

TMD's Numerical Weather Prediction System

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Outline

- U History of TMD's NWP
- Craphic User Interface
- Operation System
- Future Work





History of TMD's NWP





1000MBs

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Graphic User Interface (GUI)



Server	localhost		Processing	Exit	i avx	🗹 chem	🔽 build	I runnow I Verbose
User	user		< Run Application>					To build and control the Weather Research and Fore
Models Dir	Dir ~/apps/wrf/gnu/7.4.0/openmpi/4.0.2		appswrf					please chose the button of any options.
Opt Dir	Opt Dir ~/apps/wrf/gnu/7.4.0/openmpi/4.0.2/opt		bin dir	/home/user/pybin				The hdf5, netcdf-c,netcdf-fortran and netcdf-cxx4
Source Dir ~/src/WRF		run of	ingest,ungrib,metgrid,rea				Contact @ boonlert.arc@tmd.go.th	
Source Package	ickage ~/src/packages		🗆 get data grib					
Pybin Dir	/home/user/pybin		get emission		Domain No.	1	arwpost	
Compiler	gnu	Version 7.4.0	WRF core	anw 😑			Ctitemplate	
MPI	openmpi	Version 4.0.2	projection	mercator -	Domain No.	1	🗆 upp	
			Max Domain	1		16	processes	
Run Type	current	current or restart	geogrid	2 processes		2	GRIB No.	
Run case	THA30S		ungrib	1 processes		Big_En	Endian	Drocoggag
Run Dir	~/MyRun/wrf		metgrid	2 processes	Domain No.	1	archive wrfout	110002202
Run time	3_0:0:0	day_hour:minute:second	🗆 real	1 processes	Domain No.	1	Slected Variable	
Time Step	60	seconds	🗆 wrf	2 processes	~/apps/wrf/gn	u/7.4.0/op	ncks command	
Initial time	-1	YYYYMMDDhhmmss or -1		-1 nprocx	~/apps/wrf/gn	u/7.4.0/op	ncrcat cmmond	
Initial Dir	~/data			-1 nprocy	XLAT, XLONG	XTIME,R	Variables	
Initial Used	gfs			4 niogroup			ncks	
Emission User	finn_emis,firms_	modisci		-1 niotaskpergro	up			
WPS Namelist				2 io number			Dynamic Graph	
WRF Namelist			comGSI	comgsi_run_regional	None		js dir	
Geog Dir	~/data/WPS_GE	OG	🗆 gsi	64 processes			🗆 tojs	K N
Geogrid file ~/MyRun/wrf/wrf_geogrid_THA30S.tar							🗆 sftp	
Archive Dir /wrfoutiii/netcdf/user/THA30S							gallary	
Post Dir ~/data								
Qsub								
Queue name								
Qstat								

Is native python language

To developed for reconfiguration and operational the numerical weather prediction system

To configure and installed related libraries packages and WRF model to fit on the computing environment on both local and/or remote machine

HOST=localhost BUILD=True ~/pybin/wrf_apps

HOST=localhost ~/pybin/wrf_apps



The Cycle run four time per day at 00, 06, 12 and 18UTC with forecast. There are 3 domain for operational which are the WRFV3.8.1 (changing to latest 4.1.3)

- Short range forecast (0-72 hours):

Forecast +48 hours run spacing grid 2 km². output hourly

Forecast +72 hours run spacing grid 6 km². output hourly

- Medium-range forecasting system (4 – 10 days)

Forecast +10 days run spacing grid 18 km². output 3 hourly

The Cycle run a time per day at 00 with forecast. There are 2 domain for operational which are the WRFV3.8.1 (changing to latest 4.1.3)

- Long range forecast (climate model)

Forecast +397 days run spacing grid 27 km². output 6 hourly



Global Forecasting

2004 Global RAMS (Regional Atmospheric Modeling System) after that is Ocean-Land-Atmosphere Model (OLAM)
2005 A global version of the fifth-generation Pennsylvania State University–National Center for Atmospheric Research Mesoscale Model (PSU–NCAR MM5)
2007 Experimental Climate Prediction Center (ECPC) Global to Regional Spectral Model (G-RSM)

- 2015 Global Weather Research and Forecasting Model (WRF-ARW)
- 2017 Model for Prediction Across Scales-Atmosphere (MPAS-A)
- 2018 OLAM-SOIL
- 2019 Couple system of WRF and NEMO (currently on the way to coupling)







Configuration domain for run WRF GSI

Grid point	resolution/time forecast
1483x741X19=20,879,157	27 กม. (Fc 126 Days)
585x55x40=12,987,000	18 กม. (Fc 10 Days)
547x544x40=11,902,720	6 กม. (Fc 3 Days)
547×913×40=19,976,440	2 กม. (Fc 2 Days)





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System computer types

Performance : 228 TF

Operating system : Linux

High-speed storage: 3PB

192 Nodes (compute) (3 tyes)

Main memory : 128 GiB per node

High Performance Computing





Ungrib data Metgrid Initialization real Model integration GRIB2 Post Processing

8191.8 84.6%



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Mobile Application





Hourly Table/Time-Series/Map











TMD Weather Forecast API

https://data.tmd.go.th/nwpapi/doc

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Forecasting Results

Short-term and long-term weather forecasting system, WRF-4.1.3, 2-km (48-h), 6-km (72-h), 18-km (10-days), 4- time a day, (http://www.nwp.tmd.go.th)







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Short-term and long-term climate forecasting system,, WRF-4.1.3, 54-km, and 18-km (397-days), once a day. http://weather.tmd.go.th/seasonal





Point/Area Forecasting Results





Development of weather with high performance phase I (2017 to 2020)

<u>Forecast Range</u>	Forecast Resolution	Forecast member ensemble
1.6 month	27 km. X 27 km (729 sqm)	> 7 members
2. 240-h(10 day)	18 km X 18 km (324 sqm)	-
3. 72-h (3 day)	6 km X 6 km (36 sqm.)	-
4. 48-h (2 day)	2 km X 2 km (4 sqm)	-

5. Testing seasonal forecast with ensemble

6. To do data assimilation every 6-h for short range forecast



Development of weather with high performance phase II (2021 to 2025)

<u>Forecast Range</u>	Forecast Resolution	Forecast member ensemble
1.6 month	27 km. X 27 km (729 sqm)	> 50 members
2. 240-h(10 day)	9 km X 9 km (81 sqm)	> 10 members
3. 72-h (3 day)	3 km X 3 km (9 sqm.)	> 10 members
4. 48-h (2 day)	1 km X 1 km (1 sqm)	> 10 members

5. To develop data assimilation every hour for short range forecast

- 6. To develop and test couple models
- 7. To develop regional climate change projection
- 8. To Applied AI



The technology of numerical weather prediction or forecast by computer have been developed and used in the country for a long time more than 20 years, to be used as tools in support of the weather and climate prediction of forecaster and meteorologists.

According with the rapidly developed on height performance computing and the weather forecast technology,

TMD has updated the numerical weather prediction systems to ensure efficiency and accuracy in weather forecasting for nowcasting, short-range, medium-range, long-range and extended-range expectations for natural disasters such as the heavy rain flooding, tropical cyclone movement and track, drought, storm surges in the risk area especially in mountain areas and southern and western coast of Gulf of Thailand.



Acknowledgements

WRF model developer groups which strong update and continuous improved,

NCEP for available initial and boundary condition data,

ITs developer,

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Thank you for your Attention



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