-paragraph contains the same components starting with data assimilation and objective analysis, description of the model, of operational techniques for application of NWP products, and a section on Ensemble Prediction Systems if used for that range. List of products available for WMO members should be indicated. All sub-paragraphs should include information regarding any performed research activities in the related field.

The list of suggested items in each sub-paragraph is given for 4.2 (it is assumed that for 4.3-4.7 they will be similar).

4.2 *Medium range forecasting system (4-10 days).*

4.2.1 *Data assimilation objective analysis and initialization*

4.2.1.1 In operation

- Assimilated data,
- Assimilation cycles, including cut-off time,
- Method of analysis (e.g. 3 D-VAR, 4D-VAR)
- Analysed variables
- First guess
- Coverage
- Horizontal resolution
- Vertical resolution (levels)
- Initialization (non linear normal mode, diabatic etc.)

4.2.1.2 Research performed in this field

4.2.2 *Model*
(If no model is operationally runs for this time range, indicate, if any, the other GDPFS centre and its model from which you use products)

4.2.2.1 In operation

- Basic equations
- Independent variables
- Dependent variables
- Numerical technique (in horizontal, vertical and in time), hydrostatic or non hydrostatic
- Integration domain (in horizontal and vertical)
- Horizontal and vertical resolution
- Time step
- Orography, gravity wave drag, bathymetry (ocean models)
- Horizontal diffusion
- Vertical diffusion
- Planetary boundary layer
- Treatment of sea surface earth surface and soil
- Radiation
- Convection (deep and shallow)
- Atmospheric moisture
- Boundaries
- Type of ocean model (deep and shallow waters)
- Source of input (e.g. wind etc.) data (ocean models).

4.2.2.2 Research performed in this field

4.2.3 Operationally available *Numerical weather prediction products*. This item should contain a brief description of variables which are outputs from the model integration and the list of products available for WMO Members on Internet and on GTS. *(If no model is operationally runs for this time range, indicate the list of products, if any, you use from another GDPFS centre)*

4.2.4 *Operational techniques for application of NWP products*. This item should include only a brief description of automated (formalized) procedures in use for interpretation of NWP output (MOS, PPM, Kalman filter, Expert System, etc.) for example, “the MOS from ECMWF NWP is used to derive extreme temperatures and daily precipitation”.

4.2.4.1 In operation

4.2.4.2 Research performed in this field

4.2.5 *Ensemble Prediction System (Number of members, initial state perturbation method, number and different models used, perturbation of physics, post-processing: calculation of indices, clustering).* This item should be a brief but clearer description of the techniques used for the ensemble prediction system, including the main post-processing techniques applied.

4.2.5.1 In operation
4.2.5.2 Research performed in this field
4.2.5.3 Operationally available EPS products. This item should contain a brief description of variables which are outputs from the EPS integration and the list of products available for WMO Members on Internet and on GTS.

5. Verification of prognostic products. Centres producing standard scores are requested to produce an annual summary for insertion in the WMO Progress Report on the GDPFS. The recommended content of this summary is given below:

VERIFICATION SUMMARY FOR INCLUSION IN THE ANNUAL WMO PROGRESS REPORT ON THE GDPFS

RSMC error	Z 500	NH, SH: against analysis 4 extra tropical standard area: against observations
RMS vector wind error	W 250	Same areas
RMS vector wind error	W 250	Tropics: against analysis
RMS vector wind error	W 850	Tropical standard area: against observations

Forecast range: 1, 3 and 5 days

All values to be the average of the monthly values over the year.

For ensemble system, provide annual and seasonal averages of the Brier Skill Score at 24, 72, 120, 168 and 240 hours for Z500 and T850.

6. Plans for the future *(next 4 years)*

6.1 Development of GDPFS.

6.1.1 Indicate major changes in the data processing and forecasting system which are expected in the next year.
6.1.2 Indicate major changes in the data processing and forecasting system which are envisaged within the next 4 years.

6.2 Planned Research activities in NWP, Nowcasting, Long-range Forecasting and Specialized Numerical Predictions. Indicate your planned research and development efforts in the area of understanding of physical processes, models, EPS and other techniques for the next 4 years.

6.2.1 Planned Research Activities in NWP
6.2.2 Planned Research Activities in Nowcasting
6.2.3 Planned Research Activities in Long-range Forecasting
6.2.4 Planned Research Activities in Specialized Numerical Predictions

7. Consortium *(if appropriate)*

There are a number of GDPFS Centres participating in Consortia. Those Centres participating in and/or responsible for a Consortium should indicate it in this item. Details on the system and/or model developed and/or operated by a Consortium, including approaches to the data assimilation, use of different numerical techniques and so on, should be reported in sub-paragraphs 7.1-7.7, using a similar approach as described in item 4.

7.1 *System and/or Model*
7.1.1 In operation
7.1.2 Research performed in this field

7.2 *System run schedule and forecast ranges*

7.3 *List of countries participating in the Consortium*

7.4 *Data assimilation, objective analysis and initialization*
7.4.1 In operation
7.4.2 Research performed in this field

7.5 *Operationally available Numerical Weather Prediction (NWP) Products*

7.6 *Verification of prognostic products*

7.7 *Plans for the future (next 4 years)*
7.7.1 Major changes in operations
7.7.2 Planned Research Activities

8. References: Give references to the sources where more detailed descriptions of different components of the data processing and forecasting system can be found, including WEB sites addresses.