

WMO OMM

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU



World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

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

Ref.: 30002/2017-1.0 LCP

Notre réf.: 22087/2017/WDS/DPFS/GDPFS-NWP/2016

7 août 2017

Annexes: 2 (disponibles en anglais seulement)

Objet: Rapport annuel d'activité technique de l'OMM pour 2016 sur le Système mondial de traitement des données et de prévision (SMTDP) et les travaux de recherche connexes sur la prévision numérique du temps

Suite à donner: Faire parvenir votre contribution au rapport le **5 octobre 2017** au plus tard

Madame, Monsieur,

Le rapport annuel d'activité technique de l'OMM sur le Système mondial de traitement des données et de prévision (SMTDP), associé au compte rendu des travaux de recherche connexes sur la prévision numérique du temps, permet aux Membres de se tenir au courant de la situation concernant les installations, les activités de recherche et les applications des centres du SMTDP, situation qui évolue constamment au gré des besoins et des progrès de la technique. Le rapport en question renseigne les experts de terrain et les chercheurs sur: 1) les moyens et installations dont disposent ces centres, y compris les systèmes d'analyse et de prévision, les systèmes de prévision numérique du temps et leurs applications spécialisées; 2) les activités de recherche-développement que mènent les centres pour comprendre les processus météorologiques, et l'évolution constante des modèles numériques et des techniques de prévision opérationnelle. En outre, en étudiant dans le détail tous les rapports reçus, l'Organisation peut comprendre et suivre constamment le fonctionnement du SMTDP à l'échelle mondiale, régionale et nationale.

Dans ce contexte, j'ai le plaisir de vous informer que les rapports soumis par les Membres pour 2015 et ceux relatifs aux années précédentes (annexe I) ont été rassemblés et mis en ligne sur le site Web de l'OMM à l'adresse suivante:
<http://www.wmo.int/pages/prog/www/DPFS/ProgressReports/2015/GDPFS-NWP-2015.html>.

Aux: Représentants permanents (ou directeurs des Services météorologiques ou hydrométéorologiques) des Membres de l'OMM
Directrice générale du CEPMMT
Directeur de l'ACMAD

cc: Présidents et vice-présidents de la Commission des sciences de l'atmosphère et de la Commission des systèmes de base
Membres du Groupe de gestion de la CSA
Membres du Comité scientifique mixte de la CSA pour le GASO du PMRPT
Membres des groupes de travail relevant du GASO du PMRPT
Membres du Groupe de gestion de la CSB
Membres du GASO du STDP relevant de la CSB
Agents de liaison des CMRS pour les interventions en cas d'éco-urgence et/ou pour la modélisation inverse

Les Membres sont maintenant invités à établir et communiquer au Secrétariat de l'OMM leur contribution au rapport pour 2016. Afin de faciliter la fourniture d'informations sur les activités menées par votre centre et/ou un consortium de centres du SMTDP dans des domaines qui vont de la prévision immédiate à la prévision à longue échéance en passant par la prévision à échéance prolongée ou bien en rapport avec les applications spécialisées de la prévision numérique du temps et du post-traitement des données (par exemple pour les vagues océaniques, les ondes de tempête, les glaces de mer, le transport et la désagrégation des polluants de la mer, les cyclones tropicaux, le transport et la dispersion des polluants atmosphériques, le rayonnement solaire ultraviolet, la qualité de l'air, les fumées, les tempêtes de sable et de poussière, etc.), un formulaire reprenant la table des matières du rapport (annexe II) a été établi et mis en ligne sur le site Web de l'OMM à l'adresse suivante: <http://www.wmo.int/pages/prog/www/DPS/gdps.html>.

Je vous saurais gré de bien vouloir faire parvenir votre contribution au rapport pour 2016 **sous forme électronique uniquement** au Secrétariat de l'OMM, dans les plus brefs délais mais de préférence le **5 octobre 2017 au plus tard**. Vous pouvez l'envoyer par courriel (dpfsmail@wmo.int), de préférence en MS Word ou dans d'autres formats compatibles, à l'attention de Mme Pascale Gomez.

Je voudrais saisir cette occasion pour vous remercier de la contribution que vous apportez à ce rapport et j'engage vivement les Membres qui n'ont pas encore apporté leur contribution ou qui n'ont pas procédé à une mise à jour depuis plusieurs années à le faire sans tarder dans l'intérêt de tous les Membres de notre Organisation.

Veillez agréer, Madame, Monsieur, l'expression de ma considération distinguée.



(W. Zhang)
pour le Secrétaire général

**Annual WMO Technical Progress Reports on the
GDPFS and related Research Activities on NWP
(for 2015, or latest report year)**

ECMWF (2015)	Latvia (2013)
Algeria (2013)	Lithuania (2012)
Argentina (2013)	Lybia (2015)
Armenia (2015)	Madagascar (2008)
Australia (2010)	Malaysia (2011)
Austria (2015)	Montenegro (2008)
Belarus (2012)	Morocco (2006)
Belgium (2008)	Mozambique (2015)
Bolivia (2010)	Myanmar (2015)
Bosnia and Herzegovina (2008)	Netherlands (2010)
Botswana (2010)	New Zealand (2015)
Brazil (2010)	Oman (2015)
Bulgaria (2006)	Pakistan (2015)
Canada (2014)	Panama (2005)
Chile (2015)	Peru (2007)
China (2014)	Poland (2015)
Côte d'Ivoire (2004)	Portugal (2011)
Croatia (2015)	Qatar (2012)
Cyprus (2015)	Republic of Korea (2015)
Czech Republic (2013)	Romania (2015)
Denmark (2010)	Russian Federation - English (2015)
Ecuador (2008)	Russian Federation - Russian (2015)
Egypt (2015)	Saudi Arabia (2008)
Estonia (2008)	Serbia (2015)
Fiji (2010)	Singapore (2015)
Finland (2015)	Slovakia (2015)

France (2015)	Slovenia (2012)
Georgia (2004)	Spain (2015)
Germany (2015)	Sri Lanka (2010)
Greece (2013)	Sweden (2015)
Hong Kong, China (2015)	Switzerland (2015)
Hungary (2015)	Thailand (2015)
India (2011)	The former Yugoslav Republic of Macedonia (2010)
Indonesia (2009)	Tunisia (2003)
Ireland (2015)	Turkey (2009)
Islamic Republic of Iran (2006)	Ukraine (2015)
Israel (2012)	United Kingdom (2015)
Italy (2015)	United Republic of Tanzania (2009)
Japan (2015)	United States of America (2013)
Kazakhstan (2015)	Uruguay (2008)
Kenya (2013)	Uzbekistan (2015)
Kyrgyzstan (2004)	

**ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA-
PROCESSING AND FORECASTING SYSTEM (GDPFS) INCLUDING NUMERICAL
WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2016**

TABLE OF CONTENTS

Introduction

[National Contributions and/or Consortia]

1. Summary of highlights

2. Equipment in use at the Centre

3. Data and Products from GTS in use

4. Forecasting system

4.1 System run schedule and forecast ranges

4.2 Medium range forecasting system (4-10 days)

4.2.1 Data assimilation, objective analysis and initialization

4.2.1.1 In operation

4.2.1.2 Research performed in this field

4.2.2 Model

4.2.2.1 In operation

4.2.2.2 Research performed in this field

4.2.3 Operationally available Numerical Weather Prediction (NWP) Products

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

4.2.4.1 In operation

4.2.4.2 Research performed in this field

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

4.2.5.1 In operation

4.2.5.2 Research performed in this field

4.2.5.3 Operationally available EPS Products

4.3 Short-range forecasting system (0-72 hrs)

4.3.1 Data assimilation, objective analysis and initialization

4.3.2.1 In operation

4.3.2.2 Research performed in this field

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

4.6.2 Research performed in this field

4.6.3 Operationally available EPS products

4.7 Long range forecasts (30 days up to two years) (Models, Ensemble, Methodology)

4.7.1 In operation

4.7.2 Research performed in this field

4.7.3 Operationally available products

5. Verification of prognostic products

5.1 Annual verification summary

5.2 Research performed in this field

6. Plans for the future (next 4 years)

6.1 Development of the GDPFS

6.1.1 Major changes in the operational DPFS which are expected in the next year

6.1.2 Major changes in the operational DPFS which are envisaged within the next 4 years

6.2 Planned Research Activities in NWP, Nowcasting, Long-range Forecasting and Specialized Numerical Predictions

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)

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

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 subparagraphs 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.
