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

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ANNUAL JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM (GDPFS) INCLUDING NUMERICAL WEATHER PREDICTION (NWP) RESEARCH ACTIVITIES FOR 2015

Thai Meteorological Department, THAILAND

1. Summary of highlights

No changes in the operational data processing and forecasting system in 2015.

2. Equipment in use

Thai Meteorological Department (TMD) still has used IBM RS/6000 SP II system in operation since 2000. It comprises 6-wide nodes (Power2 SC 135 MHz) and 32-thin nodes (Power2 SC 120 MHz).

- Each wide node: 512 MB of memory and 4.5 GB storage.
- Each thin node: 128 MB of memory and 2.2 GB storage.
- Total site peak performance: 7.488 GFLOPS (LINPACK DP) and 12.96 GFLOPS (LINPACK TPP).
- Total Primary Mass Storage Capacity: 582 GB.
- Total Robotic Tape Archive Subsystem Storage Capacity: 10 TB (up to 46.4 TB)
- PC Cluster WRF model for experiment and research.

3. Data and Products from GTS in use

3.1 Observations

The total number of observations processing is available in 24 hour period

Global

- SYNOP is 7249
- SONDE is 547
- Satwind is 0.
- Aircraft is 2821

Southeast Asia

- SYNOP is 1424
- SONDE is 181
- Satwind is 0.
- Aircraft is 2629

Thailand

- SYNOP is 249
- SONDE is 12
- Satwind is 0.
- Aircraft is 81.

Note: For Satwind, the Data collection system didn't support the GRIB2 format.

3.2 Gridded Products

Model products from WMC Washington and ECMWF are available to forecasters as additional guidance.

4. Forecasting system

The Atmospheric forecasting system based on the Unified Model V4.3 and consists of

- Global atmospheric forecast model at 100 km resolution and 19 levels forecasted 7 days ahead and supported by analysis correction scheme data assimilation.
- Southeast Asia atmospheric forecast model at 48 km resolution and 19 levels forecasted 3 days ahead and supported by analysis correction scheme data assimilation.
- Thailand atmospheric forecast model at 17 km resolution and 31 levels forecasted to 3 days and supported by analysis correction scheme data assimilation.

- Southeast Asia, Thailand and Bangkok atmospheric forecast model at 30 km resolution and 28 levels forecasted 3 days, Thailand model at 10 km resolution and 28 levels forecasted 3 days and Bangkok model run at 3 km. Resolution forecast 24 hrs.

4.1 System run schedule and forecast ranges

For UNIFIED model

Type	Model	Data time	Start time	Forecast period
Main run for NWP products	Global Southeast Asia Thailand	00 Z	03:05 UTC	T+168 T+72 T+72
Intermediate run for background fields	Global Southeast Asia Thailand	06 Z	09:05 UTC	T+6 T+6 T+6
Main run for NWP products	Global Southeast Asia Thailand	12 Z	15:05 UTC	T+168 T+72 T+72
Intermediate run for background fields	Global Southeast Asia Thailand	18 Z	21:05 UTC	T+6 T+6 T+6

For WRF model

Type	Model	Data time	Start time	Forecast period
Main run for NWP products	Southeast Asia Thailand Bangkok	00 Z	04:05 UTC	T+72 T+72 T+24
Main run for NWP products	Southeast Asia Thailand Bangkok	12 Z	18:05 UTC	T+72 T+72 T+24

4.2 Medium range forecasting system (4-10 days)

4.2.1 Data assimilation, objective analysis and initialization

4.2.1.1 In operation

Analysis Correction scheme based on UM V4.3 is the data assimilation scheme

4.2.1.2 Research performed in this field

None of activity

4.2.2 Model

4.2.2.1 In operation

Global atmospheric forecast model based on UM V4.3

4.2.2.2 Research performed in this field

Weather Research and Forecasting model (WRF) has been run for research.

4.2.3 Operationally available Numerical Weather Prediction Products

Precipitation, Wind, Pressure, Temperature, Relative humidity and Geopotential height at standard pressure levels products are available in TMD website.

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

4.2.4.1 In operation

QPE and QPF technique

4.2.4.2 Research performed in this field

Radar data for data assimilation in very short range forecast.

4.2.5 Ensemble Prediction System (EPS)

4.2.5.1 In operation

None of activity

4.2.5.2 Research performed in this field

None of activity

4.2.5.3 Operationally available EPS Products

None of activity

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

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

Analysis Correction scheme based on UM V4.3 is the data assimilation scheme

4.3.1.2 Research performed in this field

3D-VAR data assimilation by using the WRF Preprocessing System (WPS).
Radar data for data assimilation in very short range forecast.

4.3.2 Model

4.3.2.1 In operation

Southeast Asia and Thailand atmospheric forecast model based on UM V4.3

4.3.2.2 Research performed in this field

WRF model has been run for research.
WRFV3.5 Bangkok model high resolution (3x3km.35lev.) for 24hrs. urban prediction.
The Gridpoint Statistical Interpolation and Ensemble Kalman Filter (GSI/EnKF) and Model Evaluation Tools (MET) from Developmental Testbed Center (DTC),UCAR.

4.3.3 Operationally available NWP products

Wind, Pressure, Temperature, Relative humidity and Geopotential height at standard pressure levels and Precipitation products are available in TMD website.

4.3.4 Operational techniques for application of NWP products

4.3.4.1 In operation

None of activity

4.3.4.2 Research performed in this field

Temperature from UM products was performed by using the Kalman Filtering.
3D-VAR data assimilation by using the WRF Preprocessing System (WPS).
Radar data for data assimilation in very short range forecast.

4.3.5 Ensemble Prediction System

4.3.5.1 In operation

None of activity

4.3.5.2 Research performed in this field

None of activity

4.3.5.3 Operationally available EPS Products

None of activity

4.4 Nowcasting and Very Short-range Forecasting Systems (0-6 hrs)

4.4.1 Nowcasting system

4.4.1.1 In operation

None of activity

4.4.1.2 Research performed in this field

None of activity

4.4.2 Models for Very Short-range Forecasting Systems

4.4.2.1 In operation

None of activity

4.4.2.2 Research performed in this field

None of activity

4.5 Specialized numerical predictions

None of activity

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

4.5.1.1 In operation

None of activity

4.5.1.2 Research performed in this field

None of activity

4.5.2 Specific Models (as appropriate related to 4.5)

4.5.2.1 In operation

None of activity

4.5.2.2 Research performed in this field

None of activity

4.5.3 Specific products operationally available

None of activity

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

4.5.4.1 In operation

None of activity

4.5.4.2 Research performed in this field

None of activity

4.5.5 Probabilistic predictions (where applicable)

4.5.5.1 In operation

None of activity

4.5.5.2 Research performed in this field

None of activity

4.5.5.3 Operationally available probabilistic prediction products

None of activity

4.6 Extended range forecasts (ERF) *(10 days to 30 days)*

4.6.1 Models

4.6.1.1 In operation

None of activity

4.6.1.2 Research performed in this field

Experimentally

4.6.2 Operationally available NWP model and EPS ERF **products**

None of activity

4.7 Long range forecasts (LRF) *(30 days up to two years)*

4.7.1 In operation

None of activity

4.7.2 Research performed in this field

Experiment in use

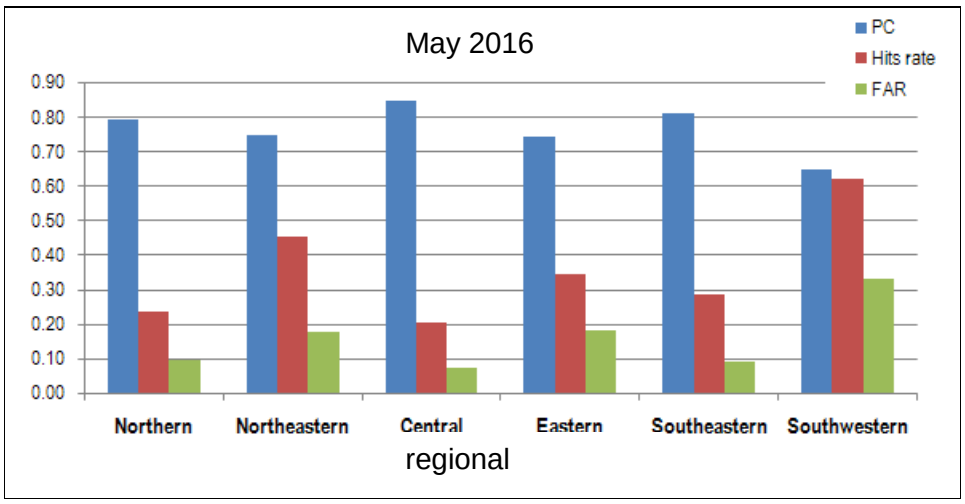
4.7.2 Operationally available EPS LRF products

None of activity

5. Verification of prognostic products

Table 1 Percent correct (PC), Hits rate and False Alarms Rate (FAR) of quantitative precipitation Forecast (thresholds of 10mm)

Region	PC	Hits rate	FAR
Northern	0.79	0.24	0.09
Northeastern	0.75	0.46	0.18
Central	0.85	0.21	0.07
Eastern	0.74	0.35	0.18
Southeastern	0.81	0.29	0.09
Southwestern	0.65	0.62	0.33
avg.	0.77	0.36	0.16



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

To create a multi-model ensemble prediction system.
Run high resolution (2 km.) grid boxes on HPC 2016

6.1 Development of the GDPFS

6.1.1 TMD is going on design for new HPC system for the next year (2016-2017) for run high resolution grid scale.

- To initialize the NWP models with the high resolution Lateral Boundary condition data from ECMWF

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

6.2.1 Planned Research Activities in NWP

Application and Development for interpreted NWP product to local users.

6.2.2 Planned Research Activities in Nowcasting

6.2.3 Planned Research Activities in Long-range Forecasting

-Statistical Downscaling approach to seasonal Forecasting (4 months forecast)

6.2.4 Planned Research Activities in Specialized Numerical Predictions

7. References

Met Office. Scientific & Technical Papers: Unified Model & Observation Processing System. Bracknell, 1998.
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